BOOK OF ABSTRACTS

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Many perspectives on our world

ABSTRACT BOOK

University of Hohenheim, Stuttgart, Germany

17 - 18 November 2023

Scientific Student Conference 2023
Euroleague for Life Sciences
THE POWER OF SCIENCE - Many perspectives on our world
17 - 18 November 2023
University of Hohenheim
Stuttgart
Germany

Editors: Gabriele Klumpp, Ludwig Hölzle, Anna Neujahr, Annemarie Jung

Layout: Annemarie Jung, Sabine Terzoglou

Organization and Acknowledgements

Organizing Committee at UHOH
Gabriele Klumpp
Ludwig Hölzle
Annemarie Jung
Theresa Kaufmann
Claudia Bieling
Georg Petschenka
Sabine Zikeli
Sebastian Bopper

The organizing committee at the University of Hohenheim gratefully acknowledges the support of

University of Natural Resources and Life Sciences, Vienna
Czech University of Life Sciences, Czech Republic
Swedish University of Agricultural Sciences, Sweden
Warsaw University of Life Sciences, Poland
Wageningen University and Research, The Netherlands
Faculty of Bioscience Engineering - Ghent University, Belgium
Norwegian University of Life Sciences, Norway
Estonian University of Life Sciences, Estonia
L'Institut Agro, France
Lincoln University, New Zealand
Hebrew University of Jerusalem, Robert H. Smith Faculty of Agriculture, Food and Environment

And all student assistants and volunteers!

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Food for the world

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The effects of long-chain omega-3 fatty acid supplementation on systemic inflammation in Chronic Obstructive Pulmonary Disease

M. Spohn[1,2], S. K. Kirschner[1], R. Jonker[1], C. Perez[1], N. E. P. Deutz[1], M. P. K. J. Engelen[1]
[1]Center for Translational Research in Aging & Longevity, Texas A&M University, College Station, United States of America,
[2]Universitaet Hohenheim, Hohenheim, Germany

Abstract body

Background: Chronic obstructive pulmonary disease (COPD) is mainly caused by tobacco smoking and characterized by a low-grade systemic inflammation, contributing to the development of systemic features such as muscle wasting. The omega-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are suggested to have anti-inflammatory properties and occur mainly in fish oil (FO). Previously, an increased appendicular and total lean mass was observed in COPD patients after 4 weeks of daily EPA + DHA intake. It was now examined whether changes in systemic inflammatory response have contributed to this.

Objectives: Differences between COPD patients and healthy controls and the effect of a 4-week daily EPA + DHA supplementation in COPD patients on plasma systemic inflammatory markers were assessed.

Methods: For the first aim, 18 healthy subjects and 32 COPD patients were studied in a cross-sectional design. For the second aim, a randomized, double-blind, placebo-controlled trial was conducted in the COPD patients to investigate the effect of a 4-week supplementation of either a low dose (2.0 g/d, n=10) or high dose (3.5 g/d, n=12) of EPA + DHA as a FO supplement compared to a placebo (7 g/d olive oil, n=10) on inflammatory markers. The COPD patients completed two identical study days before and after the intervention including a blood draw, various measurements, and questionnaires.

Results: Pro-inflammatory markers were increased in COPD patients compared to healthy controls. After the FO intervention in COPD patients, one anti-inflammatory cytokine increased in the high dose group while some pro-inflammatory markers increased, and some decreased by comparing the low dose or high dose to the placebo group and with each other.

Conclusion: This study was the first to measure a broad range of inflammatory markers in COPD patients compared to healthy subjects, and after a 4-week FO supplementation. Elevated concentrations of various pro-inflammatory markers in COPD patients support the presence of a low-grade systemic inflammation. Alterations in inflammatory markers after FO supplementation with a dose-dependent manner between the FO groups suggest that the previously observed increase in lean mass could be partially due to a reduction in the systemic inflammatory response. However, the exact underlying mechanisms are not fully understood yet and future research is needed to obtain an in-depth understanding and further guide nutritional approaches.

Acknowledgements

I would like to express my sincere gratitude to my supervisors Prof. Dr. Mariëlle P.K.J. Engelen and Prof. Dr. Nicolaas E.P. Deutz at the Center for Translational Research in Aging and Longevity at Texas A&M University for their unwavering support.

I want to thank my supervisor Prof. Dr. Stephan C. Bischoff at the University of Hohenheim, who accepted to evaluate my external thesis.

Thank you to Dr. Sarah K. Kirschner for her unique support and to Carolina Perez for her help in the laboratory.

A-309

Effects of a DASH-style dietary intervention rich in wholegrains and nuts on heart rate in pre-hypertensive individuals: analysing data from individual n-of-1 interventional studies using dynamic modelling analysis

F. Pepping[1], B. de Roos[2]

[1]Wageningen University & Research, Human Nutrition & Health, Wageningen, The Netherlands, [2]The Rowett Institute, University of Aberdeen, School of Medicine, Medical Sciences and Nutrition, Aberdeen, United Kingdom

Abstract body

Consuming wholegrains and nuts may lower the risk of cardiovascular diseases (CVDs), but outcomes from studies measuring effects on CVD risk factors are inconsistent, possibly due to inter-individual variability in response. N-of-1 studies study one individual and can establish the efficacy of wholegrain and nut consumption on the individual level, by exploiting intra-individual variability within one single individual over time. With the use of dynamic regression modelling analyses, we assessed whether behavioural, physiological, and environmental factors affected heart rate, an important risk factor of CVD, and to what extent a dietary intervention with wholegrains and nuts affected heart rate, in 11 pre-hypertensive participants. During each n-of-1 study, lasting 24 weeks, a participant collected daily measurements, including heart rate values, actigraphy data, and morning and evening questionnaires. Each participant consumed 3-4 portions of wholegrains and one portion of nuts daily, during an 8-week intervention phase, which was sandwiched between an 8-week observational phase. For one participant an increase in wholegrain consumption, and for another participant an increase in nut consumption, was associated with a decrease in heart rate. For four participants the intervention phase was associated with a decreased heart rate. Heart rate was also affected by alcohol consumption, time of measurement, the menstrual cycle, outside temperature, being in a social setting, and physical activity. In conclusion, wholegrain and nut consumption was associated with a significant reduction in heart rate in over 50% of the participants, potentially lowering the risk of CVD. Every individual had a unique set of variables that predicted their heart rate, which emphasizes the importance of measuring and analysing, on an individual level, the potential external factors and time-related variables that may affect heart rate, in addition to a dietary intervention itself.

Acknowledgements

I would like to acknowledge Baukje de Roos and Tilly Potter for their help and contribution during my MSc Thesis. I would like to acknowledge the work of Tilly Potter, as the data from the MI-DIET (Modelling Individual Determinants to Intervention using Ecological Tracking) study utilised in this research report is part of her PhD. Related to this, I would like to acknowledge the financial contribution of BBSRC and Unilever for funding the MI-DIET study.

A-215

Comparison of food-associated and clinical Cronobacter sakazakii isolates regarding growth and surface adhesion

M. Ladurner, E. Wagner, K. J. Domig
BOKU - University of Natural Resources and Life Sciences, Department of Food Science and Technology, Vienna, Austria

Abstract body

The Gram-negative bacterium *Cronobacter sakazakii* is well known for its occurrence in powdered infant formula (PIF) and its pathogenic potential in neonates. It is highly stress-resistant and can endure harsh conditions regarding desiccation, acidity, and temperature. Therefore, it can occur in a broad range of food products and poses a threat of causing serious infections in adults as well. Additionally, the capacity of *C. sakazakii* to build biofilms contributes to contamination during food processing and is a crucial aspect of its pathogenicity. Even though there are regulations regarding the microbiological criteria of *Cronobacter* spp. in PIF, there are no comparable restrictions for other food categories.

In the scope of this thesis, 51 food products, including dry foods like cereals, spices, and nuts, were screened for the presence of *Cronobacter* spp. Eight samples (16%), mostly cereal-based products, led to positive results. Using Multilocus Sequence Typing, seven isolates were identified as *C. sakazakii* and one as *C. dublinensis* and assigned to eight different Sequence Types (8, 23, 64, 616, 17, 3, 494, 40, 162). They were compared with 20 clinical *C. sakazakii* strains regarding growth characteristics and bacterial adhesion under various conditions. Growth curves were measured in tryptic soy broth (TSB) and AB minimal medium supplemented with lactose (AB) at 15°C, 24°C, and 37°C for 72 h. Adhesion on polystyrene was investigated using a crystal violet-based assay with three different media (TSB, AB, reconstituted PIF), at three temperatures (15°C, 24°C, 37°C) for three different incubation times (24 h, 48 h, 72 h). Statistical analysis of the data showed that neither growth nor biofilm formation correlated significantly with the origin of the isolates. Bacterial growth was strongly strain dependent. Biofilm formation correlated significantly with temperature, incubation time, and medium, as well as the combination of those. The strongest biofilm formation occurred in PIF at 37°C for 24 h. However, when incubated at 24°C, biofilm formation increased over time. At 15°C, biofilm formation was generally weak, regardless of the conditions.

In summary, no significant difference regarding growth and biofilm formation could be observed between clinical and food-associated isolates. Virulence, however, relies on a number of additional parameters. In order to confirm or disprove a connection between origin and virulence, further research is still required.

Acknowledgements

I want to thank Eva Wagner and Konrad J. Domig for the great supervision during my master thesis!

Food for the world

A-298

Identifying molecular markers for breeding a future oil crop, Lepidium campestre

N. Lodenius
Swedish agricultural university (SLU), Plant breeding, Enskededalen, Sweden

Abstract body
The cold hardy novel oil- and cover crop *Lepidium campestre* is currently being domesticated as a potential oil crop for the Nordic region. To achieve this objective, multiple traits have previously been identified as desirable to improve, including seed oil content and composition, and glucosinolate (GL) content. This study aims to find improve future breeding efforts for these traits, by identifying favourable markers in *L. campestre*, as well as evaluate related species for future interspecific hybridization. In line with this, major genes involved in the biosynthetic and degradation pathways of seed oil and glucosinolate were evaluated in 40 accessions of Lepidium with the aim of finding a significant association with polymorphisms and total oil content, oleic acid (OA) and erucic acid (EA) contents as well as total GL content, Sinalbin (Sb) and glucoallysin (Gl) contents. In total, 113 significantly associated markers were identified. Among these markers, 27 were identified as especially interesting, 13 markers with oil content, eight with oil composition (OA and EA), and six with GL content. In addition, relatives of *L. campestre* were evaluated for morphology, seed oil content, oil composition and glucosinolate content. Their phylogenetic relationship with *L. campestre* was also evaluated for use as potential candidates for interspecific hybridization. In this analysis two species with beneficial OA content were suggested for future crosses, *L. hirtum subsp. calycotrichum* and *L. heterohyllum*. An additional four species with beneficial oil-, OA-, EA- and GL-content were identified as interesting targets for future embryo rescue protocol adaptation, necessary to overcome breeding barriers. These include *L. graminifolium, L. sativum, L. virginicum subsp. menziesii*, and *L. perfoliatum*.

Acknowledgements
Supervisor: Cecilia Hammenhag, Swedish University of Agricultural Sciences, SLU, Department of Plant Breeding

Assistant supervisor: Mulatu Geleta Dida, Swedish University of Agricultural Sciences, SLU, Department of Plant Breeding

Examiner: Therése Bengtsson, Swedish University of Agricultural Sciences, SLU, Department of Plant Breeding

A-192

Accelerating plant breeding through multivariate genomic prediction using gfBLUP

K. A. C. Melsen, J. Kunst, W. Kruijer, F. van Eeuwijk, C. F. W. Peeters
Wageningen University & Research, Biometris, Wageningen, The Netherlands

Abstract body

Datasets in several fields of research have become larger than ever with plant breeding being no exception. The development of high-throughput phenotyping (HTP) technologies has given plant breeders access to high-dimensional data containing thousands of features characterizing candidate varieties. The challenging aspect of this abundance of data is the extraction and interpretable integration of relevant information to help inform the selection decisions breeders have to make.

We have developed the multivariate genomic prediction methodology gfBLUP (genetic factor best linear unbiased prediction): a fast, easy to use, and novel approach that integrates HTP data to improve genomic predictions. It utilizes the idea that high-dimensional HTP data consists of many noisy measurements reflecting a lower-dimensional set of latent factors.

Our approach either outperforms or matches the performance of other methods in several data settings. We use simulated data to show the importance of the quality of HTP features and the impact of this quality on model performance. Furthermore, we show how gfBLUP produces easily interpretable parameters that reveal biologically relevant patterns in data on wheat yield combined with hyperspectral reflectivities.

Acknowledgements

Jonathan Kunst, Willem Kruijer, Fred van Eeuwijk, Carel F.W. Peeters

A-217

Black seed oil-containing emulsion as a delivery system for thymoquinone: evaluation of extraction and entrapment efficiency

A. Ardhi
Universität für Bodenkultur Wien, Food Science and Technology, Wien, Austria

Abstract body

Black seed oil (BSO) or *Nigella sativa* contains numerous bioactive components, in which thymoquinone (TQ) becomes a functional key compound and serves as an analytical marker. With its non-polar characteristic, lipid-based delivery systems can be a solution to improve the solubility of BSO. Thus, it is necessary to have a valid basis for TQ quantification, especially in the emulsion as the delivery system of BSO. This study aimed to employ a validated Gas Chromatography-Flame Ionization Detector (GC-FID) method to evaluate TQ extraction from BSO and BSO-containing emulsion and determine the entrapment efficiency of the emulsion. The extraction of TQ with the sample:methanol ratio of 1:9 and 30-min centrifugation yielded the maximum TQ recovery from BSO and BSO-containing emulsion. The entrapment efficiency in emulsion reached 64,83% obtained with the density-changing centrifugation method. Overall, this GC-FID method demonstrated that the selected condition in the methanol extraction could effectively separate TQ from both BSO and its emulsion matrices and support the determination of the entrapment efficiency of the BSO-containing emulsion. This finding will provide a solid foundation for our study on developing further TQ delivery system in the form of nanostructured lipid carriers of BSO (NLC-BSO), especially to assess the entrapment efficiency as a critical indicator of optimal NLC-BSO formulation and to determine the TQ bioavailability.

Acknowledgements

Matthias Schreiner

Food for the world

A-113

Enhancing FAO-56 Penman-Monteith Evaporation Prediction With Machine Learning Under Temporal And Spatial Environmental Factors

N. Averbuch, M. Moshelion
The Robert H. Smith Institute of Plant Sciences and Genetics in Agriculture, Plant Sciences and Genetics in Agriculture, Rehovot, Israel

Abstract body

Determining irrigation needs is crucial globally, especially in developing countries where measuring equipment is often costly. The FAO56-Penman-Monteith equation (FPME) is commonly used to calculate evapotranspiration (ET) and apply irrigation requirements using only meteorological parameters. However, the use of a single station might lead to significant estimation errors. In this research, we hypothesized that the accuracy of FPME is affected by microclimatic changes over time and space. Therefore, we tested the impact of numerous spatial and temporal environmental measurement points taken in a commercial greenhouse, on the accuracy of the FPME by comparing it to the actual evaporation rate obtained from dozens of weighing lysimeters. Additionally, we used machine learning algorithms to utilize the extensive data collected for predicting the ET. Results revealed that the daily FPME exhibited a discrepancy in accuracy compared to the lysimeters, with overestimation in winter and underestimation in summer (*±22%)*. Interestingly, more data points per day resulted in less accurate FPME evaluation at the temporal scale. We found that the accuracy loss was explained by hysteresis which the FPME doesn't consider. However, machine learning algorithms (Decision-Tree, Random-Forest, XGBoost and Neural-Network) prediction showed impressive accuracy (*R2>0.918)* when considered temporal parameters. Our study also demonstrated that spatial sampling has higher gravity compared to the data amount as the best-performed models showed accuracy of *R2=0.935*. Our approach explored the potential of advanced computational methods to enhance water loss estimation in diverse environments, which will be helpful when predicting plant absolute evapotranspiration and training the model.

Acknowledgements

This research was supported by the Israel Science Foundation (Grant No. 1043/20)

A-124

Avocado water footprint: media sensationalism or a cause for concern?

S. Melder, A. Feuerbacher, F. Krumbe, S. Klos, L. Autenrieth
University of Hohenheim, Stuttgart, Germany

Abstract body

Avocados came under intense media scrutiny in recent years, their water footprint garnering and sustaining attention. However, it remained unclear whether criticisms are related to the avocado itself, or its countries of origin. A more multifaceted narrative might be appropriate, as the EU imports avocados from countries with varying levels of water availability. This paper therefore explores the media coverage of avocado water consumption and the resulting impact of avocado trade on the water status in the countries of origin. We conducted a media analysis of German newspapers and a trade data analysis for the European market. The media portrayal of avocado as well as substitutional crops was evaluated both quantitatively and qualitatively. Chickpea, banana, cocoa, olive, and walnut were chosen as substitutes. The trade data was combined with weighted water footprints of all examined crops. In doing so, we are able to show whether and to which extent the production of avocado is worsening water scarcity and how accurate the image of avocado created by the media is. Our results highlight a lack of nuance in media reports on avocado in combination with higher numbers of articles on its water use. Our research further suggests that the impacts of the water consumption of chickpea and avocado are comparable, while the water footprints of olive and walnut have higher impacts on the water availability of their origin countries. Local water stress is consequently aggravated to a larger extent by these crops. Therefore, similar or greater issues may be attributed to crops other than avocado, yet media disapproval is less frequent. If agricultural water usage is unsustainable and high in water stressed countries, concerns are raised for every crop with high water demands grown under such conditions. The importance of this subject matter merits a depiction of its complexity. Focusing only on the water consumption of one crop does not support informed decision-making by consumers, which is imperative when promoting sustainable consumption and water use within society.

Acknowledgements

This research work was not funded by any third party.
The research was conducted by Simone Melder, Falk Krumbe, Lydia Autenrieth and Samuel Klos under the supervision of Jun.-Prof. Dr. Arndt Feuerbacher.

A-290

Life cycle assessment of seaweed protein: Can Danish Saccharina latissima act as sustainable protein source?

N. Buchenau[1], S. Bruun[1], A. Kruse[2]

[1]University of Copenhagen, Department of Plant and Environmental Sciences, Copenhagen, Denmark, [2]University of Hohenheim, Department of Conversion Technologies of Biobased Resources, Stuttgart, Germany

Abstract body

Today's protein production coupled with rising future demand threatens to exacerbate global change crises such as climate change and biodiversity loss. One solution is offered by novel plant-protein sources that replace unsustainable meat products. Seaweed cultivation might offer this nutritional quality while simultaneously mitigating coastal eutrophication, climate change, biodiversity loss, ocean acidification and deoxygenation, and demanding almost no resources like freshwater, arable land, fertiliser, and pesticides. In this study, we conduct a life cycle assessment (LCA) to examine the impacts of production of 1 t of protein contained in 1) seaweed meal and 2) seaweed protein extract. Sugar kelp *Saccharina latissima* is modelled to be grown on an average Danish farm. For the former product, the biomass is dried and milled, the latter product includes an additional phase of protein extraction through pH shift. Both products are also compared with analogue soy-based products as a more conventional protein source. The LCA revealed seaweed meal to offer strong mitigation of marine eutrophication, but adversely affect climate change, fossil resource use, and acidification due to usage of fossil-based steam in the drying phase. The sum of weighted impacts was slightly lower than for soybean meal protein. Seaweed protein extract also alleviated eutrophication but had much higher impacts throughout many different impact categories such as acidification, climate change, and freshwater ecotoxicity, mainly due to its inefficient production and highly processed nature, with large amounts of chemicals and electricity being used in the extraction process. Impacts were worse compared to soybean protein extract in all categories except marine eutrophication. We conclude that the seaweed products modelled here do not present sustainable novel protein sources. While seaweed meal from *S. latissima* has a protein content too low to serve as protein-rich food, seaweed protein extract causes too high emissions and resource usage to be deemed sustainable. Various limitations concerning this LCA, and barriers for possible large-scale implementation in Denmark are outlined. Despite these barriers, optimised or alternative methods of production, such as cultivating more protein-rich seaweed species, still hold potential for sustainably meeting future protein demand.

Acknowledgements

I want to thank my supervisor Sander. He provided an office for me to work in, right next door to his, and was therefore always available for questions, support, and feedback. I also want to thank my co-supervisor Andrea Kruse who was open to the project collaboration from the start, and quick to answer any questions I posed. Besides this, I am truly grateful for the invaluable emotional support that my friends, family and partner provided throughout these months.

Working together for a greener future

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Post-minig sites as ecological traps for dragonflies

A. Josková, F. Harabiš, A.-M. Poskočilová, A. Tetaur
Czech University of Life Sciences Prague, Faculty of Environmental Sciences, Prague, Czech Republic

Abstract body

Habitat loss is one of the main causes of biodiversity loss. The aim of ecological restoration is to restore damaged or destroyed habitats. However, it is no secret that restored habitats often do not reach the quality they had before they were destroyed. In particular, the problem arises when animals prefer restored habitats to natural habitats, even though they have lower fitness and higher mortality in restored habitats. At this point, restoration inadvertently creates ecological traps. The aim of the experiment was to compare the body condition and mortality of dragonfly larvae (Sympetrum spp.) reared in natural habitats with larvae reared in restored habitats, and to determine whether restored habitats can act as ecological traps for dragonflies. The experiment was conducted in the Czech Republic, near the town of Sokolov, at ten sites, five of which were artificially created during landscape restoration after coal mining (potential ecological trap habitats) and five were natural ponds (control sites). Body condition was determined on the basis of fat content and mask size of dragonfly larvae. The results of this research confirm that restored sites in post-mining areas are of lower quality than control sites, as the larvae had significantly lower body condition and significantly higher mortality. There is a risk that these sites could act as ecological traps for dragonflies. By confirming that the environment affects larval performance, dragonflies have demonstrated that they can be used to monitor ecological restoration progress.

Acknowledgements

Harabiš Filip; Poskočilová Anna-Marie; Tetaur Adam

A-224

The Wild, the Domestic and the Stealthy: Mapping Seasonal Livestock Depredation By Spotted Hyenas

M. Weimar
Wageningen University and Research, Wageningen, The Netherlands

Abstract body

Determining the drivers underlying the spatial distribution of livestock depredation can aid in identifying high risk areas. Studies that documented livestock depredation often found a difference in the frequency of depredation per season. However, it is unknown whether the spatial distribution of this depredation differs between seasons. My aim was therefore to map the seasonal probability of livestock depredation by spotted hyenas (*Crocuta crocuta*) to better understand its spatiotemporal patterns. Presence-only data of livestock depredation were collected in the Olkiramatian and Shompole Group Ranches in the South Rift of Kenya. This mixed-use landscape is divided into several human land uses with varying degrees of protection. I modeled the distribution of depredation in Maxent in the wet and dry season. The spatial variables that were included to predict livestock depredation were distance to the nearest boma, distance to the nearest spotted hyena den, NDVI, and mean monthly precipitation. The majority of the livestock depredation cases occurred in the wet season. Depredation in the wet season was most likely within 4km of the nearest boma and in direct proximity to a den, while dry season depredation increased with higher NDVI values. Moreover, the probability of livestock depredation in the wet season was higher in areas of permanent settlement and wet season grazing. Depredation in the dry season was most likely inside and along the edges of the conservancies. The findings of this study emphasize the importance of separately assessing the patterns of depredation for each season, as the drivers and spatial distribution of livestock depredation differ per season. Understanding the seasonal patterns of species with conflict potential and of the conflict itself can aid in prioritizing mitigation efforts and promoting coexistence to prevent global range collapses in wildlife species in mixed-use landscapes.

Acknowledgements

Femke Broekhuis
Guy Western
Peter Meiponyi, Koike Parsaloi, Dan Sepis, Silvia Nashipae, John Sarara, Sikona Nkanuma, Leyeiyio Ntumuna, Loserem Pukare, Patrick Nkele, Joshua Parsaloi, Julius Nadoonyek, Cisco Sompeta and Steiner Sompeta
Veronika Hohnec and Sarah van Driel
Fundatie van Renswoude te ‘s-Gravenhage, Erasmus Plus and Holland Scholarship

A-346

Facebook as a tool for monitoring selected bird species endangered by illegal trade in Indonesia

N. Tesařová
Czech University of Life Sciences Prague, Department of Ecology, Prague, Czech Republic

Abstract body

Populations of many bird species across Southeast Asia are experiencing drastic declines and in the wild due to habitat degradation and high demand for trade and breeding. Indonesia represents one of the countries with the highest rate of illegal capture and trade in birds. Currently, species threatened by these factors face a new threat in the form of online trade via social networks. Cultural traditions and economic opportunities put enormous pressure on wild populations of endangered species. The research part of this thesis is focused on the issue of illegal unsustainable trade in Indonesian bird species, the extent of the modern market via social networks, cultural and economic aspects of bird breeding in Indonesia and the characteristics of the taxa under investigation. During my own research, 113 groups on the social network Facebook were monitored. Data collection took place over the period of 17 months from November 2021 to the end of March 2023. Advertisements with eleven species of Indonesian songbirds selected for data collection were recorded. In total, 8,042 advertisements were recorded in the created database, which contained offers of a total number of 16,812 of birds. The total sales of the advertised birds were IDR 16,775,017,000, which is equivalent to CZK 24,122,000. The main objective of this thesis was to map the extent of illegal online trading across selected Indonesian regions and to find out specifications and structure of the trade during the monitored period. Other goals of the work included comparing the prices of individual taxa and monitored years, comparing the given localities at the level of large cities and rural areas, and evaluating the age composition of the birds offered. A significant dispersion of prices between the selected species was discovered for three taxa, it was the most evident for the straw-headed bulbul. The largest dispersion of prices within the monitored years was recorded in 2022. Despite the majority of advertising found in close proximity to large Indonesian cities, an unexpectedly high number of locations was recorded in rural areas, especially on the islands of Sumatra, Java and Bali. The assumed advertising of adult birds was confirmed in the majority of advertisements, yet the number of advertised chicks and juveniles amounted to 31 % of the total number of birds. The results of the work show that online (illegal) trade is a significant problem and further research is needed to map its extent.

Acknowledgements

Supervisor: prof. Mgr. Miroslav Šálek, Dr. *(Department of Ecology, Czech University of Life Sciences Prague, Faculty of Environmental Sciences, Kamýcká 129, 165 00 Praha 6 Suchdol)*

Advisor: Ing. Tereza Švejcarová *(Department of Ecology, Czech University of Life Sciences Prague, Faculty of Environmental Sciences, Kamýcká 129, 165 00 Praha 6 Suchdol)*

Working together for a greener future

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A helping hand of plants in the fight against polluted air. Limitations and prospects.

A. Nawrocki, R. Popek, A. Przybysz
Warsaw University Life of Sciences, Section of Basic Research in Horticulture, Warsaw, Poland

Abstract body

Particulate matter (PM) is one of the most dangerous pollutants present in the air. Many cities in Europe and around the world face the problem of high concentrations of PM in the ambient air. The main sources of PM emissions in urbanized areas include e.g. road transport, house heating, heavy industry. Currently, many initiatives are being taken to reduce PM emissions into the atmosphere. Phytoremediation is a biotechnology which use plants to cleaning the environment from pollutants. The potential of plants to clean the environment has been confirmed in many studies. It depends mainly on the size of the plant, the structure of the canopy, but most of all the morphological properties of the leaf, e.g. amount of waxes and epicuticular trichomes. It is a very effective and completely environmentally friendly biotechnology. Unfortunately, currently there are very few studies that would confirm the effectiveness of this method in the autumn-winter period, when most plants in a temperate climate shed their leaves. Therefore, in this study, the phytoremediation potential of plants found in the roadside environment of cities in the autumn-winter period was examined. Plant samples were collected throughout the year from various plants, e.g. yew, mountain pine, hornbeam and herbaceous plants found on lawns and urban meadows. Analyzes showed that conifer plants accumulate PM the most efficiently. However, dead leaves of deciduous plants, remaining on the plant during the winter, can also capturing PM from the air. Herbaceous plants growing on lawns and urban meadows remaining unmowed in the autumn-winter period accumulate similar amounts of PM as in spring. The conducted research showed that plants can capturing and remove significant amounts of PM from the air also in the autumn-winter period and thus improve the quality of the air in urbanized area. This is a very encouraging thought because even the smallest reduction in air pollution has a positive effect on people's well-being.

Acknowledgements

Acknowledgments: This research was funded in whole by National Science Centre, Poland [Grant number 2020/39/D/NZ9/00969].

A-402

Life cycle assessment of ion exchange/adsorption technology for nutrient recovery in urban wastewater treatment

L. Simon[1], S. Bruun[1], M. Birkved[2], G. Langergraber[3]

[1]University of Copenhagen, Plant and Environment, Copenhagen, Denmark, [2]University of Southern Denmark - SDU, Department of Life cycle engineering, Odense, Denmark, [3]University of Natural Resources and Life Sciences - BOKU, Vienna, Austria

Abstract body

Nutrient recovery technologies are gaining more attention worldwide as part of a willful transition from a linear towards a circular view to resource use and management. Ion exchange/adsorption on a chosen medium for recovery of ammonium in wastewater treatment has been researched as promising technology. This study is an ex-ante environmental assessment of ion exchange/adsorption technology for the recovery of ammonium using zeolite-Na as an adsorbent and KCl as regenerant, integrated into urban wastewater treatment, combined with a high-rate activated sludge system as a secondary treatment step. The study is part of Horizon 2020 project WaINUT funded by the European Union. The environmental assessment was carried out using consequential life cycle assessment methodology, by comparison to a baseline scenario. The functional unit was the yearly load of wastewater and external sludge treated. Three nutrient recovery scenarios were contrasted with a baseline scenario: scenario 1 included only NH_4^+ recovery, while scenario 2 and 3 both NH_4^+ and K^+ recovery. Scenarios 1 and 2 were modelled using a zeolite adsorption capacity based on laboratory data (2 $mg_{NH4+}g^{-1}_{zeolite}$); scenario 3 used a higher adsorption capacity zeolite from literature data (109 $mg_{NH4+}g^{-1}_{zeolite}$). The baseline scenario included no nutrient recovery unit and used conventional activated sludge system as a secondary treatment step. Results indicate notably bigger environmental impacts in almost all categories for IE/AD scenarios with a zeolite adsorption capacity at 2 $mg_{NH4+}g^{-1}_{zeolite}$, while an additional scenario with an elevated zeolite adsorption capacity of 109 $mg_{NH4+}g^{-1}_{zeolite}$ showed similar performance to baseline scenario in most impact categories, with a stark reduction in impacts compared to the baseline in the impact categories land use and land use change related climate change, ecotoxicity in freshwater, eutrophication – freshwater and marine, land use and ionizing radiation. Zeolite production process was shown to be the highest contributor to impacts within the IE/AD unit. Further research and optimization of the technology is needed before large scale application of the IE/AD technology as nutrient recovery in urban wastewater treatment.

Acknowledgements

My sincerest thanks to my supervisors, Sander Bruun and Günther Langergraber, as well as Morten Birkved and Miriam Beyers for their vital contributions, the time and energy spent on consultations, kindness, and encouragement along the way.

My family and loved ones have provided me with an unending baseline support without which it would have been impossible to complete this thesis. I'm grateful for calls, library meetings, coffee- and lunch breaks.

A heartfelt thank you to everyone,
Lilla Simon

A-271

High-Resolution Simulation of Crop Growth in Agrivoltaic Systems - Model Calibration and Climate Change Impact Evaluation for a Pilot System in Southern Germany

S. Wolf
Universität Hohenheim, Stuttgart, Germany

Abstract body

Increasing the share of renewable energy to mitigate climate change while preserving valuable agricultural land requires innovative solutions such as agrivoltaics. Thereby, agrivoltaics refers to the concept of dual land use through photovoltaic (PV) electricity generation and agricultural production on the same piece of land, potentially increasing land use efficiency.

