18th WELLMANN INTERNATIONAL SCIENTIFIC CONFERENCE

BOOK OF ABSTRACTS

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University of Szeged Faculty of Agriculture
Hódmezővásárhely (Hungary)

Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timisoara
Faculty of Agricultural Management (Romania)

Hungarian Academy of Sciences Regional Committee in Szeged (Hungary)

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ROLE OF RHIZOBACTERIA IN PLANT ABIOTIC STRESS MANAGEMENT

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The major challenges in the agriculture are to cope with the continuously increasing demand for agricultural products and the losses caused by the changing environmental conditions. Biotic and abiotic stress factors limit the plant growth, causing lower yields in crop production. In order to increase the crop productivity, two biotechnological approaches are available: the development of stress tolerant crops using genetic engineering and the utilization of plant colonizing microorganisms to provide stress tolerance. The role of rhizobacteria in diminishing the effect of abiotic stress was studied in recent years. Rhizobacterial strains can influence the survival and adoptability of plants using different mechanisms such as the production of plant growth promoting substances, phytohormones and reactive oxygen species (ROS) management. The aim of our research was to evaluate the effect of taxonomically different plant growth promoting bacteria from Sapientia University's bacterial strain collection under abiotic stress conditions (salt and heavy metal) on *Zea mays* early growth and development. Bacterial strains were tested for their plant growth promoting (PGP) properties, heavy metal and salt tolerance. The stress tolerant PGP strains were selected and used in plant experiments under controlled conditions. Plant growth (length and weight) and physiological parameters (chlorophyll content, ROS production) were measured and evaluated. Several bacterial strains proved to alleviate abiotic stress in case of *Zea mays*, deserving more attention in future research due to their potential in sustainable agriculture practice.

STRENGTHENING THE COMPETITIVENESS OF THE AGRI-FOOD SECTOR THROUGH INTEGRATION ACTIVITIES ON THE EXAMPLE OF ANCIENT GRAIN, GARDENA AND NOVA GRASS PROJECTS

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Abstract: A considerable problem of many entities of the entire agri-food sector in Poland is their low competitiveness on the international market. It results, inter alia, from the lack of access to up-to-date knowledge, advice and information (both market and technological). The answer to these problems may be integration (horizontal and vertical) and stimulation of innovation processes throughout the agribusiness sector.

A good example of activities integrating the agri-food sector is the Cooperation measure implemented under the Rural Development Program 2014-2020. It supports the creation of the so-called "Operational Groups" which include, among others, farmers and entrepreneurs, as well as advisory, self-government and scientific institutions. Such cooperation accelerates the transfer of innovative solutions increasing the market competitiveness of the entities involved. A good example of such cooperation are three operational groups: "Ancient Grain", "Gardena" and "Nova Grass".

The leader of all three operational groups is the UTP University of Science and Technology in Bydgoszcz (Poland). Their members are farmers, entrepreneurs, local government units, advisory and scientific institutions. This type of cooperation allows for achieving synergy effects which rely on networking and the mutual use of knowledge, information and competences held by individual entities involved in such a cooperation.

SHORT- AND LONG-TERM EFFECTS OF *TRICHODERMA HARZIANUM* ON GROWTH, METAL UPTAKE AND FRUIT QUALITY OF TOMATO

Dejana Panković, Gordana Racić, Igor Vukelić, Mirjana Bojović, Ljubinko Jovanović

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The short-term effects of *Trichoderma harzianum* on growth, content of chlorophyll and epidermal flavonols and metal distribution was examined in young tomato plants grown in the climate chamber. *T. harzianum* was applied near the root in the phase of sixth established leaves, and plants were grown in a growth cabinet up to the stage of 10 leaves. *Trichoderma* application positively affected growth of tomato plants, and significantly increased content of epidermal flavonols. Also, the significant decrease of Cd in all plant parts was observed. However, content of Cr and Ni was lower only in roots. The primary goal of the examination of the long-term effect of *T. harzianum* was the fruit quality of two commercial tomato cultivars grown in organic system of production in the field under polytunnel. One cultivar had a significant response to *Trichoderma* application. The increase of leaf epidermal flavonols was observed, however as the chlorophyll content decreased, the nitrogen balance index has also decreased, indicating a shift from primary to secondary metabolism. The fruit quality of the same cultivar was improved by increased total flavonoids content, decreased starch, increased Bioaccumulation Index (BI) for Fe and Cr, and decreased BI for heavy metals Ni and Pb. Data indicate that in some cultivars of tomato the interaction with *Trichoderma* contributes to improved health promoting properties of tomato fruit.

HUNGARIAN KNOW-HOW TRANSFER TO NORTH AFRICA AND MIDDLE EAST – THE ROLE OF HUNGARIAN DAIRY RESEARCH INSTITUTE IN INNOVATIVE CAMEL MILK PROCESSING TECHNOLOGIES

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The Middle East and North Africa are home to the dromedary, a one-humped camel (Camelus dromedarius), a species adapted successfully to the hot, dry, arid and semi-arid environment. As a farm animal, for millennia camels played a central role in contributing to the sustenance and survival of the locals as well as to the development of societies. Following the urbanisation of recent decades, camel farming has somewhat lost its appeal. But as the population grows rapidly, climate change exerts its negative impacts, and water resources are becoming more and more limited, this milk and meat-producing species comes into the spotlight again. No less because research into camel milk has shown that it has considerable health benefits.

The Hungarian Dairy Research Institute Ltd. has been doing research and development activities together with the Dubai-based Emirates Industries for Camel Milk & Products and its head researcher since 2012 to ensure a constant supply of high-quality raw camel milk, on the one hand, and to tailor state-of-the-art dairy production technologies to camel milk, on the other.

Since our work with camel milk has proven highly successful, we wish to enter into and engage in a dialogue with experts of countries in the Middle East and North Africa who, relying on Hungarian expertise and being familiar with local conditions, would cooperate in establishing long-term camel milk production.

THEMATIC SESSIONS

IMPLICATIONS OF THE COVIND-19 PANDEMIC ON ROMANIAN TOURISM

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Tourism is among the sectors severely affected by the COVID-19 pandemic. A major player in the European economy, the restrictions imposed on travel restrictions have led to the decimation of the tourism sector, with significant losses both in terms of accommodation units and operators of travel agencies. The European tourism market accounts for almost half of the global tourism market, and the difficult situation generated by this pandemic is very visible in the economies of European countries such as Spain, Italy, France and Greece.

At the level of each state, attempts are being made to identify solutions that will revitalize the tourism sector, trying to save millions of jobs and ensure safe conditions for those who want to practice a tourism activity.

Romania, a country with a high tourist potential, started on this road, being elaborated a series of strategies for relaunching the Romanian tourism. In this regard, the main actions will target the not very crowded tourist destinations, the green, sustainable destinations, thus developing a lot of forms of rural tourism (agritourism, ecotourism, green tourism).

In choosing a holiday destination, priority will be given, first of all, to the following aspects: health safety, non-crowded areas, quality, sustainability, ecotourism, being preferred the holiday houses and apartments, pensions and smaller hotels. In this context are the Romanian rural areas, with a high agritourism and ecotourism potential such as the Danube Delta, Transylvania, Bucovina and Maramures etc.

AGRICULTURAL RECYCLING OF SPENT MUSHROOM COMPOST AFTER MICROBIOLOGICAL TREATMENT

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Besides good quality spawn and mushroom compost, the basis of the economic and efficient production of champignons (*Agaricus bisporus*) is the excellent quality casing material. In mushroom growing houses, the mushroom compost colonized by the mycelia of champignons is covered by the casing material, the role of which is primarily to ensure the fruiting body formation and provide high water retaining capacity. The nutrient-rich mushroom compost can be characterized by low water retaining capacity, which is compensated by the high water retaining capacity of the casing material. The depletion of peat mines in Hungary and Europe, as well as the environmental problems arising from peat mining lead to an emerging need for development of alternative options for the production of high-quality casing materials. Recycling of spent mushroom compost has been attempted in some cases by vermicomposting. Microbiological re-composting may be a possible alternative.

Due to the outstanding fiber content of the harvested mushroom compost it may serve as an excellent raw material for the development of casing materials. We select and characterize fungal and bacterial strains that can be used for the controlled exploration and transformation of spent mushroom compost, in this way recycling it to casing material. Microorganisms (bacterial strains including *Bacillus subtilis* and *B. licheniformis*, as well as fungi including *Aureobasidium pullulans*) were isolated from samples deriving from experimental re-composting process of spent mushroom compost and deposited in a strain collection after species-level molecular identification. The strains were subjected to further selection steps in ecophysiological and enzyme activity test as well as seed germination experiments. The spent mushroom compost is tested for use as casing layer in mushroom cultivation, as well as a plant growth medium.

The study was funded by the NKFI grant 2020-1.1.2-PIACI-KFI-2020-00111.
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CHED'S PERCEPTION ON NUTRITION AND HEALTH

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Recently, due to several socio-economic factors such as time scarcity, there is a tremendous increase in convenience in food preparation. To meet this demand, an increase in the establishment of catering units throughout the country happened. Eating out became an essential part of consumers' lifestyles around the globe. With the rise in obesity and non-communicable diseases such as CVD and diabetes, there is a need for healthy eating out practices and healthy food items on the menus. Therefore, this study surveyed random chefs in various catering establishments distributed randomly within Hungary between February and April 2021. We surveyed them regarding their perceptions on four aspects; health, nutrition, nutritional practices, and consumer concerns in the context of menu planning and food service. The results showed that chefs strongly agree that catering professionals consider nutrition an essential factor during menu planning and creation. The chefs also perceive that the number of customer requests for modified menu items was increasing. However, they do not perceive that consumers consider nutrition as an essential factor when selecting a restaurant. The study found that the chefs` working experience does not affect their perceptions of the four aspects. The survey also indicated that chefs no longer perceive that the preparation of low-fat foods requires additional work. They can be made equal in taste to foods containing higher amounts of fat. Additionally, chefs confirmed that the finished products' quality is the primary concern during food preparation and service.

COMPARISON BETWEEN (OCIMUM BASILICUM L.) AND (CUCURBITA PEPO L.) GERMINATING PARAMETERS UNDER DROUGHT STRESS

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Drought stress is becoming an intimidating obstacle to global agriculture in the 21st century, creating major food security challenges. Drought-sensitive crops, in particular, to which pumpkin and basils belong, reduce yield potentials. Lack of water can inhibit germination of sown seeds and manipulate germination parameters. An experiment was conducted to investigate the effect of drought stress, induced by (polyethylene glycol) (PEG), on some germination parameters (germination percentage, germination energy, germination rate index, mean germination time and root elongation) of pumpkin *(Cucurbita pepo L.)* and Basil *(Ocimum basilicum L.)* from Lamiaceae. The PEG concentration was (2.5%) in this experiment, along with a control (nutrient solution), on both species in three replicates of every treatment. Germinated seeds were counted every day at the same time, and the daily associated root elongation was measured by using a regular ruler. Each stage was considered finished when the average hypocotyl of the control treatment reached 3 cm long. Pumpkin took nearly 7 days to reach maximum root elongation, whereas basils took 8 days but failed to reach average root length and died. The results showed that basil seeds extremely sensitive for water deprivation, could not germinate in PEG 2.5 percent, but pumpkin seeds germinated well in PEG. It illustrates that the PEG treatment reduced germination by 25% in the case of pumpkin, but basils could not germinate and the PEG treatment reduced germination by 75%. It demonstrates that pumpkins can withstand drought stress better than basils. There are also germination parameters that vary between them.

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EFFECTS OF EUSTRESS AND DISTRESS APPLIED AT DIFFERENT GROWTH STAGES TO *BRASSICA OLERACEA VAR. ITALICA*

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Planet Earth exists for approximately 5 billion years and it has seen many drastic events. However, the last three centuries were highest in the number of revolutions and developments which led to unprecedented transformations of the world itself. As a result of this rapid transformations came the biggest global problem, Climate Change. One of the biggest issues of climate change is drought, the recent study reported that droughts will be even more frequent and drastic as the temperatures rise and it will lead to the water and food shortages across the globe, which will severely impact the humanity. In this study we observed the implications of eustress such as drought using 2,5 % Polyethylene Glycol (2,5% PEG) and different light quality on broccoli (*Brassica oleracea var. italica*) plant and evaluated the seed germination progress for three samples of each solution. The results demonstrated 25-30% marked slow-down of the germination rate in 2,5% PEG-induced *Brassica oleracea var. italica* plants in comparison to control (Nutrient Solution) treatment. We believe that the in-depth analysis and data obtained in this study will be useful in order to overcome drought crisis while producing more beneficial plants that being consumed can confer stress resistance to humans and animals.