Since agrivoltaic systems affect the microclimate, most notably in terms of light reduction, the effects on crop growth are currently being investigated, with results suggesting that the shade provided by the PV modules may have a positive effect on crop yield in hot and dry years. Therefore, this thesis investigated the impact of an agrivoltaic system on crop growth, specifically potato, based on the system design and experimental data of a pilot system in southern Germany. In order to simulate the impact of fluctuating light due to shading by the module rows during the course of the day, hourly resolved climatic input data were used and compared with daily climatic input data for the years 2017 and 2018 using the crop model GECROS_h. Furthermore, bias-adjusted HYRAS data, consisting of two climate models each for a low (RCP 2.6) and a high (RCP 8.5) CO2 concentration scenario, were used to evaluate the impact of climate change on crop growth until 2050. A calibration of the crop models was conducted using the software UCODE and field observations from the years 2017 and 2018.

The results show that the extended calibration and hourly climatic input for the crop model GECROS_h did not improve the yield predictions for 2017 and 2018 compared to a less intense (GECROS) or uncalibrated (SPASS) crop model with daily climatic input data. Furthermore, the crop models showed difficulties in simulating the effect of the agrivoltaic system, overestimating the effect of the agrivoltaic system in 2017 and underestimating the effect in 2018. The deviations from the observed yields thereby ranged from - 9.74 % to + 14.22 %. In terms of climate change impact, yields were simulated to decrease for both CO2 concentration scenarios over the simulation period from 2020 to 2050. However, the simulated average annual yields for the agrivoltaic system are higher with 6054 ± 556 kg/ha (RCP 2.6) and 5787 ± 856 kg/ha (RCP 8.5) compared to a reference site with average annual yields of 5967 ± 574 kg/ha (RCP 2.6) and 5728 ± 926 kg/ha (RCP 8.5).

Acknowledgements

I would like to thank my first and second supervisors, Prof. Dr. Thilo Streck from the University of Hohenheim and Dr.-Ing. Matthew Berwind from the Fraunhofer Institute for Solar Energy Systems (ISE). Many thanks also to Dr. Sebastian Gayler for the great scientific support and to Julia Riedelsheimer for the valuable preliminary work. Special thanks also go to the Agrivoltaics group at Fraunhofer ISE, where I found a great atmosphere to work and discuss.

Working together for a greener future

A-380

Social preferences in nature photography as an important guideline in shaping our surroundings and human impacts

P. Pluta
Warsaw University of Life Science, Forestry, Warsaw, Poland

Abstract body

Each person perceives the world around us in a different way and has their own preferences. The diversity of preferences in society becomes problematic when there is a need to prepare something for a larger audience. Therefore, it is necessary to examine and analyze these preferences in order to determine how to visually and thematically convey certain issues to society. During an event organized at the Warsaw University of Life Sciences campus, two exhibitions of nature photography were held, featuring a total of 19 boards with 72 photographs. While viewing the exhibition, visitors filled out a survey in which they provided information about their age, education, and interest in nature. From each board, they selected one photo that they liked the most, as well as one board from each exhibition that appealed to them the most. A total of 120 completed surveys were collected during this event. In the subsequent analysis of the survey results, a clear division in photo selection was observed. Children were more likely to choose photographs featuring animals, but this trend decreased with the age of the respondents. Old-growth forest-themed photographs were a common choice among all individuals. The choice of photos was also influenced by their color and exposure. As the study showed, significant differences in photographic preferences exist within society. Each age group has its own preferences. The information obtained in this study should be taken into account, for example, when creating nature information boards.This will allow the creation of places where society will be more inclined to visit, thus providing an opportunity to engage with educational content. This will have a direct impact on the shape of our surroundings and an indirect impact on the growth of ecological awareness.

Acknowledgements

I would like to sincerely thank my supervisor for the impact on my project.

A-248

A sampling method incorporating operational constraints for environmental mapping.

M. Dumont[1,2], G. Brunel[1], O. Taugourdeau[2], J. Nespoulous[2], H. Boukcim[2], B. Tisseyre[1]
[1]ITAP, Univ. Montpellier, Institut Agro, INRAE, Montpellier, France, [2]Valorhiz, Montferrier-sur-Lèz, France

Abstract body

This work aims at introducing a new sampling method for environmental mapping. It accounts both for i) sample representativeness by capturing the variability of available ancillary data like remote sensing images or other high spatial resolution data, and ii) operational constraints like travel time from one sample site to another. In the literature, sampling methods often focus on a high representativeness of the sample sites over the study area. However, sampling (i.e botanical survey) is usually a costly and time limited task. Thus, in an operational context such constraints must be considered, especially for large-scale areas. The main lever to reduce these is the travel time between sampling sites. To address this issue, several authors proposed new methods to optimize cost constraints. Those methods optimized absolute access cost to each point, but not travel time per se. Our approach proposes an original method to ensure a short travel time between sampling sites while preserving sample representativeness. Hence, this method helps environment surveyors to prepare and conduct optimized field surveys. It provides several optimal sampling schemes which let the practitioner to choose the best option according to desired sample quality and available time resources. This method relies on NSGA-II, a multi-criteria optimization algorithm based on Pareto optimality and genetic algorithm. Two criteria were used: a) cLHS objective function that ensures the sample to reproduce ancillary data marginal distribution and b) travel time between sampling sites computed with OSRM route API, an open-source routing engine for road networks. Along iterations, it simultaneously optimizes both criteria to efficiently approach optima. The method was applied and tested on a hedges mapping project already conducted in 2019 in western France on a 47km2 area. It was compared to the actual sampling design already performed on the area. Results show that our method provides sampling schemes that are more optimized (with both criteria): for a same sample size, it provides an equivalent representativeness and a significantly smaller travel time than the real sampling. To conclude, our approach gives promising results for field sampling for environmental mapping. As it optimizes both sample representativeness and cost constraint, this method may be a relevant decision support for environmental surveyors.

Acknowledgements

We acknowledge the support and funding of Valorhiz company in conducting this research project.

A-379

Indonesia’s New Capital City Development and Ecological Impacts: Social Views with An Emphasis on Climate Change

H. Mahabbah, P. Sacher
University of Göttingen, Human Geography, Göttingen, Germany

Abstract body

This study examines the ecological impacts of Indonesia's new capital city development, IKN (Ibu Kota Nusantara), with a particular focus on climate change, utilizing a socioecological approach. Limited scientific research has been conducted in the area, highlighting the need for further investigation. Extensive fieldwork, including interviews, photography, and on-site observations, was conducted in the villages of Bukit Raya, Bumi Harapan, and Pemaluan, where the KIPP (Kawasan Inti Pusat Pemerintahan) of IKN will be located. Supplementary data was collected from open-source resources and analyzed using content analysis and an inductive category development model. The findings, correlated with the enhanced NDC (Nationally Determined Contributions) and green economy, reveal social perspectives on the ecological impacts categorized as diversity, climate change, and disasters and inconveniences. Impacts on biodiversity encompass fauna, agriculture, and forestry, while climate change impacts are observed through changes in rainfall patterns and temperature. Disasters and inconveniences include flooding, drought, dust, the presence of large vehicles, and deteriorating road conditions. This study provides an initial understanding of social views on the ecological impacts of the KIPP IKN development, with an emphasis on climate change.

Acknowledgements

This research is part of my master thesis for the program of Erasmus Mundus Joint Master Degree IMSOGLO (International Master in Soils and Global Change). This is the result of my independent research with the help of Dr. Philipp Sacher of *Georg-August-Universität Göttingen* as my main supervisor and Mag.rer.nat. Dr.phil. Veronika Gaube of *Universität für Bodenkultur Wien* as my co-supervisor.

Our planet as a resource

A-281

Enhancing Livelihood Diversification Strategies among Cocoa Farmers in the Ahafo Ano District, Ghana: Exploring the Influencing Factors

W. Nkomoki, S. Kassim, E. Donkor, T. Larbi
Czech University of Life Sciences, Economics and Development, Prague, Czech Republic

Abstract body

This study investigates the factors influencing off-farm livelihood diversification among cocoa farmers in the Ahafo Ano District of Ghana. While cocoa farming is a primary income source for smallholder farmers, it faces challenges related to limited profitability and sustainability. To mitigate these risks, farmers are increasingly turning to off-farm activities for income diversification. Understanding the factors that contribute to this diversification is crucial for designing effective strategies to support farmers in achieving sustainable livelihoods. The research aims to explore the socioeconomic factors that impact off-farm engagement, assess its effects on income diversification and output, and identify the limitations of cocoa production in the study area. Data was collected through interviews and surveys, analyzing responses from 50 participants using descriptive statistics, regression analysis, and nonparametric tests. The findings highlight the significance of off-farm work in enhancing income and output among cocoa farmers. Age, farming experience, and land ownership were identified as influential factors affecting the likelihood of engaging in off-farm jobs. Additionally, the study reveals that health concerns and limited access to credit play a role in off-farm engagement among cocoa farmers. Moreover, farmers with off-farm jobs demonstrated higher incomes and outputs compared to those without such diversification. These findings contribute to the understanding of sustainable cocoa farming and rural livelihood strategies in Ghana, emphasizing the importance of promoting off-farm opportunities for income enhancement and poverty reduction.

Acknowledgements

Ing. et. Ing. William Nkomoki, Ph.D
Ebenezer Donkor

A-191

Above and belowground dynamics of a changing tundra ecosystem

O. Redeyoff
University of Copenhagen & University of natural science Vienna (BOKU), Copenhagen, Denmark

Abstract body

As the Arctic ecosystem is under threat of a changing climate system, it is important to understand how the ecosystem is influenced by the changing climate. With the projected increase in temperature and precipitation in certain regions of the Arctic, plant and microbial activity will be highly impacted and change the planet's energy, carbon, and nutrient budgets. The study aims to see how the above- and belowground soil samples from Zackenberg, North East (NE) Greenland, respond to five different treatments; control plots (C); plots with a longer growing season driven by reduced or removed snow cover in spring (LG); shaded plots (as climate change is expected to increase plant and cloud coverage, increasing shade over the Arctic) (S); a shorter growing season due to more snow and later snowmelt (SG); and, finally, summer warming with open top chambers (T). The aim is to investigate how the different treatments affected the top and subsoil levels of total C, N, and nutrient availability, and how the different treatments would affect the total plant cover and estimate of plant greenness. In addition, specific leaf traits in Arctagrostis latifolia and Salix arctica, two dominant plant species in the site, were investigated.

Results showed that there were generally no significant differences between the treatments, except for the temperature and the δ13C in S. arctica. There were significant differences between the soil depths, except for C:N ratio and the gross primary production (GPP) flux. Some trends showed a reduction in soil carbon concentrations in warmed plots compared to C and in LG treatment. Normalised difference vegetation index (NDVI) showed a higher trend in the T treatment, whilst moss height was non-significantly higher in C and LG treatments. The ecosystem respiration (ER) and net ecosystem exchange (NEE) were numerically higher in the SG treatment, followed by the C treatment, suggesting that climate change has already impacted the area. Whilst observing A. latifolia and S. arctica, they suggested that SG and S treatments had less exposure to drought stress than the other treatments, with LG and T treatments causing the most ecological stress. Because the results were not significantly different between treatments, it is suggested that more time or higher replicates be used to determine whether treatments affected top and subsoil C, N, and nutrient availability, as well as total plant cover and estimated plant greenness.

Acknowledgements

I would like to thank Prof. Anders Michelsen and prof. Sophie Zechmeister-Boltenstern for the support during the thesis research.

A-190

Understanding the sustainability issues of the Maltese dairy cattle sector

N. J. Tirchett, E. De Olde
Wageningen University & Research, Animal Production Systems, Wageningen, The Netherlands

Abstract body

Livestock systems in Europe are facing increasing pressure to adopt more sustainable practices, and the dairy cattle sector in Malta is no exception. This study aims to analyze stakeholder perceptions of the current performance and sustainability challenges faced by the Maltese dairy sector. By understanding these challenges, stakeholders can take the necessary steps to ensure the long-term viability of the sector.

To achieve this goal, semi-structured interviews were conducted with 14 participants, including farmers, academics, employees from the government, and the dairy cooperative. These interviews, along with a comprehensive review of local literature, helped identify key themes within the three sustainability pillars: economical, environmental and social.

Several significant issues affecting the Maltese dairy sector were highlighted by the stakeholders. The most commonly mentioned challenges include high costs associated with feed purchase (n=14), low farmer income (n=10), inadequate management and handling of manure (n=10), limited availability of agricultural land and resources (n=9), and uncertainties regarding the future of farms and farmers' livelihoods (n=10). These issues, if left unaddressed, have the potential to undermine the sector's sustainability.

Based on the findings from both the interviews and the local literature, it is evident that immediate action is required to tackle the present challenges and ensure a sustainable future for the dairy sector. Several recommendations emerged from the study, including the need to enhance collaboration and dialogue among stakeholders, empower farmers with relevant information and incentivize their willingness to adapt and invest in innovative practices. Furthermore, there is a necessity to improve public awareness about the industry, encourage more professionals and experts to provide their services to farmers, and develop a strategic plan to guide the sector towards a sustainable future.

By implementing these recommended actions and changes, the Maltese dairy sector can potentially deal with the challenges faced with, and move towards a more sustainable and resilient future.

Acknowledgements

I would like to express my gratitude to the participants who generously shared their insights and perspectives through the interviews. Their valuable contributions greatly enriched this study and made it possible.

Our planet as a resource

A-203

Developing Spectral Estimation of Carnosic Acid Content in Field Grown Rosemary Cultivars for Optimizing Breeding Strategies

A. Krief[1], I. Herrmann[1], N. Dudai[2]

[1]The Hebrew University of Jerusalem, The Robert H. Smith Institute of Plant Sciences and Genetics in Agriculture, Rehovot, Israel, [2]Newe Ya'ar Research Center, Agricultural Research Organization (ARO), The Unit of Aromatic and Medicinal Plants, Neve Ya'ar 3009500, Israel

Abstract body

Rosemary (*Salvia rosmarinus)*, a widely cultivated aromatic shrub, is a valuable natural resource of chemical compounds, particularly of interest to the food industry as a natural preservative food additive, i.e., E-392. The antimicrobial properties of rosemary are attributed to terpenes, including Carnosic Acid (CA). The CA content in dry rosemary leaves exhibits a variation ranging between 1% and 10%. This study aimed to nondestructively assess the CA content in field grown rosemary panel using *in-vivo* hyperspectral reflectance data. The spectral estimation of CA content in field grown rosemary cultivars using hyperspectral data holds significant promise for the Unit of Medicinal and Aromatic Plants of the ARO that is engaged in a breeding program aimed at rosemary varieties with elevated CA levels. One of the cultivars has already commenced commercial cultivation for this specific purpose. Hyperspectral data was obtained using Hi-Res FieldSpec4 spectroradiometer while CA content was assessed using High-Performance Liquid Chromatography (HPLC). The spectral data was analyzed to identify the best two spectral-bands combination for CA estimation using the Normalized Difference Spectral Index (NDSI). In order to use the entire spectral bands available, that usually improves the model accuracy, Partial Least Squares Regression (PLSR) was applied. The Pearson correlation coefficient (r) was calculated to investigate the relationship between spectral regions and CA content for the NDSI data. NDSI analysis identified three highly correlated spectral regions potentially associated with the absorption of phenolic compounds, the presence of water molecules (r = 0.72), and carbon-hydrogen aromatic bonds (r = -0.54). The PLSR model resulted in Root Mean Square Error (RMSE) values of 1.4, 1.5 and 1.6 % of dry matter for calibration, cross-validation (CV), and prediction respectively, and coefficient of determination (R^2) values of 0.65, 0.56, and 0.54 for calibration, CV, and prediction, respectively. These findings highlight the potential of hyperspectral data analysis for characterizing rosemary cultivars and establishing a method for estimating chemical compounds *in vivo*, which can benefit breeders and eventually will increase farmer's profitability. Future work will include incorporating additional relevant traits, such as the influence of water content, and exploring additional machine learning regression algorithms to improve the estimation accuracy.

Acknowledgements

I am deeply grateful to Dr. Ittai Herrmann and Prof. Nativ Dudai, my thesis advisors, for their unwavering support, insightful feedback, and invaluable guidance that have shaped the direction of this research. I would also like to express my sincere appreciation to The Robert H. Smith Institute of Plant Sciences and Genetics in Agriculture at The Hebrew University of Jerusalem for their generous support and funding, which have been instrumental in making this research possible.

A-121

Influence of extreme precipitation events on nutrient and sediment discharge from Kielstau catchment area

A. Kuehn
Swedisch University of Agriculture, Uppsala, Sweden

Abstract body

Though the EU implemented the Water Framework Directive, the quality of water bodies has not improved yet enough to achieve the directive's goals. The increasing anthropogenic use and change of landscapes leads to excessive nutrient concentrations in surface water bodies and erosion. A growing number of extreme precipitation events due to climate change transports even more nutrients into water bodies. This work aims to extrapolate from extreme precipitation events to nutrient and sediment discharge in a lowland catchment area and derive possible counter measures.

The Kielstau catchment area (50 m^2) in Northern Germany is dominated by agricultural use. As a monitoring and studying area of the Christian-Albrechts-University Kiel, a long-term and continuous data series is provided. Water samplers were triggered by a rise of water level of 2 cm within 2 hours and logarithmically distributed samples were taken for 24 hours. Three events at two measuring locations were investigated and analysed for nutrient (total P, PO_4-P, NH_4-N, NO_3-N & NO_2-N) and sediment concentration. The results were compared to the mean concentrations of the daily composite samples. Additionally, using R Studio the relationship between change of water level after a precipitation event and both nutrient and sediment concentrations was statistically evaluated.

Ignoring outliers mean concentrations of the daily composite samples were always higher than concentrations detected after precipitation events. Furthermore, each event behaved differently, thus a statistical unambiguous pattern was not observed.

Due to the small amount of events sampling errors had a strong impact on the outcomes, not allowing to develop a course of action. Hence, a second adapted campaign should be run including more background data to establish effective management options.

Acknowledgements

Thanks to Henrike Risch, PhD Student at Christian-Albrechts-University zu Kiel, supervising my field work and thesis.

A-327

Insect Exuviae and Frass: A Sustainable Solution for Enhanced Plant Growth and Pest Management

R. R. Manda[1], P. Tirello[2], D. Scaccini[2], A. Pozzebon[2]

[1]Wageningen University & Research, Wageningen, The Netherlands, [2]University of Padova, Department of Agronomy, Food, Natural Resources, Animals and Environment, Padova, Italy

Abstract body

With the world's population growing rapidly, the challenge of providing sufficient, hygienic, and nutritious food is pressing. However, the traditional reliance on agricultural land for grazing and animal feed production is straining resources. To achieve sustainability, innovative protein sources such as insects are gaining traction, offering a viable alternative for human and animal consumption. Insects, such as the yellow mealworm (YMW), are gaining popularity as an alternative protein source for human and animal consumption. This study investigates the integration of waste from YMW insect production into the agricultural system to promote circularity and sustainability. The effects of incorporating YMW exuviae and frass into greenhouse-cultivated tomato plants were examined. Key morphological parameters were evaluated, and the results were compared with conventional chemical fertilizer and organic manure. The findings revealed that amending the soil with YMW exuviae and frass had a positive impact on tomato plant growth and development. Treated plants showed considerable improvements in various parameters, including plant height, stem diameter, root length, number of compound leaves, fresh shoot biomass, and overall fruit yield, comparable to those treated with organic manure and chemical fertilizer. Moreover, the study explored how these amendments influenced the survival and behavior of invasive brown marmorated stink bugs. The presence of YMW exuviae and frass significantly influenced the stink bugs, leading to increased pest mortality and reduced preference for treated tomato plants compared to the untreated control plants. The positive effects observed can be attributed to the nutrient-rich composition of the residual streams, the presence of chitin promoting beneficial microbe activity, and the stimulation of induced systemic resistance in the treated plants. The exact mechanisms that govern the effects of insect residual streams on the survival and behavior of brown marmorated stink bugs have not been studied. Hence, gaining a deeper understanding of these mechanisms may facilitate the optimal utilization of these insect residual streams to not only enhance plant growth and development but also reduce pest pressure.

Acknowledgements

My sincerest thanks and heartfelt recognition to my respected supervisors Prof. Alberto Pozzebon and Prof. Gerben Messelink for their excellent guidance and assistance throughout my master internship. Your constructive suggestions and guidance were beneficial to my studies and the execution of this task.

Pigs, pine trees and everything in between

A-135

Assessment of the Accuracy of NIRS Technology for Determining the Proximate Composition and Amino Acid Content of Commercial Soybean Meal Samples

L. Dardabou[1,2], G. G. Mateos[3], L. Aguirre[3], M. A. Ibañez[2]

[1]University of Natural Resources and Life Sciences (BOKU), Institute of Animal Nutrition, Livestock Products, and Nutrition Physiology, Vienna, Austria, [2]Universidad Politécnica de Madrid, Departamento de Economía Agraria, Estadística y Gestión de Empresas, Madrid, Spain, [3]Universidad Politécnica de Madrid, Departamento de Producción Agraria, Madrid, Spain

Abstract body

In total, 30 commercial samples of soybean meal (SBM) from the USA (n = 11), Brazil (n = 10), and Argentina (n = 9) were randomly collected by trained personnel from European feed mills. DM, CP, amino acids, EEh, and CF were analyzed by wet chemistry (WCh) and NIRS. All wet analyses were performed in the same laboratory using official methods. NIRS values were determined by 4 specialized European laboratories (A, B, C, and D) using their own calibration models. Independently of the SBM origin, the average and range of WCh values (as fed bases) were: 88.7% (85.6-91.1%) for DM, 46.2% (44.2-49.8%) for CP, 2.41% (1.40-3.30%) for EEh, 4.66% (4.10-5.20%) for CF, 2.91% (2.75-3.06%) for Lys, 0.63% (0.53-0.68%) for Met, and 0.67% (0.59-0.75%) for Cys. Bias, slope, and unexplained error were the statistics used to investigate the accuracy of WCh vs. NIRS, including comparisons among the 4 labs. The analysis was supported by a scatter plot of the ratio of NIRS to WCh (di) vs. NIRS values (ni) on a logarithmic scale, including bias confidence limits (BCL), limits of agreement, and any other trend that could be detected in the plot. DM content was properly determined by the 4 labs, with 95% of the ratios within the 0.981 to 1.031. CP values were close to reference values, with a mean ratio between 0.992 and 1.048. The BCL variation among labs implied that the under- and overestimation for the CP varied between 2% and 5%, respectively. For EEh and CF, the variability of the ratio ranged from 0.49 to 2.37 and from 0.47 to 1.29, respectively. The scatter plot trends showed that the magnitude of the detected error depended on the variable measured. For Lys, NIRS values were similar among companies, with lab “C” showing the lowest rate and an underestimation of around 7%, whereas for lab “D” the overestimation was as high as 7%. For Met, lab “C” had a slightly higher prediction error than all the others, with over- and underestimation being of 6% and 4%, respectively. The error for Cys varied by 4% and 9%, for under- and overestimation, respectively. NIRS data from labs "A" and "D" were similar to WCh data, with a SSEP of 0.02. In summary, the data showed that NIRS technology is a valid alternative to WCh to estimate the chemical constituents of commercial SBM. However, its accuracy depends on the analyzed component, the company that developed the calibration data, and factors, such as the country of origin of the SBM, that affects the chemical composition of the samples.

Acknowledgements

I would like to express my heartfelt gratitude to BOKU University, particularly the Institute of Animal Nutrition, Livestock Products, and Nutrition Physiology (TTE), for accepting me as a PhD student and granting me the prestigious position of university assistant. I am honored and humbled to be given this opportunity to contribute to the academic community and pursue my research interests. Thank you for believing in my potential and providing me with the platform to grow and thrive.

A-170

Dietary effect of wheat with higher levels of lutein and zeaxanthin in laying hens

J. Szmek[1], E. Skřivanová[1,2], M. Englmaierová[2], M. Skřivan[2]

[1]Czech University of Life Sciences, Department of Microbiology, Nutrition and Dietetics, Prague-Suchdol, Czech Republic, [2]Institute of Animal Science, Department of Nutritional Physiology and Animal Product Quality, Prague-Uhříněves, Czech Republic

Abstract body

Poultry farming plays an important role in promoting economic development, securing the market with supply and increasing farmers' income. The importance of laying hen farming lies in egg production. In terms of quality, the most important feature for the simplistic consumer is the colour of the yolk. The preference for yolk richness varies considerably from country to country according to consumer requirements. For this reason, either natural or synthetic carotenoids are often added to the feed mixtures for laying hens. The aim of the experimental part of work was to evaluate the effect of biofortified wheat variety PEXESO with increased content of natural carotenoids in the diet of laying hens on performance characteristics and egg quality. The experiment was carried out in the Institute of Animal Science in Prague Uhříněves. The experiment included 240 laying hens of the Lohmann Brown genotype at the age of 42 weeks. These layers were housed in enriched cages and divided into 4 groups according to wheat variety (TERCIE × PEXESO) and fat source (rapeseed oil × pork lard) in the diet. There were 6 repetitions of ten hens in each group. The experiment lasted 10 weeks. The results were statistically evaluated by SAS software. The addition of PEXESO resulted in an improvement in performance parameters, specifically, it reduced feed intake ($P < 0.001$) and feed conversion ($P = 0.013$). Laying hens whose diets included PEXESO produced eggs with reduced Haugh units ($P < 0.001$), but on the other hand, higher yolk color intensity ($P < 0.001$) and higher egg shell thickness ($P = 0.037$) and firmness ($P < 0.001$). The carotenoids lutein ($P < 0.001$) and zeaxanthin ($P < 0.001$) contents of the yolk were significantly higher in the PEXESO groups. Lutein ($P = 0.001$) and zeaxanthin ($P = 0.001$) deposition was also positively affected by lard. The diet with PEXESO and rapeseed oil increased the concentration of α-tocopherol ($P = 0.008$) and γ-tocopherol ($P = 0.012$) in the yolk. PEXESO and lard significantly increased the oxidative stability of fresh ($P < 0.001$, $P = 0.008$) and stored ($P = 0.050$, $P = 0.021$) eggs. In conclusion, PEXESO wheat variety increased the retention of biologically active substances, which was subsequently reflected in the performance of laying hens and produced egg quality. PEXESO wheat is a suitable component of feed mixtures for laying hens, but additional addition of another source of carotenoids is necessary for more pronounced egg yolk colouration.

Acknowledgements

A big thank for the great help and appreciation of warm support goes to the aforementioned co-authors, who are my supervisor Prof. MVDr. Eva Skřivanová, Ph.D. and my consultants Ing. Michaela Englmaierová, Ph.D. and Prof. Ing. Miloš Skřivan, DrSc.

Thanks also go to the Institute of Animal Science in Prague Uhříněves for providing the background necessary for the implementation of the research. This research was funded by the Ministry of Agriculture of the Czech Republic, grant number MZE-RO0723.

A-116

Sustainable intensification of cattle husbandry systems in the Colombian Amazon (Caquetá) - A cost-benefit analysis

A. Lüdtke[1], C. Lippert[2], S. Burkart[3], A. Lienert[2]

[1]University of Hohenheim, Center for Organic Farming (309), Stuttgart, Germany, [2]University of Hohenheim, Production Theory and Resource Economics, Stuttgart, Germany, [3]International Center for Tropical Agriculture (CIAT), Tropical Forages Program, Cali, Colombia

Abstract body

The extensive cattle husbandry systems in the Caquetá department, located in the Colombian Amazon, lead to severe environmental impacts, including deforestation, greenhouse gas emissions, soil erosion and biodiversity loss. To improve the understanding of farmer behaviour regarding the adoption of sustainable production alternatives, such as the use of improved forages or the establishment of silvo-pastoral systems, it is important to address the lack of information about the different types of cattle husbandry systems in this region and to analyse their profitability and cost structures. In the context of this project, a case study based on semi-structured interviews with 20 farmers and key informants will be conducted to produce well-founded cost-benefit analyses on sustainable cattle feed production alternatives. Data collection will take place from May to July and first results of the study will be presented at the ELLS Scientific Student Conference 2023. Through the analysis, it will be possible to identify the prevalent benefit-cost structures and differences in profitability levels among different types of farmers. Furthermore, to assess the vulnerability of the different farm types, sensitivity and risk analyses taking into consideration the impacts of, among others, price shocks and extreme weather events will be carried out. Carrying out a vulnerability assessment is particularly important in the study region where the impacts of the recent global economic crisis and the ongoing climate change are increasingly felt by farmers. It is, therefore, increasingly important to establish farming systems that are resilient and sustainable. Moreover, as a result of a subsequent SWOT analysis, context-specific policy recommendations will be derived to promote the sustainable intensification of the cattle sector in the Caquetá department. The analysis will, therefore, address the knowledge gap concerning the heterogenous production methods in the study region and will provide decision criteria for cattle farmers regarding investments in sustainable feed production alternatives.

Acknowledgements

I would like to thank my supervisors Prof. Christian Lippert and Dr. Stefan Burkart, as well as M.Sc. Anja Lienert, for their guidance throughout this project.

Pigs, pine trees and everything in between

A-390

Who overnights in the forest? – a profile of Polish bushcrafter

W. Juszczyk, K. Rzepka, A. Szczepaniak
Warsaw University of Life Sciences, Forestry, Warsaw, Poland

Abstract body

Forests have many different functions in human life – from economic and natural ones to those recently gaining an increasing interest i.e. – social functions. Widely understood tourism and recreational use of forest areas meet the growing need of people to rest from the pace of everyday life. The group particularly associated with staying in the forest are bushcrafters.

The aim of the study was to characterize the average Polish bushcrafter as well as to compare their profile with the foreign counterparts from Scandinavia and United Kingdom. An additional question that guided the following work was to check whether the ‘Zanocuj w lesie’ (‘Overnight in the Forest’) project launched by the State Forests in Poland has met the expectations of its target group, i.e. tourists willing to spend the night among the trees, which primarily include bushcraft lovers.

We prepared two surveys aimed at indicating the most important features that distinguish a bushcrafter. Respondents were asked about their age, education, origin, preferences regarding staying in the forest, familiarity with the ‘Zanocuj w lesie’ project and any proposals for changes that could be introduced to it. The questionnaire was distributed via bushcraft fanpage on Facebook. Nearly 200 responses were received, which after processing were used to create a profile of the native forest man, who turned out to be a middle-aged male from medium-sized city. Comparison of this image against a foreign background showed high similarities except for minor legal differences.

Acknowledgements

We would like to sincerely thank everyone who took part in creating this project, researching, and building the final version of a project.

Special acknowledgements should be given to all the members of our Tourist Section of the Scientific Club of Student Foresters and our supervisor - PhD Szymon Bijak. Thank you all for a great teamwork and all the support.

Last, but not least - many thanks to those who decided to respond in the questionnarie - it wouldn't be possible without you.

A-322

The evaluation of non-linear functions for modeling the relationship between breast height diameter and tree height in pine stands of different age classes in Lubsko Forest District

J. Rynkiewicz, B. Krukowska
Warsaw University of Life Sciences, Faculty of Forestry, Warsaw, Poland

Abstract body

Tree height is a characteristic used to determine the size of the tree stock, including volume and biomass. Height measurements are labor-intensive, hence statistical methods are used in forestry to save time during fieldwork. For this purpose, a sample is taken from the stand (usually 25-30 trees), on the basis of which a regression model of the relationship between height and breast height diameter (DBH) is built. This model, known as a height curve, enables the assignment of height to a tree of any given breast height within a stand that may consist of several thousand trees.

The objective of this study is to compare various non-linear functions for constructing height curves in pine stands of different age classes. The set of non-linear functions selected on the basis of the literature study also includes the Näslund function, which is commonly used in Polish forestry.

Empirical data were collected from measurements carried out in the Lubuskie Forests on sample plots established on typical pine habitats representing young (29 yrs), middle-aged (77 yrs) and old (123 yrs) Scots pine stands. Tree height and diameter at breast height (1.30 m) were measured.