INTERACTIONS BETWEEN TREES, CROPS AND PEDOSPHERE: EXPERIENCES IN IRRIGATED BIOENERGY - AGROFORESTRY SYSTEM IN HUNGARY

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Aim of our study was to evaluate a complex agroforestry system with the intercropping of aerobic rice and the utilization of reclaimed water for sustainability and climate change adaptation. The foreseeable positive outcomes of the intercropping system could be higher yields for the arable crops, additional woody product and indirectly favourable microclimate, water conservation, increased biodiversity and wind damage reduction.

In our small scale (0.3 ha) experiment aerobic rice production took place between poplar and willow rows in 2019. Hungarian rice cultivar ‘M488’ was irrigated with River Water and Effluent Water from an intensive catfish farm (micro sprinkler irrigation). The effect of different irrigation doses on the tree species via measurement of phenology parameters and root growth was analysed. Beside the rice and woody plant biomass production, the changes of soil parameters and mineral composition of rice were evaluated as well due to the properties of the effluent water (high nitrogen, sodium (313 mg/dm^3) and bicarbonate (951 mg/dm^3) content of the water). According to our hypothesis the inorganic nitrogen content of the effluent water contributes to meeting plant nutrient requirements, however the soil salinization should be avoided. In addition, the effects of soil improvements (limestone grit; 2.5 t calcium-carbonate per ha) and mulch (winter wheat straw, 2.5 t/ha) on soil processes were also explored. The effect of irrigation and organic mulching on earthworm abundance, biomass and species composition was also investigated. Soil mulching significantly increased earthworm abundance and biomass in summer, while irrigation quality and doses significantly decreased it.

NATURAL FUSARIUM TOXIN CONTAMINATION OF WHEAT IN SOUTHERN PART OF HUNGARY

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Fusarium head blight (FHB) is an important fungal disease of small grain cereals. In Hungary bread and durum wheat are the most affected by this disease. FHB results not only reduction in yield, but also spoils quality and usability, the fungus can produce harmful secondary metabolites (mycotoxins). In 2019, weather conditions were favorable for *Fusarium* infections, in May the average amount of precipitation was 134 mm. A severe *Fusarium* epidemic occurred in most regions of the country. 192 samples of different bread wheat (*Triticum aestivum* L.) genotypes from two conventional breeding nurseries (Szeged, Makó) were tested for deoxynivalenol (DON) toxin contamination in 2019. The wheat genotypes were the same at the two locations and represented a high variability in resistance. After extraction and clean-up, samples were assayed with HPLC-DAD. Samples were analyzed by gradient HPLC method. Average level of DON contamination was 3.80 mg/kg, it is three times higher than the European maximum limit for unprocessed cereals intended for human consumption (1.25 mg/kg). The content range was very wide (0.15–20.71 mg/kg), 76% of the samples exceeded the EU risk threshold level. Wheat samples derived from Szeged had lower levels of DON contamination, average 1.84 mg/kg, while samples from Makó the average contamination was 5.77 mg/kg. The 49% of the examined genotypes in both locations had lower toxin content than the average levels, 28% was higher than the average toxin contaminations. It is very important that producers are familiar with this potentially damaging disease and protect appropriately their crops.

FIRST RECORD OF *DACTYLOGYRUS VASTATOR* (NYBELIN 1924) (MONOGENEA: DACTYLOGYRIDAE) IN COMMON CARP (*CYPRINUS CARPIO* LINNAEUS, 1758) FROM AQUACULTURE FACILITIES IN MACEDONIA

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The representatives of the class Monogenea are of great importance in fish pathology. *Dactylogyrus vastator* (Nybelin 1924) (Monogenea: Dactylogyridae) is a common pathogenic monogenean parasite in common carp (*Cyprinus carpio* Linnaeus, 1758) from freshwater lakes and cyprinid ponds, worldwide. In our study, a total of 133 specimens of common carp from cage culture system on Mladost Reservoir (Macedonia) were subjected to a parasitological investigation, by seasons. Only fresh fish were subjected to routine identification, dissection, and observation methods. Parasite identification was performed morphologically, based on the character of significant organs, using referent keys for determination. *Dactylogyrus vastator* was found in winter, on gills of 27 specimens of common carp, with a prevalence of 2.818%, and mean intensity of 6.850. During our research, the presence of *Dactylogyrus vastator* was determined in an aquaculture facility with very high fish stock density. Whether this parasite would lead to fish mortality, depends primarily on the mean intensity, the fish condition and size, as well as the water temperature and oxygen content.

Our findings of *Dactylogyrus vastator* in common carp are first recorded in Macedonia, and the common carp is a new host for this parasite species in Macedonian waters.

ISOLATION AND IDENTIFICATION OF EPIPHYTIC AND ENDOPHYTIC FUNGAL AND BACTERIAL STRAINS FROM SWEET POTATO PLANTS FOR THE DEVELOPMENT OF FOLIAR FERTILIZER

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One of the main problems we face today is the increasing global chemical pollution and its harmful consequences. In addition to industry, agricultural activities also release significant amounts of chemicals (e.g., pesticides, fertilisers) into the environment. Therefore it is important to find ecological and sustainable solutions for both industrial and agricultural production. One of these potential options in agriculture is the use of biological crop protection, including biocontrol agents (BCA). In plant biology, those microorganisms are called biocontrol agents which are able to suppress plant pathogens in some way and, in favourable cases, can even stimulate plant growth. There are many examples of biocontrol agents among bacteria and fungi. The aim of our research is the characterization of new fungal and bacterial strains with good biocontrol capabilities.

In the frame of this, we isolated more than 150 fungal and bacterial strains from the surface (epiphytes), plant tissues (endophytes) and rhizosphere of sweet potato (*Ipomoea batatas*) plants from different plantations. Among them, about 50 isolates have been identified by sequencing and subjected to various ecophysiological tests (temperature and pH optimum, water activity test, enzyme activity measurements). We are currently working on detailed studies of some *Bacillus licheniformis* strains (selected after, e.g., siderophore production, *in vitro* confrontation tests, depsipeptide production capacity) and also isolation work is ongoing from further sweet potato samples.

Our long-term objective is to create a high depsipeptide content foliar fertilizer formulation stabilised with chitosan nanoparticles using fungal and bacterial strains with biocontrol capabilities, which we would like to test extensively in greenhouse and field conditions.

CRITICAL ASPECTS OF DEVELOPING INTEGRATED PEST MANAGEMENT TO MANAGE CEREAL LEAF BEETLE *OULEMA MELANOPUS (*L) – A LITERATURE REVIEW

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The cereal leaf beetle (CLB), *Oulema melanopus (*L.) (Coleoptera: Chrysomelidae) is an Eurasian pest damaging a range of cereal crops including wheat, oat, and barley. Management of this pest and control intervention decision require information on the temporal and spatial dynamics of the population.

As for the temporal aspect, *O. melanopus* population densities have two distinct peaks. The first peak of adult occurrence is in April corresponds to the number of insects emerging from overwintering sites. The second peak of adults at the beginning of May resulted from the development of eggs laid on cereal crops and other grass plants in the spring.

As for the spatial aspect, both inter- and intrafield heterogeneity are known in the population of *O. melanopus* in different life stages. Adults have a high aggregation rates at field edges of adjacent habitats. However, aggregation patterns of eggs, larvae, and adults at larger field scales, does not have an edge effects and indicated colonization of interior field.

The most important mortality factors in CLB populations; competition among individuals, the availability of predators and parasites, which is affected by the density of *O. melanopus*, and plant morphology vis-à-vis different cereal crop species. Moreover, abiotic environmental factors such as wind, temperature and humidity.

Our presentation we will give information about CLB behavior, population dynamics, spatio-temporal distribution and how it affects the distribution of natural enemies based on literature review. These information may contribute to the development of a successful integrated pest management protocol, to meet today's IPM requirements.

ECOTOURISM – POSSIBILITY OF SUSTAINABLE DEVELOPMENT OF THE WESTERN AREA OF ROMANIA

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In the last period, we become increasingly aware of the complexity, fragility, and priceless value of our planet. Sustainable tourism develops the idea of meeting the needs of current tourists and the tourism industry and, at the same time, protecting the environment and opportunities for the future. It is taken in consideration the satisfaction of all needs of the "actors" from tourism activity. The place of tourism in sustainable development is logically given by its role as an industry that sells the physical and human environment as its product. Tourism is one of the industries that must be involved in sustainable development, as a resource industry, dependent on the endowment of nature and the cultural heritage of each society.

On the territory of the Western Area of Romania there are ecotourism resources represented by the 138 natural reservations of national interest, distributed as follows: 53 in Caras-Severin County, 42 in Hunedoara County, 20 in Arad County, 23 in Timis County. The development of the western area has been influenced and continues to be supported by the important natural resources existing in this region with diverse relief, which includes the particularly fertile plains from the west of Timis and Arad counties, hilly areas with important mineral resources, and an important segment of the Southern and Western Carpathians, which includes one of the most important natural parks from Europe, the Retezat National Park.

So therefore ecotourism can be an alternative to traditional, classic tourism, as well as to the standard tourist offer.

EXTENSIVE MANAGEMENT SYSTEM ENHANCES MARKETABLE YIELD OF TOMATO LANDRACES

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Landraces are valuable part of World agricultural heritage, however, the production of them requires compromises from consumers in terms of visual characteristics. In contrast with that of modern varieties, their so-called untouched genetic background still contains traits which contribute to the development of serious abiotic disorders; this characteristic severely ruins their marketability. In the past, these landraces were managed by extensive cultivation practices without any drastic intervention to the vegetative development of individual plants.

In the present study, a previously developed and tested extensive cultivation system was applied on three Hungarian tomato accessions (‘Cegléd’, ‘Mátrafüred’, and ‘Gyöngyös’) to compare the impact of pruning on the qualitative and quantitative yield parameters. For this, an experiment was set up in 2019 at the Experimental and Educational Field of Hungarian University of Agriculture and Life Sciences, Soroksár, Budapest. The main elements of the system are a manure layer on the soil, woven plastic fabric soil coverage, 2×2m plant spacing, and wooden frames for the support of tomato plants. The cultivation was done without any irrigation or additional nutrients. The results showed that the yield of ‘Gyöngyös’ is less influenced by pruning, while ‘Cegléd’ and ‘Mátrafüred’ showed nine- and fourteen-fold higher marketable yield, respectively, when not pruned in the applied extensive system. On the other hand, the weight of infected fruits was 2-5 times higher, possibly due to denser plant foliage. Nutritional analyses and replication of the open-field experiment will follow the present results.

YIELD TRIALS, FIELD PERFORMANCE AND QUALITY INVESTIGATIONS OF ANCIENT HEXAPLOID, TETRAPLOID AND DIPLOID WHEAT GENOTYPES

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Cereal Research Non Profit Co. Ltd. Szeged

In line with the commercial wheat production of conventional agriculture, recently there is an increasing need for new resources to produce health-promoting products by modern food industry. Due to their special ingredients, lines of ancient wheat species might be valuable resources for these purposes. Agronomical practices and the productivity of these lines grown by the current technology is widely unknown.

The goal of this 4 years experiment was to select proper lines or biotypes from the *T. spelta, T. sphaerococcum, T. vavilovii, T. dicoccon, T. turgidum, T. polonicum, T. turanicum, T. persicum* and *T. monococcum* ancient wheat genotypes which may be produced economically by farmers using currently usual agronomical processes and their high quality grains are adequate for the above goals. Based on the results of four years experiments at two locations, and phytopathology tests under provocative conditions one promising line of *T. spelta* was selected for further studies and breeding efforts. Also other candidates with special composition performance were found among *Triticum persicum* and *Triticum turgidum* species.

According to several studies, the ancient *Triticum* species show healthier nutritional profiles than the modern cultivars of bred species, some of them have remarkable functional features. We have tested the milling and flour quality of 30 strains (9 hexaploids 19 tetraploids and 2 diploids) and 2 spelt variety candidates which were grown in a series of field trials for 2 years in Szeged. We have found significant difference in thousand kernel weight, hardness index, and protein content, falling number value and wet gluten content between the genotypes, where the values were sometimes quite extreme. The year effect was significant in case of grain physical properties and falling number, and slightly effected the quantity and quality of proteins as well. Significant variability between species also manifested in *farinograph* properties. In the case of soluble and insoluble dietary fiber content, similarly to common wheat, we measured high values and found some species where low *fructan* content values were obtained. This proved that among these ancient species consists a potential for healthier food production. The results provide-with agronomic properties as well- information for the breeders, which genotypes are suitable and worthy to include them in breeding programs.

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DIELECTRIC MEASUREMENTS FOR MONITORING DAIRY TECHNOLOGY PROCESSES

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Dielectric properties of milk has been well studied, however, there are just few researches about analyzing dielectric behavior to monitor processes of dairy technology. In our study, the change of dielectric constant and dielectric loss factor were measured during chymosin-inducted coagulation of cow milk, and the ripening period of Trappist cheese and Bácskai kneaded cheese. The dielectric measurements were carried out using open-ended coaxial probe technique in the frequency range of 200-2400 MHz. The enzymatic coagulation was monitored by measuring relative viscosity. During cheese ripening, texture profile analysis and instrumental color analysis were also applied to determine whether the changes of dielectric properties are correlated with the physico-chemical changes.

Our results show, that dielectric parameters increased tendentiously with frequency during the enzymatic coagulation. The process was detectable by observing that the significant increase of dielectric constant broke, when the viscosity growth of the forming gel structure appeared. As a function of ripening time, the dielectric constants decreased for Trappist cheese, while increased for kneaded cheese. The hardness, the adhesive force and the difference of dielectric constants determined between the rind and the center of the cheeses reached maximum or minimum values on the same day of ripening period. Moreover, linear correlations were observed between the dielectric constants at specific frequencies and the averages of color coordinates. Our results verified that the rapid, non-destructive and chemical-free dielectric measurement method has great potential to determine the optimal time period of dairy technology processes.

DEVELOPMENT POTENTIAL AND THE LEVEL OF INVESTMENT EXPENDITURE OF RURAL COMMUNES OF EASTERN POLAND IN 2010-2019

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Local development is a process of quantitative and qualitative changes in line with the needs of the local community. The problem in its implementation is the level of financial resources available to municipalities. The assessment of the financial situation was made on the basis of a synthetic measure determined by the Technique for Order Preference by Similarity to an Ideal Solution method. The study covered 484 rural communes in the region of Eastern Poland in 2010-2019. Empirical data was obtained from the Local Data Bank of the Central Statistical Office. Eastern Poland is an area with a low level of development in Poland and in the European Union. The financial situation are determined both by financial, economic, infrastructural, environmental and entrepreneurial variables. The synthetic measure of development ranged from 0.35 to 0.64 in 2019 and from 0.34 to 0.60 in 2010. In 2018, the level of investment expenditure in total expenditure was from 0.00 to 0.47, in 2010, from 0.01 to 0.47. The development process and investment expenses were influenced by, among others birth rate, net migration, the number of the unemployed, the level of own income, economic entities. Poviat authorities should take care to improve the economic potential, which will increase the attractiveness of the area and attract new entrepreneurs and improve the quality of life of the inhabitants. The undertaken activities should focus on achieving social, economic and spatial cohesion. The obtained results may be an important source of information for local government authorities on disproportions between units.

RESEARCH ON LEG TAGS IN GOAT BREEDING FOR ELECTRONIC IDENTIFICATION PURPOSES*

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This study is on the fall and readability of electronic leg tags, plastic ear tags and electronic ear tags used in 2 flocks of goats. Honamlı and Turkish Hair goat flocks were followed for 4 months and bred under different conditions. While the flock of Honamli goats went to pasture every day, the Turkish Hair goats remained indoors. It was found that the leg tags fell from 5 goats in the Honamli flock (96%), while none fell in the Turkish Hair flock. Plastic ear tags attached to goats were found to have fallen from 11 goats (92%) in the Honamli flock and 7 goats from Turkish Hair goat flock (90%). The readability of electronic leg tags, plastic ear tags and electronic ear tags used in goats for 4 months was determined as 100%. It is useful to carry out research on the use of electronic leg tags as an alternative option for goat breeding for identification purposes, with different trial groups formed on animals of different ages and different legs.

RESEARCH ON THE GROWTH OF KIDS IN GOAT BREEDING WITH GOOD FLOCK MANAGEMENT: PILOT VILLAGE BEŞKAVAK MODEL*

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This study was carried out to demonstrate the effect of "Good Flock Management" on the growth characteristics of goats. Studies conducted in the province of Burdur in Turkey under "Focused District Development Project". Goat flocks were in Beşkavak village which was selected as a model village, were used in the study. The study was carried out in 2019 in two goat flocks. The birth weights of the male and female kids were determined as 4.04 kg and 3.58 kg and 4.09 kg and 3.52 kg respectively for the first and second flock. On the90th day of the first and second flock, the live weight values of male and female kids were determined as 17.68 kg and 14.17 kg and 19.81kg and 16.94 kg respectively. Single born kids' live weight value on the 90th day in flock 1 determined as 15.85 kg.

CONFLICTS AND COOPERATION BETWEEN NATIONAL PARKS AND FARMERS – A CASE STUDY FROM KISKUNSÁG NATIONAL PARK

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National parks and other forms of protection ensure the natural values in Hungary. However, a significant part of protected areas is under agricultural cultivation which forces cooperation between the two sectors. In our work, we identify the policy, institutional and sectoral changes, examine their effects, and the conflicts that accompany them by exploring the area of Kiskunság National Park (KNP). Based on document analysis, in-depth interviews, and GIS processing, we present the main reasons for the counter-interest between the sectors. We found that agricultural subsidies have an essential influence on nature conservation in Hungary because the lobbying capacity of producers has been strengthened and they maintain agricultural production in areas with the worst agricultural suitability and high natural value. As a result, experts believe that conservation's "playing field" has been reduced in recent years, and agriculture became determinative of what is happening in the landscape. Of course, the subsidy system has positive effects too such as the stabilization of land use in protected and Natura 2000 sites. But our results also draw attention to the fact that processes in the vicinity of protected areas have a significant impact on them. Therefore, comprehensive policy coordination and complex spatial planning are needed to achieve sustainable land use in our protected areas. From an institutional viewpoint, the KNP has less and less influence on the landscape management of protected areas so the cooperation between the two sectors needs to be improved and they should be treated as equals and independent of each other.

ANALYSIS OF MC1R PIGMENTATION GENE IN THE HUNGARIAN POPULATION OF GOLDEN JACKAL (*CANIS AUREUS*)

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The golden jackal (*Canis aureus*) is a widespread opportunistic mid-sized canid, distributed throughout Southern Asia, Middle East and South-Eastern and Central Europe. European populations have undergone significant population changes in recent decades. The melanocortin-1 receptor (MC1R) is one of the most important genes in melanin synthesis and is the most widely studied pigmentation gene in wild population of mammals. The aim of this study was to detect whether the well-known white (Arg306Stop) and the melanistic mask (Met264Val) non-synonymous coat colour mutations of the dog occur in the Hungarian golden jackal populations, or not. Muscle tissues were obtained from free-ranging animals legally shot between 2004 and 2016 in Hungary. Samples were analyzed by a PCR-RFLP method using *Nla*III and *Eco*47III restriction sites. Two out of thirty-two individuals with phenotypically visible melanistic mask were heterozygous (6.25%) and one was homozygous (3.13%) for Met264Val variant, which resulted 0.06 observed (H_o) and 0.17 expected (H_E) heterozygosity. Furthermore, also two out of twenty-five individuals with white coat were heterozygous (8%) and one was homozygous (4%) for Arg306Stop variant, which means 0.08 observed (H_o) and 0.22 expected (H_E) heterozygosity. This study demonstrated that the white coat colour and the melanistic mask also occur in the Hungarian golden jackal population, which have been presumably transmitted from dogs. „SUPPORTED BY THE ÚNKP-20-3-II-SZIE-7 NEW NATIONAL EXCELLENCE PROGRAM OF THE MINISTRY FOR INNOVATION AND TECHNOLOGY FROM THE SOURCE OF THE NATIONAL RESEARCH, DEVELOPMENT AND INNOVATION FUND."

THE VULNERABILITY OF SMALL BUSINESSES IN TIMES OF CRISIS

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Small and medium-sized enterprises have a key role in the functioning of local, regional and national economies. SMEs are the backbone of the economy and before the pandemic they generated more than half of the European Union's Gross Domestic Product. But, to the same extent, SMEs are the most vulnerable to shocks. The paper aims to analyze at the level of the European Union the behavior of small businesses in the face of the COVID-19 pandemic, as a global shock. The pandemic has had a major impact on SMEs, leading to the closure or drastic reduction of the activity of many small family businesses. The collapse of SMEs in many vulnerable sectors (tourism, HoReCa, entertainment, gyms and others) has a major impact on the economy and the standard of living of their employees.

THE ROLE OF THE ORGANIC FARMING IN RURAL DEVELOPMENT IN LAST DECADE

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After the booming performance of organic farming in the world, one would rightly expect it to play an increasingly important role in rural development. This could be the case, but the Hungarian experience shows otherwise. Its development has stagnated, or it is the small farms that do well in elite markets or the larger export units that exist. This division in turn shows that it is not fulfilling the role it was intended to play decades ago. However, as a forward-looking production method in principle, with the right support system it can not only be an attractive sector for a small group of producers supplying a narrow elite, but can also be a good example of rural development and sustainability. With the right support for the supply side (seeds, land, dissemination of production methods, training), it could develop into a production sector that could be more widely used, thus providing consumers with a greater quantity and variety of healthy food, not only in rural areas. The aim of the study is to present the last decade of Hungarian organic farming, its main trends, characteristics and reasons for stagnation. It will provide producers and traders with suggestions on how more products can reach domestic consumers at affordable prices.

THE CONNECTION BETWEEN STORAGE AND QUALITY OF MEADOW HAY

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The practical application of hay quality is of particular importance in Hungarian beef cattle and horse farming. Due to the high price of protein and supplementary feeds on the international market, it may be a worthwhile alternative to base the demand for feedstuffs exclusively on high feed value meadow hay. To do this, it is necessary to be aware of the daily variation in quality and quantity. Following the good practice guidelines both livestock farming and product marketing can be planned. Our recommended solution is focusing on quality reservation. The presented technology (ventilation, dry floor, large air space) guarantee the conservation of the genuinely high value hay. Strict protocol must be applied (mowing at the right time with conditioner, forage sampling for digestible fibre content). After stacking, bale temperature increases during the first 5 days up to 41℃. Then the next 8 days a stagnant trend is seen. At the final stage, core temperature stabilizes at 30℃. Preventing caramelization and hay stack fires are priorities for every farmer.

DIELECTRIC MEASUREMENTS AND MICROWAVE PRE-TREATMENTS FOR ENHANCED BIODEGRADABILITY OF WASTEWATER AND SLUDGE

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Microwave irradiation is a promising pre-treatment method for improving sludge stabilization, but there are few studies focusing its effect on organic matter solubility and aerobic biodegradability of wastewater and sludge originated from food industry.
In our researches microwave irradiation was applied standalone and in combination with alkaline treatment to enhance the solubilisation and biodegradation of organic matter content of meat industry wastewater and municipal sludge, respectively. Furthermore, the energy efficiency was calculated, as well. The total and soluble chemical oxygen demand (TCOD, SCOD) was determined photometrically. For the characterization of aerobic biodegradability, biochemical oxygen demand was measured in respirometric BOD meter. Mesophilic anaerobic digestion tests were carried out to investigate biogas production. To detect physicochemical changes, dielectric properties of wastewater and sludge were determined in the frequency range of 200-2400 MHz by an open-ended coaxial probe.
Our experimental results have revealed that the most efficient pre-treatment process from energetically aspects to increase the organic matter solubility and biodegradability of wastewater and sludge were the lower power and energy intensity microwave-alkaline treatments. Moreover, a strong linear correlation was found between the solubility of organic matter (SCOD/TCOD) and aerobic biodegradability (BOD/COD) and the ratio of dielectric constants measured at the frequency of 300 and 2400 MHz in both treated materials, respectively.
Based on our results, dielectric measurement is a suitable method to predict real-time the improvement of biodegradability, and can be considered as a promising method to estimate the efficiency of sludge pre-treatment methods.

SPECTROPHOTOMETRIC DETERMINATION OF TOTAL STEROLS IN MARGARINE

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Cholesterol as an animal sterol is a precursor of vitamin D3, steroid hormones and bile acids. It is mainly found in food of animal origin. Usually, on food labels you can find information about total and saturated fats but not so often the cholesterol amount. Cutting off butter for health reasons, people use margarine which is cholesterol free but rich in phytosterols. In our research we tried extraction of total sterols from margarine. The protocol started with direct saponification with 1 mol/L methanolic NaOH solution for 15 minutes. After that we added 10 mL deionized water and 1 mL 96% (*v/v*) ethanol and carried out extraction twice with solvent mixture of n-hexane: chloroform (1:1, *v/v*). The moisture was absorbed with anhydrous Na_2SO_4 crystals, filtered and evaporated until dry in room temperature. The formed residue was dissolved in chloroform. Spectrophotometric determination of total sterols was performed with Liebermann – Burchard (LB) method mixing the sample and standard solutions with LB reagent, consisted of acetic anhydride and concentrated sulfuric acid. The dark green product developed after 90 minutes was recorded in 420 nm wavelength. The method showed linearity in analyzed concentration range 0.5 to 0.02 mg/mL (R^2=0.995). Based on LB method, total sterol content in margarine was estimated upon constructed calibration curve and its value was 0.257 mg/mL or 51.4mg/ 100 g sample. The method is simple, cost-effective and sensitive. It is an alternative method to more expensive chromatographic methods.