Regression analysis was used to fit selected functions to the empirical data.

The set of evaluated functions included equations with two parameters (power, exponential and hyperbolic - Näslund function), equations with three parameters (power, hyperbolic, parabolic, monomolecular, logistic, as well as Gompertz, Weibull, and Chapman-Richards functions), and equations with four parameters (Sloboda and Chapman-Richards functions). The R-squared statistics were calculated and used to find the functions most useful for constructing height curves for Scots pine from Lubsko Forest District. The highest strength of the relationship between height and dbh was found in the youngest pine stand, where R-squared statistics reached the value of nearly 80%. In the overall ranking, the best function was a power equation with three parameters, and the Näslund function, commonly used in Polish forestry, took fifth place in the ranking, giving satisfactory values of goodness-of-fit measures.

Acknowledgements

The authors would like to thank all participants of the Interdisciplinary Camp of the Forestry Students' Scientific Association "Bory Lubuskie 2022" for their help in carrying out fieldwork.

A-279

The impact of equine-facilitated psychotherapy on suicidal clients

L. Štvrtňová
Czech University of Life Sciences Prague, Department of Ethology and Companion Animal Science, Prague, Czech Republic

Abstract body

The main aim of the paper was to use standardized psychometric scales to evaluate the extent to which equine-facilitated psychotherapy affects the level of suicidal tendencies as well as negative and positive feelings in patients hospitalized with suicidal tendencies at the Bohnice Psychiatric Hospital.

The actual research was focused on assessing the impact of EFP on positive and negative feelings, using the standardized Positive and Negative Affect Schedule (PANAS) questionnaire. In addition, the actual extent of suicidal tendencies, was measured using a standardized suicidal severity scale C-SSRS (Columbia-Suicide Severity Rating Scale). Both the experimental (n=30) and control (n=30) groups had identical schedules throughout their hospitalization, except for one optional activity (EFP) each week, which was the subject of the experimental group. Participants in the experimental group attended the EFP. In contrast, participants in the control group attended therapeutic workshops. The activities took place on the premises of the psychiatric hospital, 1 time per week for a period of 8 weeks.

The results of PANAS showed a statistically significant difference between the groups in the areas of pride ($p = 0.007$) inspiration ($p = 0.013$), determination ($p= 0.009$), attentiveness ($p= 0.002$), and activity ($p= 0.008$). A difference within the experimental group was observed in the area of timidity between the 1st and 2nd measures ($p< 0.05$), but it was not observed in case of the control group ($p< 0.01$). In these areas, we can consider a positive effect of EFP on individuals with suicidal tendencies. The results of C-SSRS indicated a statistically significant difference between groups in the second ($p= 0.008$) and third ($p= 0.001$) measure. In addition, at the end of the follow-up period, more than 71% of respondents in the experimental group showed no suicidal tendencies, compared with only 22% in the control group.

Based on these results, the positive effect of EFP on individuals with suicidal tendencies can be confirmed. EFP appears to be an effective therapeutic method in reducing suicidal risk. However, more research in this area is necessary in order to use EFP as an effective method in suicide prevention.

Acknowledgements

doc. Ing. Kristýna Machová, PhD.
Mgr. Veronika Juríčková

Big perspectives on small things

A-164

Correlative microscopy – a new perspective on barley endosperm

S. Huber, E. Stöger, E. Arcalís
University of Natural Resources and Life Sciences, Department of Applied Genetics and Cell Biology, Vienna, Austria

Abstract body

Cereal endosperm is a highly differentiated tissue that provides an appropriate environment for long-lasting accumulation of proteins and starch. The remarkable specialization of this tissue is evident in its endomembrane system, which undergoes extensive reorganization and rearrangement during seed maturation that results in the formation of storage organelles. Hordeins are the major storage proteins in barley seed endosperm, which are co-translationally inserted into the ER lumen and ultimately deposited within protein storage vacuoles (PSVs). In spite of the abundant literature about hordein bodies, the temporal and spatial relationship with the ER and the precise storage protein transport route to the vacuole remain elusive. Here, we establish a correlative light and electron microscopy (CLEM) approach using high pressure freezing for cereal endosperm that allows for the observation of constitutively expressed fluorophores combined with the high resolution of electron microscopy and provides new perspectives on the study of barley endosperm. Using a transgenic line expressing secreted GFP and other marker lines for the endomembrane system allowed efficient targeting of regions of interest for examination under light and electron microscopy. Here, we demonstrate that (i) an electron-dense hordein fraction is likely trafficked through the golgi, and (ii) the presence of a putative autophagic body raises the question of an alternative route for vacuolar content incorporation in barley.

Acknowledgements

The authors acknowledge the HRSM project NANOBILD for infrastructure support and the Core Facility Multiscale Imaging (BOKU, Vienna, Austria) for technical advice and assistance.

A-333

Fermented red kidney bean (Phaseolus vulgaris L.) fortified with dahlia tuber inulin (Dahlia sp.) lowers cholesterol and triglyceride levels in diabetic rats

N. F. Setyaningrum[1], P. S. T. Suyoto[2], A. N. Haniyyah[2], M. Khoiriya[2], S. R. Savitarasmi[2]
[1]Wageningen University, Wageningen, The Netherlands, [2]Universitas Gadjah Mada, Yogyakarta, Indonesia

Abstract body

Type 2 diabetes mellitus (T2DM) is characterized by lipid abnormalities and subclinical inflammation. Red kidney bean (*Phaseolus vulgaris L.*) contains fiber that can inhibit lipid absorption and fuel gut microbiota to produce short-chain fatty acids, which may attenuate the inflammation process. Fermentation on food products is known to increase phenolic content and antioxidant activity, which may reduce oxidative stress levels in T2DM. This study investigated the simultaneous effects of fermented red kidney bean fortified with dahlia tuber inulin on blood cholesterol and triglyceride levels in diabetic rats. Red kidney bean was fermented using *Bacillus subtilis*, while inulin was extracted from dahlia tubers (*Dahlia sp.)*. Diabetes was induced by injecting 65 mg/kg streptozotocin and 230 mg/kg nicotinamide into all groups except the healthy control group (HC). Thirty male rats were fed either a semi-purified diet (HC and diabetic control/DC) or supplemented with red kidney bean (RB), red kidney bean + inulin (RBI), fermented red kidney bean (FRB), and fermented red kidney bean + inulin (FRBI). FRBI group showed the largest significant reduction of cholesterol and triglyceride levels compared to DC. RB, RBI, and FRB groups also observed improved cholesterol and triglyceride levels. Fermented red kidney beans and dahlia tuber inulin have a synergistic effect in decreasing cholesterol and triglyceride levels in diabetic rats.

Acknowledgements

Our study was financially supported by the Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada.

A-362

Endophytes' antagonism power: from phylogenetic signal to cross-kingdom effects

M. Berri
Wageningen University, Phytopathology, Wageningen, The Netherlands

Abstract body

Banana cultivation is key for global food security, sustaining the lives of more than 400 million people globally. However, the reliance of the banana export market on one single clone, the "Cavendish" variety, and the large monocultural systems in which it is cultivated increase banana vulnerability to disease outbreaks. Currently, three major diseases are threatening banana production: Banana Xanthomonas Wilt caused by the bacterium *Xanthomonas campestris*, Black Sigatoka Disease caused by the fungus *Pseudocercospora fijiensis* and Fusarium Wilt of Banana caused by the fungus *Fusarium oxysporum* TR4. The ineffectiveness and concerns of environmental and human safety associated with current methods of protecting banana crops highlight the need to explore new approaches. Harnessing the plant microbiome to antagonize pathogens offers a promising avenue for developing resilient crops that require reduced pesticide inputs. In particular, the portion of the microbiome that resides within the plant tissues (endosphere) offers attractive prospects for future applications. The endosphere provides a stable environment where endophytes are more intimately adapted and associated with the plant and can even be systemically transported throughout the plant and spread to the next generation through the seeds. This study aimed to screen a collection of endophytic bacteria from a wild banana accession in Indonesia to identify and investigate their in vitro antagonistic potential against the three aforementioned banana pathogens. We demonstrated a strong antagonistic phylogenetic signal against all three bacterial and fungal pathogens within the *C. erzurumensis* species, by performing a high throughput screening. Therefore, a cross-kingdom antagonistic effect by *C. erzurumensis* spp. was proven. A primary investigation of the mode of action revealed a broad defense strategy in the banana endosphere, with *C. erzurumensis* strains mostly relying on agar-diffusible compounds. In addition, strains belonging to *C. erzurumensis* used different modes of action against bacterial and fungal pathogens.

Acknowledgements

I would like to thank all the people within the Laboratory of Phytopathology from Wageningen University and Research who helped me during my thesis. In particular:
my supervisors Dr. Desalegn Etalo and Sen Xie for their invaluable help and support; my examiner Prof. Gert Kema; Prof. Jos Raaijmakers, Dr. Nurmi Pangesti, and Dr. Yemisirach Mulugeta, for donating the material collected in Indonesia and Ethiopia; my colleague Weizheng Peng for the data he shared with me, and all the lab technicians.

Big perspectives on small things

A-292

Can thermal acclimation to heat waves induce species-specific effects on the heat sensitivity of the predator Phytoseilus persimilis and its prey Tetranychus urticae?

M. Leitner, T. Austerlitz, T. Tscholl, A. Walzer, K. Wieczorek
Institute of Plant Protection, Department of Crop Sciences (DNW), Vienna, Austria

Abstract body

According to the trophic sensitivity hypothesis, higher trophic levels (e.g., natural enemies) are more sensitive to heat stress than lower trophic levels (e.g., herbivorous pests). We tested these assumptions using a prominent predator-prey couple in biological control, the predatory mite *Phytoseiulus persimilis* and its preferred prey, the two-spotted spider mite *Tetranychus urticae*. First investigations indicated that juvenile development under extreme heat waves (daily T_{max} = 38°C) resulted in smaller body sizes in the predator, but not in prey. These inter-specific shifts may favour prey under heat stress because large individuals are less prone to water loss. Alternatively, the predator may compensate for small body size by upregulating the expression of heat shock protein (HSP) genes involved in protecting protein structure. To test these assumptions, we first reared juveniles and females of both species under constant +25°C (non-acclimated to heat stress) or under extreme heat waves (acclimated), exposed them to short-term extreme heat stress (5 to 15 min, 42°C-60°C) and then evaluated the survival rates of the mites. Second, to explore plastic acclimation effects on gene expression, transcription levels of HSP-related genes are determined in both species by quantitative PCR following reverse transcription of RNA isolated from different life stages. Preliminary statistical analyses revealed that the survival rates increased in acclimated juveniles and females of the predator and also in female, but not juvenile prey. Preliminary investigations indicate that the acclimation effects in predatory females are induced by the upregulation of several HSP-related genes. Ongoing investigations will verify if this is also true for the other acclimation effects. However, these intra-specific acclimation effects on the thermal LD_{50} values were small (predator: juveniles = +0.4°C, females = +0.45°C; prey: females = +1.5°C) compared to the large inter-specific effects favoring prey (difference in juveniles = +2.0°C, females = +9.81°C). So far, our findings underline that *T. urticae* is better adapted to heat waves than its counteractor, which could consequently impair the success of *P. persimilis* in biological control with progressing climate change. Nonetheless, these results cannot be simply extrapolated to the practice of spider mite control and further experiments in tri-trophic systems are necessary to verify this assumption.

Acknowledgements

Krzysztof Wieczorek, University of Natural Resources and Life Sciences, Vienna
Andreas Walzer, University of Natural Resources and Life Sciences, Vienna
Tina Austerlitz, University of Natural Resources and Life Sciences, Vienna
Thomas Tscholl, University of Natural Resources and Life Sciences, Vienna
Andreas Dietl, University of Natural Resources and Life Sciences, Vienna

A-397

Prey-sharing behavior in aphid predators: a comparison of two lacewing species Micromus angulatus and Chrysoperla carnea

G. Bolletta
Wageningen University and research, Laboratory of Entomology, Wageningen, The Netherlands

Abstract body

The effects of prey sharing have been investigated in mammals and birds, in which this behavior showed advantages for the predators like reducing fights for food, increasing predation efficacy, and safeguarding food availability by reciprocal sharing, providing immediate and delayed benefits for the sharers. However, little is known about the incidence of prey sharing in arthropods and the implications on biological control have been mostly overlooked. In this study, the feeding behavior of two aphid predators, *Micromus angulatus* and *Chrysoperla carnea*, was investigated to test the incidence of prey sharing and its consequences on the biological control of aphids. A video-recording setup was used to test the feeding behavior of the predators at various predator-prey ratios by placing different numbers of predatory larvae into arenas containing five *Myzus persicae* subsp. *nicotianae*. The behavior of the predators was recorded for six hours and the number of prey killed was scored. Our results indicate that prey sharing is a density-dependent behavior, increasing at higher predator-prey ratios. Larvae of *M. angulatus* performed prey sharing more frequently than *C. carnea* and accepted higher numbers of predators sharing a single aphid. Interestingly, a positive correlation between the number of prey-sharing events and number of aphids killed by the predators was found, suggesting that prey sharing could increase kill rate. Additionally, the presence of conspecific larvae enhanced the predation success of *M. angulatus*. Our findings indicate that prey sharing is an adaptive behavior that could improve the foraging efficacy and kill rate of predatory lacewings, by facilitating the capture and consumption of aphids.

Acknowledgements

I would like to thank all the people that made this study possible.
My supervisors Karen Kloth, Apostolos Pekas, and Marcel Dicke.
The R&D Team of Biobest group for providing the study organisms.
Hans Smid for the video recordings.
The Business Unit of Bioscience from Wageningen University and Research for providing the camera setup.

A-363

Directional preference of pupae of Tenebrio molitor in a controlled magnetic field under dark conditions

M. Čapková[1,2], M. Čapková[3]

[1]Czech University od Life Sciences, Department of Plant Protection, Praha-Suchdol, Czech Republic, [2]Zemědělský výzkumný ústav Kroměříž, s.r.o., Department of plant protection and agricultural technology, Kroměříž, Czech Republic, [3]Czech University od Life Sciences, Department of Game Management and Wildlife Biology, Praha-Suchdol, Czech Republic

Abstract body

Tenebrio molitor (Linnaeus, 1758) generally known as mealworm is a beetle with holometabolic transformation. Two final stages, before development is complete, are the prepupa and pupa stages. Pupae of this stage can move on a limited scale by rotation in the abdomen while the bodies of prepupae generally move more. The aim of this project predominantly was to follow the preference of the pupae concerning the magnetic field as well as prepupae, using the example of yellow mealworm. The data was obtained from measurements made in the magnetic coil. More than 2716 individuals were used in this experiment under dark conditions. They were left in separate containers in the electromagnetic field of the coil at a constant temperature until transformation into an adult as well as control groups were left in a laboratory environment. In addition the same experiment with the same amount of test subjects was also done in light conditions. In the pupa stage, the directional preference at a constant level of the electromagnetic field and the preferred sector of the pupae were monitored. The sex was determined for the adults through preparation. In the NIS Elemens program, the length of the left elytra and the size of the pronotum were measured. Measurements of alignment were done in a newly created small program in the Geogebra. All data were then processed and evaluated in the Oriana 4. Males were found to align with magnetic field lines, while females sought only the sector in the magnetic field under dark conditions. Under the light conditions, pupae avoided various angles and sectors to the North. Pupae were aligned according to their prepupal stage. No individual under both light and dark conditions were found to have degenerative changes. These results could potentially be very useful, because if the prepuae and pupae are rotated correctly, the breeding could be automated. This could potentially lead to a mass production especially since June 2020 Tenebrio Molitor larvae dried or frozen are considered novel food by EFSA – European Food Safety Authority (Turck et al., 2021).

Acknowledgements

I would like to thank my supervisor Ing. Hana Brinkeová, Ph.D. for her guidance on writing bachelor's thesis. Furthermore I would like to thank to doc. Ing. Vlastimil Hart, Ph.D. for help with the evaluation of the results in the Oriana 4 program, Ing. Jiří Synek, Ph.D. for dedication during the establishment and progress of each attempts and Ing. Roman Vyčánek for his supervision in compiling a new program for evaluation of directional preference in Geogebra.

Big perspectives on small things

A-386

"Identification and evaluation of fermentation abilities of yeast isolated from honey from city apiaries"

J. Sękul, M. Pląder, K. Kawa
Institute of Food Sciences, Department of Food Biotechnology and Microbiology, Warsaw, Poland

Abstract body

Urban beekeeping is developing dynamically bringing many benefits. Urban apiaries are generally located on the roofs of residential buildings, organizations or enterprises. High osmotic pressure and low pH level of honey create a hostile environment for the majority of microflora. However, many studies confirm that honey is not a sterile product and contain microorganisms that can survive in difficult conditions like high osmotic pressure and originate from primary or secondary microbiological contamination (e.g. osmophilic yeasts such as *Zygosaccharomyces siamensis* or *Saccharomyces cerevisiae*). . However, research like that has not been conducted on honey from urban apiaries yet.

The aim of the conducted research was to isolate emerging strains of yeasts resistant to high osmotic pressure from honey from urban apiaries.

Honey samples from urban apiaries located in Polish cities were examined. From yeasts cultures DNA was isolated with use of chloroform-phenol method, after that PCR reaction of DNA fragments (LSU regions) was conducted and DNA was sequenced. Received sequences were analysed in BLAST programme, the aim was to compare received sequences with other available sequences deposited in the NCBL database. Then fermentation abilities of identified yeasts were tested in liquid substrate with Durham tube (glucose, fructose, saccharose and maltose were tested). The assimilation of selected sugars by the tested strains was checked by determining the growth curves after culturing for 48 hours in the Bioscreen C.

Obtained from honey samples from urban apiaries isolates of yeasts belonged to *Zygosaccharomyces*, *Candida* and *Saccharomyces* species. Fermentation abilities depended on type of yeasts. *Zygosaccharomyces rouxii* are able to ferment glucose, fructose and maltose but *Zygosaccharomyces mellis* and *Candida sp.* ferment only glucose and fructose. *Saccharomyces cerevisiae* are able to ferment glucose, fructose, saccharose and maltose. Their fermentation abilities may be used in mead production.

Acknowledgements

Research carried out as part of the Main Project for Scientific Students Clubs of the Warsaw University of Life Sciences, based on decision 4/2023

Supervisors: Katarzyna Pobiega and Anna Maria Kot

A-314

Optimizing the fixation process of shrimps of the genus Neocaridina in histological research.

R. Wild
Warsaw University of Life Sciences, Department of Ichthyology and Biotechnology in Aquaculture, Warsaw, Poland

Abstract body

Crustaceans are gaining increasing prominence as valuable model organisms in contemporary scientific research, owing to their intricate biology, complex anatomy, and suitability for experimentation in diverse fields such as genetics, toxicology, and histology. Among these organisms, the *Neocaridina* genus of shrimp stands out, widely favored for their vibrant colour variations, making them popular subjects in home aquariums and frequently employed in experimental investigations.

Proper fixation process plays a pivotal role in the meticulous preparation of histological specimens, ensuring accurate analysis and comprehensive evaluation. In an experiment aimed at refining the fixation methodologies for *Neocaridina* shrimp, ten distinct fixation variants were thoroughly investigated. Three fixative solutions: neutral buffered formalin (NBF), Bouin's solution, and Davidson's fixative, were analyzed, along with the implications of enzymatic digestion before and after fixation. Additionally, the effects of decalcification and decapitation on the fixation process were explored. The comprehensive qualitative evaluation involved parameters such as sectioning, tissue staining specificity, assessment of autolysis occurrence, and the overall quality of the resulting histological preparations.

The experiment conclusively demonstrated that NBF is not an optimal fixative for *Neocaridina* shrimp, as it induced a higher degree of autolysis compared to Bouin's solution and Davidson's fixative. Similarly, enzymatic digestion did not yield discernible improvements in specimen quality. Bouin's solution resulted in abnormal tissue staining, while decapitation had minimal impact on the fixation process.

Remarkably, the most optimal results were achieved by employing Davidson's fixative in conjunction with decalcification. This fixation variant yielded specimens with minimal autolysis and exhibited proper staining quality. These findings expand the possibilities for histological analyses in shrimp, facilitating the assessment of anatomical and histological changes in response to various factors.

Acknowledgements

PhD Dobrochna Adamek-Urbańska

Big perspectives on small things

A-208

Intestine-on-a-chip models: merits and drawbacks for emulating the in vivo intestine of current models.

A. M. Molenaar, C. Govers
Wageningen University, Wageningen, The Netherlands

Abstract body

The study of the human physiology has been of great interest for decades, answering questions on, amongst others, the functioning of the human body, human behavior, and disease mechanisms. Most studies involving the human physiology have been performed with the use of *in vitro* cell cultures or *in vivo* animal models. However, the former are often too simplistic to realistically represent the human *in vivo* physiology. The latter show more complicated physiology, yet animal physiology remains different from human physiology. Organ-on-a-chip (OOAC) models span the gap between the *in vitro* and *in vivo* models. In an OOAC, a miniaturized organ is grown on or inside a microfluidic chip with dynamic conditions and a controllable environment. OOAC models emulate the human physiology better than *in vitro* and *in vivo* models and they can provide new insights by studying the human physiology and, for example, its intercellular communication, disease mechanisms, and nutrient absorption in a more relevant context. As the intestine is an important organ due to its multiple functions, intestine-on-a-chip (IOAC) models, which allow for the study of the human intestine's physiology and thereby functionality, have been of great interest. In the current literature, an overview of the available IOAC models, their model characteristics, and the emulation quality of the *in vivo* intestine is lacking. Therefore, this review aimed at evaluating the merits and drawbacks of IOAC models and IOAC model characteristics concerning the emulation quality of the *in vivo* intestine. Hence, a comparative analysis of currently available IOAC models was performed, for which the reviewed IOAC models were divided into three groups and compared on the emulation quality of the *in vivo* intestine within each group. Moreover, applications and limitations of the currently available IOAC models were discussed together with some future perspectives. Overall, the current IOAC models already do a good job of trying to emulate the *in vivo* intestine. However, they still have limitations, for which further studies with these IOAC models need to be performed or for which the development of new IOAC models might be necessary. Therefore, amongst others, ideas on the improvement of the fabrication material and the addition of scaffolds were proposed.

Acknowledgements

AMM and CG designed the study. AMM collected the data and wrote the manuscript. CG supervised the process and provided feedback. AMM and CG read the final manuscript.

A-161

The Effects of Multiple Testing in Studies Comparing Gut Microbiota of Patients With vs Without Ulcerative Colitis: A Systematic Review

M. Reijn
Wageningen University & Research, Biomedical Sciences, Wageningen, The Netherlands

Abstract body

Background: The most accepted hypothesis for the pathogenesis of UC is an immune reaction against environmental agents in genetically susceptible individuals. With the gut microbiota as an environmental agent, new forms of treatment focus on the restoration of the gut microbiome. Genomics studies have to do with statistical inference problems, due to the testing of numerous amounts of null hypotheses. Therefore, I performed a systematic review to identify how multiple testing affected study outcomes on the differences in microbiota in UC patients compared to healthy controls.

Methods: A systematic search has been performed through the database PubMed for studies from 2010 until November 7, 2022, that compared the microbiome of UC patients with healthy controls. The primary outcomes were the difference in alpha diversity and differential abundance in UC patients compared to healthy controls. Studies that had not corrected for multiple testing were corrected with the Benjamini-Hochberg procedure, if they presented their exact P-values. The Newcastle-Ottawa Scale has been used to assess the quality of the included studies of this review.

Results: 31 studies have been included in this systematic review. The alpha diversity was either similar or decreased in UC patients. Most differences in differential abundance have been observed in increased amounts of Escherichia, decreased amounts of Clostridium cluster IV, and conflicting differences in amounts of Bacteroides. Half of the included studies have not taken multiple testing into account in their analysis, while other studies that had, showed too less transparency in their statistical methodology. Correction for multiple testing for 9 studies resulted in a decrease in evidence for the differences in Lactobacillus and Bacteroides.

Conclusions: This systematic review found differences in microbial diversities, but due to limitations in comparability no concrete conclusions were able to be made. Correction for multiple testing reduced the amount of significant tests and affected evidence for current findings. Studies consider multiple testing too rarely in their analysis and show too less transparency in their statistical methodology. Future large-scale research with better microbiome assessment methods is necessary.

Acknowledgements

I would like to give a special thanks to my supervisor Hendriek Boshuizen and the Wageningen University & Research.

A-218

Optimalisation of Matrigel ECM model for drugs studies in glioma in 3D culture

K. Kręgielewski[1], K. Kręgielewski[2], M. Grodzik[2]

[1]Warsaw University of Life Sciences, Faculty of Biology and Biotechnology, Warsaw, Poland, [2]Warsaw University of Life Sciences, Department of Nanobiotechnology, Warsaw, Poland

Abstract body

Glioma is one of the most common and deadly brain cancers diagnosed worldwide. Drug discovery screenings are often made using 2D cell cultures or *in vivo* experiments. Although 2D cultures can not simulate complex organisms, *in vivo* experiments require sacrifices, raising ethical concerns and protests. Between both, there are 3D cultures, that can mimic *in vivo* tumor environments without the need for the use of the animal. Even closer to the *in vivo* environment can be achieved by embedding 3D cultures in extracellular matrixes (ECM) or scaffolds.

In our research, we examined the influence of embedding U87 spheroids, previously grown for 7 days on agarose wells, in Matrigel ECM on the morphology and viability of spheroids. To do so, spheroids were embedded in different Matrigel ECM concentrations, using the sandwich technique, and cultured for 7 days, after which spheroid viability was assessed by AlamarBlue assay. To evaluate the ability of Matrigel ECM to incorporate nanoparticles we used graphene oxide (GO) in different concentrations. We also repeated the spheroid embedding procedure and incubated it for 3 and 7 days to study the effect of GO on spheroids morphology and viability in a time-dependent manner.

Analysis of the morphology, viability, and physical properties of different concentrations of Matrigel ECM allowed us to determine the optimal concentration for further study. Analysis of GO incorporation into the Matrigel ECM showed a change in spheroids viability dependent on incubation time and GO concentration. Morphology analysis showed a tendency for spheroids to migrate toward GO in higher concentrations and a tendency for GO flakes to wrap around spheroid branches. Our preliminary experiments showed promising results for the use of the model and will be further continued using other drugs.

Acknowledgements

I'm incredibly grateful to Prof. Marta Grodzik for her support.

Social economy in a changing world

A-399

Unravelling complexities on Land Dispossession in Namibia: a case study on Tsintsabis Settlement

I. Dall'Omo
Wageningen University and Research, Wageningen, The Netherlands

Abstract body

Namibia is a country with one of the most unequal land distributions in the world, and this disparity in access to and control over land is a primary cause of rural poverty, socioeconomic inequalities, and social discontent. Land displacement abounds with complexities that are often nationally and internationally overlooked and affect the entire Namibian population. Among other tribes, especially San ('Bushmen') groups have been, and continue to be, dispossessed of their lands and relocated through resettlement processes and development programs that have often further impoverished them. Starting from the reasons why resettlement is so problematic, this thesis contributes to existing literature by examining how land access and distribution is affected both by a change in land classification (i.e. resettlement/settlement, commercia/communal) and its relation to leadership figures and structures, together with migration patterns. Based on a qualitative case study and ethnographic fieldwork at the Tsintsabis settlement in northern Namibia, the research explores how the shift from resettlement farm to formal settlement might impact the Hai//om and Xung! San communities living there. I argue that the above-mentioned dynamics all together enhance land dispossession of the San tribes, as they build upon relationships reminiscent of colonial times and neglect ethnic differences, thus perpetuating injustices concerning land access and distribution. The way land management is tackled lacks a fair recognition of the indigeneity of the San and fails to remember and address the complexities behind land dispossession. Action without memory is blind, unjust, and susceptible to further injustices.

Acknowledgements

I thank my thesis supervisor, Stasja Koot, for helping me in revising this abstract.

A-368

Bridging the Spatial Gap: A Model Linkage Approach for Integrating Biodiversity-Friendly Measures into Market Models

S. Osterkamp
Universität Hohenheim, Stuttgart, Germany

Abstract body

Because of the dramatic decline of terrestrial biodiversity in the agricultural landscape it becomes important to design effective, efficient, and socially acceptable measures for biodiversity conservation. Economic assessments of biodiversity measures so far have mostly focused on the costs for implementing biodiversity-friendly measures, but the economic benefits and ecosystem services of such measures have rarely been addressed on a market level (Wesseler 2022). Computable general equilibrium (CGE) models can shed light to the multiple effects of policy measures on society and the whole economy and have recently been extended to also address ecological aspects (Banerjee et al. 2020a; Banerjee et al. 2020b; Banerjee et al. 2019). One difficulty (amongst others), however, when simulating biodiversity measures with CGE models is the spatial scale: CGE models operate on a regional to (inter-)national level, whereas biodiversity conservation measures take place at the landscape or field level. The spatial allocation of biodiversity measures is however crucial for the ecological efficiency of the measure (Grass et al. 2021; Kremen 2015; Phalan et al. 2011) as well as for economy and society (Sponagel et al. 2022). Matching spatial scales between CGE models and biodiversity conservation measures can promote and improve ecological-economic modeling of biodiversity and add relevant information to the development of biodiversity-friendly policy measures (Falco et al. 2021). This contribution explores the feasibility of linking a CGE model with a landscape scale model for integrating biodiversity-friendly measures. By simulating a stylized scenario (e.g., 10% increase of semi-natural habitats in Baden-Württemberg), challenges, requirements and pitifalls for a successful integration are highlighted. For this purpose, a simple CGE model is linked to a spatially explicit linear optimization model that incorporates ecological relationships at a finer spatial resolution (Sponagel et al. 2022). A two-way link integrates market effects into the landscape model (top-down, Delzeit et al. 2020) and allows for economic impact assessment of landscape scale biodiversity measures (bottom-down, Delzeit et al. 2020). The findings from this work ultimately contribute to how model integration can be used to better capture the economic impacts of biodiversity conservation measures, and to assess the impact of agricultural policies at the landscape level.

Acknowledgements

I would like to thank Christian Sponagel for the provision of the landuse model PALUD and Arndt Feuerbacher for the supervision and guidance. Thanks to Hannah, Falk, Vivi, Jonathan and Anne for being the best project team members one can imagine.

A-304

Unraveling Governance Challenges in the Provision of Extension Services for Carbon Agricultural Projects: Evidence from Western Kenya

M. Diaz, C. Bosch, A. Birkenberg, F. Hasenbach, B. Regina
University of Hohenheim, Social and Institutional Change in Agricultural Development (490C), Stuttgart, Germany

Abstract body

Development projects aimed at increasing Soil Organic Carbon (SOC) stocks in agricultural soils are considered one of the great opportunities opened up by the Clean Development Mechanisms (CDM) created by the Kyoto Protocol. By promoting Sustainable Agricultural Land Management (SALM) practices, projects intend to sell carbon units in the voluntary carbon markets and assure the provision of extension services even when the projects have come to an end. However, it is still unclear how the extension services, the monitoring phase and the carbon markets are connected. In order to increase the understanding of the governance systems, this study aims to examine the role of the state, the private and the third sector in the delivery of extension services within the Soil Protection and Rehabilitation of Degraded Soils for Food Security (ProSoil) project. This project is being implemented in Western Kenya, and is commissioned by the Federal Ministry for Economic Cooperation and Development (BMZ) and organized by the German Society for International Cooperation (GIZ). The study combines New Institutional Economics concepts and an applied theoretical framework for the evaluation of extension and monitoring services. For data collection, two qualitative empirical methodologies were used; the participatory mapping technique known as Net-Map and expert/key informant interviews involving a broad set of stakeholders. The results highlight external elements that can compromise the scope of this type of projects, such as the presence of private stakeholders with interests a) opposed to the Prosoil project and powerful enough to impede project outcomes, or b) similar to those of the project that prevent adequate impact measurement. Internal governance challenges include the lack of long-term follow-up given the monitoring program's design and the potential for SOC storage reversibility given the ambitious nature of the project's strategy and coverage, which makes it difficult to ensure additionality. By identifying the governance challenges that may emerge when implementing projects of this nature, policymakers will be able to make adjustments in future or current carbon sequestration projects, especially when improving monitoring phases assuring the accountability of carbon stocks and considering the institutional environment to stablish synergies among initiatives and institutions.

Acknowledgements

This study was undertaken as part of the GIZ "ProSoil" project in Kenya. The authors especially thank the Kenya Staff of GIZ, GFA consulting group, and Welthungerhilfe in Kenya for their logistic support of the fieldwork. Many thanks to all participants and research assistants for their time and efforts. The views expressed in this document may not be taken as the official views of these organizations.

Social economy in a changing world

A-350

Women's Empowerment Through Agri-Cooperatives In Rural Ghana

B. Adu-Boahen, J. Mazancova
Czech University of Life Sciences, Prague, Czech Republic

Abstract body

Cooperative societies and farmer-based organisations are increasingly gaining popularity among farmers due to their promising potential for capacity development and empowerment. They are seen as an avenue to address the socio-economic needs of rural communities, especially in Sub-Saharan Africa. Gender gaps and dynamics within the agriculture sector have created differences in the control of productive assets for farm production despite women's contribution to the agriculture sector. In Ghana, investment programmes within the agricultural sector are working towards attaining Sustainable Development Goal 5 (SDG5), which aims to empower women and promote gender equality. This study examines the effect of joining agricultural cooperatives on women's empowerment in agriculture in rural Ashanti Ghana using the Women Empowerment Approach Index (WEAI) tool. A cross-sectional study was employed with data collected through administration of questionnaire to 106 conveniently sampled rural women farmers of which 75 belong to agri-cooperative and 31 non-members. A Pearson chi-square association test was employed to examine the relationship between agricultural cooperative membership and women's empowerment. The results indicated a statistically significant association between agricultural cooperative membership and women's empowerment. Upon detailed analysis of statements adapted from the five domains of empowerment (Production, Resources, Income, Leadership and Time) in the Women's Empowerment in Agriculture Index, the study revealed that 68% of the empowered respondents belonged to an agricultural cooperative. The study recommends awareness creation on the benefits of joining an agriculture cooperative among female farmers as cooperatives have the potential to promote gender equality and empower women.

Acknowledgements

Ing. Jana Mazancova PhD

A-366

Proposal of Methodological Model for Assessment of Biogas Technology Impact on Women

S. Waltrová[1], J. Mazancová[2]

[1]Czech University of Life Sciences/ University of Hohenheim - Double Degree, Tropical and Subtropical Agrisciences, Prague, Czech Republic, [2]Czech University of Life Sciences, Sustainable Technologies, Prague, Czech Republic

Abstract body

Technological advancements are increasingly important as the world focuses on sustainable development. Biogas technology has been proven to be benefitial for development based on a decentralized approach to the utilization of renewable energy sources and the management of waste materials in rural areas of developing nations. The gender dynamics within the household are significant factor influenceing the impact of biogas technology. The men are responsible for the household decision making and women for everyday managerial responsibilities. Through biogas technology, the household activities burden of women has the potential to be reduced. Women tent to be responsible for household energy, traditional role of women and children is fuel and water colection and cooking. In Sub-Saharan Africa, the constraints that prevent women from attaining agricultural and household developments remain obstacles to their well-being in many important regards. Global initiatives such as the United Nations 2030 Agenda has directly and indirectly supported the global movement for biogas technologies, especially the SDG 5, Gender Equality. Nevertheless, there persists lack of research and methodological models in the sphere of sex and gender-disaggrgated data, especially in countries of Sub-Saharan Africa. The following proposal formulates a holistic analysis of biogas technology impact primarly on women, integrated assesment combining Huis et al's Three Dimensional Model of Women's Empowerment and Kabeer's Social Relations Framework, utilzed as a multi-level exploratory matrix, categorizing the evaluation into three levels: personal empowerment (individual), relational empowerment (household & community), and societal empowerment (nationa, society) and Women's Empowerment Framework which indicated the conceptual intersectional linkages of women's issues among three levels and approach to ensure gender equality. The model further analyzes the impact of biogas technology on women among the three levels through two differential subgroups: women with prio experience using biogas technology and women with no experience who are expecting biogas technology. The pilot assesment in Western Province of Zambia exploited methodological model, found biogas technology to provide social benefits, particularly personal level women's empowerment. The assesment emphasized the importance of culturally specific gender-based approach for the future use of the proposed model. < quillbot-extension-portal ></quillbot-extension-portal>

Acknowledgements

Honor to be part of the ELLS conference and thankful for the organization of the event and support of the Czech University of Life Sciences in Prague and University of Hohenheim.< quillbot-extension-portal ></quillbot-extension-portal>

A-222

Implementation of a circular economy - a qualitative analysis of water-related circular economy projects

L. Bischof
Boku Vienna, Vienna, Austria

Abstract body

The problem with the circular economy concept is that it is a young field of research and lacks standardization on many levels. Furthermore, there is little knowledge about the practical applications of strategies of the concept as well as their implementation. Therefore, the research question for this paper aims to find out what circular economy strategies are used frequently, and which barriers occur in the implementation of water-related circular economy projects. The objective of this bachelor thesis is to provide a better understanding of the concept of circular economy and to gain insights into water-related research projects in practice. The general approach used for this thesis started with reading basic literature on circular economy. After that, an analysis of the published data of the examined projects followed. Before entering the writing process, the collected knowledge was structured and compared in order to get a detailed plan for putting the results on paper. The research method used in this bachelor thesis is a descriptive analysis of qualitative data from published papers and deliverables of the examined projects. Findings are that strategies to extend the lifespan of materials, as well as strategies to use resources again in a useful manner, are applied regularly in water-related circular economy projects. Additionally, barriers to implementation occur on different levels. The main issues are lacking consumer awareness, institutional problems, and financial difficulties. The results from this thesis complement the current research as it delivers a view on specifically water-related circular economy projects and combines information from existing literature with an analysis of projects conducted in real business conditions.

Acknowledgements

Hereby I want to thank all the people who supported me during the time I worked on my thesis. First of all, thanks to my family - they allowed me to study in Vienna and explore the world with open eyes and curiosity. Besides that, I will thank also my colleagues at university and my friends who were always very supportive. Last but not least I will thank my supervisors André Martinuzzi and Anja Grüll for the whole process, meetings, and corrections during the work on my thesis

Food for the world

A-389

From waste to taste: Recycling of the coffee by-product “fresh pulp” into fruit spreads

A. F. Schlösinger[1], A.-J. Reineke[1], C. Acuña-Gutiérrez[1,2], T. Chacón-Ordóñez[2,3], J. Adrián Chaves[3], O. Acosta Montoya[3], V. M. Jiménez[2], J. Müller[1]

[1]Agricultural Engineering in the Tropics and Subtropics (440e), University of Hohenheim, Stuttgart, Germany, [2]Research Centre for Grains and Seeds (CIGRAS), University of Costa Rica, San José, Costa Rica, [3]National Centre for Food Science and Technology (CITA), University of Costa Rica, San José, Costa Rica

Abstract body

Coffee, after crude oil, is the second most important economic product worldwide that can generate a significant amount of waste (e.g. coffee pulp). The waste can be re-purposed into nutritious food products like fruit spreads that can offer an additional income source for smallholder farmers or opportunities for the food industry. In this context, this study aims to produce safe, easy and tasty fruit spread recipes that can be applied in many coffee producing countries worldwide. The study also aims to develop a product that maintains as many health-beneficial properties from the coffee pulp as possible. For this purpose, also physiochemical and nutritional properties are about to be analyzed.

The coffee pulp used in this study was sourced from the Bella Vista Coffee Plantation in Cartago, Costa Rica. After a washing and cleaning process, the coffee pulp was shredded within a cutter to obtain a pulpy consistency. The pulp is then converted into three different fruit spread recipes with pectin (1), without pectin (2) and with local guava (3) at two different levels of sugar (pulp: sugar ratio 1:1 and 2:1), resulting in six recipes. Analysis of tannin (VDLUFA method), caffeine (HPLC CUV-Vis), total carotenoids (HPLC-DAD UV-Vis) and chlorogenic acids (UV-Vis) will be determined for the fresh coffee pulp, the homogenized pulp, and the fruit spreads. A sensory panel will finally evaluate the color, taste, consistency, and mouth feeling of two chosen recipes have been found out to be the best in pretrials.

The first trials without pectin have been conducted, showing that the shredded product is well suitable for fruit spread production. The trials for the other spreads are still ongoing. A pH value of 3.5 was stable after adjustment with citric acid, both in the laboratory and on a larger scale. It is expected that the fruit spread with guava will have a lower level of caffeine. Moreover, the addition of this fruit will substitute the need to add pectin to achieve a suitable consistency, and it is foreseen to have a high consumer acceptability because of its taste. Additionally, it is expected that spreads with low sugar and prepared with lower heating temperatures will retain more nutrients than the industry standard reference prepared with high sugar and high heating temperatures. The physicochemical analyses are still pending. Nonetheless, all the results are expected by the end of September, so they can be presented at the conference in November.

Acknowledgements

This research project was financially supported by the Dr. Hermann-Eiselen Research Grant (No. 202302) of the Fiat panis foundation.

A-295

Comparison of natural waxes as ingredients in edible coatings for mango

A. Berková
Czech University of Life Sciences Prague, Faculty of Tropical AgriSciences, Crop Sciences and Agroforestry, Prague, Czech Republic

Abstract body

Mangoes are one of the most economically important tropical fruits, mainly imported to Europe or the United States. Mangoes are climacteric fruits that are perishable. Consequently, long-distance transport can result in large losses, which can result in economic losses. Edible coatings could help to prolong shelf life and maintain the quality of the fruit. When an edible coating is applied, a thin barrier is formed on the surface of the fruit for the transfer of gases, moisture, and solutes. The loss of moisture is one of the most important factors in maintaining the quality and extending the shelf life of the fruit. For this reason, this work aimed to compare the application of different natural waxes as an edible coating to prevent fruit weight loss. The comparison was made between shellac 5.5 %, shellac 10.20 % and carnauba wax. Different application methods (dipping, spraying, and spreading) were also compared. Mangoes were stored at 9 °C for 30 days. All coatings showed much lower weight loss compared to the control samples. Control samples had a weight loss of 4.21 %. The best coating that had the lowest weight loss was shellac 5.5 %. At the end of the experiment, it had a loss of 2.60 %. Carnauba wax had the highest loss (3.57 %). Regarding the method of application, the spreading had the best results with a loss of 2.56 %. However, after drying, the coating was visible on the surface. A similar result to the spreading was measured for the spraying, which showed a 0.04 % higher weight loss than the spreading. Therefore, spraying with 5.5 % shellac could serve as a suitable method of applying an edible coating to mango fruit. Based on the data, the best variant for reducing weight loss was found to be 5.5 % shellac applied by spraying.

Acknowledgements

IGA 20233101

A-173

Better meat analogues: fibre formation in meat analogues re-imagined through the perspective of the Grace curve

D. X. Chew
Wageningen University & Research, Food Process Engineering, Wageningen, The Netherlands

Abstract body

Strides toward sustainability and a burgeoning human population motivated the protein transition from animals to plants, with alternatives such as plant-based meat analogues. The fibrous texture of meat analogues is an important sensory parameter and it relates to the structuring process of meat analogues. However, the exact mechanism behind meat analogue structuring has eluded scientists.

The mechanism behind fibre formation in meat analogues has been attributed to the deformation of the dispersed droplets in a phase separated system, where the degree of deformation is influenced by the viscosity ratio (dispersed/continuous phase) in a relationship underpinned by the Grace curve. This study aims to understand how the viscosity of the dispersed phase affect meat analogue structuring using the Grace curve. Blends (44 wt% total dry matter) of soy protein isolate (SPI) and pectins of different viscosity were structured into meat analogues with thermomechanical processing (140 °C, 15 min) at rotations of 20 s^{-1} and 39 s^{-1}. The tensile properties of the meat analogues were measured. The blends were also analysed by oscillatory rheological tests (time, frequency, and amplitude sweep). At 20 s^{-1}, fibres formed for all the samples, and the fracture stress of the samples was inversely correlated to the viscosity of the pectins. It was also found that while SPI's viscosity was at least 10 times that of the pectins, the combination blend of SPI and pectin resulted in a viscosity higher than SPI. Therefore, it was hypothesised, based on the Grace curve, that the dispersed phase was a pectin-influenced SPI, instead of solely pectin which was the common assumption. Pectin was believed to have interacted with neighbouring SPI; thus, increasing the SPI's viscosity and forming a region of higher viscosity than the bulk SPI. At 39 s^{-1}, only one of the samples formed fibres. This was attributed to the lower elasticity found in the blend of the fibrous sample based on the oscillatory rheological tests.

The conclusion from this study presented a new way of interpreting results obtained from structuring meat analogues. With this new perspective, researchers can re-visit their assumptions, potentially shedding light on new insights that could improve the texture of meat analogues. The global production of meat analogues is tied to consumers' acceptance, hence an improvement in fibrous texture of meat analogues would further convince consumers toward a more sustainable food system.

Acknowledgements

Miek Schlangen, Atze Jan van der Goot

A-232

Sensory quality of selected confectionery products from gluten-free ingredients using modified recipes

D. Musiienko
Czech University of Life Sciences Prague, Faculty of Agrobiology, Food and Natural Resources, Praha, Czech Republic

Abstract body

The study was focused on evaluating the sensory properties of individual gluten-free confectionery products prepared using modified recipes. The work was divided into two main parts: theoretical and practical. The theoretical part addressed fundamental concepts related to gluten and its components. Information on gluten-related disorders, such as celiac disease, non-celiac gluten sensitivity, and gluten allergy, was also provided. This section described factors that can contribute to the development of these conditions, including epidemiology, clinical manifestations, diagnostic methods, and treatment. The work explained the impact of a gluten-free diet on human health and associated risks. Chapters in this section included studies on gluten-free diets and food labeling. Information on gluten-free flour and recipes for gluten-free cookies was presented at the end of the theoretical part.

The practical part of the study involved sensory analysis of three types of cookies made from gluten-free flour. Samples for tasting were prepared using modified base recipes that incorporated a gluten-free mix for confectionery products, buckwheat flour, and coconut flour. A total of 15 individuals aged 23 to 27, without celiac disease or gluten allergy, participated in the tasting.

The results of the sensory analysis confirmed the first hypothesis that selected gluten-free confectionery products would exhibit high sensory quality. These products were highly rated by the selected panel of evaluators. However, the second hypothesis, suggesting that the technological processing of gluten-free ingredients wouldn't be comparable to gluten-containing ingredients, was not supported. It was found that the technological processing of gluten-free ingredients for dough preparation and subsequent baking of confectionery products was at a similar level to that of gluten-containing products.

This study provides important insights into the sensory quality of gluten-free confectionery products and confirms their suitability for individuals with gluten restrictions in their diet. The contribution of this work also lies in providing information on gluten-related disorders and the impact of a gluten-free diet on human health. Further research in the field of gluten-free products can lead to improvements in their preparation technologies and expand the options available to consumers with various dietary restrictions.

Acknowledgements

I would like to express my gratitude to Mrs. Ing. Mgr. Diana Chrpová, Ph.D., for her professional guidance, supportive approach, and the time she dedicated to me during the realization of this work. I would also like to thank the evaluators for their participation in the sensory analysis of confectionery products made from gluten-free flours.

A-376

Development of a Recipe for Plant-Based Ripened Cheese Analog with Mold Cultures

M. Ziółkowska[1], I. Dębkowska[1], W. Śliczniak[2]
[1]Warsaw University of Life Science, Warsaw, Poland, [2]Warsaw University of Life Science, Warszawa, Poland

Abstract body

Year after year, there is an increasing demand for vegan products. Consumers are reaching for them for a number of reasons expecting them to be tasty and healthy. A plant-based alternative to mold-ripened cheeses is an important product on the market both for people who can't or don't want to eat traditional mold-ripened cheeses and for those who are simply looking for new and interesting flavors.
The purpose of this study was to develop a recipe for a plant-based analogue of maturing cheese with mold, physicochemical analysis and organoleptic analysis of prepared plant-based alternatives of camembert-type cheese. The materials were plant raw materials: cashews, pistachios, soy flour, chickpea flour, pea protein, pumpkin protein, hemp protein, spirulina, calcium chloride and sodium chloride. Strains of lactic fermentation bacteria used were: *Streptococcus salivarius KKP 3251* and *Lactococcus lactis KKP 3020*, as well as commercial bacterial starter cultures from Cashewbert: for vegan analogs of fresh and ripened cheese (mesophilic and thermophilic), and mold cultures from species:
Geotrichum candidum and *Penicillium candidum*. The scope of the work included the development of an analogue recipe (the ratio of water to plant matrix), the evaluation of fat, protein and dry matter content in the Food Scan apparatus, and an organoleptic survey of the cheeses. As a result we created ripened cheese alternatives that delighted both in appearance and taste.

The research was carried out within the framework of the project entitled: "Plant-based alternative of mold ripened cheese as an innovation among dairy analogs" funded under the program called "Student Scientific Circles Create Innovations" (Contract Number: SKN/SP/495 b71/2021).

Acknowledgements

We would like to thank Dr. Agata Fabiszewska for her invaluable assistance in this project. Her expertise, guidance, and unwavering support were instrumental in its completion. Her knowledge and feedback greatly enriched the project, and her availability and patience were greatly appreciated. We are grateful for the trust and encouragement she provided throughout.

A-263

Comparison of fish quality (Channa micropeltes) in natural ecosystems and farmed systems in Southeast Asia

C. Thanh[1,2], H. Mith[2], C. Peng[2], A. Servent[3], N. Durand[3], S. Avallone[1]

[1]L'Institut Agro Montpellier, APAB-Biochimie et Physico-chimie des Bioproduits et Aliments, Nutrition, Montpellier, France, [2]Institute of Technology of Cambodia, Research and Innovation Center, Phnom Penh, Cambodia, [3]UMR Qualisud, Cirad, Montpellier, France

Abstract body

Fisheries resources form the basis of diets and food security in Southeast Asia. These resources are threatened not only by global warming, but also by various forms of human pollution and overfishing (Yoshimura et al., 2022). It is against this backdrop that aquaculture is developing to reduce the pressure on natural environments, create income for producers and feed communities. The aim of the research being carried out is to assess the impact of fish growth conditions on their overall nutritional profiles and their contamination with heavy metals (arsenic, cadmium), mycotoxins and microplastics. Macronutrients and micronutrients (Fe, Zn, Mn, etc.) were assessed and overall nutritional quality scores (SAIN, LIM) were calculated to compare foods according to their content of 'positive' nutrients whose consumption should be encouraged and 'negative' nutrients whose consumption should be limited (Darmon et al., 2009). The fish studied were *Channa micropeltes*, one of the most popular species in Cambodia especially in aquaculture because it is resistant and adapts well to the conditions of the Tonle Sap Lake (TSL) (Barreto et al., 2022). The overall nutritional profiles (SAIN, LIM indicators) of wild and farmed fish were very similar whatever the production method. A significantly greater accumulation of lipids was observed in fish reared in cages. In our research, farmed fish were richer in omega-3 than wild fish. Reassuringly, mycotoxins did not accumulate at all, whatever the farming method, and heavy metals did not exceed the recommended limits per 100g, with the exception of mercury. The microplastics are currently being characterised. However, some heavy metals were detected and could expose certain vulnerable groups (pregnant women, young children) to health risks, as local populations can ingest quantities higher than 100g per day. Aquaculture makes it possible to obtain products of the same or even higher quality than those found in the ecosystem. Aquaculture is therefore an interesting alternative solution to develop and support, as it increases the availability of fish in the regions and generates income for the families in the communities. But the Cambodian government should pay more attention to protecting the TSL by strengthening public policies governing the management of urban waste and effluents, the use of agricultural inputs and pesticides, and fish quality controls.

Acknowledgements

This work was supported by the French Government Scholarship (BGF) co-funded by the Ministry of Education, Youth and Sport (MoEYS) program (115017X, 115034X, 122385Q, 125829R), Research and Innovation Center, Institute of Technology of Cambodia, and Cambodia Higher Education Improvement Project (Credit No. 6221-KH).

A-344

Investigation on the acclimation method of out-of-season European perch fry to pond conditions. Changes in the enzymatic profile of livers caused by decreasing temperature over extended period of time.

B. Łosiewicz[1], W. Wiechetek[2]
[1]Warsaw University of Life Sciences, Warsaw, Poland, [2]Warsaw University of Life Sciences, Warsaw University of Life Sciences, Department of Ichthyology and Biotechnology in Aquaculture, Institute of Animal Science, Warszaw, Poland

Abstract body

Research question: Production of European perch in recirculating aquaculture systems (RAS), has been practiced in Europe for almost 20 years. However technology still needs constant optimalization on multiple levels, for example lack of standardized procedures for raising fish from larval stage and offseason breeding in RAS cultures. This research is part of project focused on developing new standardized method of European perch production using combination of RAS culture and ground ponds. This experiment is looking for most optimal time of acclimation from RAS in which European perch fry was grown from offseason spawning, to temperature prevailing in ground ponds.

Methodology: During this study 4 groups of fish were examined. Each group contained 12 fish and were carried in 3 seperate tanks. 4 samplings of test material were performed, first one as a zero group at the start of the experiment, second one after 3 days of acclimation, third one after 6 days and the fourth one after 10 days of acclimation period to temperature prevailing in ground pond. Each fish was measured and weighed then the liver was dissected. From each sample of liver a biochemical panel was carried out which contained tests for alkaline phosfatase (ALP), acid phosfatase (ACP), superoxide dismutase (SOD) and glutation peroxidase (GPX), all measurements were standarised for total protein content.

Results and discussion: In this experiment, changes in liver enzyme profiles were observed during different acclimation periods. The activity of enzymes related to responding to oxygen free radicals (SOD, GPX) increased with longer acclimation times, indicating oxidative stress. ACP activity also increased, with a slight rise on day 6 and a significant increase on day 10 of acclimation. ALP activity did not show a similar relationship, but it significantly increased on day 3. These changes suggest liver acidification and cellular-level stress induction. Additionally, fish in the 10-day acclimation group experienced weight loss. These findings indicate that the duration of temperature changes, rather than the daily gradient, is the crucial factor in inducing stress. Slow and prolonged decrase in temperature trigger continuous adaptive responses and protective mechanisms, rather than adaptation to temperature change. Based on the results, an acclimation period of 3 to 6 days is recommended for better European perch welfare.

Acknowledgements

The study was conducted as part of the project "Diversification of the productive function of earthen ponds based on semi-intensive rearing of perch *Perca fluviatilis* - PRO-PERCH" (no. 00002-6521.1-OR1400004/17/20) founded by Operational Program "Fisheries and Sea 2014-2020". I would like to express my deepest appreciation and gratitude to the thesis supervisor PhD. Hubert Szudrowicz who supervised my work on the research project

Big perspectives on small things

A-349

Qualitative comparison of DNA isolation methods from insect specimen

A. Anđelković
Czech University of Life Sciences, Department of Ecology, Prague, Czech Republic

Abstract body

Correct identification of the species is one of the most crucial steps in forensic entomology. While morphological identification can be performed, it has a high margin of error, therefore making it a non-reliable source of information in forensic research. Molecular identification based on DNA has proven to be a significantly more accurate method and is the preferred way of identifying insects found on remains. The methods of obtaining the DNA vary in quality of the results, price and ease of handling. In this research, three different methods of extractions were performed and assessed. The DNA was isolated from previously collected and bred specimens of Thanatophilus sinuatus (Fabricius, 1775) and the specimens were stored in 96% EtOH. Two of the assessed methods of extraction were commercially available extraction kits: DNeasy Blood & Tissue Kit (Qiagen), NucleoSpin DNA Insect (Macherey-Nagel), and the third method used was direct PCR. Three different tissue amounts were also assessed throughout all three extraction methods: 1 leg, 2 legs and 3 legs. The amounts isolated were then measured using NanoDrop 1000 UV Visible Spectrophotometer and by Qubit 4 Fluorometer. The extracted DNA was followed by the amplification of the Cytochrome oxidase subunit I (COI) using the forward and reverse primer sequences. Obtained sequences were then visualized using the software Chromas 2.6.6. and blasted against GenBank (http://www.ncbi.nlm.nih.gov/genbank/). The results showed that all three methods had a satisfactory performance in terms of obtaining the desired sequence. The NucleoSpin DNA Insect Kit has shown the best performance in all the assessed parameters, but the price per sample and the requirement of owning not so commonly used laboratory equipment had to be taken into account. The direct PCR method had the lowest success rate, although the price and handling time presented as a significant advantage. This research suggests that, in the field of forensic entomology where precision is of the utmost importance, the NucleoSpin DNA Insect Kit would be the best extraction method, while direct PCR method could be used in situations where the amount of samples is high and the available funds are low.

Key words: Coleoptera, Silphinae, Thanatophilus sinuatus, Forensic Entomology, DNA extraction, extraction kits, PCR

Acknowledgements

Supervisor: Ing. Pavel Jakubec, Ph.D.
Assistant supervisor: Ing. Karolina Mahlerova
Laboratory partner: Rodrigo Ordonez

A-196

Arabidopsis Era1 GTPase homolog is involved in 16S rRNA maturation in chloroplasts

K. Gołębiewska, P. Gawroński
Warsaw University of Life Sciences, Institute of Biology, Department of Plant Genetics, Breeding and Biotechnology, Warsaw, Poland

Abstract body

Chloroplasts are semi-autonomous organelles that originated from endosymbiosis and share many characteristic features with prokaryotic molecular systems. The regulation of the chloroplast gene expression primarily occurs during translation and requires various factors that are encoded predominantly by the nuclear genome. However, all necessary rRNAs and tRNAs, that constitute the chloroplast translation machinery are encoded by chloroplast genome (plastome).

One of the proteins, that plays a role in rRNA maturation and contributes to the assembly of the small (30S) ribosomal subunit is Era1 GTPase. This protein stimulates 16S rRNA maturation by binding to the anti-Shine-Dalgarno region followed by GTP hydrolysis, which signals for RNazes recruitment. The aim of this study was to initially characterise a novel protein in *Arabidopsis thaliana*, the Era1 putative homolog encoded by the *Era1* gene.

The results indicate that the Era1 protein is localized in chloroplasts, likely in nucleoid regions. The Arabidopsis *era1* mutants accumulate precursors of 16S rRNA as confirmed by qRT-PCR, cRT-PCR and RACE. Additionally, these mutants exhibit a negative influence on the function of the photosynthetic apparatus and inhibition of photosynthetic pigments accumulation. Moreover, *era1* mutants display inhibited chloroplast translation following treatment with lincomycin and chloramphenicol.

Thus, our findings suggest that Arabidopsis Era1 homolog is an important factor in chloroplast translation, playing a role in 16S rRNA maturation.

Acknowledgements

This research was funded by The Polish National Science Centre (Narodowe Centrum Nauki) (SONATA-BIS 11, UMO-2021/42/E/NZ3/00274).

A-242

Investigating the Depth Dependence of CCA Contamination and Bacterial Productivity: A case study of the Collstrop CCA site

C. Laird[1,2]

[1]University of Copenhagen, Plant and Environmental Sciences, Frederiksberg C, Denmark, [2]University of Hohenheim, Soil Biology, Stuttgart, Germany

Abstract body

In this research, we investigated the depth dependance of CCA (chromated copper arsenate) contaminant distribution and impacts on deep soil bacterial productivity in a field study. This field study took place at the Collstrop site, a heavily-studied legacy CCA site in Denmark. Soils from depths between 0.1-6m at 8 sampling locations were analyzed for soil physiochemical properties, total contaminant concentrations, water-extractable Cu concentrations, bioavailable Cu concentrations, and potential bacterial growth rate. The results of these analyses provided tentative insights into the deep soil conditions of the Collstrop site including observations of As distribution patterns, vertical Cu mobility, irregularity in deep soil copper bioavailability between locations, and the potential existence of a threshold for the impact of bioavailable copper on deep soil bacteria. However, the main story of this thesis centers around the Collstrop site's heterogeneous nature. The extensive spatial and vertical heterogeneity observed affected every aspect of the analysis and ultimately makes the case for more specific and thorough examinations of the potential trends noted in this research.

Acknowledgements

I would like to acknowledge my supervisors, Dr. Kristian Brandt (KU), Dr. Ellen Kandeler (UHOH), and Peter Holm (KU), and Dr. Yinqi Tang (KU) for all of their help during this thesis process. Additionally, I must thank DMR Consulting, especially Morten Larsen, and the Capital Region for sharing their assessment data with us and taking samples for us onsite. Finally, I would also like to thank the lab technicians in Environmental Chemistry and MEB for their help in the lab and running samples.

A-133

Unconventional traits describing plant susceptibility to Tetranychus urticae may indicate novel gene candidates for resistance breeding.

A. G. Jezierska-Suwińska, M. Filipecki, A. Wlazło, E. Złotkowska
Warsaw University of Life Sciences, Warsaw, Poland

Abstract body

Each year, crop yields worldwide suffer significant losses due to the presence of parasitic spider mites. To enhance more efficient and sustainable food production it is necessary to understand the mechanisms of plant-pest interaction, with a focus on gene variants suitable for breeding new resistant cultivars. In our work, we focused on *Tetranychus urticae* (two-spotted spider mite; TSSM) infestation of *Arabidopsis thaliana* plants as a model system and recently created an analytical pipeline where the AI-based computer program, MITESPOTTER, is a primary component. MITESPOTTER performs analysis of the high-resolution leaf images and automatically detects eggs, damages and black faecal pellets which are frequently used for herbivore activity assessment. Our method allows for the precise quantification of the TSSM susceptibility/resistance of dozens of ecotypes or mutants. The collected data can be used for a genome-wide association study (GWAS) to identify chromosomal regions of TSSM resistance.

Here we present the adaptation of the MITESPOTTER system to detect white, guanine faeces which may reflect different TSSM resistance mechanisms. TSSM is known to produce two types of faecal pellets: dark pellets well visible in daylight and guanine white pellets which are more difficult to identify but easily distinguished by their natural fluorescence. In my research, a series of microscope hi-resolution scans of TSSM-infested leaves was made in visible and UV light, enabling accurate marking of 1000 guanine pellets on visible light scans, verified by cross checking through fluorescent scans. This collection was used to train a neural network of MITESPOTTER, which was subsequently used to analyse a large image collection, providing new data on TSSM susceptibility of *A. thaliana* ecotypes. Moreover, based on previously performed MITESPOTTER/GWAS which identified candidates for *A. thaliana* TSSM-resistance genes, a locus coding SAGA complex subunit 1 protein (SCS1) was described by extended meta-analysis and molecular tests. The results indicate that SCS1 is a promising candidate for further investigation on the mechanisms of plant-pest interaction.

This research contributes to existing host-spider mites interaction research and provides an insight into future methods of quantifying parasitic traces on plants. Further development of this and similar programmes may facilitate the improvement of mite resistance in crops and more sustainable food production.