BUSINESS IMAGE AND STRATEGIES IN ROMANIAN AGRITOURISM

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Business / corporate / organization image is a paramount when it comes to improve a company's desirability as a borrower, client, customer, employer, supplier, etc. The most important strategies to build up corporate image are creating a website, creating straightforward, easy-to-understand pricing, designing the business image, doing a referral exchange, encouraging personal recommendations, listing creatively and widely, maintaining a customer database, maintaining good employee relations, making a marketing plan, making the business look good, naming and branding, and using the press. The paper presents the most important features of these strategies illustrated by three Romanian agritourism guesthouses.

Companies use various corporate advertising techniques to enhance their image in order to improve their desirability as a borrower, customer, employer, supplier, etc. Business image needs developing and managing for the following reasons: creating good identity for the employees, thus leading to their satisfaction; enhancing corporate competitive advantage, thus leading to higher profitability; establishing a corporate goodwill for the organisation; influencing investors and financial institutions; promoting favourable relationship with the community in the environment the organisation operates to avoid difficulty in recruitment, selection and maintaining the employee morale; promoting good relationship with the government, opinion leaders and various interest groups; stimulating sales, thus influencing customer loyalty.

GENETIC DIVERSITY OF FIELD PEA GENOTYPES ASSESSED BY MORPHOLOGICAL AND MOLECULAR DATA

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Peas are one of our most ancient and important legume crops. They play an important role in both human consumption and animal nutrition. They provide an excellent source of protein and nutrients. In our work, 13 microsatellite (SSR) markers were used to identify the genetic variability of 23 field pea genotypes. In our study, the 13 SSR markers we selected showed a high degree of polymorphism. The average PIC was 0.8116. The genetic distance data for the samples were between 0.1267 and 0.2800 according to the Jaccard matching coefficient. After the construction of the UPGMA dendrogram, three main clusters were separated. The results of our marker studies were supported by morphological data obtained during field cultivation of selected samples.

INFLUENCE OF FOLIAR FERTILIZATION ON YIELD AND GRAIN QUALITY OF CORN

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We examined the influence of foliar fertilization on the yield and grain quality of corn in 2018. The experiment was set in three replications, random blocks on the area of Tangazdaság Ltd. in Hódmezővásárhely. The soil of the experiment was meadow chernozem. We sprayed out three different foliar fertilizer products individually and combined with each other as well, so there were six treatments and the control to be examined. The year 2018 was not favourable for corn production. In 2018, the amount of precipitation in the vegetative period of corn was lower by 54.2 mm than the average. The monthly average temperature in the vegetative period of corn was higher by 4 °C than the average of several years. We evaluated the obtained data by single factor analysis of variance. We obtained 10.33 t/ha in the control treatment, and with the foliar fertilization the yield ranged between 10.52-11.40 t/ha. The foliar fertilization products increased the yield of corn, but this difference was not significant. By the application of foliar fertilization, the crude protein and starch content of corn grain did not changed significantly. Our scientific results showed, that the foliar fertilization has positive effect on the yield of corn and small effect on the examined grain quality parameters.

EXPECTATIONS AND EXPERIENCES WITH GEOGRAPHICAL INDICATION IN THE CASE OF NAGYKUN RICE

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With various producer subsidies and consumer information, at least a part of the European rice market can be independent of the Asian market. The consumer encounters more and more information on the packaging of food products, among others, the GI label. Geographical Indications contain information about both the origin of the food and the quality associated with the origin. The Nagykun Rice Consortium in Hungary aimed at the EU geographical indication to highlight the values of Nagykun rice. There were several reasons for the demand for PGI designation. According to the 2013 Land Act, companies with GI products are entitled to pre-emption, so one of the reasons was to keep the lands or buy new land easier. Secondly, they had been using organic label for several years, so they were also aware of the marketing opportunities of the new label. Important features of Nagykun rice for consumers are the extremely low level of arsenic and the fact that the product is 100% gluten free. Since the introduction of the organic label increased the price, producers can hope that the PGI label can also increase it among conscious consumers in long-term. The PGI registration process itself is relatively long, but the government agencies have proven to be supportive and helpful. The case of the Nagykun Rice Consortium can be a good example not only for other rice producers, but also for producers of other agricultural products.

ANTIMICROBIAL ACTIVITY OF NATURAL PHENOLICS AGAINST FOOD SPOILAGE YEASTS

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Plant polyphenols represent a class of natural products important in plant defense against microbial pathogens. Such natural compounds have been shown to exhibit antimicrobial properties against spoilage microorganisms. In this study, we investigated the growth, biofilm formation, and adhesion inhibitory properties of different classes of phenolic compounds against spoilage yeasts, namely *Pichia anomala*, *Saccharomyces cerevisiae*, *Schizosaccharomyces pombe*, and *Debaryomyces hansenii*. Most tested phenolics significantly inhibited the planktonic and biofilm growth of yeasts. Cinnamic acid and vanillin exhibited the highest antimicrobial activity on the yeast strains. Cinnamic acid inhibited the growth of all studied yeasts by >90% and it showed 87% eradication activity against the *S. pombe* biofilm. Vanillin had >90% growth inhibition in *D. hansenii* and *P. anomala* and 97% biofilm inhibition in *D. hansenii*. In *S. pombe*, checkerboard assay showed 16- and 4-fold reductions in MIC of (–)-epicatechin and cinnamic acid, respectively, in the presence of vanillin. For vanillin and (–)-epicatechin combination, synergy was observed at 1 mg/ml vanillin and 0.25 mg/ml (–)-epicatechin concentrations, while it was occurred at 1 mg/ml vanillin and 0.125 mg/ml cinnamic acid concentrations in the mixture of vanillin and cinnamic acid. Fluorescence microscopy analysis revealed the disruption of the biofilm matrix by the phenolics. These findings suggest that natural phenolics can be crucial interventions against food spoilage yeasts. This research was supported by the NKFI FK 134886 and connected to the project GINOP-2.3.2-15-2016-00052.

REDUCING MICROBIAL GROWTH AT SLICED MORTADELLA WITH ɣ-IRRADIATED BLACK PEPPER

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Mortadella (bologna-type) sausage represent quality meat product on the European market. During shelf-life deterioration changes occur. What was really important for this study, was evaluating the possibilities for reducing of microbial growth at sliced mortadella, with adding adding treated black pepper with gamma irradiation (9 kGry), stored at household conditions (100 g. sliced portions, packed in normal polyamide/polyethylene cases at 4±2˚C).

Microbial analysis of black pepper, showed significant differences of microbial population expressed as total cell count of bacteria (cfu/g), at irradiated samples microorganism weren't detected, compared to normal non treated black pepper were we obtained initial $1x10^5$ cfu/g.

Sampling analyses for sensory evaluation and microbiological determination, were four times during fifteen days at 0,5,10 and 15^{th} day of storage. Sensory evaluation results, showed that irradiation does not had unpleasant impact on aromatic components of black pepper and after 10 days of storage samples contain irradiated black pepper showed higher ($p<0,05$) results in appearance, hardness and juiciness. Obtained results of microbiological analyses showed that trend of significant lower amount of TVC at mortadella slices prepared with ɣ-irradiated black pepper, continued during storage.

Irradiation treatments of black pepper used in meat processing industry are alternative that need to be considered for decreasing microbial growth during household storage. In our study we obtained, reduce of microbial growth, which can be indicator for better sensory parameters, and it can also extending shelf life.

INVESTIGATION OF THE EFFICIENCY OF TRAPPING OF HOODED CROW AND MAGPIE IN A LOWLAND HUNTING AREAS

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The depletion of crows has always played an important role in game management, but their numbers and the resulting damage are still a problem for most hunting companies today. Their numbers show an increasing trend, as evidenced by estimates and table data. The number of the hooded crow and magpie is also increasing in the inhabited areas.
Hypotheses: Each trap type is at least 95% selective. The Larsen trap is mainly for the magpie, while the Swedish and ladder trap is more suitable for the hooded crow. Trapping with traps is more effective than armed reduction. Trapping is a cost-effective method.
To support the hypotheses, I performed trapping activity with different types of traps in two periods. I used traps in several locations on different habitat types. In order to investigate the effectiveness of armed reduction, I also reduced the crows with a weapon in the two studied periods, and then I compared these results with my trapping results. To examine cost-effectiveness, I recorded the costs of trapping.

STRUCTURAL CHANGE OF THE MAJOR FIELD CROPS IN THE AGRICULTURE OF THE SOUTHERN GREAT PLAIN

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The most important natural resource of Hungary is the soil. Soil types, physical conditions, quality of the fields and topographic conditions are prosperous for agricultural production. About 80% of the territory of Hungary is arable land, which includes forests, reeds, fishponds and agricultural areas. Different production structures have developed in different parts of the country, depending on natural geography and cultural factors, which vary over time from region to region. During the research, I investigated how the production area and average yields of the four most important and highest production values crops in the Southern Great Plain have changed between 2000 and 2019. I used one-way analysis of variance (ANOVA) to determine whether the share of the cultivated areas of the studied field plants differs significantly in the main regions of the country. I also examined the trends in the share of wheat, rapeseed, sunflower, and corn acreage in the nationwide cultivated production areas. The databases of the Hungarian Central Statistical Office were used for the analysis. In the Southern Great Plain, the share of the four main field crops in the nationwide cultivated production areas do not show a significant change over time, so each field crop maintains its share in the examined 20-year period (2000-2019) and it is expected in the future as well. Applying the ANOVA and Tukey test, I found that only the sown area of wheat and sunflower by region did not show a significant difference. The distribution of land by cultivation branches has not changed markedly in the Southern Great Plain since 2000. The most significant change occurred in rapeseed harvested areas: it increased by 2.8 times in 2019 compared to 2000.

IMMOBILIZATION OF FUNGAL LIPASES ON ACCUREL MP1000 HYDROPHOBIC SUPPORT

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Lipases are widely used biocatalysts in the industry due to their ability to catalyse triacylglycerol hydrolysis, and trans- and interesterification reactions in eco-friendly way. The main limitations of their application are the moderate stability and the difficulties in the enzyme recovery. Immobilization of enzymes can improve their stability even under harsh reaction conditions, as well as allow the recovery and reusability in several reaction cycles. Among immobilization techniques, one of the most efficient method is the adsorption onto hydrophobic matrices such as the polypropylene Accurel MP1000. When this matrix is used as a carrier, a selective hydrophobic interaction can be established between the enzyme and the porous support. In this work, the commercial *Aspergillus niger*, *Rhizopus oryzae*, *Rhizopus niveus*, *Rhizomucor miehei* and *Candida rugosa* lipases were immobilized onto Accurel MP1000 support. We optimized the adsorption by changing the binding conditions (pH, temperature, time, enzyme volume). In addition, treatment of the enzyme-carrier complexes with 1-3% glutaraldehyde was also examined. Immobilization efficiency calculation indicated high affinity between the lipases and the hydrophobic surface. Biochemical characterization assays revealed improved stability of the immobilized lipases compared to the free enzymes. Glutaraldehyde treatment provided elevated stability for the enzyme-carrier complexes. The reusable biocatalysts developed can contribute to economical catalysis of industrial processes. This research was funded by the NKFI FK 134886 and connected to the project EFOP-3.6.1-16-2016-00008. A.K. is supported by the ÚNKP-20-4 New National Excellence Program of the Ministry for Innovation and Technology from the source of the National Research, Development and Innovation Fund.

MEAT QUALITY PARAMETERS AT DOMESTIC TURKEYS FED VARIOUS DIETARY RATIONS

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With respect to other poultry species, turkeys belong to the largest poultry and the best producers of high-quality poultry meat, because it contains a high percentage of protein, especially essential amino acids and low fat content.

Turkeys that have been taken as research material originate from the domestic breed of turkey (white and black). A total of 30 heads of turkeys was grown under the so-called indoor keeping system in Pelagonia region, North Macedonia. The aim of the research was to determine the differences in the body weight in the period of 10 - 90 days and the slaughtering characteristics of turkeys fed with two different rations in relation to the origin of feed proteins (group R - fed with fish flour and group S - fed with whey powder).