Acknowledgements

The National Science Centre
Krzysztof Misztal

A-395

Advancing Species Identification: Assessing the Potential of DNA Barcoding for Identification of Cryptic Species in Comparison to Traditional Taxonomy

J. Stradal
Czech University of Life Sciences Prague, Faculty of Forestry and Wood Sciences, Prague, Czech Republic

Abstract body

Molecular taxonomic methods based on DNA sequence analysis are gaining prominence due to ongoing technological advancements. These methods are not limited to functional laboratories but are also being employed in field stations located in forests. They serve a dual purpose, contributing to traditional taxonomy by describing molecular characteristics of species, as well as aiding in the study of global biodiversity, identification of cryptic species or monitoring the composition of food in the food industry. One such method is DNA barcoding. The objective of this research is to elucidate the functional nature of DNA barcoding, highlight its advantages and limitations, and explore its applications in various domains, particularly in the determination of cryptic insect species. The efficiency of DNA barcoding was assessed using termites (Blattodea: Termitoidea) as a model organism. Termites demonstrate a high level of uniformity, posing a challenge for differentiation based solely on external morphological features. Therefore, in theory, DNA barcoding holds immense value in their identification. A selected set of twenty-four species was identified in the laboratory using COI and COII DNA barcodes, and the results were subsequently compared with classical identification methods that rely on external morphological features. Five termite experts were tasked with the morphological identification. Three criteria were evaluated: speed, precision, and overall performance of molecular and morphological determination. Results demonstrated that DNA barcoding exhibited the highest level of precision, successfully identifying ten species with 97% certainty. In contrast, taxonomists managed to identify only four species in total, although their main advantage over DNA barcoding was the speed and rapid classification into genera. Thus, we contend that DNA barcodes should be incorporated into future standards for species identification. When identifying species, a combination of both genetic and morphological traits yields the most accurate results. It is also crucial to note that DNA barcoding does not seek to replace classical taxonomy but rather to complement it.

Acknowledgements

I would like to express my sincere gratitude to my supervisor, Ing. Jiří Synek, Ph.D., for his guidance and to Mgr. Petr Stiblík, Ph.D., who introduced me to the field of DNA barcoding and provided invaluable advice without which this work would not have been possible. I would also like to thank the entire Termite Research Team, whose members assisted me with sample identification.

Big perspectives on small things

A-167

Oviposition priming may improve the wild tobacco's tolerance response to larval feeding

S. I. Richard[1], R. E. H. Cramer[2], A. Steppuhn[1]
[1]University of Hohenheim, FG Molecular Botany (190a), Stuttgart, Germany, [2]Freie Universität (FU) Berlin, Molecular Ecology, Dahlem Centre of Plant Sciences (DCPS), Berlin, Germany

Abstract body

Insect egg deposition can serve as stimuli which indicate future herbivory for the plant, as it often precedes the attack of herbivorous larvae. Various plant species improve their induced defence against herbivorous larvae when they previously perceived insect egg deposition as a priming signal. Defence priming is assumed to be an adaptive strategy by which the plant optimizes cost-benefit trade-offs of induced defence. Hence, we investigated the metabolic state and fitness consequences of oviposition priming and herbivory on the wild tobacco, *Nicotiana attenuata*. This plant induces more defensive phenylpropanoid-polyamine conjugates in response to feeding by lepidopteran larvae when it had been previously oviposited (1,2). Further, the attack of the lepidopteran specialist (*Manduca sexta*) is known to induce tolerance responses, such as transient carbon allocation to the roots that can result in a prolonged reproductive phase (3). Therefore, we exposed plants in a full-factorial setup to oviposition and larval feeding by *M. sexta*, followed by a total aboveground shoot removal. We determined growth parameters and the production of reproductive units such as flowers, capsules and seeds as fitness estimates of the re-grown plants. Additionally, we investigated sugar content and transcript levels of assimilate transport-related genes in the roots and shoots to monitor the carbon allocation. These experiments revealed that previous oviposition in combination with larval feeding can increase the fitness of regrown plants. Thus, oviposition-mediated defence priming may increase tolerance responses to larval feeding.

(1) Bandoly et al., 2015; Plant J., 83(4)
(2) Bandoly et al., 2016; Plant Cell Environ., 39(4)
(3) Schwachtje et al., 2006; PNAS, 103(34)

Acknowledgements

Philipp Bauer

A-250

Microbial community coalescence in sourdough

S. Rohringer, B. Zwirzitz, K. Domig
University of Natural Resources and Life Sciences, Vienna (BOKU), Department of Food Science and Technology, 1190 Vienna, Austria

Abstract body

Community coalescence occurs when different and initially separate units mix and form a new coherent community. This community has new and characteristic properties compared to the original units.
The coalescence of different communities basically results in two possible outcomes: an equal contribution of founder communities or the dominance of one community over another. After such a coalescence event, microbial interactions can remain within the original communities or entirely new interactions can form between the previously separated microorganisms. Therefore, the consequences of these outcomes can significantly impact structure and function of microbial communities, including their use in biotechnology and medicine.
So, the following statement describes the character of this topic quite perfectly:
The whole is greater than the sum of the parts - Aristotle
Nevertheless, little is known about what determines the expected outcome of coalescence. Here, microbial community coalescence will be further analysed using sourdough as a model system.
Sourdoughs are populated by microorganisms, especially yeasts and lactic acid bacteria, which are responsible for the characteristic properties of sourdough. Notably, the microbial community of sourdoughs is less complex than communities from natural environments. Because of this, sourdough represents an interesting model system for research on microbial community coalescence, as a suitable model system should demonstrate patterns of community formation and dynamics similar to those found in more complex systems, while still being simpler than natural communities.
In this project, two sourdoughs are prepared using quinoa and rice flour. Backslopping of the sourdoughs is performed until the microbiological profile remains stable. Due to the stable sourdoughs, it can be concluded that further changes in the microbiome are due to the experiments that followed. The two sourdoughs are then mixed in varying amounts and their microbiological profile is monitored for 2 weeks to find out how the stable microbiome reacts when it is combined with communities of other sourdoughs.
The analyses are carried out both by cultivation-dependent (MALDI TOF MS) and independent (qPCR) methods.

Acknowledgements

I would like to thank the Department of Food Science and Technology, especially Konrad Domig and Benjamin Zwirzitz.

A-276

Do insects threaten the cultivation of Robinia pseudoacacia and Styphnolobium japonicum in the territory of the Czech Republic?

K. Hortenska
Czech University of Live Sciences Prague, Faculty of forestry and wood sciences, Prague, Czech Republic

Abstract body

A research study examined the insect spectrum on non-native black locust (*Robinia pseudoacacia,* Linnaeus 1753) in the Czech republic. In its natural range of North America, the black locust is heavily parasitized by over 300 species of insects, which significantly hinder its extensive cultivation. In the past, five insect pests of black locust from its natural range were confirmed in the Czech Republic, and in 2021, another species was confirmed in Italy. The study also aimed to investigate whether some of the native insect species in the Czech Republic also cause damage to the black locust tree. For comparison, the research also monitored the spectrum of insects on the non-native tree species Japanese pagoda tree (*Styphnolobium japonicum*, Linnaeus 1830) from Asia. The Japanese pagoda tree belongs to the same family as the black locust but, unlike the black locust, it does not have known natural enemies in Europe. The Enemy release hypothesis can explain the presence of natural enemies in Europe only for the black locust. According to the hypothesis, this is because black locust has been cultivated for a longer period of time and on a larger scale compared to the Japanese pagoda tree. Insect collection for the research was conducted from May to September 2022 using the „beating“ method. In total, 371 insects belonging to 45 species were captured, including 4 invasive species. Three species that can cause damage were found on the Black locust and two of them were invasive species from the natural range *(*Obolodiplosis robinae and *Parectopa robinella*). On the Japanese pagoda tree, four species that can cause damage were recorded, but none of them belonged to the natural range of the Japanese pagoda tree. However, several domestic insect species, such as *Pyrrhocoris apterus*, which is predominantly found on species of the Tilia genus in the Czech Republic, were regularly captured. Due to the Enemy release hypothesis and climate change, the future is expected to bring an increase in natural enemies of these trees in Europe, which may hinder their cultivation. However, no species causing mortality or posing a potential threat to economic trees were found during the research. Therefore, currently, insects do not affect the cultivation of the non-native tree species Black locust and Japanese pagoda tree in the Czech Republic.

Acknowledgements

I would like to thank to my diploma thesis consultant, Mgr. Jiří Trombik (CZU), for his help and guidance throughout. Additionally, I would like to extend my gratitude to my Ph.D. studies supervisor, doc. Ing. Miroslav Hájek, Ph.D. (CZU), for his valuable support and mentorship.

A-223

Metabolic Engineering of Komagataella phaffii towards an Efficient Production Host for a Methanol-based, Carbon-neutral Bioeconomy

M. Kuzman[1,2], L. Sanvito[3], B. Mitic[2], O. Ata[1,2], D. Mattanovich[1,2]

[1]Austrian Centre of Biotechnology (acib), Vienna, Austria, [2]University of Natural Resources and Life Sciences (BOKU), Department of Biotechnology, Vienna, Austria, [3]University of Milano Bicocca, Department of Biotechnology and Biosciences, Milan, Italy

Abstract body

Biotechnology is one of the keys to developing sustainable technology for the 21st century[1]. Moving away from sugar as substrate for biotechnological microorganisms, one-carbon (C_1) substrates are a promising alternative, since its utilization gives great opportunity for a carbon-neutral, circular bioeconomy[2]. Methanol for instance can be directly produced from greenhouse gases such as methane and carbon dioxide. Due to this, the ability of microbial production hosts to utilize C_1 substrates is gaining increasing attention. *Komagataella phaffii* (*Pichia pastoris*) is an industrial and biopharmaceutical production host. It is mainly used for heterologous protein production, and more recently, also for non-protein products[3]. The aerobic methylotrophic yeast can utilize methanol as sole carbon and energy source. This constitutes a great chance for its establishment into a methanol-based bioeconomy. However, the natural methanol assimilation pathway of the yeast, called the Xylulose monophosphate (XuMP) cycle, has poor energy efficiency. Optimization towards a better biomass yield on methanol is desirable to enable efficient and cheap production processes.

The aim of this study is to metabolically engineer *K. phaffii* towards a more energy efficient methanol assimilation, by introducing a heterologous version of the Ribulose monophosphate (RuMP) cycle from *Bacillus methanolicus*. This was done by using Golden Gate Assembly and CRISPR/Cas9 systems for creating knock-outs and introducing the heterologous bacterial genes.

We were able to re-engineer the methylotrophic yeast with a peroxisomal heterologous RuMP cycle. The resulting strain, RuMPi, was able to grow on 1% methanol as sole carbon and energy source. Although the strains biomass yield on methanol was still inferior compared to the wild type, this proof of principle study sets the first-generation *K. phaffii* RuMPi strain. By further metabolic engineering and adaptive lab evolution, the resulting next generation strain can give new momentum for the use of methanol as alternative, carbon-neutral feedstock in biotechnological production processes.

Acknowledgements

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A-384

Microbiological analysis of tempeh-like fermented products

M. Pląder, Z. Lis, A. Kot
Institute of Food Sciences, Warsaw University of Life Sciences, Department of Food Biotechnology and Microbiology, Warsaw, Poland

Abstract body

Tempeh-like products are made by fermenting soybeans. They are eaten mainly in Asia, but their consumption in the world is constantly growing. They owe their popularity to a large amount of protein, which makes them a vegan alternative to meat. The microorganisms responsible for the fermentation process are primarily lactic acid bacteria, yeast and selected Rhizopus mold strains.

The aim of the study was to evaluate the microbiological quality of tempeh-type fermented products. The research material consists of eight tempeh products, two of: natural, fried, marinated and smoked, purchased on the retail market. Mesophilic and psychrophilic microorganisms, lactic acid bacteria and fungi were tested. Moreover, the presence of Escherichia coli, Salmonella, Listeria monocytogenes, and coagulase-positive staphylococci was checked. Salmonella was not found in 25 g of tempeh, and the remainig bacteria were not found in 0,1 g. The number of mesophilic, psychrophilic microorganisms and lactic acid bacteria was respectively: 1,0*103 – 4,6*106 CFU/cm3, 2,8*103 – 1,6*107 CFU/cm3 and 7,8*103 – 3,3*106 CFU/cm3. In terms of microbiological quality, the tested products were of good quality and did not contain pathogenic microflora.

Acknowledgements

I would like to thank Dr. Anna Kot for substantive care and valuable comments.

Big perspectives on small things

A-139

Ocean protection through biotechnologies

A. Le Gall
Institut Agro Dijon, Côte d'or, Dijon, France

Abstract body

How to prevent ocean's pollution due to sun cream in creating a sustainable and ecological solution

Background

Skin cancer's rate has increased dramatically since the 2000s. UVs from the sun cause more than 2 millions skin cancers every years . Sun exposure is one of the major cause of this rise. As a result, the using of sunscream is rising .[1]

Today's solutions

To prevent from UV 's damages, people need to protect their skin in wearing shirt and hat and using suncream. But, active compounds used in some sun cream are toxic for our health [4] [5] and marine ecosystem [6] coral and fishes. [7] [8]

Purpose

Protecting our skin is needed because UV rays induce skin aging and cancer. The ocean is one of the most important carbon sink and it provides us a lot of ecosystem services. As a result one have to make It sustainable. However, today's solutions are not efficient enough to protect the latter .

Solution

To prevent our skin from Uv's damages and to prevent marine life from chemicals pollution, the use of biotechnologies can be the alternative solution. I have found some molecules which seem to have a strong potential In cosmeceutical sector .

Molecule A, an effective chemopreventive agent for many of the adverse effects of sunlight on human health may thus serve as natural alternatives for photoprotection. « A » helps in reducing erythema response.
Molecule B, extracted from marine organism is a water-soluble molecule that absorbs UV-A and UV-B radiation. It can be served as an anti cancer agent and anti-aging agent.
Molecule C, a powerful antioxydant has proven to have bio activities such as anti-allergic, anti cancerous, anti-inflammatory properties and protection from UV-radiation .It absorbs UV-C and UV-B.

Trans-Resveratrol is an anti aging and anti inflammatory molecule . Moreover this antioxydant has chemopreventive actions [14].It absorbs UV-B and UV-C .

All in all, a solution can be given by creating a sunscreen made with these molecules in order to protect human health and marin ecosystems .

Methods

Dermatological tests havent' been realized yet. The product is still in development . The cosmeceutical formulation would pass few tests in order to be sold :

- Stability tests with a turbiscan , spreading and viscosity measurement.
In vivo SPF testing of sunscreen.
In vitro SPF testing
- Photostability test.
- Waterproof tests : Determinate the water retention percentage of solar products, calculate SFP before and after water immersion
- Ecotoxicity tests

Acknowledgements

Acknowldgments

AL.Goumon, agricultural engineer, D2A2E department, Institut Agro Dijon,France
A.Bordas, student engineer at the Engineering Faculty of Life Sciences, Toulouse, France
D.Champion, Professor of food physical chemistry and quality management, Food Sciences & Technology Research Unit (UMR PAM), Institut Agro Dijon, France

A-288

Bamboo (Bambusa bambos) on Mars and Moon Regolith Simulants

E. Mooney
Wageningen University, Wageningen, The Netherlands

Abstract body

Growing plants using resources that can be found on site is a sustainable way of approaching Mars and moon missions. An example of these resources is the regolith on Mars or the moon. This can be used to plant and grow, for example, crops for food. However, the possibility of using it to grow plants that can be used as building material has not yet been investigated. This experiment is the first to test if bamboo (*Bambusa bambos*) seeds germinate and how well they can grow on Mars and Moon regolith simulants. Bamboo seeds were sown in regolith simulants and germination and development of the plant was observed. The aim of this experiment was to test bamboo as a possible building material to grow on other solar bodies. No significant difference was found in the germination of seeds planted on Mars and Lunar regolith compared to Earth soil. This suggests these regoliths are just as suitable as Earth soil for the germination of bamboo seeds. However, the height of first shoot and dry weight is significantly smaller in plants grown on moon and Mars regolith simulant compared to Earth soil, suggesting a preference for Earth soil. This experiment is a starting point to improve cultivation of bamboo on Mars and moon regolith simulants. Additionally, it opens the door for further research into growing bamboo and other plants that can serve as construction material on Mars and moon regolith simulants.

Acknowledgements

All the help of personnel in the greenhouses; M. Otten, M. Wellink, R. Verwoert, R. van Genderen and W. Krijnen, was greatly appreciated. J. van der Most kindly assisted in the statistical analysis. G.W.W.W. Wamelink and I.F. Kapper’s help and supervision was also greatly appreciated.

A-243

Using simple observations and weather data to streamline vine water status monitoring

Y. Zhang, L. Pichon, B. Tisseyre
ITAP, L'Institut Agro Montpellier, SABP Génie Rurale, Montpellier, France

Abstract body

Frequent monitoring of vine water status is crucial for optimizing vine yield in terms of quantity and quality. However, collecting Predawn Leaf Water Potential (PLWP) observations, a reference indicator for vine water status in Mediterranean vineyards, poses strong logistical challenges. To tackle this issue, an index called iG-Apex has emerged, based on vine shoot growth observations. iG-Apex observations are easy to collect thanks to a dedicated mobile application, and this index has demonstrated a good correlation with PLWP during critical vine growth phases. However, the relationship between iG-Apex and PLWP becomes increasingly uncertain over the season. Therefore, it is essential to introduce uncertainty into the predictive model connecting PLWP and iG-Apex. In parallel, weather data have been commonly used in various agronomy decision-making processes, thanks to their widespread availability. Integrating weather data may provide a solution to reduce prediction uncertainty. In this study, a novel method called Recursive-Duo-Model (RDM) was proposed. The approach combines predictive modeling and Bayesian resampling to predict PLWP using time series of iG-Apex and weather data. Results of this study shows that the RDM method significantly improves the accuracy of vine water status classification under moderate to severe water deficit conditions, providing valuable decision-making suggestions for farmers. It enables early predictions of PLWP with high certainty at the beginning of the growing season. This result may empower farmers to adopt proactive water management strategies with high confidence, showcasing how using two easily accesible data can lead to substantial improvements in water management practices. Ultimately, under high water deficit conditions, the RDM method generates more realistic PLWP values compared to methods reliant solely on iG-Apex, which is particularly intriguing for agronomic research purposes, as it can facilitate deriving observational data for inverse modeling, and advance our understanding of vine water status dynamics.

Acknowledgements

This work was supported by the French National Research Agency under the Investments for the Future Program, referred as ANR-16-CONV-0004. The ApeX-Vigne project was part of the DATI project, supported by the French National Research Agency under the Horizon 2020 PRIMA Program (ANR-21-PRIM-0001).

A-373

"Exploring the Knowledge, Perceptions, and Responses of Smallholder Farmers to the Living Income Differential in Ghana's Cocoa Sector."

E. Amankwah
University of Hohenheim, Social and Institutional Change in Agricultural Development, Stuttgart, Germany

Abstract body

Farmgate cocoa prices in Ghana and Côte d'Ivoire are typically low, contributing to poverty and food insecurity among smallholder households. In response, the governments jointly introduced the Living Income Differential Initiative (LID) in 2019 to raise the farmgate price through a premium paid by international buyers. As a result, Ghana experienced a 28% increase in farmgate prices for the 2020/2021 season. However, there is a knowledge gap in how far farmers know about the LID and how different farmer types and actors perceive and respond to it, e.g., cocoa production expansion, as well as potential effects on input costs and credit interest rates. For instance, input suppliers may raise their prices to benefit from farmers' improved income if farmgate prices rise. To fill this gap, this study will examine the experiences of serval farmers in Ghana's Dunkwa and Mankranso cocoa areas, key producers with a diversified farmer population. The study aims to answer three research questions. First, what are farmers' awareness, knowledge and perceptions regarding cocoa pricing and the LID? Second, how do different actors, such as input suppliers and cocoa buyers, react to increased cocoa prices, and how much of the increase do farmers receive? Finally, what are farmers' responses to the LID, and how does it impact their arrangements and sense of security in maintaining or acquiring land? The research is qualitative and uses a comparative case study design. Data collection methods include focus group discussions, proportional piling, and individual in-depth interviews with farmers and relevant actors. Field work is conducted between May and July 2023. Preliminary results demonstrate that some farmers are aware of a joint initiative between the two countries, but none know about the LID compared to some actors, e.g., local buying agents. Some actors view the LID as insufficient, with little farmer involvement. Farmers profited from the price in 2020/21, but in subsequent years, a majority sold their farms to miners or shifted careers, leaving marginalised sharecroppers unemployed. The inflation boosted production costs for inputs and labour. Illegal gold mining is further adding to labour costs. This knowledge can provide valuable insights for future policy design on how such policies pass through, incentivise, and ultimately affect different actors across the initial stages of the cocoa value chain.

Acknowledgements

Professor Regina Birner
Dr Christine Bosch
Dr Athena Birkenberg
Dr Ole Boysen

A-303

Impact of grazing and natural landscape features on butterfly assemblages in coastal grasslands

J. Fjodorova
Eesti Maaülikool, Tartu, Estonia

Abstract body

Abstract:
Coastal grassland butterflies are part of the fauna whose communities can be influenced by various factors, such as grazing and changes in natural landscapes.
The aim of this study was to assess the abundance and dominant species of butterflies, as well as the effects of landscape region, land use and transect (edge effect) on butterfly abundance and species richness in the mainland coastal grasslands of Western Estonia. Butterflies were surveyed four times during the summer months of 2023, from two different landscape regions and two land use types in coastal grasslands. Transect counts were conducted on four transects per study area. Each transect was walked at a uniform pace, and all adult butterflies within an imaginary box measuring 5 meters in height and 5 meters in width were recorded. Collected individuals were identified to species or, if necessary, only to the genus level, and their abundance and species richness were
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analyzed across different coastal grasslands. Data analysis was performed using the RStudio statistical software.
In total, 496 butterfly individuals and 37 species were recorded, with 31 species found in the The Gulf of Riga Coastal Lowland on sandstone bedrock and 29 in the West-Estonian Lowlands on limestone bedrock. The results showed that the most common and frequently occurring butterfly species were the Maniola jurtina and the Aphantopus hyperantus. In addition to these two dominant species, the Pieris napi had a higher abundance in the The Gulf of Riga Coastal Lowland coastal meadows. The highest individual and species richness was observed in the coastal grasslands managed by grazing and located on sandstone bedrock. The effects of edge (first transect) were significant both within different landscape regions and land use types. Butterfly abundance was significantly higher on the mainland side of the coastal grasslands compared to the seaside, regardless of land use. The extent of managed areas, such as grasslands and agricultural lands in the surrounding landscape, directly influenced most butterfly species.
These preliminary findings provide a basis for further research on the effects of coastal grassland management on butterfly community dynamics.
Keywords: abundance, butterflies, coastal landscapes, coastal grasslands, edge effect, grazing, limestone bedrock, species diversity, sandstone bedrock, sustainable management

Acknowledgements

I would like to thank Anu Tiitsaar, who conducted the butterfly counting in coastal grasslands as part of the SHOWCASE project. The fieldwork mentioned above was funded by the European Union's Horizon 2020 program (Grant No. 862480). I would also like to thank Kätlin Põdra for her assistance with map processing and different landscape data, and Mylene Martinez for her statistical data processing and ordination analysis figures.

A-280

Paranormal tourism development potential in Estonia

M. Gorbats
Estonian University of Life Sciences, Tartu linn, Estonia

Abstract body

Paranormal tourism in Estonia has not yet been thoroughly studied or researched, but various companies offer paranormal tours and other entertainment related to paranormal tourism. The popularity of paranormal tourism in Estonia is unknown, and it is unknown which companies and services exist in Estonia. Paranormal tourism in Estonia has been poorly researched so it is not known how it could be developed in Estonia, what is needed to make it happen or what is already appearing, what the tourism industry is like, how economically viable and beneficial it can be.

The aim of the thesis was to investigate the possibilities for the development of paranormal tourism in Estonia and to identify potential services or services already on the market that could promote paranormal tourism. In addition, the interest of people in paranormal tourism and the average number of tourists on tours were studied. The existing paranormal tourism services in Estonia were also analysed.

To achieve the objectives of the thesis, a qualitative study has been used. Between February 2023 and March 2023, 10 interviews had been conducted with different companies involved in paranormal tourism.The results of the research showed that most of the interviewed companies have plans to develop in the field of paranormal tourism and some of them already have a solid idea that they want to bring to the market. Some companies have not yet decided what exactly they want to develop or are still in the early stages of developing a new service idea. Museums, tours and shows related to paranormal tourism already exist.

The popularity of paranormal tourism in Estonia is certain. The number of customers varies from company to company, depending on the size of the company, the frequency of tours and other offers, and the number of participants in the company's events. People are interested in going on paranormal tours to satisfy their curiosity and to learn about history. The number of visitors to paranormal tours could be higher compared to all companies in Estonia. The main reason is seasonality, as most of the companies interviewed offer services in the open air. The interview did not reveal how seasonality could be reduced, so there is still room for improvement.

Acknowledgements

I want to thank everyone who helped me to write my research, all the people who took part in the interview. In particular, I want to pay tribute to my supervisor Tarmo Pilving. Thank you very much for your help and support.

Our planet as a resource

A-369

Identification of novel seed treatments and adapted agronomic practices to control common bunt in organic wheat production

M. E. Fischbach[1,2], J. Mark[1], M. Zehnder[1], A. Iten[3], J. Jost[3], H.-J. Schärer[1]
[1]FiBL - Research Institute of Organic Agriculture, Frick, Switzerland, [2]University of Natural Resources and Life Sciences, Vienna, Austria, [3]fenaco, Winterthur, Switzerland

Abstract body
Common bunt caused by the fungi *Tilletia caries* (DC.) Tul. & C. Tul. and *T. laevis* J.G. Kühn can lead to severe yield and quality losses in wheat. The disease is of particular importance in organic farming systems, because the use of synthetic fungicidal seed treatments effectively suppressing the pathogen is not allowed, while permitted treatments often solely provide limited control.
A promising control strategy in organic wheat growing could be to combine treatments applied to seeds before sowing with appropriate agronomic management practices.
Therefore, this study aims to identify seed treatments able to reduce the common bunt severity in wheat and compliant with organic production standards, as well as to validate their efficacy in field trials in combination with adapted agronomic practices.

More than ten different seed treatments were tested in several greenhouse experiments. The chosen products contained various types of active ingredients, including bacterial and fungal microorganisms, plant extracts, micronutrients and natural polysaccharides.
In each greenhouse experiment, a synthetic chemical seed treatment (Coral® Extra) was used as reference treatment. For all treatments, except the water control treatment, seeds were artificially inoculated with *T. caries* prior to sowing. The common bunt disease severity, expressed as percentage of seeds showing common bunt symptoms, was assessed visually at the time of grain harvest.

Results from the greenhouse experiments showed that several of the tested products could significantly reduce the common bunt severity on wheat. The most effective seed treatment consisted of a formulated product containing bacteria of the genus *Pseudomonas*. This product, which is not yet commercially available, was able to significantly reduce the common bunt severity on seeds by 100% compared to the pathogen inoculated plants (without seed treatment) in two independent experiments at a significance level of 0.05. Its efficacy was identical to the synthetic chemical reference treatment.

To conclude, this study could highlight the potential of organic seed treatments to provide an additional tool for farmers to control common bunt in wheat production. The most promising treatments are currently tested in field trials in combination with different agronomic practices, such as different cover crop types, and first results are expected by the end of 2023.

Acknowledgements
I would like to thank my colleagues from the "Crop Protection – Phytopathology" group of the Research Institute of Organic Agriculture (FiBL) in Switzerland that are hosting me for an internship and that are supporting me in this research project. Moreover, I am grateful for the support from fenaco (an agricultural cooperative in Switzerland), especially from Andrea Iten and Jürg Jost.

A-351

The influence of harvesting term on the mass and quality of valerian roots (Valeriana officinalis L.)

K. Raj, J. L. Przybył, Z. Węglarz, K. Bączek
Institute of Horticultural Sciences, Department of Vegetable and Medicinal Plants, Warsaw University of Life Sciences, Warsaw, Poland

Abstract body

Common valerian is one of the most important medicinal plant cultivated in Poland. The raw material collected from this species are underground organs (rhizome with roots), commonly named roots. In phytopharmaceutical industry it is used to produce drugs applied in insomnia and nervous anxiety. According to European Pharmacopeia (Eur. Ph., IX), the roots are standardized on the content of valerenic acids (not less than 0.17%) and essential oil (not less than 4mL/kg DW).

In Poland the species is usually cultivated in 1.5 year cycle. The seeds are sown in summer on seedbed, the obtained seedlings are planted out into the field at the early autumn and the raw materials are collected next year from September to December (sometimes even in January). So far, the relationship between the root mass increment and the accumulation of biologically active compounds during the harvesting period (in particular valerenic acids), has not been sufficiently clarified.

The aim of the research was to determine the root mass increment and the accumulation of biologically active compounds during harvesting period of valerian.

The experiment was carried out at the valerian plantation situated in central Poland. The object of the investigation was ‘Lubleski’ landrace cultivated in 1.5-year cycle (field experiment was established in autumn, 2021). The roots were collected successively, three times during vegetation, i.e.: in September and November, 2022 and in January, 2023. The collected raw materials were cleaned, cut, dried at 40℃and subjected for chemical analysis using HPLC-DAD to determine the content of valerenic acids, namely: hydrovalerenic, acetoxyvalerenic and valerenic acids (according to Eur. Ph., IX). The essential oil (EO) content was determined by hydrodistillation method (Eur. Ph., IX).

The mass of the roots increased distinctly from September to November, when it reached its maximum, and slightly decreased in January. In turn, the content of valerenic acids increased significantly from September (0.31 mg × $100g^{-1}$ DW) until January (0.67 mg × $100g^{-1}$ DW), while the content of essential oil was rather stable during harvesting period (mean 0.44%).

It can be concluded that the highest yield and quality of valerian roots, expressed by the content of both valerenic acids and essential oil, is obtained at late autumn (November).

Acknowledgements

Funding: This work was partially financed by Polish Ministry of Agriculture and Rural Development under the project title "Genetic and developmental aspects of yielding and quality of valerian raw materials" (Task no. 32)

A-353

Interspecific variability of stinging nettle (Urtica dioica L.)

S. Styczyńska, J. L. Przybył, Z. Węglarz, K. Bączek
Institute of Horticultural Sciences, Department of Vegetable and Medicinal Plants, Warsaw University of Life Sciences, Warsaw, Poland

Abstract body

Stinging nettle (*Urtica dioica* L.) is an important medicinal plant used in urinary tract and genital disorders. The major raw material of the species are leaves collected exclusively from natural sites. Such raw material is highly diversified in terms of the content and composition of biologically active compounds. The stable content of these compounds in herbal raw materials may be obtained only from selected genotypes of the plants introduced into cultivation.

The aim of the study was to determine interspecific variability of stinging nettle population selected in our previous investigations.

The plants were cultivated at the experimental field of Warsaw University of Life Sciences -SGGW. The population was represented by 15 genotypes (clones, n=10). They were characterized in the second year of vegetation, at three consecutive stages, i.e.: at the vegetative stage, at the beginning of flowering, and at the full flowering as to the mass of herb and the content of four phenolic acids (neochlorogenic, chlorogenic, coffeoylmalic, and cichoric acids), two flavonoids (rutoside and hyperoside) and assimilative pigments (chlorophyll a, b and carotenoids) in the leaves. The chemical analysis concerning phenolic acids content was done by HPLC-DAD, while chlorophylls and carotenoid content, spectrophotometrically.

The obtained results indicate significant differences between genotypes, especially concerning the content of chlorogenic and caffeoylmalic acid (mean: 194.14 and 921.94mg×100 g^{-1}DW; CV: 50.18 and 41.56%, respectively), on which the raw material is standardized. According to European Pharmacopoeia (10^{th}, 2019), the sum of these acids should not be lower than 0.3%. The diversity was the highest at the vegetative stage (recommended harvest term). The diversity of herb mass (mean 0.18 kg×$plant^{-1}$ DW; CV=22.65%) and assimilative pigments was distinctly lower.

The obtained results clearly indicate significant interspecific variability of stinging nettle and show great potential for clonal cultivation of selected nettle genotypes.

Acknowledgements

The authors thank the research team for their support and valuable comments.