An analysis of the chemical composition of the large breast muscle (Musculus pectoralis superficialis - MPS) was also performed on samples of the two groups of turkeys. Statistics (ANOVA) on turkey growth (10-90 days) show significant differences in body mass between the two groups of S and R for different feeding intervals ($p < 0.05$).

The results of the examinations of the chemical composition of the MPS showed higher values for protein and fat in the meat of turkeys fed with whey powder and were (protein 25% and fat 8.67%) compared to the values of turkeys fed with fish flour and were 23.27 and 6.5% respectively. At the same time, protein and fat values were significantly different ($p < 0.05$) among the groups.

DEVELOPMENT OF EXPERIMENTAL AGROFORESTRY SYSTEMS ALONG IRRIGATION DEVELOPMENT AND FORESTRY RESEARCH GOALS

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In Hungary, agricultural professionals, researchers and farmers alike have to face worsening drought damage, inland excess water inundation and the consequences of multiple soil degradation, which make farming conditions more difficult as a combined consequence of climate change and anthropogenic impacts. The aim of our research is to provide an alternative option for farmers to irrigate reused water (in case of temporary or regional water shortage), which would not otherwise meet the requirements in terms of soil protection based on water quality recommendations. One of the objectives of the project is to promote the irrigation utilization of reused waters, especially for waters with high Na concentrations (> 500 mg/l), to promote the function of agroforestry systems in agricultural production in the context of changed climate and water scarcity as well. The co-cultivation of woody plants and arable crops has a positive effect on, among other things, the microclimate, thereby having a positive effect on crop production. The aim of the research is to investigate the role of agroforestry systems in the light of agrometeorological factors and the preservation and improvement of biomass production and soil quality. The international significance of the project is demonstrated by the fact that the research topic is related to SDG6-12-13-15 sustainable development goals. The diversity of the project, which results from the complexity of the researches' goals covering each slice of the biosphere, hydrosphere, lithosphere and atmosphere, requires that the topic have dealt with consortium level (the Hungarian University of Agriculture and Life Sciences and the University of Sopron).

MACROELEMENT AND SODIUM ANALYSIS OF WILLOW (*SALIX ALBA* L.) IRRIGATED WITH EFFLUENT WATER OF AGRICULTURAL ORIGIN

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Water security is now a global issue and the irrigation utilization of wastewater and agricultural effluents can be an alternative solution. In our irrigation experiment with the effluent of an intensive African catfish farm, macroelement content of the short rotation willow clone at different irrigation water doses was determined. The effluent contains large amount of secreted metabolites, faeces, other organic matter and possibly chemicals. Due to the origin of thermal water, wastewater has a high total dissolved salinity and sodium concentration. The study was set up on a 3ha area at MATE IES ÖVKI in Szarvas in 2014. A candidate variety of the FRI, 'Naperti' (*Salix alba* L.) was used. Two types of irrigation water were used (effluent water and the local oxbow lake of the River Körös). Seven treatments were set up, with one non-irrigated control. Effluent and Körös River water was irrigated with 15, 30, 60 mm doses, respectively. Irrigation was performed on a weekly basis with a micro sprinkler system during the growing season. The sampling took place in 2016 after the irrigation cycle. Different plant parts (leaves, stems, roots) were collected. Nitrogen, phosphorus, potassium and sodium contents were determined. As a conclusion, type of irrigation water did not significantly affect the macroelement content of the plants. However, sodium content of the roots was significantly higher, especially in the case of 30 and 60 mm effluent irrigation.

TRITICALE BREEDING AND RESEARCH FOR QUALITY: RESULTS OF THE LAST TEN YEARS IN SZEGED

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Triticale (x *Triticosecale* Wittmack) is the first man-made cereal, hybrid of wheat and rye, which has been cultivated. Its history only began in the 19th century, and the largescale production started in the last 30 years all over the world. In recent decades, the triticale breeding in Hungary has risen, 14 Hungarian varieties have been released, and these are likely to use in the growing area of about 100 thousand hectares. Our company has a significant role in Hungarian triticale breeding and seed business as owner of five widely used cultivars including the market leader, cv. GK Maros. In our breeding program, the main goal is yield improvement; however, recently, the utilization of this crop has required more concentration in selection procedure for quality traits (feed, food and industrial aspects). We use mainly Mid European hexaploid winter type gene-pool to investigate basic grain physical- (thousand kernel weight, diameter, hardness) and chemical (fibers, protein, starch and minerals) traits as well as technological (falling number, rheology, baking) values. Also, we examine the variation, parent-offspring relationships and the effects of genotype vs. environment on the magnitude of these parameters. The results help to choose new lines and varieties appropriate for economical field production, feeding, industrial usage as well as for human consumption. The results could be a good guidance for further quality improvement during breeding. In the future, new varieties with improved nutritional benefits and more favorable technological characteristics can be developed, which could help to keep the position of the Hungarian varieties in seed market.

UTILIZATION OF *IN VITRO* ANDROGENESIS IN CR LTD.'S CROP BREEDING PROGRAMS

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The importance of doubled haploid (DH) plant production is incontrovertible in modern plant breeding. The methods (chromosome elimination, anther- and isolated microspore culture) serve the quickest way for production of homozygous lines to accelerate the plant breeding and applied research.

CR Ltd.'s laboratory, the improvement of *in vitro* androgenesis of cereals have been in the focus of research for more decades. Nowadays, we use the method of anther culture for DH plant production in cereals (common and spelt wheat, triticale, barley and rice), while isolated microspore culture is under improvement in rapeseed. In the last few years, the flow cytometric analyses have been established in our laboratory, which method offers a quick and simple way for identification of individuals with different ploidy level.

The produced DH lines have been integrated in CR's breeding programmes. After a strong selection system, the best lines can take part in Hungarian national tests (NÉBIH). In 2019, a new DH variety 'GK Déva' have been released based on these results.

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PATTERNS IN THE MULTIVARIATE ANALYSIS OF THE IMPACTS OF ARMED CONFLICT USING LANDSAT IMAGERY

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The analysis of satellite imagery has been used widely to study warfare consequences on the environment; these studies have increased significantly in the last 15 years, becoming an indispensable and accurate tool to understand the reasons behind the conflicts, their consequences and that may support the restoration plans of the affected landscapes.

This article assesses this growing topic to present which is the correlation between conflict-related impacts, geographical location, type of conflict and remote sensing features. Thus, we present a structured approach focused on the assessment of the existing datasets and the analysis of the connection between geographical conditions, causes and the assessment using remote sensing methods in areas affected by warfare. We found; trends, convergence and divergence patterns. Then we consider variables such as biome, forest cover affectation, scale, and satellite imagery sensors to identify the link between conflict drivers with geographical location assessed by remote sensing methods. We collected data from 57 studies from international peer-reviewed journals from 1994 to 2020 that are indexed using scientific search engines. Reviews similar to those presented here can be used to assess the environmental impact of warfare in future conflict affectations on the environment.

EFFECT OF MILKING SYSTEM ON THE MILK QUALITY AND QUANTITY

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We analysed one Holstein- Friesian dairy farm using two types of milking technologies. One of them is a parallel milking parlour (2x8), where 200 cows are milked twice a day. The other part of the animals (500 cows) is milked with robotic milking machine. We processed data from nearly 700 cows. Based on the two different milking technologies, we formed two groups for the calculations. Within the groups, the animals were arranged according to their lactation period (14 months). We collected daily milk production (kg / day), milk protein (% / kg), milk fat (% / kg) and somatic cell count (SCC) (cell number / cm^3) data, based on a monthly test-day. Using the SPSS-26 program, we compared the results of the two groups with an independent T-test.

Each month, there was significantly more milk production for robotic milking (P <5%) compared to conventional milking technology. In the 2nd month of lactation, at the time of peak production, the average milk production of the animals was 43 kg and 37 kg, respectively. The milk protein content was higher in conventional milking. At months 2, 3, 4, and 11 of lactation, the difference was significant. In the month of peak production (month 2): 3.27 and 3.22 (milk protein %). Milk fat% was higher in conventional milking only in months 2 and 3 of lactation, however, this level was significantly higher in the second half of lactation in addition to robotic milking. The somatic cell count of milk was lower each month for robotic milking. This difference was significant for the first 11 months. At 2 months of lactation: 133,000 and 188,000 (number of cells / $cm^{3)}$ (P <5%).

Based on our results, we can conclude that significantly more milk and milk fat can be produced and significantly less the SCC with the robot milking. This technology milk the udder thoroughly, which stimulates the animal to produce more milk. At the end of milking comes the milk with a higher fat content, which can also be increased by thorough milking too.

THE SIGNIFICANCE OF THE HUNGARIAN MAIZE PRODUCTION IN RELATION TO THE COMMON AGRICULTURAL POLICY

Tamás Mizik, Zoltán Máté Rádai

Corvinus University of Budapest

Maize is one of the major crops of Hungary. This can be used in various ways, most notably for human consumption, feeding purpose, and ethanol production that is used as a fuel additive. The major indicator of its market competitiveness is maize yield which varied among the years. This was mostly caused by the weather conditions. The use of more resistant maize varieties, as well as proper amount of fertilizer (especially nitrogen and potassium as active ingredients), would help to stabilize yields. On the sales side, the price determines the efficiency of production. The Common Agricultural Policy plays a key role in this regard as direct payments contributed to the gross revenue of the crop producers by 57.2% on average. The article aims to provide a detailed overview of these issues from 2010 to 2020. Based on our results, we formulated policy recommendations. Regarding maize trade, processing and, therefore, a higher share of value added products would be essential (canned products, gluten, corn germ oil, gluten) on the export side. This would further increase Hungary's agri-food trade surplus as well as create new jobs. However, the exceptional (roughly 47%) price increase in 2021 may not be motivating enough for the different market players.

THE SIGNIFICANCE OF THE HUNGARIAN WHEAT PRODUCTION IN RELATION TO THE COMMON AGRICULTURAL POLICY

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Wheat is one of the most important domestic crops as well as one of the most important cereals. It has a wide range of use, not only for making basic foods, but is also widely used for animal feeding. The most important measure of the market competitiveness of the production is the average yield, which fluctuates strongly from year to year, mostly driven by the weather conditions. Besides, the use of proper seeds and fertilizer, especially nitrogen and potassium. On the sales side, the price determines the effectiveness of production. Of course, the impacts of the Common Agricultural Policy should not be ignored as direct payments contributed to the gross revenue of crop producers by 57.2% on average. The aim of the article is to present these elements between 2010 and 2020 and to formulate agricultural policy recommendations based on the results obtained. The production and export of higher value-added products, such as various durable foods, but at least seed or durum variety, should be a priority of the Hungarian agricultural policy. This could also stimulate the manufacturing industry, which would have a positive employment effect in addition to an even larger trade surplus. However, the tremendous, 30% price increase in 2021 may not encourage the different stakeholders for any changes.

TO LIFT OR NOT TO LIFT SWEET POTATO VINES? – A POSSIBLE ANSWER TO A FREQUENT QUESTION

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Sweet potato is a vigorously growing crop developing roots - even storage roots - from vine nodes touching the soil. Water and nutrients supplied to these roots are considered to be wasted, resulting in a reduced yield of marketable roots. We examined the effect of lifting vines on the yield and marketability of sweet potato in farm-size experiments (ca. 520 plants in 13 rows per treatment, shared between two repetitions) in Sarkad, East-Hungary, in two years. In 2019, the average yield per plant was 570 grams if vines were lifted and 520 grams if not. In contrast, in 2020, lower yield (730 grams) was achieved with lifting and higher (750 grams) without. The differences were not significant. In 2019, the qualification resulted in minor differences between the proportion of 1^{st}-2^{nd} class tubers from the 'lifted' (81%) and the 'non-lifted' (80%) treatments. In 2020, the difference was 77% and 87%, respectively.
Our results give a possible answer to the question: to lift or not to lift the sweet potato vines. As it is statistically revealed, the efficiency of vine lifting is not unequivocal. The difference between the yields achieved with or without vine lifting is not significant and even extrapolated to hectare level, the difference is not more than 1.5 tons Ha^{-1}. This little difference makes the - even not always - beneficial effect and thus the necessity of vine lifting questionable, especially if considering how labor-intensive this activity is.
The research was supported by the "VP3-16.1.1-4.1.5-4.2.1-4.2.2-8.1.1-8.2.1-8.3.1-8.5.1-8.5.2-8.6.1-17" Rural Development Program.

SUSTAINABLE DEVELOPMENT GOALS IN ECOVILLAGES

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In 2015 the Sustainable Development Goals (SDGs) were ratified by 195 countries. To be achieved by 2030, the goals aim to transform our world by leaving no one behind. In 2017 the Global Ecovillage Network investigated how 30 ecovillages from 5 continents already contributed to the UN SDGs. The results were presented on the 2018 High-Level Political Forum (HLPF).

Fascinated by the GEN research outcomes, we examined 17 international Ecovillages. We aimed to understand how ecovillages relate to the UN SDG framework. The research was done with Ecovillages Around the World subject students. Before the analysis, students became acquainted with the SDGs' targets and their implications in different communities. As a preparation for the study, lecturers from six communities presented their activities, good practices and aims through the 17 SDGs.

The research methods were web-content analysis and self-assessment from the ecovillages representatives. As a final step, we compared the results of the web-content analysis with the ecovillages self-assessment.

We found that the researched ecovillages already contribute to most SDGs. Still, many don't know about the SDG framework and do not intend to use it in their communication. The results indicate a communication gap between the global political community and local ecovillages. Both global and local efforts aim to support sustainable development, but there could be vast differences in the interpretation of sustainability. Therefore there is a significant need to establish communication channels and platforms to support the partnership between stakeholder groups working for sustainability at different levels.

TOTAL SAPONIN CONTENT OF DIFFERENT ALFALFA (MEDICAGO SATIVA L.) CULTIVARS CULTIVATED IN FIELD EXPERIMENT

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Saponins are secondary metabolites produced by various plants. These compounds have important role in the defence system. The word saponin refers to a group of different chemical compounds. Basically, sugar conjugates of triterpenoids or steroids are called saponins. Triterpene-type saponins are more specific among dicotyledonous plants, while steroid-type saponins are more characteristic of plants belonging to the monocotyledonous taxonomic group. Alfalfa is a large-scale cultivated and foraged fodder plant in Hungary. In the defence mechanism of alfalfa, saponins also play an important role. However, large amount of saponins can be toxic in animal fodder, especially in the poultry farming and piggery. As a dicotyledonous plant, the alfalfa saponins are mainly triterpenoid type. In our study we measure the total triterpenoid saponin content and leaf stem ratio of field cultivated alfalfa cultivars. Samples were collected from a randomized block design experiment, planted in the Demonstration Garden and Arboretum of Institutes of Agricultural Research and Educational Farm, in Debrecen, in 2018. Three different cultivar were investigated, and the samples were collected three different times of the growing season at growing stage of early flowering, for three years (2018-2020.). Differences were measured in the examined parameters between cultivars and sample collecting time too. These results are useful for the right cultivar selection for fodder production.

ORGANIZATIONAL STRATEGIC MANAGEMENT RESPONSES TO THE CONSEQUENCES OF COVID-19 PANDEMIC

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One consequence of the COVID-19 pandemic is that companies based on traditional value creation logic, even agricultural enterprises, are forced to make such strategic decisions and apply such strategic planning techniques which have not characterised them so far.

This paper points out the different leadership and management methods of traditional and non-linear companies and – with the help of an extensive literature review – it systematizes the changes and new aspects which the companies in question have adopted and copied from the practice of non-linear organizations.

The pandemic has accelerated all the transformation processes which could have already been observed so far too: during the value creation of traditional companies, special sets of functions emerge that are non-linear in their nature. These include the development of adaptation skills, activities focusing on innovation, creativity management, rethinking of HRM, coordinating digital transformation, and the skills needed to successfully respond to an increasingly unpredictable operating environment.

However, the impact of the pandemic is leading companies towards a financial and self-oriented sustainability, which threatens the fulfillment of other sustainability objectives and the spread of a global, holistic approach. The good news, however, is that the emergence of nonlinear dimensions in parallel with traditional organizational processes not only serve the financial survival in the short run, but can also induce long-term efficiency gains.

STUDY REGARDING THE ECONOMIC IMPACT OF WASTE RECYCLING IN TIMIȘ COUNTY

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Romanian legislation regarding the storing and organizing of waste states that, local public administration authorities must provide the necessary space for distinctive waste collection.Research conducted in Timiș county during 2020, in regard to the quantity of recyclable waste shows a rise in interest and attention paid to the proper collection and capitalization of said waste.Considering that Romania is confronting with an extremely low level of proper waste management, with only 13-14% of collected waste being recycled while, the target is 65%, packagings have proved to be a considerable source of capital if, properly recycled and reused, instead of ending up in a landfill.An important role in this process is played by OIREPs, societies with expertise in logistics, that rid producers of the responsibility of waste produced by their packagings by, providing proper acquiring and capitalization of said waste.

There's 3 factors that can considerably contribute to a rise in volume of recycling and capitalization of rubbish:

-increasing garbage collecting taxes;
-making producers more accountable;
-educating the population.

In Romania, selective waste collection has become mandatory since January 1st, 2019, thanks to the waste management system called "Pay what you dump" and, taxes for depositing rubbish at a landfill have risen from 30 Ron/ton to 80 Ron/ton.With a quantity of 1.8-1.9 million tons of packaging introduced on the market annually, societies that specialize in responsible waste transfer have the role of increasing the percentage of selective collection and recycling, thus reaching the goal of 65% recycling rate, proposed by Romania.

STUDY REGARDING ACCOUNTING TREATMENT OF GREEN CERTIFICATES

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Accounting regulations approved through Order 1802/2014 makes remarks regarding the reflection of green certificates in accounting. Green certificates are titles that attest the production of a quantity of electrical energy from renewable sources. These can be traded distinctly from the amount of electrical energy that they represent. A.N.R.E. (National Agency of Energy Regulation) rewards producers of renewable electricity to benefit the promotion of sustainable energy through green certificates. Electricity providers and some producers are required to purchase a number of green certificates on a quarterly basis. They are then required to transmit to the National Agency of Energy Regulation, in the specified format and by the deadline set by them, the quantities of electrical energy for which they need to purchase green certificates, in conformity with law 220/2008. The cost of green certificates is billed separately from the price of electric energy in the invoice sent to the final customers. Providers or producers that do not meet the yearly quota must pay the value of green certificates not acquired in said timespan. According to the ministry's of public finance Order 1802/2014, producers of renewable energy, that benefit from green certificates provided by the transport and system operator must register the green certificates received into their accountings using specific accounting accounts.

THE EFFECT OF DIFFERENT SUBSTRATES ON MORPHOLOGICAL CHARACTERISTICS OF ACCLIMATIZED *BOWIEA VOLUBILIS*

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Bowiea volubilis is an endemic, drought tolerant medicinal plant with large, poisonous, round bulb, twisted, long green stems and inconspicuous flowers. The over-collecting of bulbs (which contains cardiac glycosides) drastically decreased wild populations. Because of the small seed production, low germination ratio and difficult division of succulent, fleshy bulbs (with slow regrowth), *in vitro* studies were carried out in order to multiply the plants effectively. Sterilised segments of bulbs or inflorescence stalks were placed onto Murashige and Skoog (1962) media with different hormones (2,4-D, BA, NAA) and during multiplication, rooting, acclimatization of shoots, hormone-free media, clean subtrates (e.g. peat + sand) were resulted high volumes of plantlets. Before acclimatization, *in vitro* bulbs were cleaned (their roots, shoots removed), and classified into 4 sizes (6-8; 9-10; 11-12; 13-15 mm). We formed a total of 10 groups with 30-30 individuals, distributing the sizes evenly. Four types of substrate (peat, perlite, coconut fiber, sand) and their mixtures of 50-50% were used. Previously we examined three parameters: length, diameter and weight of the bulbs; later the weight of the successfully acclimatized plants, the number and length of roots and leaves were measured. The acclimatization was done in one of the greenhouses of the Buda Arboretum, where the plants were grown with veil foil covering, irrigated every three days, without nutrient replenishment and artificial lighting. Our results showed that plants developed effectively on perlite-peat, sand-perlite and sand-peat mixtures. In these cases, we achieved the largest increases in roots, green parts, bulbs and total weights.

WAXY MILLET *(PANICUM MILIACEUM L.)* CULTIVARS IN UKRAINE

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There are four waxy cultivars (Chabanivske, Zhyvynka, Osoblyve and Alternatyvne) in Ukraine. They have high agro-morphological and grain characteristics. Their grain is of high biochemical quality (the protein content is 13.50-14.0%, the carotenoid content is 4.8-5.6 mg/kg). Chabanivske is susceptibile to 13 smut races: Osoblyve and Alternatyvne mid-resistance to smut. Zhyvinka was showed to be only cultivar with high resistance to 8 smut races (Rs 1, Rs 4- Rs 7, Rs 9- Rs 11). Cultivars Chabanivske and Zhyvynka are grown for amylose-free starch; cultivars Osoblyve and Alternatyvne are also grown for livestock feed. Addition of 2.5% or 5.0% flour waxy flour from Chabanivske to wheat flour improves the bread-making qualities of the latter. The dough extensibility were 129.8 and 108.5 mm, respectively, the P/L ratio the flour strength to 261, without affecting the sedimentation index 32.0 and 30.0 ml, respectively. Bread containing waxy millet flour had larger volume and better palataqbility. The total bread-making scores was higher when amylose-free flour was added to traditional one than for control bread made from pure wheat flour.

GENETIC DIVERSITY OF SOYBEAN VARIETIES AND THEIR BIOLOGICAL POTENTIAL AS AFFECTED BY AGRONOMICAL PRACTICES

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The genotype affects significantly high productivity and raw material quality of soybean. The realization of biological potential of soybean varieties is closely associated with growing factors such as growing season, soil fertility, soil moisture and photosynthetic activity radiation. So, for high yield of soybean the complex of additional agronomical practices is needed to be used which influences on nutrition optimization and grow and development process optimization.

Twenty-three soybean varieties were investigated by 4 SSR markers (Satt726, Satt063, Satt114 and Satt228) for genetic diversity assessment. Three of them (Kano, Hieba and Ustia) were studied as affected by moisture retainer "Aquasorb", organic fertilizer "Parostok", growth regulators "Vermystym D" and "Ahrostymulin". The effects of agronomical practices were assessed based on yield, protein and oil content. The study was carried out during 2016-2018.

As result it was found that the most similar varieties based on 4 SSR markers were varieties with genetic distances 1.73. The most different was Aliaska variety with genetic distances 3.16-3.87. Hieba, Kano and Ustia varieties, which are early-season varieties, were distributed in different clusters. It was determined that maximum of yield was obtained for Kano variety with combining moisture retainer, organic fertilizer and growth regulator "Vermystym D". The highest protein content in studied varieties was determined in case of combining organic fertilizer and growth regulators. The maximum of oil content was noted in Ustia nad Kano varieties with application moisture retainer, organic fertilizer, growth regulators "Vermystym D". Thus, the biological features and applied nutrition affected studied indicators.

DYNAMICS OF DROUGHT RESISTANCE IN WINTER BREAD WHEAT (TRITICUM AESTIVUM L.) VARIETIES AT DIFFERENT STAGES OF ONTOGENESIS

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Drought resistance is very important for high yields of winter wheat. In the juvenile phase, resistance to soil drought is important, while in the reproductive phase – to air drought. The juvenile resistance was determined on osmotic 14% and 16% PEG-6000 solutions.

The highest percentages of germinated seeds were seen in Mawken (84.1), Lyra Odesskaya (83.6), Tobac (82.6), Pryvablyva (77.4). Altigo (19.4%) and Dagmar (54.3%) were the least resistant. In the reproductive phase, resistance was determined by the water-holding capacity of leaves. The varieties were ranked from the most drought-resistant to the least resistant. The drought resistance of varieties in the reproductive period of ontogeny changed dynamically. We identified accessions with the maximum drought resistance during heading: Dagmar (score 10.5), Altigo (9.5), Lyra Odesskaya (8.0), Krasa Laniv (7.5), Perfect (7.0); accessions with a peak of drought resistance during stem elongation: Orzhitsa (10.5), Mawken (9.5), Dagmar (8.5). Sdobna is noticeable for consistently medium drought resistance (4.5). Darynka Kyivska and Orzhitsa showed high drought resistance during stem elongation and flag leaf emergence, with a sharp decrease during the heading. Dagmar was highly drought-resistant, with a maximum value during the heading (8.5; 7.5; 10.5). Altigo showed low drought resistance at the beginning of the growing period with a sharp increase during the heading (1; 1; 9.5). Tobac demonstrated a linear increase in drought resistance (1.5; 6.5; 6).

ACCOMODATION TO A ”NEW NORMALITY” – RISK OR BENEFIT?