A-195

Battling invaders with allies: combining native entomopathogenic fungi and baculoviruses against the fall armyworm, Spodoptera frugiperda

F. Campacci
Wageningen University & Research, Plant Sciences, Wageningen, The Netherlands

Abstract body

The fall armyworm, *Spodoptera frugiperda* (Lepidoptera: Noctuidae), is a problematic pest of many crops, including staple crops such as maize. Chemical control of *S. frugiperda* is complicated by its ability to rapidly develop resistance to several insecticidal compounds, leading to the search for alternative management strategies such as those relying on the use of entomopathogens, including entomopathogenic fungi (EPF), baculoviruses and their combinations. Nevertheless, although their combined use could potentially increase the control efficacy, information about the feasibility of this approach is still scarce. Therefore, this study aimed to investigate the interactions between the EPF *Metarhizium rileyi* and the baculovirus Spodoptera frugiperda multiple nucleopolyhedrovirus (SfMNPV) isolate V7 on third-instar *S. frugiperda* larvae. Virulence tests to determine the median lethal concentrations (LC_{50}) and lethal times (LT_{50}) of four *M. rileyi* isolates to identify the most virulent isolate to be used for the combination tests revealed isolate Mr8 was the most effective, inducing a mortality rate of 52.80% and exhibiting the lowest LC_{50} and LT_{50} values. Combination tests showed that simultaneous application of the virus and fungus and sequential application of the virus 24 hours before the fungus resulted in additive interactions. However, when the fungus was applied 24 hours before the virus, the interaction was antagonistic. Interestingly, most cadavers resulting from mixed infections exhibited symptoms of only one species, with a higher proportion showing viral infection symptoms. The present work highlights the potential of combining EPF and baculoviruses for improved biological control of *S. frugiperda* and emphasizes the importance of application time.

Acknowledgements

Thank you to Dr. ir. Vera Ros from the Laboratory of Virology and Prof. dr. Duur Aanen from the Laboratory of Genetics for allowing me to work on such an important project. A special thanks to Ahmed Gbenga Hussain for his help with this work.

A-343

Carry-over effect of different alternative organic fertilization strategies in organic cabbage production on succeeding winter wheat

D. Patel[1], S. Zikeli[1], C. Weiler[2]

[1]University of Hohenheim, Center for Organic Farming, Stuttgart, Germany, [2]University of Hohenheim, Center for Organic Farming, Stttgart, Germany

Abstract body

Vegetable crops require high amounts of nutrients for securing marketable yields. In organic vegetable production, the nutrient demand is covered by plant or animal derived organic fertilizers such as farm yard manure, slurry, horn grit, blood meal or compost. Often, these organic fertilizers used within the EU are either produced by conventional animal husbandry or imported from non-EU countries. However, from 2030, Demeter, one of the important organic farming associations in Germany, will only allow Nitrogen fertilizers from certified organic origin. Thus, to fill arising nutrients gaps in organic farming without compromising quality and yield, there is a strong need to look for alternative organic fertilizers. In this experiment, residual effects of different alternative organic fertilizers based on plant materials, waste from organic food industry, and household waste such as silage, tofu whey, clover pellets, biogas digestate, and horn grit were tested in winter wheat (*Triticum aestivum* L.). The fertilizers were applied to the previous crop, white cabbage (*Brassica oleracea* var. *capitata f. alba*) in a field trial in South-West Germany. Analysis of variance (ANOVA) revealed that different alternative fertilizers did not show significant difference for all the parameters such as grain and straw yield of wheat, Nitrogen content in wheat grain and straw, soil N_{min} up to 90 cm soil depth, and leaf chlorophyll content (SPAD). However, significantly higher thousand kernel mass (TKM) was measured from the plots treated with clover pellets. As almost all the parameters investigated in the experiment didn't show a significant difference, there is a scope of development of development of alternative organic fertilizers based on plant materials, and waste from organic food industry & household waste, as they had a same results as standard organic fertilizer such as horn grit.

Acknowledgements

I would like to express my deep sense of gratitude to Dr. Sabine Zikeli and Carolin Weiler for giving me this opportunity to join the research group. Their constant support, and guidance was really helpful. A special thanks to Sophie Stein for her support during soil sampling, harvesting, threshing, and milling of wheat. I am very thankful to Dr. Jens Hartung and Naveen Kumar for his suggestions and assistance while developing statistical model and data analysis.

Sincerely,

Dhruv Patel

A-152

OMI derived tropospheric NO_2 and O_3 trends over urban areas of Bangladesh from 2015-2022

A. A. Nayeem
Wageningen University and Research, Environmental Science, Wageningen, Bangladesh

Abstract body

Nitrogen dioxide (NO_2) and Ozone (O_3) is a key indicator of urban air pollution and play a vital role to influence the atmospheric chemistry. Nowadays, satellite remote sensing provides long-term observation of global ambient NO_2 and O_3 concentration. This study utilized OMI (Ozone Monitoring Instrument) datasets from 2015-2022 to analyze the spatio-temporal variability of vertical tropospheric columns of NO_2 and O_3 in urban and industrialized cities of Bangladesh. Ground based NO_2 and O_3 data were retrieved from publicly available national air quality monitoring sites and meteorological data were collected from National Oceanic and Atmospheric Administration (NOAA). The average NO_2 column was higher in Dhaka ($5.12X10^{15}$ molecules/cm^2) compared to Chattogram ($1.41\ X10^{15}$ molecules/cm^2) and Khulna ($2.32\ X10^{15}$ molecules/cm^2) regions. Similar patterns were also observed for O_3 columnar. The study also found a significant positive relationship between OMI and ground-based NO_2 concentration in selected areas, while an inverse relationship was observed between NO_2 and O_3 (at α=0.01). All the selected regions experienced higher concentration of NO_2 column in the winter season while O_3 was mostly in summer. The seasonal variability of NO_2 column was observed following the sequence; winter > Pre -Monsoon> Post Monsoon > Monsoon. Moreover, the observed seasonal variation of NO_2 and O_3 column is significantly associated with the change in meteorological conditions.

Acknowledgements

I would like thank NASA GIOVANNI for providing the data support for this study.

Working together for a greener future

A-394

Raising Awareness for Viennas hidden water sources

H. Cada, C. Danner, S. Grohmann, H. Jedlizka, A. Köttl, V. Wenninger
Universität für Bodenkultur Wien, Wien, Austria

Abstract body

The background of this paper are temperature increases caused by climate change, which make life in the city more difficult in many places. The activation of previously unused water, such as that of the Wienerwald-streams, could contribute to avoid urban heat islands and to implement a more resource-efficient water management. The current problematic shows the lack of awareness for the Wienerwald-streams among decision-makers and the population. The awareness of the existing Viennese streams has disappeared due to their almost complete canalisation. This paper points out possible measures for awareness raising, which could subsequently stimulate a social change. Based on literature, target groups and measures were predefined. The following conduction of expert interviews led to a catalogue of target group-specific measures. Key finding of this paper is the importance of addressing the two target groups, the beneficiaries on the one hand and on the other hand the multipliers, which have a lot of potential to actively promote social change. This paper can also raise awareness in the direction of policy makers, which have a relevant role in creating a framework for implementing these measures.

Acknowledgements

We thank our supervising professor Mr. Dipl.Ing. Florian Kretschmer for the advice and guiding our project.

A-115

Effects of Urbanization and Vegetation Density on Land Surface Temperature Using Satellite Remote Sensing Indices in Prague, Czech Republic

F. Yılğan, S. Matula, M. Miháliková
Czech University of Life Sciences Prague, Faculty of Agrobiology, Food and Natural Resources, Department of Water Resources, Prague, Czech Republic

Abstract body

Recently, rapid population growth and the increase in migration from rural areas to cities have caused some negatives in the world. At the beginning of these negativities are excessive urbanization and some inadequacies in energy resources because industrialization is increasing in order to provide sufficient resources for the population. In addition to this, the need for shelter from the increasing population causes natural areas to be built and urbanised. As buildings absorb heat more than vegetated areas, surface temperatures in industrial and urban areas are higher than vegetated areas in cities. Thus, the temperature increases experienced triggers heat-related deaths and negatively affects the comfort of life in metropolitan areas, as well as it causes global warming and climate change. In this study, the relationship between vegetation density, surface temperature and urbanisation in Prague was analysed using remote sensing indices from the Google Earth Engine online platform. The capital of the Czech Republic, covering an area of 496 km^2 and population is approximately 1.3 million. The Landsat-8 operational land imager (OLI) and thermal infrared sensor (TIRS) satellite images were selected as the month of July in summer and time series of these images are 2016 and 2020. The normalized difference vegetation index (NDVI), the normalized difference build-up index (NDBI), and the land surface temperature (LST) were calculated for both years and the correlation relationships between the indices were statistically analysed. As a result of statistical analysis, a strong negative correlation was detected between NDVI and LST, while a strong positive correlation was observed between NDBI and LST. Thus, these statistical relationships show that the increase in urban areas has a positive effect on temperature. The accuracy analysis of Landsat LST data was performed with Moderate Resolution Imaging Spectroradiometer (MODIS) daily 1 Km spatial resolution LST data using 12 control points homogeneously distributed over the study area, since there was not enough ground station data. As a result of the accuracy analysis, the values of the root mean square error (RMSE) were found to be ± 3.04 ° C and ± 2.17 ° C for 2016 and 2020, respectively. Furthermore, a strong positive correlation was found between the two datasets, 0.81 for 2016 and 0.84 for 2020.

Keywords: Land surface temperature, Climate change, Remote sensing, Vegetation index

Acknowledgements

First of all, I would like to thank my supervisor, Prof. Ing. Svatopluk Matula, CSc. who supported me to participate in this conference and than to my university that is Czech Universtiy of Life Sciences Prague.

A-358

The role of shading on biometeorological conditions in the historic centre of Prague, Czech Republic.

L. Chlapcová[1], A. Urban[1,2], J. Kyselý[1,2]

[1]Czech University of Life Sciences Prague, Faculty of Environmental Sciences, Prague, Czech Republic, [2]Czech Academy of Sciences, Institute of Atmospheric Physics, Prague, Czech Republic

Abstract body

Prague is the capital and the largest city of the Czech Republic and its historic centre near the Vltava river is a popular tourist destination. Especially the area along the right bank of the Vltava river, called Náplavka, is one of the most popular locations to visit during the summer months due to many social and cultural events that take place here. However given the north-south orientation of the Vltava river and the lack of greenery and shade in this area, the question arises as to what extent thermal conditions are comfortable during hot summer days at Náplavka. Many previous studies have shown that the presence of greenery and shade is essential for reducing the heat stress in the streets.

In this study we assessed the effect of shading on biometeorological conditions at eight different measuring sites located along a loop between Charles Square and the Náplavka riverbank. We used a Kestrel 5400 heat stress tracker, to measure and record meteorological parameters (including air temperature, relative humidity, wind speed, Heat Index, Wet-Bulb Globe Temperature) every two hours between 8:00 a.m. and 6:00 p.m. CEST on 16 summer days from 2019 to 2022. In addition, fisheye photographs were taken at each location in order to quantify the effect of shading. From these data, we calculated advanced thermal comfort indices (Physiologically Equivalent Temperature, Universal Thermal Climate Index) and Sky View Factor (SVF) in the RayMan Pro program.

Our results showed that while in the morning Náplavka's biometeorological conditions were most comfortable among all measurement sites, they became most stressful in the afternoon. The analysis of the fisheye images showed that the lack of greenery and shading at Náplavka contributed significantly to the high heat stress levels. Our results suggest that the relocation of day-long events from Náplavka to other locations (e.g. a park at Charles Square) should be considered and/or adequate sun protection should be provided on hot summer days.

Acknowledgements

I am grateful to Mgr. Aleš Urban Ph.D. and doc. RNDr. Jan Kyselý Ph.D. with whom I have had the pleasure to work during this and other related projects.

A-391

The effect of information on the perception and acceptance of façade greening using the example of Kreuzgasse 74, Vienna

L. Krampl
University of Natural Resources and Life Sciences, Vienna (BOKU), Vienna, Austria

Abstract body

Green spaces will become a central issue in the coming decades, especially with regard to the changing urban climate. They reduce heat and have other beneficial effects on both, the climate of the immediate surroundings and the people who are around them. In urban areas, free spaces are rare and often needed for non-green infrastructure. Façades are among the largest unused residual surfaces and offer great potential for vertical greening. Acceptance among the population plays an important role in the implementation of innovative projects such as façade greening, which is why this work within the GLASGrün project deals with the connection between the level of knowledge and social acceptance and opens up the following research question:

What effect does the level of information of people have on their perception and acceptance of façade greening using the example of Kreuzgasse 74, Vienna?

The work consists of a literature research in advance, the creation of a questionnaire and a survey conducted over four days. The data obtained was then analysed. For the evaluation of the hypotheses, cross tables were used, the open questions were evaluated manually and simple frequency analyses were made with the programme LimeSurvey.

It shows that the level of information has a positive influence on the perception and acceptance of green facades. In addition, it can be seen that vertical greening in general already has a high level of acceptance among the population. This indicates that the expansion of green facades is a sustainable and accepted urban design measure to combat the negative effects of sealing and the consequences of climate change. It would therefore be desirable to promote green facades, especially in urban areas.

Acknowledgements

Authors: Alexander Friedrich, Laura Harrer, Nicolas Alter, Lydia Krampl

Supervisors: Priv.-Doz. Dr.phil. Christa Schafellner, Mag. phil. Dr.phil. Barbara Smetschka, Dipl.-Ing. Dr. Willi Haas

A-127

Restorative Green Spaces in Displacement: Theoretical concepts of restorative landscapes and their potential application in refugee camps

S. Jajeh
Czech University of Life Sciences, Landscape and Urban Planning, Prague, Czech Republic

Abstract body

The journey of displacement is accompanied by a wide range of challenges that negatively impact the overall health and well-being, particularly mental health, which was recorded to be on a distinct level of disturbance in refugee communities compared to the general public. This research proposes recommendations to design a restorative green space to reduce stress among the displaced following Ulrich's stress reduction theory. Drawing on multiple data collection methods, including interviews with experts and researching the existing restorative green space recommendations, particularly healing gardens in healthcare departments, the criteria for selecting the recommendations were based on the recurrence of design recommendations between healthcare departments and the outcomes of the methodology. The results depicted a high level of similarity between the qualities emphasized in a restorative landscape in healthcare departments and the qualities needed in the context of displacement. Additionally, findings suggest initiating the green space on a small scale and realizing it in phases. Furthermore, incorporating refugee camps as part of the environmental policies of encouraging biodiversity and improving environmental quality. This research argues for integrating design interventions from healthcare departments in the context of displacement and allowing the flexibility to use them based on the available resources and space in the camp.

Acknowledgements

Peter Kumble
Karolina Doughty
Agnès Patuano
Ellen Kampman
Margriet Smit

A-404

Challenges and opportunities in the maintenance of renewable energy communities

C. Vitovec[1], M. König[1], M. Sabitzer[2]

[1]Universität für Bodenkultur, Klosterneuburg, Austria, [2]Universität für Bodenkultur, Vienna, Austria

Abstract body

The serious effects of the climate crisis and the current energy crisis underline the social, ecological and economic urgency of the global energy transition. At the EU level, the European Green Deal and the legislative package "Clean Energy for all Europeans package" were therefore developed, which was consolidated nationally in Austria through the "Renewable Energy Expansion Act (EAG)". Thereby, the legal framework for the establishment of renewable energy communities was created, which describes the cooperation of at least two members, who can jointly produce, store, consume and sell renewable energy on a local level.

But how is the implementation of these renewable energy communities going so far? This project examines already established energy communities in the province of Lower Austria and fills socially relevant gaps by analysing current challenges and needs within energy communities. Therefore, the research question "What are the challenges and opportunities in the maintenance of renewable energy communities?" was developed.

In order to analyse and evaluate this question, besides a literature research, seven qualitative interviews with founders and members of renewable energy communities in the area of Lower Austria were conducted, using a semi-structured interview guideline. Relevant and topic-related statements of the experts were evaluated according to Mayring.

The interviews show a stagnation of supportive measures for members and a lack of communication with grid operators as the biggest hurdles. An improvement of the organisational, technical and financial foundation of the maintenance of an energy community has the potential to make energy communities accessible to a broad population, which currently shows a strong motivation to join an energy community during the energy crisis. Continuous funding, a clearly organised data transfer with grid-operators and bottom-up information workshops are seen as concrete measures for energy communities to reach their socio-economical and socio-ecological potential.

Acknowledgements

Special thanks to our supervisors Dr. Judith Feichtinger & Dr. Elisabeth Unterfrauner from ZSI, Vienna (centre for social innovation) and our project coordinator Dr. Christa Schafellner.

A-282

Sustainable livelihoods for smallholder tobacco farmers in Zimbabwe: Overcoming challenges and promoting resilience

S. Kassim, W. Nkomoki
Czech University of Life Sciences, Economics and Development, Prague, Czech Republic

Abstract body

This study aims to analyze the challenges faced by smallholder tobacco farmers in Zimbabwe and explore their implications for achieving sustainable livelihoods. Employing a mixed-methods research design, the study will combine quantitative and qualitative data collection techniques. A survey will be conducted among 120 targeted smallholder tobacco farmers in selected regions of Zimbabwe, supplemented by key informant interviews and focus group discussions involving farmers, policymakers, and other stakeholders. The anticipated findings are expected to highlight key challenges faced by smallholder tobacco farmers, including climate variability - affecting crop yields, limited access to resources, environmental and health risks, and market volatility. Existing policies are likely to be insufficient in addressing these challenges, underscoring the importance of targeted interventions to promote sustainable tobacco farming practices. The study aims to contribute to the existing literature on smallholder farming, sustainable agriculture, and rural development. It seeks to emphasize the significance of sustainable agricultural practices that prioritize smallholder farmers' livelihoods, protect the environment, and address socioeconomic issues. The research findings will offer valuable insights to policymakers, providing a potential roadmap for more effective policy interventions that can foster sustainable tobacco farming practices and enhance the livelihoods of smallholder farmers in Zimbabwe. By examining the socioeconomic dynamics, environmental issues, and policy-related concerns surrounding tobacco farming in Zimbabwe, this study will contribute to a better understanding of the challenges faced by smallholder tobacco farmers. It will provide policymakers with valuable insights into the need for targeted interventions to overcome these challenges and promote sustainable livelihoods in the tobacco farming sector. Ultimately, the study seeks to empower smallholder farmers and promote resilience within their communities.

Acknowledgements

Ing. et. Ing. William Nkomoki, Ph.D.

Working together for a greener future

A-283

Enhancing Knowledge and Information Support Systems for Sustainable Agriculture Practices in Southern Africa: A Case Study in Goromonzi, Zimbabwe

S. Kassim, W. Nkomoki, T. Tamirepi
Czech University of Life Sciences, Economics and Development, Prague, Czech Republic

Abstract body

This abstract highlights the importance of knowledge and support systems in promoting sustainable agricultural practices (SAPS) among small-scale farmers in Southern Africa, with a focus on Goromonzi, Zimbabwe. The region faces challenges such as poor crop yields, soil fertility issues, and the impacts of climate change. The United Nations' Sustainable Development Goals (SDGs) provide a framework for eradicating poverty, and hunger and addressing climate change. This study explores the sources of knowledge that enhance the adoption of SAPS and identifies barriers to information transfer in the study area. A mixed-methods approach was employed, multistage: combining snowball and convenient sampling techniques to select two villages in Goromonzi. Data was collected using a semi-structured questionnaire administered to 112 respondents from December 2022 to January 2023. The collected data were analyzed using Microsoft Excel and IBM SPSS statistics software. The findings reveal that farmers in Goromonzi practice crop rotation, mulching, and agroforestry as SAPS to improve soil fertility, increase yields, and diversify food supply. The farmer-to-farmer model emerged as the most common source of information sharing among farmers, followed by radios and WhatsApp messenger groups. However, access to extension officers and cooperatives was limited. The study also highlights the positive perception of extension officers' expertise and the moderate benefits farmers derived from their training. These findings emphasize the need to enhance knowledge transfer and information support systems for small-scale farmers in Goromonzi and similar regions. Effective dissemination of agriculture information through various channels, including digital platforms and farmer-to-farmer networks, can play a vital role in promoting SAPS. Improving access to extension services and strengthening farmer cooperatives can also enhance knowledge sharing and the adoption of sustainable practices. Ultimately, empowering farmers with the necessary knowledge and support systems will contribute to building a resilient and sustainable agricultural sector in Southern Africa.

Acknowledgements

Ing. et. Ing. William Nkomoki, Ph.D.

A-149

Tropical forest mapping using high-resolution SAR and deep learning

S. Nakamura, J. Reiche
Wageningen University & Research, Wageningen, The Netherlands

Abstract body

Tropical forests play a vital role in biodiversity, climate regulation and human well-being, yet deforestation and forest degradation are ongoing challenges. For assessing the extent, state and changes of forests, effective forest mapping is essential. Recently, high-resolution SAR images have become commercially available, providing fine-scale details of forests from space. These images exhibit high intra-class and low inter-class variability with a single band, requiring suitable algorithms for accurate forest/non-forest detection. Paying attention to the ability of deep learning to consider contextual information, this study aims at exploring the potential and challenges of high-resolution SAR for forest mapping using deep learning.

First, we created novel reference datasets for the Capella image with binary, multiple-class and sub-class categories. We then performed land cover classifications using weighted and unweighted U-Net, investigating the impact of the class imbalance on the model performance. Additionally, we employed random forest as a reference model for comparison.

The experimental results demonstrated the poor performances of RF across all the datasets, while U-Net showed outstanding results in the binary and multi-class datasets and acceptable results in the sub-class dataset. The outperformance of U-Net suggests the usefulness of texture information rather than individual pixel values to deal with the unique variability of pixel values within and between specific classes. Moreover, the weighted U-Net yielded higher metrics scores than unweighted U-Net in the binary and multi-class datasets, but lower scores in the sub-class dataset. It indicates the potential importance of class balance in training datasets. The results also highlighted difficulties in sub-class segmentation and edge detection with U-Net, necessitating further research for keeping the information in high-resolution and distinguishing similar features at a sub-class level.

Acknowledgements

Johannes Reiche (Wageningen University & Research, Wageningen, the Netherlands)
Adugna Mullissa (CTrees, California, USA)

A-230

Outdoor Recreational Activities in Bali, Indonesia: The Cultural Landscape Subak as a Respite

K. Nilsson
Swedish University of Agricultural Sciences (SLU), Department of People and Society; Faculty of Landscape Architecture, Horticulture and Crop Production Sciences, Alnarp, Sweden

Abstract body

While Indonesia faces countless environmental challenges due to deforestation and exploitation of nature, Bali's terraced rice landscapes – subak – appear to be more protected and better preserved than the rest of the country's greenspaces. It is therefore imperative to ponder upon why this discrepancy may be and investigate how subak visitors have been using these areas for outdoor recreational activities and thus contribute to greater environmental awareness. This first study of outdoor recreational activities in the cultural landscape subak aims to identify what characterises these activities and describe how these activities connect to sustainable development. The study compiled a quantitative questionnaire answered by 58 respondents, 5 semi-structured in-depth interviews, and a series of participant observations. Based on mixed methods analysis, 9 characteristics were identified: colours of nature, smells of nature, wide open space, sounds of nature, species richness, distinctive cultural and religious practices, togetherness, protection, and affordability. The study described positive and negative connections between outdoor recreational activities in the cultural landscape subak with the 2030 Agenda, particularly on SDG 3 Good Health and Well-Being, SDG 11 Sustainable Cities and Communities, and SDG 12 Responsible Consumption and Production. The results revealed: (1) outdoor recreational activities in the subak areas have yielded benefits, namely improved cognitive and social skills, as well as an enhanced state of health and well-being, (2) the role of the subak areas in facilitating the activities has shown cognitive, emotional, and behavioural changes in the study participants, and (3) outdoor recreational activities in the subak areas have fostered a more environmentally conscious mindset that helps improve human health and well-being. Above all, the study emphasises a new environmental mindset, whereby there is a genuine desire to preserve/conserve the subak environment and to achieve the SDGs within this study's framework. Overall, the mixed methods analysis provided new transcendent perspectives that in future research can form the starting point for emphasising outdoor recreational activities with characteristics that can improve health and well-being. In summary, such research can both inspire change and usher in concrete actions and solutions to address environmental threats to the UNESCO World Heritage Site: the cultural landscape subak.

Acknowledgements

Special thanks to:

• The Swedish government Sida (Swedish International Development Cooperation Agency) for a scholarship of 27,000 SEK to conduct the fieldwork.

• All study participants for sharing their experiences and insightful thoughts with me.

• My thesis supervisors – Associate Professors Anna Bengtsson and Mats Gyllin – who always provided me guidance throughout this project and constantly allowed this thesis be my own work.

• My lifetime companion in this life's adventure, Jeanna.

A-268

Incorporation of Nano-Zinc Oxide as a Strategy to Improve the Barrier Properties of Biopolymer-Suberic Acid Residues Films

A. Jeżo
Warsaw University of Life Sciences, Wood technology, GRODZISK MAZOWIECKI, Poland

Abstract body

keywords: barrier properties of nanofilms, nano-zinc oxide nanoparticles, suberic acid-residues, biodegradable finishing coatings, biological resistance

Finishing coatings used in the wood-based composites industry not only play a key role in the final appearance of the finished product, but also protect against fungi and/or mould and minimize the emission of harmful substances, mainly formaldehyde and volatile organic compounds (VOC). This role can be played by carbon-rich materials, such as those remaining from the extraction of birch bark - suberin acids. It has been proven in previous research that the addition of suberin acid-residues (SAR) at 20%w/w and 50%w/w levels significantly improves the gas barrier properties of the surface finishing materials based on poly(lactide) - PLA and polycaprolactone - PCL, regarding the Total VOC and formaldehyde emission. Therefore, the scope of the following research is to answer the question if these properties could be further improved and developed by incorporation of nano-zinc oxide (nano-ZnO), since it has been proven by other researchers that these nanoparticles have a high biological resistance and can positively influence the properties of prepared nanofilms.
The materials used in the following study were PLA and PCL finishing layers, mixed with SAR powder, 20% and 50% w/w and nano-zinc oxide nanoparticles. All the prepared blends were milled to achieve a powder smaller than 0.1 mm, which has been formed in a hot press to achieve the 1 mm thick film. The prepared film has been pressed in a hot press on the surface of a plywood. The Total VOC and formaldehyde emission tests have been completed in the emission test chamber, carried out after 24 hours of conditioning the samples by analyzing the chamber air over three repetitions after 20 minutes each, with the use of JD-3002 Air Quality Tester. The mould resistance of the surface covered by produced finishing layer has been also evaluated. It is expected that examined PLA/SAR and PCL/SAR composites with the addition of nano-zinc oxide nanoparticles will perform significantly improved properties in terms of barrier properties, opening a new path of development of biodegradable coatings for the furniture industry with improved barrier properties. In addition, the project, thanks to the use of SAR, which is post-extraction residue, fits perfectly into the idea of upcycling.

Acknowledgements
The mentioned research is conducted with the support of the Student Furniture Scientific Group (Koło Naukowe Meblarstwa), Faculty of Wood Technology,Warsaw University of Life Sciences – SGGW. This research has been funded by the NationalScience Centre, Poland under the ForestValue Programme, reg. no. 2021/03/Y/NZ9/00038.The author would acknowledge Janis Rizhikovs, Latvian State Institute of Wood Chemistry,Riga, Latvia, for kindly providing the bark post-extraction residues.

A-340

Use of biochar, compost and plant growth promoting rhizobacteria in the management of tomato early blight disease

M. Rasool[1], A. Akhter[2]

[1]Ghent University, Faculty of Bioscience & Engineering, Ghent, Belgium, [2]Univeristy of the Punjab, Faculty of Agricultural Sciences, Lahore, Pakistan

Abstract body

Environmentally damaging pesticides have long been a primary tool used by plant pathologists for managing plant diseases. However, in order to pave the way for a greener future, particularly in agriculture, scientists have been exploring and testing a range of eco-friendly solutions. These include biochar, compost, and PGPR (Plant Growth-Promoting Rhizobacteria). The individual role of biochar, compost and PGPR has been widely studied in increasing the productivity of plants by inducing resistance against phyto-pathogens. However, the knowledge on combined effect of biochar and PGPR on plant health and management of foliar pathogens is still at juvenile stage. The effect of green waste biochar (GWB) and wood biochar (WB), together with compost (Comp) and plant growth promoting rhizobacteria (PGPR; Bacillus subtilis) was examined on tomato (Solanum lycopersicum L.) physiology and Alternaria solani development both in vivo and in vitro. Tomato plants were raised in potting mixture modified with only compost (Comp) at application rate of 20% (v/v), and along with WB and GWB at application rate of 3 and 6% (v/v), each separately, in combination with or without B. subtilis . In comparison with WB amended soil substrate, percentage disease index was significantly reduced in GWB amended treatments (Comp + 6%GWB and Comp + 3%GWB; 48.21 and 35.6%, respectively). Whereas, in the presence of B. subtilis disease suppression was also maximum (up to 80%) in the substrate containing GWB. Tomato plant growth and physiological parameters were significantly higher in treatment containing GWB (6%) alone as well as in combination with PGPR. Alternaria solani mycelial growth inhibition was less than 50% in comp, WB and GWB amended growth media, whereas B. subtilis induced maximum inhibition (55.75%). Conclusively, the variable impact of WB, GWB and subsequently their concentrations in the soil substrate was evident on early blight development and plant physiology. To our knowledge, this is the first report implying biochar in synergism with PGPR to hinder the early blight development in tomatoes.

Acknowledgements

Authors are thankful to the Faculty Agricultural Sciences (FAS), University of the Punjab Lahore, Pakistan for providing consumables as well as laboratory and greenhouse facility for experimentation.

A-253

Habitat Natura 2000 sites as a refuge for valuable bird species in West Pomeranian region

K. Grabska
Warsaw University of Life Sciences, Warsaw, Poland

Abstract body

The European Ecological Network Natura 2000 functions as an unified form of nature protection. Natura 2000 areas are divided into habitat areas, which are designated based on the Habitats Directive and aim to protect habitats and animal species of European value, and bird areas, which are designated based on the Birds Directive and aim to protect bird species of European value. The aim of the 2021 study was to characterize the avifauna of three Natura 2000 areas (Bobolickie Jeziora Lobeliowe PLH320001, Jeziora Szczecineckie PLH320009, Dolina Radwi, Chocieli i Chotli PLH320022) located in the West Pomeranian region in Poland. The study was also conducted to demonstrate that habitat areas serve, not only as a refuge for valuable animal species and habitats, but also are a place where bird species protected throughout Europe occur. Two to three transects were set in each area, on which observations were conducted. Transects were set in the nearby of postglacial lakes, peatlands, mixed forests and in the Radew river valley. The observations consisted of looking for bird species and/or signs of bird activity (e.g. nests, tracks, singing males), as well as recording the voices of calling birds. During the study, in order to recognize and record occurrence of the bird species binoculars, a telephoto lens camera, and a smartphone with a voice recorder were used. Weather conditions appearing on a given day in given area were also collected during the observations. In observed areas, total of 16 bird species of European importance, that appear in Annexes I and II of Birds Directive, were observed. Among others, pair of whooper swans *Cygnus cygnus*, two pairs of common goldeneyes *Bucephala clangula*, colony of great white herons *Ardea alba*, song thrush *Turdus philomelos*, flock of migrating cranes *Grus grus* (which consisted of 276 individuals), common snipe *Gallinago gallinago*, kingfisher *Alcedo atthis* and a pair of eurasian teals *Anas crecca* were recorded during the study. Observed richness and abundance of bird species proves that habitat Natura 2000 areas serve as refuges for valuable bird species of European importance.

Acknowledgements

Dr Krzysztof Klimaszewski

A-311

Laboratory Calibration of TMS-4 Sensor for Continuous Monitoring of Soil Water Content and Evaluating Sensor Performance in Response to Compost Amendment

S. Yamamoto, M. Mihalikova, C. Almaz, R. S. Kara, K. Batkova, P. Dvorak, M. Kral
Czech University of Life Sciences Prague, Faculty of Agrobiology, Food and Natural Resources, Department of Water Resources, Prague, Czech Republic

Abstract body

Continuous monitoring of soil water content (SWC) using automated sensors is widely employed for research and practice. Promising among these sensors are the TMS-4 sensors by Tomst Inc. due to their convenience, independence, long battery life, and affordability. They measure SWC in the surface layer (14 cm), soil temperature, and air temperature (1 and 15 cm above the soil surface), making them suitable for monitoring microclimate changes induced e.g. by mulching.

However, the sensor's accuracy and precision can be affected by the sensor-to-sensor differences or by various soil conditions including installation mistakes. The aim of this study was to carry out the individual sensor calibration for the soil of the research locality in Moravia in order i) to improve the precision of the measurements compared to factory calibration; ii) to evaluate the sensor precision by using four brand new sensors; iii) to evaluate the sensor accuracy affected by organic matter (compost) added to the soil. In addition, obtained calibration equations were used to evaluate field measurement at the locality over 8 months.

The soil was repacked into a calibration container to achieve a target dry bulk density of 1.37 g/cm3, matching the natural field value, in prepared SWC levels from 0 % to 35 %. Real SWC and BD were determined by gravimetric method (in 5 repetitions for each SWC).

Results showed significant differences between factory and individual calibration. While factory calibration was based on quadratic equations, we found logarithmic equations more reliable. The results of the Calibration and Gravimetric Analysis differed between localities. One of the four tested sensors performed differently from the others. Finally, compost admixture (the equivalent of 20 t/ha) has an influence on sensor performance. TMS-4 signal has significantly lower values for the soil amended by compost, especially in the dry range.

In conclusion, TMS-4 sensors are recommended but should be used with an adequate number of repetitions and tested before field application.

Acknowledgements

Syed, Mohammad Zohaib
Yilgan, Furkan

Food for the world

A-157

Optimizing Irrigation Design through Integration of Remote Sensing and Machine Learning :A Precision Agriculture Approach

D. M. Peters
BOKU, Vienna, Austria

Abstract body

This project explores the optimization of irrigation design through the integration of remote sensing data, weather forecasts, and soil data. The objective is to improve water management in agriculture by maximizing water use efficiency and minimizing wastage.

Using remote sensing data, including satellite imagery and aerial ortho-photography, vegetation health, soil moisture levels, and crop stress indicators will be monitored. Weather forecasts will provide insights into precipitation patterns, evapotranspiration rates, and temperature fluctuations. Soil data will be analyzed to understand soil characteristics such as texture, permeability, and water-holding capacity.

The project employs data analysis and machine learning algorithms to optimize irrigation schedules, water application rates, and system design. The aim is to dynamically adjust irrigation practices based on real-time data and environmental conditions to meet the specific water requirements of crops at any given time.

By integrating remote sensing, weather forecasts, and soil data, this project aims to enhance precision agriculture and sustainable water management practices. The findings will contribute to improved irrigation design, maximizing crop growth and productivity while minimizing water losses through evaporation and runoff.

In conclusion, this project seeks to leverage the power of remote sensing, weather forecasts, and soil data to optimize irrigation design and advance efficient water use in agriculture.

Acknowledgements

This project aims to optimize irrigation design in agriculture through the integration of remote sensing data, machine learning algorithms, and other relevant information. The primary objective is to improve water management practices by maximizing water use efficiency and minimizing wastage.

A-160

Institutional challenges in agri-food chains of Kosovo with a view to European Union accession

L. Shkodra
University of Hohhenheim, Department of Agricultural Markets, Stuttgart, Germany

Abstract body

This research focuses on the challenges faced by Kosovo, a developing country aspiring for European Union (EU) accession, in its agri-food chains. Currently, the lack of harmonization with EU standards and certification processes creates barriers for Kosovo's agri-food sector in accessing EU markets, and this poses a substantial competitive disadvantage in comparison to other countries in the region. The objective is to identify the importance of institutional changes in this respect. For this, a comparative analysis of meat and dairy products in Kosovo with other Southeast European countries, particularly Croatia, is conducted. Croatia has been chosen because it has already undergone the accession process. Through this comparative analysis, the study aims to identify the key obstacles hindering Kosovo's progress in meeting EU standards.

The research focuses on the significance of institutional change, as it involves effective regulations, standards, and monitoring systems for improving food quality standards. Based on preliminary results and the review of existing literature, articles, and reports, this research identifies several institutional challenges that Kosovo's agri-food chains are facing. These challenges include legislative and regulatory frameworks, enforcement mechanisms, infrastructure such as approved reference laboratories including equipment, and traceability systems.

Addressing these challenges requires the development of strategies for private and public decision-makers to adopt. These strategies may include strengthening regulations, improving enforcement, investing, and promoting capacity-building initiatives. Collaboration among stakeholders, such as farmers, processors, government, and consumer organizations, is essential for the effective transformation of Kosovo’s food-safety-related institutions. Yet, further research is necessary to develop specific strategies and recommendations.

In conclusion, this research emphasizes the institutional challenges faced by Kosovo's agri-food chains as the country aspires for EU membership.

Keywords

Food quality standards, Kosovo, Institutional change, EU accession, agri-food chains.

Acknowledgements

Prof. Dr. Sebastian Hess

A-226

How consumers categorize food products according to their degree of processing and nutritional quality.

J. Youssef[1], S. Chambaron[2], G. Arvisenet[1]
[1]L'Institut Agro Dijon, Dijon, France, [2]INRAE, CSGA, Dijon, France

Abstract body

For a few decades, ultra-processed food products (UPFs) have been occupying a larger part in consumers' diet, due to several factors (e.g., globalization, industrialization, convenience of such products, etc.). Some studies have suggested a negative impact of all UPFs on health, while other studies have not generalized this for all UPFs. To guide consumers food choices, scientists have attempted to categorize food according to different properties (e.g., degree of processing, nutritional properties). But how consumers categorize food according to these properties is not well understood.

Our objective was to examine how consumers categorize food products according to their nutritional and processing properties, particularly UPFs. First, we investigated if consumers' classification of food products according to these criteria is consistent with that of scientific community. Our second objective was to verify if consumers associate the nutritional quality of food with their degree of processing. Indeed, dietary guidelines may contain either nutrient-based or processing-based information, which could be confusing to consumers. We composed a set of 21 foods from three food groups (fruits and vegetables; meat, fish, and dairy; starches) that were balanced in terms of scientific categorization of nutrient quality (Nutriscore: AB, C, or DE) and processing (NOVA 1, 3, or 4). Two online questionnaires were submitted to 200 participants, who assessed nutritional quality and degree of processing of these products.

Participants categorized foods differently than scientific community in terms of nutritional quality and degree of processing. An association was found between these two properties while classifying foods. e.g., products with Nutri-Score A-B and NOVA 1 were categorized in the "good" nutritional quality category. These results evidenced a halo effect between the nutritional profile of food products and their effect on "health" in participants' mind. The same is true for the degree of processing: consumers are now largely informed about a link between processing and health. The consequence of this effect could be that it is difficult for consumers to distinguish between nutritional properties and degree of processing. It could lead to a misunderstanding of scientific categorizations such as NOVA or Nutri-score, that consider these indexes individually. This could even be an explanation of the mistrust expressed by some consumers towards the Nutri-score.

Acknowledgements

We would like to thank the "Institut Agro Dijon" for giving us the opportunity to present the result of the study that was conducted by the support of the center for taste and feeding behavior (CSGA).

A-249

Economic Evaluation of a Solar-Biomass Hybrid Flatbed Dryer for Maize Cob drying in Rwanda

A. Chettiar, J. Ntwali, S. Romuli, J. Müller
University of Hohenheim, Department of Agricultural Engineering in the Tropics and Subtropics, Stuttgart, Germany

Abstract body

Maize is vital for Rwanda's food security, with an average yield of 4.5 tons/ha. However, post-harvest losses remain significant, especially during drying, contributing to around 16 % of total losses. Cooperatives traditionally use aluminium or plastic sheet shelters with wooden frames for drying, but this method has limitations. It takes up to two months and lacks proper storage, leading to spoilage and low-quality end products. Hence, the objective of this study is to assess the economic feasibility of an alternative solution: a solar-biomass hybrid dryer. This dryer, designed to be efficient and sustainable, combines solar energy with biomass to expedite the drying process and address the shortcomings of the traditional method.

The solar-biomass hybrid dryer was constructed at the farmers' cooperative in Twizamure Cyuve, Rwanda. This dryer uses solar energy for electric energy to power its fans and biomass energy as the heat source. Data on the existing drying methods were collected by interviewing farmers and processors in the maize value chain. According to a preliminary estimate, farmers produce an average of 800 kg of maize per season. The average moisture content of fresh maize is 22 % and after drying, it falls to 13 %, resulting in an average weight of 710 kg. The maize is valued at € 0.19/kg fresh and € 0.29/kg after drying. Even after the loss of mass, the farmers' revenue increases from € 152 to € 206, indicating an increase in the farmers' profit by roughly 35.5 %. The figures include labour and dryer fees. The estimated payback period for the solar system of the constructed dryer, which is the most cost-intensive component, is 1.2 years, suggesting that the overall investment is economically justified. Although the solar-integrated dryer's construction cost is higher, long-term savings in operational costs and reduced spoilage offset the initial expense.

The dryer can still be enhanced in various ways. Reducing heat loss through improved insulation, sealing gaps, and optimizing airflow to maintain consistent temperatures is crucial. A robust business model can improve its economic feasibility, including exploring additional revenue streams from neighbouring cooperatives and drying other agricultural products alongside maize. By operating throughout the year and optimizing the use of available energy, the dryer can achieve higher utilization rates and generate more consistent revenue.

Acknowledgements

Janvier Ntwali, Dr. Sebastian Romuli and Prof. Dr. Joachim Müller

A-365

Wheat Import Dependency and Climate Change in North Africa: The Case of Algeria, Egypt, Morocco, and Tunisia.

C. P. Alborghetti
Wageningen University & Research, Environmental Economics and Natural Resources (ENR), Wageningen, Netherlands Antilles

Abstract body

Wheat is the staple crop of North Africa. Its constant availability and affordability are central to regional food security. So far, governments guaranteed food security via expensive and economically inefficient systems of policies. However, the sustainability of this approach is debatable as the mismatch between regional production and demand has progressively increased, making the region the biggest global wheat importer (FAO-OECD, 2018) with the effect of exposing its public finances and wheat-provision systems to international wheat price volatility.

This thesis aims to investigate the main systemic drivers shaping the evolution of wheat supply and demand that caused such import dependency in Algeria, Egypt, Tunisia, and Morocco in the period 1970-2019, and their possible future evolution in relation to climate change. The drivers are first identified via literature review. Successively, their effect is estimated using Ordinary Least Square (OLS) regressions for country-specific demand and supply. Finally, the resulting coefficients are used with the IPCC's scenario data to estimate their future impact on wheat import dependency in 2050, 2075, and 2100.

The thesis identifies population and income growth as the main drivers of the increase in wheat demand. On the supply side, the most important constraints to production are the scarcity of land and water, as well as the sub-optimal temperature and precipitation levels that cause heat and water stress to the wheat plant. In this context, the IPCC scenario analysis shows that precipitation reduction and temperature increase are projected to exacerbate the supply damages. Also, the high demographic and income growth would cause a further rise in demand. As a result, the dependency is projected to worsen in the future, thus increasing the uncertainty of regional food security.

The results provide useful information for regional and international policymakers to design measures to ensure future wheat availability. In the short term, the diversification of import destinations, and increasing wheat reserves are needed to increase the resilience of the wheat provision system to price shocks. In the medium-term, the small wheat production systems could be aggregated to realize the benefits of the economics of scale. Furthermore, partial liberalization of the wheat market could rise the wheat systems' efficiency.

Acknowledgements

Professor Koos Gardebroek (Wageningen University & Research)

A-328

Homestead Gardening in Rural Bangladesh: Women's Contribution to Sustainable Local Food System and Security

K. N. Sharmin Tumpa
Swedish University of Agricultural Sciences, Rural Development and Natural Resource Management, Uppsala, Sweden

Abstract body

This thesis paper presents qualitative research to explore women's contribution to sustainable food systems and security through homestead gardening in rural Bangladesh. In rural Bangladesh, women frequently undertake homestead gardening, a traditional and widespread practice of producing different vegetables and rearing domestic animals in a small plot of land beside their house. The products from the homestead garden provide food nutrition for the family and income opportunities for women, which contributes to food security. However, women's roles and identities are not recognised in society despite their visible and invisible contributions. Hence, this thesis was conducted in Baneshardi village of Nagarkanda thana in the Faridpur district in Bangladesh to examine the role and contribution of homestead gardening to sustainable food production and security. The study was undertaken by conducting 12 IDI with women managing homestead gardening and 2 KII with a local government and CSO representative. The research indicated that women play diverse roles through their activities in homestead gardens in maintaining sustainable local food systems and security. The principal findings show that through homestead gardening, women are meeting four pillars (Availability, access, utilisation, and stability) of SFS and maintaining an alternative local food system which has the potential of being sustainable. Besides, women's traditional agricultural knowledge preserves biodiversity passed through generations by mothers. Despite these contributions, women face challenges due to the gender division of labour in society, which creates obstacles to identifying women as farmers and limits access to the market. The research concludes that even though women are actively taking part in agricultural activities in the form of homestead gardening and contributing to ensuring a sustainable local food system and security, however, the gender division of labour in society creates obstacles to making visible their crucial contribution and recognising role as a farmer. Besides, this study explores that women's household and homestead gardening activities are economically crucial, which is significant to recognise to make women aware of their own contribution and the significance of their activities. Hence, it is significant to address the potentiality of homestead gardening and women's contribution to meeting sustainable local food systems and security.

Acknowledgements

I want to convey my earnest gratitude to my honourable supervisor and respected teacher, Ildikó Asztalos Morell, whose sincere guidance, instructions and support have allowed me to do this thesis paper successfully. I want to thank my elder sisters, who helped me find this study's participants and were there with electronic devices to make a video call to conduct the interviews. I am grateful to all participants who have given me their valuable time despite their tight schedules.

A-261

Development and quality evaluation of pastries enriched with coffee flour produced from Costa Rican coffee cherries

K. Stadelmeyer[1], A.-J. Reineke[1], C. Acuña-Gutiérrez[1,2], T. Chacón-Ordóñez[2,3], J. A. Chaves[3], O. A. Montoya[3], V. M. Jiménez[2], J. Müller[1]
[1]Institute for Agricultural Engineering, Agricultural Engineering in the Tropics and Subtropics, University of Hohenheim, Stuttgart, Germany, [2]Research Centre for Grains and Seeds (CIGRAS), University of Costa Rica, San José, Costa Rica, [3]National Centre for Food Science and Technology (CITA), University of Costa Rica, San José, Costa Rica

Abstract body

Costa Rica is an important producer of high quality arabica coffee, with high levels of associated waste generated during coffee production. An alternative use of these residues is to convert them into nutritious food products, whereby coffee flour (CF) made from the coffee cherry is a promising option. Considering this, and to prevent food wastage, the present study aims to produce and characterize CF for its physicochemical and nutritional properties. It also aims to develop pastry recipes where a portion of wheat flour is replaced by a certain amount of CF to enrich their nutritional value. Additionally, the study seeks to generate functional foods with the health claim “source of fibre” and to evaluate the effect of CF on leavening agents, as well as on the sensory and nutritional properties of pastries enriched with CF.

The coffee fruit was obtained from the coffee farm Bella Vista in Cartago, Costa Rica. It was dried at 55 °C for 5 h in a tray dryer and grinded, first with a hammer mill and then with a centrifugal mill, to obtain CF. The CF was incorporated as an additive in two different pastries, one formulation with baking powder, one with baking yeast. Three different levels of enrichment with CF were performed for each formulation. Recipes made only with wheat flour serve as a reference. Analysis of tannin (VDLUFA method), caffeine (HPLC UV-Vis), total dietary fibre (TDF) (Megazyme Assay Kit) and protein (Kjeldahl method) content was determined for the CF as well as for the pastry formulations. Particle size distribution of the CF was analysed using a laser diffraction technique. Sensory analyses of the pastries were used to see the influence of CF on the appearance, taste, and mouthfeel.

The analysis of the particle size distribution showed that CF exhibits a monomodal distribution. In CF, particle sizes of 598.07 µm (q_3 = 62.13) are the most abundant. No particles larger than 1685.58 µm and smaller than 5.3 µm are present. Results for protein, TDF and caffeine content as well as the baking and sensory panel results are pending. It is expected that the more wheat flour is replaced by CF, the higher is the content of TDF, protein, and caffeine in the pastries. Results are expected by end of August and can be presented at the conference in November.

Acknowledgements

The research was financially supported by the Dr. Hermann-Eiselen Research Grant (No. 202302) of the Foundation fiat panis.

Food for the world

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Molecular analysis of Cronobacter spp. derived from functional food products likely to be consumed by vulnerable population groups

A. Omasits, E. Wagner, K. J. Domig
BOKU Wien/ Institut für Lebensmittelwissenschaften, Department für Lebensmittelwissenschaften und Lebensmitteltechnologie, Vienna, Austria

Abstract body

Cronobacter is a gram-negative, opportunistically pathogenic genus of bacteria, known for its ability to cause rare but life-threatening diseases in neonates and infants, often following the consumption of contaminated powdered infant formula. Most infections, however, occur in adults and though generally less severe, they have the potential to cause systemic infections and aspirational pneumonia in particularly vulnerable population groups, such as the elderly, immunocompromised individuals and stroke patients. Due to the bacterium's high resistance to osmotic stress and desiccation, raw, plant-based food products appear to be a likely cause for contaminations and food transmission.

In the scope of this thesis, dry plant-derived food products, advertised for their functional characteristics, such as high dietary fiber content, were screened for the presence of *Cronobacter* species. As these products are often either minimally processed or supposed to be eaten raw, they may pose a serious risk for aforementioned individuals. Isolates were identified using Multi Locus Sequence Typing (MLST). The growth characteristics of *Cronobacter* spp. in contaminated food products were evaluated by incubating unheated oatmeal and similar products at suboptimal storage temperatures (6 °C, 12 °C, 21 °C, 30 °C) for different time periods (0 h, 4 h, 12 h, 24 h, 48 h, 72 h) and subsequent determination of the bacterial count. Additionally, selected *Cronobacter* spp. isolates from the screened food products were sequenced using the MinION sequencing device by Oxford Nanopore Technology (ONT) for identification and molecular analysis.

In summary, the aim of this thesis was to answer the question, whether minimally-processed functional food products are suitable for immunocompromised and other vulnerable individuals with regards to *Cronobacter* spp., as well as to increase the food safety awareness for correct handling and storage of food intended for these population groups. Additionally, Third-Generation Long-Read Whole Genome Sequencing (WGS) was tested to determine whether it was suitable for *Cronobacter* spp. identification, as WGS provides a broad spectrum of additional information in comparison to the classical MLST scheme and would likely be of great potential for the identification and monitoring of this opportunistic pathogen in the future.

Acknowledgements

Thank you to my supervisors Eva Wagner and Konrad J. Domig for the great support and for making this master thesis possible.

A-229

A closer look into pangenomes of Lactic Acid Bacteria

H. Riegler[1], B. Zwirzitz[1], L. Zoccarato[2], K. Domig[1]

[1]BOKU Vienna, Food Science, Vienna, Austria, [2]BOKU Vienna, Core Facility Bioinformatics, Vienna, Austria

Abstract body

Lactic acid bacteria are essential for fermentation in modern food production. The constant environment and similar nutrients provided by fermentation processes lead to gene loss and gene acquisition which make the bacteria very adapted and specific to the environment. However, it is unclear to what extent the onset of anthropogenic fermentation impacted the evolutionary history of this bacterial clade. This ensuing evolution is investigated through genomic analysis of over 9000 genomes of *Lactobacillaceae* currently available in public databases. The entire set of genes from all strains within a clades is called the pangenome. The focus of the pangenome analysis is on investigating the whole gene content, namely core and accessory genomes of different strains, rather than just the commonly shared core genomes. The core genome is defined as genes that are commonly shared by most of the strains whereas the accessory genome is defined as gene sets that are shared only by a few strains. Exploring the entire pangenome gives insight into how genomic functions develop but also on the impact of driving factors influencing pangenome composition. After quality control of all downloaded genomes, 8187 high-quality genomes were subjected to further analysis. First, a phylogenetic tree was constructed based on 120 concatenated bacterial marker genes. Then, source of isolation, like food, date of collection and geographical location were mapped onto the tree to determine clusters. Similarly, geographic locations and distribution of genomes of the individual taxa were visualized on a world map. Different heatmaps of genes in combination with isolation source, date of collection and geographic location will reveal further clusters. The results of this research will give a better understanding of lactic acid bacteria and driving factors of their evolutionary history. To conclude, this pangenome analysis can be a starting point for further research of bacterial development and how different nutrients change the evolutionary trajectory of individual lineages.

Acknowledgements

Konrad Domig, Univ.Prof. Dipl.-Ing. Dr.nat.techn., Benjamin Zwirzitz, Ph.D., Luca Zoccarato, Ph.D.

A-259

Understanding the role of WRKY transcription factors in early blight disease of potato caused by Alternaria solani

S. Gautam[1], E. Alexandersson[2], S. R. Sivarajan[1]

[1]Swedish University of Agricultural Sciences, Plant protection Biology, Malmo, Sweden, [2]Swedish University of Agricultural Sciences, Plant plant breeding, Malmo, Sweden

Abstract body

WRKY transcription factor is a large gene family that plays an important role in biotic stress responses in plants. This study focused on the genome- and transcriptome-wide identification of the WRKY transcription factors in potato and the expression patterns of the shortlisted StWRKY genes identified in the potato genome. Eighty WRKY genes were identified in the potato genome (v6.1) and were mapped across 11 out of 12 chromosomes. Based on sequence similarity, the StWRKY genes were classified into three groups (Group I, II, and III), with Group II further divided into five subgroups (IIA, IIB, IIC, IID, and IIE). Gene duplication events were observed, revealing 23 pairs of duplicated StWRKY genes. Additionally, synteny analysis revealed the collinear StWRKY genes between *S. tuberosum* and *A. thaliana* and between *S. tuberosum* and *S. lycopersicum* along with duplication events. Gene structure and motif analyses of StWRKY sequences were performed. Prediction of promoter cis-regulatory elements showed the presence of defence and stress-responsive, drought-responsive and hormonal-responsive elements, with examples of salicylic acid-responsive and gibberellin-responsive elements. In silico protein-protein interaction analyses were performed to better understand the co-expression network of the StWRKY proteins. Selected StWRKY genes showed differential expression patterns in two cultivars with varying susceptibility to *Alternaria solani*, the causing agent of early blight, during infection. The sequence and the expressional analyses of the selected StWRKY genes lay the foundation for further studies to reveal the involvement of WRKY genes in potato early blight and other stresses.

Acknowledgements

This thesis work, developed as part of emPLANT+ (Erasmus Mundus Masters program in Plant breeding), was made possible by the European Commission's funding. It expanded my understanding of molecular biotechnology and practical applications in plant breeding. I'm grateful to co-supervisor Assoc. Prof. Erik Alexandersson and Dr Sajeevan Radha Sivarajan for their consistent support. Also thanks to the Swedish university of Agricultural sciences(SLU) for the platform for this research.

A-245

Phenotypic and genotypic analysis of a durum wheat cultivar for fusarium head blight resistance with special regard of anther extrusion and plant height

D. Fritz[1], H. Bürstmayr[2], B. Steiner[1]

[1]University of Natural Resources and Life Sciences, Vienna (BOKU) / Institute for biotechnology in plant production, Agrarbiotechnology, Vienna, Austria, [2]University of Natural Resources and Life Sciences, Vienna (BOKU) / Institute for biotechnology in plant production, Agrarbiotechnology, Vienna, Austria, Agrarbiotechnology, Vienna, Austria

Abstract body

Fusarium head blight (FHB) belongs to the most feared wheat diseases worldwide. The fungus reduces yield and quality. Main issues are the Fusarium-derived mycotoxins that contaminate the harvest. Unfortunately, genetic diversity for resistance to FHB is rather sparse in durum wheat compared to bread wheat, which hampered resistance breeding so far. Ongoing pre-breeding projects at BOKU have developed a new generation of durum wheat lines with increased FHB resistance. In my project I therefore evaluate a population of 375 of these pre-breeding lines for quantitative resistance in the field in two replications, summing up to 750 observation plots. I performed inoculation by spraying *Fusarium culmorum* conidia suspended in water (100 ml m^2 at a concentration of 12.500 conidia ml^{-1}) on durum wheat heads at flowering using a back-pack sprayer. The crop was moistened with a mist-irrigation device to promote fungal infections. Within 6-8 days after flowering, anther retention was recorded in % of florets with at least one anther retained inside the glumes. Severity of Fusarium head blight symptoms was recorded by visual observations in four-day intervals on each plot, from day 10 to day 26 after flowering. Additional traits I recorded were plant height and severity of stripe rust on leaves.

Date are currently processed and final result and thorough discussion will be shown in November. Preliminary results suggest that: 1) in this pre-breeding population the diversity for FHB severity is much larger than in current durum wheat cultivars available on the market, 2) durum wheat lines with higher anther extrusion are less susceptible, 3) taller plant types are less susceptible to FHB, but agronomically not desired. Several of the new FHB resistant pre-breeding lines appear attractive as crossing parent for breeding new and resistant cultivars. In addition, DNA markers will be developed as supplementary selection tool for FHB resistance breeding of durum wheat.

In the long run my project will contribute to food safety, as it will prevent mycotoxin contamination of pasta products directly in the field.

Acknowledgements

I especially want to thank Univ.Prof.Dipl.-Ing Dr. Hermann Bürstmayr for the interesting and globally important master thesis topic and the deliberately choice of the scientific literarure to read in the subject. The other supervisor Dipl.-Ing. Dr. Barbara Steiner I want to give thanks for her patience and cordial and carefully support. Overall, the project would not have been possible and much more complicated without labour of many IFA employees.

A-339

Genomics and evolution of plant-plant interactions: application to the cultivation of varietal mixtures for a pesticide-free agriculture.

C. Plessis
INRAE - Institut Agro Montpellier, Montpellier, France

Abstract body

Reintroducing genetic diversity into plots by growing mixtures of genotypes could be an interesting avenue to explore for developing more sustainable agriculture. The value of mixtures in agronomy has been the subject of abundant literature since the 1960s, with descriptive studies showing contrasting results. To date, the mechanisms that determine interactions between genotypes in the context of mixed crops remain largely unexplored. Using durum wheat and major wheat fungal foliar diseases, as a model system, the aim of our project is to identify genomic regions for which allelic combinations in mixture affect disease resistance and yield, to unravel the underlying mechanisms, and to identify the impact of domestication and varietal improvement on the evolution of plant-plant-pathogen interactions.

Acknowledgements

Jacques David, Hélène Fréville

A-284

Optimization of prediction models for yield and yield stability in sorghum: analysis of physiological determinisms, genomic prediction incorporating GXE and phenomic approach.

J. Salomon[1], G. Pressoir[2], J. R. Charles[2], Y. Cheremond[2], G. Morris[3]
[1]Institut Agro Montpellier (SupAgro), Montpellier, France, [2]Centre Haïtien d'Innovation en Biotechnologies et pour une Agriculture Soutenable (CHIBAS), Faculté des Sciences de l'Agriculture et de l'Environnement, Université Quisqueya, Port au Prince, Haiti, [3]Colorado State University, Colorado, United States of America

Abstract body

Haiti has great variability in terms of the nature of soils and microclimates. This pedoclimatic variability changes the relative ranking of genotype performances when they are growing from one environment to another, which makes the selection of broadly adapted genotypes difficult. Thus, choosing efficient and stable genotypes and identifying the physiological mechanisms and/or the genetic architecture associated with stability and agronomic performance is crucial for breeding programs. There are a few studies that evaluated the potential of genomic prediction for yield stability and/or optimization approaches such as the incorporation of genotype-environment interaction (GEI) component, use of selection indexes, incorporation of phenomenic and physiological data. The objective of this paper is to optimize and select the best model for predicting yield stability and performance in new environments. A sorghum population of 250 genotypes was genotyped for 13344 SNPs and evaluated in 12 environments for four agronomic traits: grain yield, brix, stay-green, and dhurrin concentration. Eberhart and Russel Regression (ERR), the superiority index of Lin and Binns, and Kang's index were used to estimate yield stability. Seven genomic prediction models were tested: G-BLUP, Bayesian Ridge Regression (BRR), BayesA, BayesB, BayesC, BGGE, and pheno-geno. The phenomic prediction was made with the H-BLUP model. Kang's index, average yield across environments, and physiological traits (brix, stay green) were used as the selection index. Genotypes, environments, and genotype-environment interactions (GEI) were highly significant for grain yield. Environments and GEI shared the largest proportion of the variance. The GEI variance distribution shows that the ERR slopes explain only a small part. Accuracy of models varied by environment, models, and prediction indexes. The predictive ability of models for new environments based on Kang's index varied from 0 to -0.48; it varied from 0 to 0.50 for prediction based on average yield. Bayesian models and average yield were more accurate to make the selection for these preliminary results. The genotype stability and performance were mainly explained by the stay-green and brix/stay-green interaction. ERR slopes are not accurate to predict yield stability. The results in this study suggest that some of the prediction indexes may not be under genetic control and/or these indexes did not capture adequately the GEI patterns.

Acknowledgements

This study is made possible with the support of the American People provided to the Feed the Future Innovation Lab for Collaborative Research on Sorghum and Millet (SMIL) through the USAID. The contents are the sole responsibility of the authors and do not necessarily reflect the views of USAID or the United States Government. Support was also provided for our trials by the Haitian Ministry of Agriculture, Natural Resources, and Rural Development, and the Inter American Development Bank.

A-188

Stability and adaptability assay of grain sorghum genotypes using GGE biplot

A. Mumtaz
Lincoln University, New Zealand, Agriculture Sciences, Lincoln, New Zealand

Abstract body

Introduction: Sorghum (Sorghum bicolor (L.) Moench) is used as a staple food more than 30 countries in Africa and Asia, also as a feed and fodder in sub-continental region of Asia i.e., India, Pakistan. Genotype – environment interaction (G × E) is a common phenomenon in plant breeding. Revealing and understanding its causes is essential for the development of high yielding sorghum cultivars with good adaptability and stability of high protein and sugar content.

Methods: The G × E interaction of six Pakistani experimental sorghum lines produced by the Pedigree method and two check cultivars were evaluated for days to 50% flowering, stalk weight, grain yield and Brix value along with their stability and/or adaptability across two locations and over two years in a randomized complete block design with three replications.

Result and Discussions: The combined analyses of variance of all the studied characters showed that they were significantly ($p<0.05$) affected by environments (E), genotypes (G) and genotype by environment interaction (G × E) in each year with the exception of Brix value. The ideal genotype evaluation proved that YSS-10 was the best line for all the four environments. Dera Gazi Khan is an ideal location for testing grain sorghum genotypes. The 'Which-won-where' biplots indicated a crossover type of G × E between experimental lines YSS-10 (2) and YSS-18 (3) for grain yield. The results were in assemble with the findings of Human et al. (2011), Teodoro et al. (2016), Mumtaz et al. (2019) and Worede et al. (2020). Different studies have estimated the genotype stability in a variety of crops for prediction of desirable lines; for example, in barley and rapeseed (Dehghani et al., 2006;2008)), in wheat (Kaya et al., 2006), in lentil (Sabaghni et al., 2008), in sorghum, (Khalil et al., 2011; Mitrovic et al., 2012; Mumtaz et al. 2019) and in maize (Munawar et al., 2013). This study will aid the breeders in prioritizing traits for breeding programmes. Location-specific adaptation of lines/varieties as found in the current study clearly implies that location-specific breeding needs are more important than focusing on wider adaptability. Another point of consideration is that it is necessary to identify location-specific cultivars with location and multi-year data for consideration before commercial release for the sake of stability of the cultivar. This is important not only to sorghum only but also in other crops as well.

Acknowledgements

Prof. John Hampton, Dr. Hossein Alizadeh and staff of Maize and Millets Research Instiute, Yusafwala, Sahiwal, Pakistan.