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The pandemia generated by the COVID-19 represents first of all a human tragedy, affecting society at its basis, and the effects induced by this boomerang are reflected on the labour market as well. The pandemia has accentuated the need of automation, even on the level of the insurance market, a fact that creates a lot of stress among the employees. The main purpose of the paper is to highlight the situation of the persons employed in various sectors of activity during the current pandemic conditions. The pandemic in the last year prompted large companies to explore more actively the opportunities to automate their activities. In the paper, the authors present the effects of automation on employed people in various fields of activity, including the field of insurance, which has the effect of losing jobs and replacing human staff with the assistance of artificial technology.

After the implementation of automation technologies, the roles and way of working of about a quarter of employees have changed globally, while one of ten employees already needed retraining. This trend will continue to grow, with respondents stating that they will have to retrain a third of the workforce in the next three years as a result of the changing roles.

The impact upon sales of goods and services is of a lasting nature and the insurance companies have to adapt their methods to reach their clients where they are, as well as in way of selling an insurance police as in ascertainment of damage and risk inspection.

EFFECT OF NITROGEN DEFICIENCY AND *FUSARIUM GRAMINEARUM* INFECTION ON RELATIVE CHLOROPHYLL CONTENT OF MAIZE SEEDLINGS

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Nowadays the global climate change significantly affects the agricultural production due to different biotic and abiotic stresses. Phythopathogens, like fusarium, can cause serious injury which could be worsened by climatic conditions. The goal of our experiment was to examine the single and the combined effect of nitrogen (N) deprivation and *Fusarium graminearum* infection on the physiology of some maize genotypes. Furthermore, we would like to know the impact of the mentioned factors on the rate of nitrogen remobilization and relative chlorophyll content (SPAD value) of leaves with different ages. Controlled pot experiment was set up in a climate room, maize (*Zea mays* L.) genotypes were grown using hydroponic conditions. Inoculation of *Fusarium graminearum* conidia was performed as a biotic stress at 5-leaf (V5) stage of the seedlings and two N level were used during the experiment: optimal N and a quarter of it from the beginning. Our results suggest that N deprivation influenced the SPAD values regardless of the age of leaves and genotype. Strong interaction was found between infection and N level in case of the younger leaves. In these leaves the relative chlorophyll content was significantly decreased due to inoculation, but just at optimal N level.

ANALYSIS OF ENVIRONMENTAL PROTECTION EXPENDITURES AND THEIR INFLUENCE ON THE QUALITY OF THE ENVIRONMENT

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The environment is an important element in ensuring working and living conditions, but the evolution of industries, especially those polluting branches, have had the effect of deteriorating the quality of the environment. Measures to protect it are becoming increasingly necessary.
Environmental protection must be a priority in all aspects of our work and we must look for ways to protect the Earth's resources for future generations.
In the article we presented an analysis of the evolution of environmental protection expenditures. Environmental protection expenditure is the economic measure of the response of the community to solve environmental problems at a given time.
Companies in the national economy reserve funds for environmental protection activities. The amounts allocated differ from one sector of activity to another, but also from one year to another.
The field of environmental protection is considered very important for the population. Expenditures on environmental protection involve, on the one hand, expenditures for carrying out environmental surveillance and protection activities, and, on the other hand, expenditures related to the prevention or repair of damages caused to it.
Expenditures for environmental protection will be analyzed in the light of the main categories of producers involved: public administration, non-specialized producers and those specialized in the production of environmental protection services.
It is found that the costs involved in environmental protection are greatly reduced when its degradation is prevented, compared to the situation in which it needs to be repaired.
The environment must be protected not only by the requirements of European directives but also by a national program to eliminate pollution.
Regarding the expenditures for environmental protection in Romania, the situation was much improved by increasing the amounts available, as a result of economic growth, but also of budget revenues.

DUSKY LEAF MONKEYS POPULAR ON YOUTUBE: RISING ILLEGAL EXOTIC PET TRADE ON SOCIAL MEDIA IN SOUTHEAST ASIA

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YouTube has become an increasingly popular social media platform for the illegal exotic pet trade of dusky leaf monkeys (*Trachypithecus obscurus*) in Southeast Asia. Here, we identified the number of pet dusky leaf monkey videos, their popularity, and engagement on YouTube. One of the authors identified videos with English-language and local language search terms for four Southeast Asia countries (Malaysia, Indonesia, Thailand, and Myanmar) from September till October 2019 to establish a prior understanding of the potential importance of the illegal exotic pet trade demands through YouTube. The number of videos portraying pet dusky leaf monkeys increased from 2016 to 2019, and in parallel, their popularity and engagement had also increased. The highest increases in both the number of videos produced and their popularity occurred in Malaysia and Myanmar. The results reflect the current "trending" videos that existed to be influential in posting viral pet dusky leaf monkey videos at an international rate. At a domestic rate, potentially effective videos tended to be established by five individual dusky leaf monkey owners. Based on comments such as "I want a baby monkey" and "I like to get one" in the English-language videos, it showed the potentials for driving demand amongst their viewers. These increases in popularity and social media activities highlighted the portrayal of the dusky leaf monkey as a suitable pet. Based on the results, we advise strengthening the wildlife trade legislation and regulating social media in keeping pace with the rapidly shifting nature of the Internet worldwide.

PERCEPTION OF OLDER ADULTS ABOUT HEALTH-RELATED FUNCTIONALITY OF FOODS

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The proportion of older adults in the population is significantly growing in the European Union, while the number of healthy life years (HLY) is not growing with the same rate. Therefore, wellbeing of the older population has become a social challenge. Functional food products could play an important role in prevention and mitigation of health-related problems, and in promotion of healthy ageing.

Our study focuses on differences between age groups to recognize the characteristics of the health-related consumption profile of older population. Common health issues, especially chronic non-communicable diseases (CNDs) are covered by the research to examine attitudes about functional food in aspect of affected consumer groups. Main nutritional claims, and wide-range of possible carrier products are also included in the research. The results are based on a quantitative (n=1002) survey, which is representative to the Hungarian adult population in terms of age, sex, and geographical distribution of households.

Findings highlight statistically significant differences in preferences by age. Older adults tend to define the 'healthy food' term from a food safety point of view, while younger respondents describe this category by nutritional aspects. Consumers generally prefer functional foods the most when functionality is attributed to increased vitamin, mineral, protein, and fibre content. Preference of older adults is higher in case of products with lower salt and sugar content. Besides, older adults have higher acceptance in regard to products of animal origin, especially dairy products. Within the consumer groups affected by particular health problems, age has proven to be less important as a factor of acceptance of functional foods.

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EVALUATION OF A BIOTIC STRESSOR'S IMPACTS ON A HUNGARIAN SUPERSWEET CORN VARIETY

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Hungary is the second largest contributor to the global sweet corn market. The climatic conditions, soil parameters, and topography allow to manufacture high quality sweet corn resulting in the biggest sweet corn growing area in Europe. It is very important to conduct more research about the reactions of this crop to different biotic and abiotic stresses because of its significant value. Corn smut is one of sweet corn production's limiting factors. The canning industry does not accept corn smut infected sweet corn cobs and grains which causes serious economic problems for farmers.

The goal of this experiment was to study the impacts of the corn smut infection on a supersweet corn variety. The experiment was conducted in a small-scale field trial. Two inoculation times were investigated, during vegetative (V4) and reproductive (VT-R1) stages. Measurements were taken seven and eleven days after the inoculation (DAI) at V4 stage, and 21 DAI at the reproductive stage.

The relative chlorophyll content, plant height and stem diameter were lower when plants were infected with corn smut compared to the control, i.e. non-infected plants, seven and eleven DAI. The dry matter-, fat-, and protein contents of grains were significantly lower in infected plants compared to the control. In addition, cob length, cob weight, kernel weight and cob diameter were also reduced compared to non-infected plants.

The results show that sweet corn is susceptible to the corn smut infection at the vegetative and generative stages, and causes decline in measured physiological characteristics of the host plant.

MUSCLE STRUCTURE DIFFERENCES BETWEEN SPECIES OF SWEET WATER FISH

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Background: Fish consumption on land is significant, mainly from fish living in ocean saltwater. However, in countries without the sea, as in Hungary, the richness of freshwater fish has developed a wide range of cooking techniques for fish with different nutrition. In this context, we suspect a different meat structure difference, which has not been investigated yet. The difference in fatty acid composition of African catfish and Siberian sturgeon is known, but no morphological studies have been performed on their muscle structure. *Methods:* The aim of this study was to compare the structure differences between freshwater fish with different lifestyles. The organization of muscle structure was monitored in meat by means of cytochemistry with scanning electron microscopic studies on tissues of two different species. The filleted muscles of African catfish ***(Clarias gariepinus)*** and Siberian sturgeon (*Acipenser baerii*) were compared after fresh and rapid freezing. *Results:* The associated complex structure of muscle in both species appearances different. One is a tightly closed muscle mass, while the other is a soft structure, which shows a different degree of softness of the meat after baking. *Discussion:* In both species, the right muscle structure is beneficial under extreme environmental conditions. The different skeletal structure in fish processing means altered processing, which we wish to continue with further testing to prepare tasty food for consumers.
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TURNING SWEET POTATO JUICE INTO PROBIOTIC BEVERAGES

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Probiotic beverages are non-alcoholic, fermented products that promote health, have special sensory properties and increased shelf life. Because probiotics need to be replenished regularly in adequate amounts in the human body, probiotic juices made from sweet potatoes are excellent for this purpose. In this research we studied the propagation of five different probiotic cultures (ABT 5, BB12, Lalcult Protect LP100, Nu trish LA 5, YoFlex Acidifiy 1.0) in sweet potato juice which was obtained from pressing of orange fleshed sweet potato tubers, Beauregard variety. Fermentation parameters: 24 h at 37°C, than juices were stored at 4-6°C for 30 days. Sugar content, organic acids, pH, probiotic bacterium count and sensory properties were analysed at the end of storage time. Probiotic bacteria count was measured at the beginning and the end of fermentation process and storage. We found that all the probiotic cultures propagated well in sweet potato juice. The bacteria count of all fermented beverages exceeded 10^6 CFU/ml after 30 day storage at 4 6°C. The fermented beverages had fine, harmonic taste except for the Yoflex fermented juice, which had a sweeter taste.

GLUTEN FREE BISCUITS FORTIFIED THROUGH SWEET POTATO FLOUR

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We studied the effect of sweet potato (SP) addition on the physical properties of gluten free dough and biscuits. For fortification we used dried orange fleshed sweet potato tuber (TF) and the SP pomace (PF) obtained from laboratory scale juice processing. Water content, texture profile and colour of fortified gluten free dough and biscuits were analysed. Addition of PF resulted in an intensive darker colour, and had more detrimental effect on dough texture, which needs to be balanced with hydrocolloid supplementation. Our data suggest that the sweet potato flour in gluten free matrix could be a valuable source for healthy nutrition.

BUSINESS SUCCESS IN PERCEPTION OF POLISH AND ROMANIAN FARMERS

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A business represents the organized effort of a group of individuals who seek to obtain and market goods and services that meet the demands of society in order to make a profit. Agricultural business are unique in that they requires the application of a specific set of principles and concepts.
Business success has different dimensions, some business owners associate success with financial rewards, while others can define success as satisfaction and completion. In the present article authors want to reveal the perception of Polish and Romanian farmers regarding business success. The perception of farmers regarding business success is emphasized by a study based on a quantitative method. Data were collected through a survey, using as research instrument a questionnaire. The research methodology involved: questionnaire design, questionnaire testing, application the questionnaire, analysis and interpretation of data and drawing conclusions. The survey was made using the application provided by Google (Google Forms), questionnaires were filled online. The questionnaire, was applied among farmers from 2 countries, all respondents manage small and medium sized farms. More precise, authors want to reveal what means success for farmers, which are the factors that determines success in their opinion, what do they do to obtain success in their business.

THE IMPACTS OF REDUCED IRRIGATION ON ITALIAN DURUM WHEAT CULTIVARS' POLYMERIC AND MONOMERIC PROTEIN DISTRIBUTION

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Reduced irrigation and drought are a polygenic stress and are considered as the most important factors limiting crop quality and yield around the world. Inadequate irrigation causes changes in protein content and protein distribution which contributes to wheat quality. These quality characteristics are very important in durum wheat for pasta and bread-making quality as well.

The variability of protein quantity and quality of eight Italian durum wheat (*Triticum turgidum* L. var. *durum*) cultivars was examined in this study. Polymeric and monomeric protein fractions were determined by size exclusion high performance liquid chromatography (SE-HPLC). The trial was conducted at Ciudad Obregon, Sonora (Mexico) during the 2014-2015 cropping season. Control, i.e. the irrigated trial received >500 mm rainfall, while reduced irrigation had 180 mm as a simulation of drought stress condition.