Food for the world

A-138

Optimizing the overall performance of cheese industrial production through a statistical approach.

M. Perrignon[1], M. Emily[2], R. Jeantet[1], T. Croguennec[1]
[1]STLO, INRAE, Institut Agro, Rennes, France, [2]Institut Agro, CNRS, Université de Rennes, IRMAR (Institut de Recherche Mathématique de Rennes)-UMR 6625, Rennes, France

Abstract body

Cheese production is a complex process with many mechanical and manual steps that are sources of variability. The latter come from the natural variability of raw milk and ingredient sources, human perception and intervention in the process, capabilities of processing tools, etc. Altogether, they affect the cheese characteristics, production yield, etc., representing potential deviation to standards and impacting the overall performance of the cheese manufacturing process. To summarize the overall performance can be defined by considering several types of indicators such as economic, quality and environmental indicators. In order to improve the overall performance of cheese manufacturing process, it is necessary to control all the sources of variability: in this view, having a global vision of the measurements collected throughout the process could constitute a powerful lever for optimising production. However, the data set collected is massive, sometimes redundant and of very different typology, which explains why at present it is imperfectly analysed in a global manner. The emergence of artificial intelligence approaches such as machine learning in the industrial field is an interesting lever/way to evaluate and optimise the overall performance of the cheese manufacturing process. In this work, a machine learning method is implemented to explain the variability of each indicator defining the overall performance by using all the parameters (more than 350 parameters) collected throughout the manufacturing process of a hard cheese (more than 120000 cheeses per year). This method establishes relationships, which are sometimes complex, between these parameters and each indicator. To optimise the overall performance of the cheese manufacturing process, a multi-objective optimisation (MOO) method is used thanks to the modelling of indicators. MOO allows a compromise between all criteria and a set of acceptable solutions. In industry, performance objectives are often conflicting, so it is interesting to take them into account simultaneously, as proposed by this method. To sum up, the development of a MOO method for maximizing the overall performance of complex processes through machine learning represents a major challenge in the dairy industry.

Acknowledgements

We are grateful for the financial support of Institut Agro Fondation.

A-312

"Development of fermented ketchup with potential probiotic and assessment impact of the product on gut microbiota by in vitro digestion "

K. Küçükgöz[1], K. Venema[2], M. Trząskowska[1]
[1]Warsaw University of Life Sciences - SGGW, Department of Food Gastronomy and Food Hygiene, Warsaw, Poland, [2]Maastricht University – Campus Venlo, Centre for Healthy Eating and Food Innovation, Venlo, The Netherlands

Abstract body

There is a growing demand for healthier food options, including fermented foods that contain beneficial microorganisms. Probiotics are live microorganisms that provide health benefits when consumed in adequate amounts. However, most fermented foods are dairy-based and inaccessible to individuals with allergies to milk proteins, lactose intolerance, vegetarians, vegans, sustainability or dietary concerns.
This research aimed to develop fermented beetroot ketchup as an alternative to dairy products, incorporating the potentially probiotic strain *Lactobacillus johnsonii* K4. The product was evaluated for its effect on gut microbiota composition and survival by in vitro digestion.
The survival of the strain was tested in a dynamic in vitro digestion system (TIM-1), specifically the stomach and small intestine. Results showed a survival rate of 26.73% for *Lactobacillus johnsonii* K4 at the end of the digestion process.
Additionally, the effect of the fermented ketchup was examined on the composition of the gut microbiota in a dynamic in vitro model of the colon. The ketchup was provided in 60 grams to colon after the adaptation period, while *Lactobacillus johnsonii* was added to 1 ml in a saline solution for three days. The intake of fermented ketchup increased beneficial and potentially beneficial bacteria such as Faecalibacterium, *Ruminiclostridium.6 Ruminococcacea*, *Blautia*, and *Catenibacterium*. Furthermore, there was a significant decrease in potential pathogenic bacteria, including *Desulfovibrio* and *Escherichia-Shigella*.
Overall, this study demonstrated the potential of fermented beetroot ketchup as a vehicle for probiotics. The findings suggest that such a product can positively impact gut microbiota composition and activity, potentially promoting better gut health.

Acknowledgements

Koen Venema
Monika Trząskowska

A-374

Plant performance in controlled environment agriculture, the effect of different ebb and flow irrigation intervals on Brassica oleracea and Lactuca sativa.

L. Post
Swedish University of Agricultural Science / SweGreen AB / Mälardälen University, Stockholm, Sweden

Abstract body

Increased interest in sustainability combined with urbanisation create a high demand for sustainable food inside cities. Due to limited availability of arable land a solution may be vertical farming. To decrease environmental footprint and increase profitability of vertical farms overal productivity must be increased. Controlled environment agriculture enables increased plant performance, that may be limited by only 1 factor. Monitored or controlled parameters in this experiment were, air velocity, temperature, humidity, light, substrate moisture, pH, electroconductivity, and irrigation intervals. This study aims to increase productivity of lettuce and kale in a vertical farm by finding what irrigation levels enable highest crop productivity. Crops were grown in stone wool substrate in an ebb and flow irrigation system under four different intervals (4, 15, 60, and 270 min). Results in fresh and dry weight indicate an optimal irrigation interval for lettuce between 5- and 15-min interval. This data is supported by mineral content of the different irrigation treatment for lettuce. No significant difference between these two smallest irrigation intervals have be found. For kale data is inconclusive and no optimal irrigation levels have been found. Mineral analysis for the different irrigation intervals for kale might suggest improved plant performance under 5 min interval compared to 270 min. Limited relatable research was available for further analysis. During the experiment airflow was hardest to control which may affected results.

Acknowledgements

In the first place I would like to thank the entire team of SweGreen for offering time, expertise, and space for making this research happen. I would like to thank my supervisor Karl-Johan Bergstrand for sharing his expertise by quick email responds over the past 6 months. A special thanks to SLU Partnerskap Alnarp for funding this research.

A-289

Legumes and their pivotal role in sustainable agroecosystems.

I. Speeckaert[1,2], J. Pannecoucque[2], H. Muylle[2], S. Maenhout[1]

[1]Ghent University, Department of Plants and Crops, Ghent, Belgium, [2]Flanders Research Institute for Agriculture, Fisheries and Food, Plant Sciences Unit, Melle, Belgium

Abstract body

Grain legumes play a crucial role in the transition towards more sustainable agroecological cropping systems. Incorporating them into traditional crop rotation schemes can bring about a myriad of advantages. Both direct and indirect ecosystem services are associated with the introduction of legumes into current cropping systems, often referred to as the 'nitrogen effect' and the 'break-crop effect' (Stagnari *et al.*, 2017). The 'nitrogen effect' alludes on the fact that legumes increase the nitrogen availability through biological nitrogen fixation, reducing the need for nitrogen fertilizers and potentially increasing the yield of following crops (Ditzler *et al.*, 2021). The 'break-crop effect' encompasses all non-legume-specific benefits, such as an improved soil water retention and availability through their deep root systems (Angus *et al.*, 2015) and an altered soil microbial community (Borrell *et al.*, 2017).

The aim of this research project is to capture and quantify these effects for three legume pre-crops (faba bean (*Vicia faba*), pea (*Pisum sativum*) and red kidney bean (*Phaseolus vulgaris*)) and to compare these with two cereal pre-crops (barley (*Hordeum vulgare*) and wheat (*Triticum aestivum*)). Additionally, yield and quality of the following cereal crop (barley, wheat and durum wheat (*Triticum durum*) will be quantified to identify the most promising pre-crop / cereal combination. Near-infrared (NIR) spectroscopy and electromagnetic induction (EMI) are put forward as cost-effective methods to monitor the mineral nitrogen availability in the soil and the soil moisture content repeatedly throughout the season. NIR spectroscopy has been used for the estimation of a multitude of soil properties, such as soil total nitrogen and carbon content (Morellos *et al.*, 2016), and recent studies support its applicability for the estimation of soil mineral nitrogen (Amirul *et al.*, 2020). Secondly, geophysical methods such as EMI are often used as a proximal soil sensing approach to measure electrical conductivity, which in turn is treated as a proxy for various soil properties such as soil moisture content (Blanchy *et al.*, 2020). Additionally, the composition of the soil microbiome of both pre-crops and following cereal crops will be determined through a metabarcoding analysis. The combination of these measurements will allow to observe and quantify forementioned potential benefits of legumes as a pre-crop and to identify the optimal pre-crop / cereal combination.

Acknowledgements

Special thanks go to all supervisors for their guidance and contributions in shaping this research project. This research project is supported by VLAIO and the European Union (HBC.2021.1055 project Leg-O).

A-166

Non-targeted NMR analysis of salads from aquaponic systems

A.-B. Sýkorová
Czech University of Life Sciences, Faculty of Agrobiology, Food and Natural Resources, Prague, Czech Republic

Abstract body

This study aimed to investigate the differences in bioactive substances between aquaponic and hydroponic plant cultivation, with focus on lettuce. The experiment involved growing the lettuce using four different cultivation technologies in three replicates (aeroponic, expanded clay, raft technology, and substrate). Irrigation was provided with either an aquaponic or hydroponic nutrient solution. The cultivation lasted for 29 days. After harvest, the samples were weighed and lyophilized. Each sample was homogenised by crushing and extracted with methanol for analysis using untargeted ^{1}H NMR spectroscopy. ^{1}H NMR analysis was performed using the 1D NOESY method, and then the spectra were adjusted in the ChenomX program. The signals of the spectra were assigned to twenty-one substances, quantified, and exported in exact concentrations for further statistical processing. A principal component analysis was performed, which revealed the first differences. Statistically significant differences between hydroponics and aquaponics were revealed for three substances: glutamine, GABA and sucrose. Samples of lettuce were also analysed for dry weight and fresh weight and also nutrient solutions were analysed for electrical conductivity, pH, temperature and O_2 levels.

The amino acid glutamine exhibited the most significant difference, showing lower levels in samples cultivated with the aquaponic solution. Glutamine plays a role as a nitrogen reservoir and regulator of plant growth, and its increased abundance can serve as an indicator of nitrogen deficiency stress. This hypothesis gains support from additional statistically significant variations in the content of other substances, specifically sucrose and GABA, which were also found in lower quantities in aquaponic samples. Significant differences were also found between aquaponic and hydroponic nutrition according to fresh weight and dry matter. Whereas aquaponics showed lower level of dry matter percentage, higher level of fresh weight was observed. The results showed a significant distinction between aquaponics and hydroponics, suggesting that aquaculture may potentially improve the resilience of the crops. To further support this hypothesis additional studies are needed. This research can aid in the development of more sustainable cultivation practices not only for lettuce. Overall, these findings highlight the promising potential of aquaponics as an intriguing ecosystem for future sustainable cultivation.

Acknowledgements

This study was supported by projects QK21010207 and LM2023064

A-202

Detection and characterization of Listeria monocytogenes in foods

A. Lišková
Czech University of Life Sciences Prague, Department of Microbiology, Nutrition and Dietetics, Prague, Czech Republic

Abstract body

Listeria monocytogenes is an important foodborne pathogen responsible for foodborne diseases, listeriosis. Despite the fact, that the disease, is relatively rare, it is characterized by severe symptoms and a high mortality rate (20-30%).

The aim of this study was monitoring of *L. monocytogenes* in risk groups of foodstuffs commonly found on the Czech market, and its characterization. In total, 51 food samples belonging to the following categories: meat products (13 samples), delicatessen (17), milk and milk products (18) and fish and fish products (3) were tested.

L. monocytogenes was determined by cultivation method according to ČSN EN ISO 11290-1/2017. The confirmation was carried out by the CAMP test, MALDI-TOF mass spectrometry and molecular genetic methods (species-specific PCR and sequencing of 16S rDNA). Confirmed *L. monocytogenes* strains were then characterized by serotyping and REP-PCR fingerprinting technique with primer (GTG)5. The pathogenic potential was assessed by detecting the presence of the internalin B coding gene, a protein responsible for adhesion and invasion to the host cells. The sensitivity of *L. monocytogenes* to antibiotics (ampicilin, benzylpenicilin (penicilin G), erythromycin, meropenem and trimethoprim-sulfometaxazole) was investigated according to ISO 20776-1 by microdilution method.

The pathogen was revealed in 2 samples (3,92 %). Both were of gourmet salad origin (Bukovánek sýrový and hollandaise salad). From each sample 14 isolates were taken and closely characterized. All strains had identical 16S rDNA sequences, were of the same serotype 1/2a and showed identical fingerprint profiles. In all isolates internalin B coding gene was detected. Thus, it can be assumed that all isolates are clones of the same organism with the ability to induce disease. The assumption is supported by the fact, that both positive samples originated from the same manufacturing facility.The sensitivity of selected strains to the antibiotics ampicilin, erythromycin, meropenem and penicillin G was confirmed within the values established by EUCAST with the same minimal inhibitory concentrations (MICs) values, but increased resistance for trimethoprim-sulfometaxazole was observed. The MIC for this antibiotic were about 10-fold higher than required. For the confirmation of antibiotic resistance more tests are required. However, this finding corresponds with serious global problem of the increasing spread of antibiotic-resistant pathogens.

Acknowledgements

Ing. Hana Šubrtová Salmonová, Ph.D. and Ing. Tereza Kodešová

Pigs, pine trees and everything in between + Social economy in a changing world

A-204

Evaluation of the selected theoretical distributions for approximation of diameter structure in pine stands of different age classes in Lubsko Forest District

K. Olędzki
Warsaw University of Life Sciences, Forestry, Warsaw, Poland

Abstract body

The Scots pine (*Pinus sylvestris* L.) is the primary forest-forming tree species responsible in Poland. It covers 67% of the country's forested areas and can be found in various habitats, ranging from dry and sandy regions to fertile forest sites and palustrine pine forests. Pine wood is extensively used across all sectors of the timber industry. Considering the significance of this tree species, it is crucial to develop growth models that incorporate the structure of trunk diameter at breast height (DBH). These models find practical applications in both theory and forestry practice, facilitating the determination of various tree and stand characteristics, supporting the planning of silvicultural treatments.

The study aimed to identify theoretical probability distributions that provide the best fit to DBH distributions in Scots pine stands, varying in age and habitat. The research was was carried out using data collected during the Interdisciplinary Scientific Camp of the Forestry Students' Scientific Association "Bory Lubuskie 2022" in the Lubsko Forest District (western Poland).
Six circular sample plots, each containing a minimum of 100 trees, were established in pine stands within typical fresh coniferous forest habitats specific to the species. These plots represented age classes from II (21-40 years) to VII (121-140 years). The diameter structure of the stands was characterized using descriptive statistics measures. The goodness-of-fit of the empirical DBH distributions to sixty theoretical distributions for continuous random variables was evaluated using the Kolmogorov-Smirnov test at a significance level of 0.05. The Dn statistic of the Kolmogorov-Smirnov test was used to rank the theoretical distributions according to age class and forest habitat type. The theoretical distributions that best approximated the DBH structure across all age classes were Generalized Extreme Value, Burr (4P), and Johnson SB distributions. The goodness-of-fit of these best theoretical distributions to the empirical distribution varied significantly depending on the age class, with the highest similarity observed in age classes from III to V. These distributions can be used to develop DBH models for Scots pine stands in fresh coniferous forest habitats.

Acknowledgements

Robert Tomusiak PhD
Rafał Wojtan PhD
Forestry Students' Scientific Association Warsaw University of Life Sciences SGGW

A-272

Utilization of lupins in the feeding of sturgeon fish

A. Chwaściński, J. Błażewicz, K. Kawalski, J. Martynow, P. Bujarski
Warsaw University of Life Sciences/Faculty of Animal Breeding, Bioengineering and Conservation, Department of Ichthyology and Biotechnology in Aquaculture, Warsaw, Poland

Abstract body

Aquaculture is currently the fastest growing food industry. Sturgeon is one of the prospective species farmed in aquaculture. Of these, the Siberian sturgeon (*Acipenser baerii*) is the most important. In the experiment, feed composed with white lupin meal inclusion was used. The test material was juveniles of Siberian sturgeon. For the purpose of the experiment, four feeding groups were designated, a reference group "Aller", a control group "Lupin 0%" and two experimental groups Lupin 5% and 10%. The feeding experiment lasted for 125 days. During the experiment, the breeding parameters of the fish were examined. After 125 days, 12 individuals from each group were killed. The liver and intestines were collected for histological analyses. HE, ABPAS and PCNA staining were performed to assess histopathological changes. Morphometric measurements were taken using a microscope.

In the Aller group, the fish had the highest weight and length. They were not statistically different in the control and experimental groups. The gastrointestinal tract sections analyzed showed no significant histopathological changes. Fish in the Aller group showed a statistically significantly reduced the height of the supranuclear layer of enterocytes compared to the other groups. A widening of the lamina propria was also observed in this group relative to the Lupin 0% group. In individuals from the other study groups, the longest intestinal folds with the proportionally largest absorptive area were found in the Lupin 10% group.

The livers of the fish studied were characterized by severe steatosis, with the largest hepatocytes observed in the Lupin 0% group. The highest number of PCNA positive cells was observed in the Lupin 10% group, but not statistically significant.

The use of lupin meal in the feeding of juvenile Siberian sturgeon has a positive effect with the low inclusion levels of this alternative protein source.Continued research is needed to demonstrate the long-term effects of lupin meal on adult sturgeon and gonad maturation.

Acknowledgements

The research was conducted as part of the project 'STAWPROPLUS' (no. 0001–6521.1-OR0700001/17/20) founded by Operational Program 'Fisheries and Sea' (2014–2020), The Agency for Restructuring and Modernisation of Agriculture (ARMA) of Poland. We thank the mentors: Prof. Maciej Kamaszewski, Dr Dobrochna Adamek-Urbańska and Adrian Szczepanski, M.Sc., who supervised the work of their research project.

A-316

Linkage analysis of amyloidogenic proteins in the domestic cat (Felis catus)

U. Maciąg, G. Damentka, M. Gryglas
Warsaw University of Life Sciences, Faculty of Animal Science, Warsaw, Poland

Abstract body

Linkage analysis of amyloidogenic proteins in the domestic cat (*Felis catus***)**

Authors: Urszula Maciąg, Gabriela Damentka, Martyna Gryglas,
Supervisor: dr Beata Grzegrzółka, dr hab. Joanna Gruszczyńska, prof. SGGW

Amyloidosis is a disease causing deposits of insoluble protein in tissues, affecting both human and animals. Amyloids have been found in domestic cat, which precursors may include serum amyloid A (SAA), islet amyloid polypeptide (IAPP), apolipoproteins A-I, A-IV, E and immunoglobulin lambda light chains (AL). The aim of this study was to determine the predictive power of associations between amyloidogenic proteins, which in domestic cats are the cause of the development of amyloidosis. The STRING v.11.0 program was used in the bioinformatics analysis. Analyzes of connections between amyloidogenic proteins showed that SAA and apolipoproteins A-I, A-IV, E as well as lambda immunoglobulin show a certain degree of functional connection with each other. Thus, if mutations do not cause ApoAI, ApoAIV, and ApoE to be amyloidogenic proteins, it is possible that functional associations with other amyloidogenic proteins cause apolipoprotein co-accumulation in amyloidoses associated with other precursors. Research funded by the project No SKN/SP/536153/2022 “Student scientific circles create innovations” financed by Ministry of Education and Science

Keywords – felids, amyloid, SAA, IAPP, apolipoproteins, AL

Acknowledgements
Research funded by the project No SKN/SP/536153/2022 “Student scientific circles create innovations” financed by Ministry of Education and Science

A-345

Is there a relationship between the occurrence of selected cancers and amyloidosis in domestic dog (Canis lupus familiaris)?

M. Gryglas, U. Maciąg, G. Damentka
Warsaw University of Life Sciences, Faculty of animal science, Warsaw, Poland

Abstract body

Key words: amyloid, domestic dog, PML, NSD1

Among the amyloids most common in dogs (*Canis lupus familiaris*) is apolipoprotein AI (ApoAI), which belongs to the group of apoplipoproteins. It is probably the main protein responsible for the anti-atherosclerotic effect of high-density lipoproteins (HDL), in which it is a building protein part.
Accumulation of amyloid in the organs leading to a disease called amyloidosis, which most often affects vital organs such as the heart, kidneys, liver and the nervous system. In dogs, one of the mors common is cutaneous amyloidosis, both primary and secondary. Ears are the most frequent cases of amyloid deposition, but they can also be located in other places of the body in the form of skin deposits or nodules in the dermis or subcutaneous tissue. It has been shown that the cutaneous form of amylosoid may be related to the proliferation of plasma cells in a given place or the dyscrasia of these cells.
Studies have shown a relationship between amyloid precursor protein and promyelocytic leukemia in the case of a high burden of atherosclerotic plaques, indicating amyloid deposition in the body. However, there are more cases of cancer with simultaneous diagnosis of amyloidosis. Another example is multiple myeloma, which has often been diagnosed in dogs that already have amyloid deposits.
The aim of this study was to identify the proteins responsible for the occurrence of amyloidosis in a domestic dog and to carry out analyzes to determine the strength of the links between these proteins, the co-expression of genes conditioning them, and to observe the relationship between proteins associated with amyloidosis and potential factors important in the development of selected cancers. The analysis was carried out using the STRING v.11.5 program and information from the KEGG database.

The connection between these cases is not accidental. The analysis showed that the *NSD1* gene, as one of the most important genes in the development of multiple myeloma, and the *PML* gene, corresponding to promyelocytic leukemia, have a common element, which is the alpha retinoic acid receptor protein. In both cases, there is co-expression between the key factors causing the occurrence of tumors and the alpha retinoic acid receptor protein.
Thanks to the analysis, a significant link was also noted between apolipoprotein AI and transthyrentin, a protein that binds thyroid hormones, but also binds retinol, which is a precursor of retinoic acid.

Acknowledgements
I would like to thank the co-authors of the work, Urszula Maciąg and Gabriela Damentka, and the supervisors of the work dr Beata Grzegrzółka and dr hab. Joanna Gruszczyńska, prof. SGGW.

A-354

Agroecology for sustanable animal production in the changing climate.

L. Nkhata
Czech University of Life sciences in Prague, Faculty of Agrobiology, Food and Natural Resources, Prague, Czech Republic

Abstract body

Agroecology offers a holistic and sustainable approach to animal production systems, addressing the limitations of conventional intensive farming practices (FAO 2019). This study focuses on the application of agroecological practices, specifically silvopastoral systems, to improve the welfare and productivity of beef cattle during summer. The research aims to achieve sustainability in the face of climate change by exploring agroforestry, rotational grazing, mixed farming, and organic practices (Rawat and Agarwal 2015).

The specific objectives of the study include:

Assessing the productivity of cattle in agroecological systems by implementing practices such as agroforestry and rotational grazing.

Evaluating animal welfare and health in agroecological systems, considering factors like access to pasture, natural behavior, and stress levels.

Understanding the impacts of climate change on animal production systems, particularly in Mediterranean climatic conditions.

Exploring agroecological techniques such as diversified forage systems, rotational grazing, agroforestry, and integrated crop-livestock systems.

Hypothesis: Implementing agroecological practices in animal production systems can enhance sustainability and resilience in the face of a changing climate.

Methodology:

The farm-trial is conducted in southern Tuscany (Italy) in an organic farm from April to September 2023. The primary objective of this experiment is to evaluate the impact of trees on beef cattle welfare and productivity. Forty-two growing cattle of Maremmana breed are divided into two systems: the Pastoral System (PA) and the Silvopastoral System (SP).

In the PA system, 21 cattle graze solely on the grassland without access to the forest. Conversely, the 21 cattle in the SP system have access to pasture and to 3.31 ha of Turkey-oak (*Quercus cerris* L.) forest available.

The aim of the current study is to evaluate the heat stress endured by beef cattle in Mediterranean silvopastoral systems studying trees impact on their welfare and productivity. To ascertain the effects of tree presence, the study will compare the results between the two systems. Weight, blood sugar, cortisol, and black globe humidity index (BGHI) will all be considered for both the forest and pasture areas (Ripamonti, A. et al. 2023).

Acknowledgements

Ripamonti, A. et al. 2023. Outcomes of a comparison between pastoral and silvopastoral management on beef cattle productivity, animal welfare and pasture depletion in a Mediterranean extensive farm. *Agroforestry Systems*. doi: 10.1007/s10457-023-00848-w.

A-396

Female unemployment in rural Poland-the question of gender equality in labor market.

B. Sibilski, S. Kalinowski, W. Biały
Warsaw University of Life Sciences, Department of Economics, Warsaw, Poland

Abstract body

Research question: What were the characteristics of female unemployment in rural Poland between 2004-2022? How did they differ from the male and total unemployment or female unemployment in urban Poland?

Objectives:

To explore female unemployment trends in rural areas of Poland between 2004 and 2022.

To compare female unemployment to male unemployment in rural areas.

To compare and explore differences in female unemployment in rural and urban areas.

Methods: Qualitative analisys of Statistics Poland and EUROSTAT data

In 2004 there were 1.6 million unemployed women in Poland, which resulted in the 13.3% total female unemployment index (FUI). In 2022 the 0.4 million unemployed women made 4.2% of all women of productive age in the country (called unemployment index). It shows a significant improvement of this negative social and economic phenomenon and at the same time raises a question on female unemployment in rural areas of the country.

The findings show that FUI in rural areas decreased between 2004 and 2022, just like in the country total, but its values were higher: 15,91% in 2004 and 5,41% in 2022. A similar downward trend was observed in female unemployment in urban areas, although it was lower both in 2004 (12.53%,) and in 2022 (3.84%). Male unemployment in rural areas was 13.64% in 2004 and over 18 years decreased to 3.86%, still indicating the feminization of unemployment in rural areas.

Based on findings the gender gap in unemployment fell down from 2.26 percent points (p.p.) to 1.55 p.p in 2022. Gender gap changes varied at the local level: it decreased in 952 municipalities (from 0.51 to 8.5 p.p.) remained the same in 42 municipalities and increased in 1493 (from 0.1 to 11.6 p.p.). Studies of female unemployment show the highest intensity of this phenomenon in the north-eastern Poland and central Poland.

The phenomenon of female unemployment in rural areas is also evident in the European Union. It stood at 10.6% in 2004 and 5.8% in 2022. Comparing these results, we conclude that female unemployment in rural Poland decreased more intensely, from a much higher value in 2004 to a very similar level in 2022.

Despite major changes, the phenomenon of female unemployment still exists and continues to be a problem in rural Poland. Further research should be carried out to provide findings, necessary to implement evidence-based policies aimed at combating this problem and achieving one of the sustainable development goals – gender equality.

Acknowledgements

Dr hab. Joanna Rakowska assistant professor
Institute of Economics and Finance Warsaw University of Life Sciences
joanna_rakowska@sggw.edu.pl

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How to increase the benefits of soil carbon projects for smallholder farmers? A case study from Kenya

F. Hasenbach, A. Birkenberg, C. Bosch, M. Diaz, R. Birner
University of Hohenheim, Social and Institutional Change in Agricultural Development (490c), 70599 Stuttgart, Germany

Abstract body

Future and current agricultural activities rely heavily on the fertility of soils. Implementing Sustainable Agricultural Land Management (SALM) practices as promoted in soil carbon sequestration projects target the increase of Soil Organic Carbon (SOC) stocks in agricultural soils. Due to the wide-ranging positive effects of increasing carbon contents in soils, soil carbon sequestration projects have been the focus of development initiatives in the recent decade to supply carbon credits. Such projects have complex organizational structures, long durations (20 years) and multiple actors involved, ranging from farmers to project implementers and carbon buyers. Smallholder farmers who implement SALM practices for the issuance of carbon certificates make up the majority of project participants. However, they are largely underrepresented in project design, monitoring and evaluation, and benefits for smallholder farmers are rather limited and active participation is low. The long-term motivation and involvement of smallholder farmers implementing SALM practices which are crucial for the legitimacy of the carbon credits issued, has received minimal attention in research. This study investigates the potential of farmer participation in data collection for monitoring of soil carbon projects and how the related benefits can be increased for participating smallholder farmers. The case study employs the Process Net-Map method, qualitative interviews, focus group discussions, and the Cellphilm and Photovoice technique, to get deeper insights into an ongoing soil carbon project, the Western Kenya Carbon Project. Two strategies for increasing benefits have been identified: a) Participatory monitoring involving farmers in data collection and monitoring for soil carbon projects. This ensures the required data collection for monitoring purposes and may contribute to a deeper understanding and ownership of the carbon project by participating farmers. b) Sharing collected data with farmers to provide feedback on their farming performance. This can be achieved by project implementers using the data as a basis for tailor-made capacity building and customized extension and advisory services. The results could help policymakers, donors and project implementers to design more inclusive monitoring systems for soil carbon projects.

Acknowledgements

This study was undertaken as part of the GIZ "ProSoil" project in Kenya. The author especially thanks Foundation fiat panis for the financial support through its Hermann Eiselen Scholarship. The authors would like to express their gratitude to GIZ for their logistic and financial support of the field work. Many thanks to all participants and research assistants for their time and efforts. The views expressed in this document may not be taken as the official views of these organization.

A-400

Youth unemployment in Poland and its regions.

A. Gnas[1], J. Jurczak[2], S. Chróściel[2]
[1]Warsaw University of Life Sciences, Department Of Economics, Warsaw, Poland, [2]Warsaw University of Life Sciences, Department Of Economics, Warszawa, Poland

Abstract body

Research question: How did the youth unemployment change in Poland and it regions between 2004-2022?

Objectives:

· To explore youth unemployment trends in regions of Poland between 2004 and 2022.
· To compare youth female unemployment to youth male unemployment in country and regions.
· To investigate structural differences in youth unemployment between regions.

Methods: Qualitative analysis data of Statistics Poland and Eurostat data

Total unemployment in Poland fell significantly from 2,999,601 persons in 2004 to 812,301 in 2022, i.e. by 73%. The share of young unemployed in relation to the total unemployed also decreased: from 24.28% in 2004 to 12.36% in 2022. During the period under review, the percentage dropped by 11.92 percentage points. By contrast, the gender distinction shows that there is a higher share of young unemployed women compared to men; during the period under review, the ratio averaged 17.92% among women and 16.62% among men.

The same trend was seen in youth unemployment: in 2004 there 728,208 young people unemployed and 100,373 in 2022, showing a decrease by 86%.

The share of the young unemployed in the total number of unemployed varied in regions of Poland: it was the largest in Wielkopolskie Voivodeship (27.41% in 2004 and 15.10% in 2022) and in Małopolskie Voivodeship 28.80% and 14.65%; while the lowest in Dolnośląskie Voivodeship 21.40% and 10.03%, Łódzkie Voivodeship 22.41% and 10.20% respectively.

The largest decline in youth unemployment between 2004 and 2022 occurred in Podkarpackie Voivodeship by 20.6% and Podlaskie Voivodeship by 19.6%.

The decline in registered unemployment of young people is a very positive phenomenon, it occurred in the country overall and in all its regions. Nevertheless, it is a phenomenon that is still occurring in significant intensity.

Among the young unemployed in Poland, the problem of feminization of unemployment is noticeable. In 2004, the ratio of young unemployed women to young unemployed men was 51.84% to 48.16%; and in 2022, 54.62% to 45.38%.

The ratio of young unemployed people without work for more than 6 months to total young unemployed people was 30.2% in 2008 and 28.8% in 2022. The ratio reached record highs in 2013 (40.5%) and 2020 (40.4%). The young unemployed in Podlaskie (34.6% in 2022) and Mazowieckie (32.6%) provinces are looking for work the longest.

Youth unemployment is one of main challenges for sustainable development.

Acknowledgements

Dr hab. Joanna Rakowska assistant professor Institute of Economics and Finance Warsaw University of Life Sciences joanna_rakowska@sggw.edu.pl

Author Index

Contact

Dr. Gabriele Klumpp
Euroleague for Life Sciences

University of Hohenheim
Schloss 1
70599 Stuttgart

gabriele.klumpp@ua.uni-hohenheim.de
www.euroleague-study.org

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