The average values of examined eight cultivars show that the reduced irrigation had significant effect on soluble large monomeric proteins (LMPS), insoluble large (LPPU) and small (SPPU) polymeric proteins, and insoluble large monomeric (LMPU) proteins. Percentage of small insoluble polymeric proteins (%SUPP) and large insoluble monomeric proteins (%LUMP) also significantly changed under simulated drought conditions. The highest decline was observed in LMPU with 24.5%, and in %LUMP (25%), respectively.

Reduced irrigation had notable impacts on protein fractions in the examined Italian cultivars in this study. These results could be useful in the generation of varieties to improve quality parameters or produce dual-purpose cultivars for both pasta and bread production.

EFFECTS OF PREBIOTIC AND DIFFERENT FLAVORINGS ON TEXTURE ATTRIBUTES OF AN EGG WHITE BASED DAIRY SUBSTITUTE PRODUCT

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A considerable percentage of today's consumers is suffering from lactose intolerance and whey protein allergy. For satisfying their demand for pre- and probiotic foods and replacing dairy products several products are developed and are available on the market. These dairy replacement products are produced usually from plant origin ingredients containing incomplete proteins and allergenic compounds.
Egg white is an appropriate protein-dense food for consumers with higher protein demand like sportsmen, pregnant women, and elderly people. Based on that advantage, egg white based dairy replacements are developed in various form and texture. In this study a yogurt-like product is introduced, and its texture examined.
Yogurt type dairy replacement was enriched with 1, 3 and 5 m/m% of inulin for improving the prebiotic effect of the product. After enrichment and cooled storage at 4-6°C for 24 hours, the texture of samples was analysed by a Physica Anton Paar MCr92 rheometer, using P-PTD200 and PP50/s measuring head (gap 1 mm, 0,01 – 150% strain, 10 radian/sec) at 15°C. Amplitude sweep was used for analysing data
Our results show that increasing inulin concentration led to higher G0' and G0" modulus. Values of τM showed higher values when inulin was added to yogurt-like products. These results confirm the results of sensorial tests: 3 and 5 m/m% inulin added affects the texture of egg white based yogurt-like products significantly.
We owe the colleagues of Dept. of Refrigeration and Livestock Product's Technologies and Capriovus Ltd. all thanks. Our research is supported by the project KFI_16-1-2017-0551, we are very thankful for that.

INVESTIGATION OF FACTORS INFLUENCING QUIT FROM PRODUCTION IN HOLSTEIN-FRIESIAN DAIRY FARMS

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Nowadays Holstein Friesian cows achieve extreme milk yield thanks to high quality breeding activity. However, at the same time useful lifespan has been decreased. Approximately 30 % of cows quit production already in the first lactation period. 2-2.3 was the average lactation in four investigated dairy farms in 2020. Drawback of this was that cows could not reach genetically maximum milk yield, as peak milk production is in the third lactation. Thus, economic efficiency decreased. This research has focused on culling reasons of four investigated dairy farms between 2015 and 2020. Main culling reasons were: low milk production 26%, reproduction disorders 23%, problem with udder health 21%. 34.5% of cows in first lactation quitted from milk production considering summed data of investigated farms. Cows in first lactation got ill in first fifty days of lactation. Nearly 50% of the first lactating cows in the investigated farms came out of the herd due to reproductive problems.

FISH REARING WITH ARTHROPOD-BASED LIVE FOOD

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The goal of our project, started nine years ago within the Csányi Foundation, is to feed fish with live arthropods in an artificial environment by modelling natural feeding conditions.
In the first experiment, food species were collected from natural watercourses: tadpole shrimp (*Triops cancriformis*), small water flea (*Daphnia pulex*) and mussels (*Ostracoda spp*.). Of these, *Daphnia pulex* was the most suitable for starting experiments, due to its high production rate. In the case of feed shortage and overpopulation, sexual reproduction takes place, triggering the formation of resting eggs. By supplying adequate oxygen level and mixed feeding with microalgae and yeast, parthenogenesis could be maintained. Overpopulation could be achieved via continuous filtration. The *Daphnias* filtered out were used for feeding guppies (*Poecilia reticulata*). The fish reared this way were more colourful than their in-store counterparts. This feeding method did not cause deficiency or mortality. Compared to traditional aquarium farming, the ecological balance of water was easier to maintain.
In the second experiment, goldfish (*Carassius auratus*) specimens of 1.5-gram initial weight were fed with natural food as well as with artificial food as control. Here, two new food species were introduced: mealworms (*Tenebrio molitor*) and superworms (*Zophobas morio*). The animals reared with natural food have become more vibrant and colour-rich with higher growth rate than their counterparts fed on artificial food.
In the framework of the ÚNKP-20-1 program, the increase in weight and length of carp (*Cyprinus carpio*) is examined by contrasting natural and artificial methods of feeding.

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INFLUENCE OF EFFLUENT WATER FROM INTENSIVE FISH FARMING ON *PERILLA FRUTESCENS* (L.) BRITT. AND *SALVIA OFFICINALIS* (L.)

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The current study examined the effect of effluent water from intensive fish farming on *Perilla frutescens* (L.) Britt. and *Salvia officinalis* (L.) at the MATE IES ÖVKI Lysimeter Station in Szarvas, Hungary. The experiment was conducted in large lysimeters, each of them has a surface area of 1 m^2. Four plants were planted per vessels. Irrigation was performed with micro sprinklers. Three treatments were used: T1: effluent water; T2: diluted effluent water with gypsum supplementation; T3: Körös river water. Plant properties like plant height (cm), plant diameter (cm), shoot length (cm), number of shoots (n./plant), SPAD value and the yield of herbs (biomass (g/plant), fresh leaves weight (g/plant), dry leaves weight (g/plant), fresh stem weight (g/plant)) were studied in 16 replications. Despite high Na-content (~ 300 mg/ l), the application of effluent water caused the maximum plant height (36.4 cm) and yield (biomass: 384.1 g, fresh leaves weight: 263.2 g, dry leaves weight: 68.0 g, fresh stem weight: 120.9 g) on sage in our experiment. The differences were significant compared to the other two treatments. In contrast, quality of water had no significant effects on the yield parameters of *Perilla frutescens.* But all treatments can be used for irrigation in *Perilla* cultivation (e.g. dry leaves weight: T1: 59.6 g; T2: 64.7 g; T3: 57.6 g). We conclude that the irrigation with reused water is an excellent opportunity to grow herbs and to save freshwater resources.

EFFECTS OF THE COVID-19 PANDEMIC ON THE ENVIRONMENT AND THE POTENTIAL SUSTAINABILITY STRATEGIES

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Abstract: The coronavirus-2019 pandemic (COVID-19) outbreak first occurred in late December 2019 at the Hunan Seafood Market in Wuhan, China, and was declared an international public health emergency in a matter of weeks by the World Health Organization. The global outbreak of coronavirus disease 2019 (COVID-19) affects every area of human life, including the environment. Measures taken to control the spread of the virus and the slowdown in economic activity have significant positive effects on the environment. Through this study, the authors intend to monitor the impact caused by the COVID-19 pandemic on the environment by analyzing the available scientific literature. The study indicates that the pandemic situation significantly improves air quality in various cities worldwide, reduces greenhouse gas emissions, reduces water pollution and noise, and reduces pressure on tourist destinations, which can help restore green systems. There are some negative consequences of the coronavirus pandemic also, such as the increase in medical waste through the use and disposal of disinfectants, masks and gloves, and the burden of untreated waste that continuously endangers the environment. It seems that economic activity will recover shortly after the pandemic, and the situation could change. Therefore, this study suggests that there are opportunities to get long-term environmental benefits due to pandemic. The proper implementation of the proposed strategies can be helpful in the global sustainability of the environment.

POLLEN CONCENTRATION DATA SET FOR BLACK LOCUST (ROBINIA PSEUDOACACIA) AND TREE OF HEAVEN (AILANTHUS ALTISSIMA) IN 2018

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Pollen concentrations of black locust and tree of heaven were analyzed in air samples collected with a 7-day Hirst-type (Burkard) pollen trap placed at a height of 14 m in Kecskemét city, Hungary in 2018. 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 flowering of the black locust in 2018 began on the 121st days of the year and the pollen season lasted 15 days. A total of 86 *R. pseudoacacia* pollen grains were detected this year. Most pollen grains were counted on 5 May (21 pollen/m^3).
In 2018, flowering of the tree of heaven began on the 138th days of the year and the pollen season lasted 37 days. A total of 130 *A. altissima* pollen grains were detected this year. Most pollen grains were counted on 22 May (21 pollen/m^3).
Pollen concentrations of *Robinia pseudoacacia* and *Ailanthus altissima* were very low this year.

FOSTERING ICT TEACHING IN AGRICULTURAL HIGHER EDUCATION IN THE PARTIUM REGION

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21st Century agriculture is heavily dependent on scientific and technological advances and their application. Adapting competitiveness to global trends is a prerequisite for a successful presence in the market, but this can only be achieved through technological advances and enhanced integration. There is therefore a need to restructure higher education in every agriculture related field. This is especially true in the case of agricultural informatics training, which is essential for the efficient use of digital technologies in agriculture. Our target region has a considerable potential to become a learning region, but there is a mismatch between practicing farming and the innovation background. In our study, we try to find out what possibilities there are to bring the two realms closer to each other, in order to develop a modern agricultural informatics education. We start with a brief analysis of the region, followed by an in-depth analysis of the agricultural higher education and its relation to ICT education. The data we have used comes mainly from the national statistical institutes, as well as the Eurostat. Of significant importance were also our informal discussions with persons in key positions in higher education and agriculture, in Debrecen (Hungary) and Oradea (Romania).

PEG- INDUCED DROUGHT STRESS EFFECTS ON SPINACH GERMINATION PARAMETERS

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One of the most important environmental factors limiting plants' growth and productivity is drought. Exposure to this stress reduces germination rate and seedling's growth with significant variations from crop to crop. An unavoidable consequence of drought exposure is the generation of reactive oxygen species. They can be extremely reactive with several cellular constituents such as proteins, lipids, and nucleic acids. Spinach (*Spinacia oleracea* L.) is one of the most consumed vegetable species for human nutrition. Spinach is rich in vitamins, such as vitamin C, and minerals, which are essential for human health. Besides, spinach contains large amounts of bioactive molecules such as glucuronic acid derivatives of flavonoids and p-coumaric acid derivatives that exhibit strong antioxidant activity.

This study investigated the effects of polyethylene glycol on spinach seed germination under drought stress. A controlled, experiment was conducted to investigate the effects of drought stress, induced by PEG on some germination parameters, mean germination time, germination speed, and coefficient of the velocity of germination, final germination speed, seed vigor index, and germination index of Spinach. The treatment of 2.5 % concentration PEG was applied to the seeds in three replicates, and for control, the nutrient solution was applied under controlled conditions. The seeds were germinated geotropically between moisten filter papers. Each roll contained 30 seeds. The germination speed and the germination index showed the considerable decrease in case of PEG as compared to control.

STUDIES ON STRESS-TOLERANT *PSEUDOMONAS RESINOVORANS* STRAINS WITH BIOCONTROL POTENTIAL AGAINST *AGROBACTERIUM* SPECIES

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Crop losses due to plant pathogens raise serious concerns about sustainable agricultural production. *Agrobacterium tumefaciens* and *A. vitis* species are the causal agents of the crown gall disease of different plant species with agricultural importance (grape, cherry, walnut, etc.). The extensive use of synthetic agrochemicals for disease control purposes often leads to soil and water contamination, with adverse side effects on ecosystems. Certain microorganisms with biocontrol potential towards plant pathogens represent an environment-friendly alternative to chemical pesticides for pest management. However, the efficacy of biocontrol microbes might be significantly lowered by different abiotic factors, such as heavy metals, pesticides, salinity or drought stress.

In our studies, 7 *Pseudomonas resinovorans* strains isolated from glyphosate-treated soil were found to have substantial inhibitory effect on the growth of 6 *A. tumefaciens* and 6 *A. vitis* strains in agar plate assays. Testing *P. resinovorans* strains for abiotic stress tolerance *in vitro* revealed that the strains were able to survive in the presence of Al, Fe, Mn, Ni, and Pb up to 0.5-1.0 mM, and 17 different pesticides up to 25 μg/ml concentration. Moreover, the isolates were found to also resist salinity (up to 6.3 g/l NaCl) and drought (up to 125 g/l polyethylene glycol 6000) stress.

Our findings suggest that the examined *P. resinovorans* strains might be considered as potential biocontrol agents of *Agrobacterium* species under various abiotic stress conditions.

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