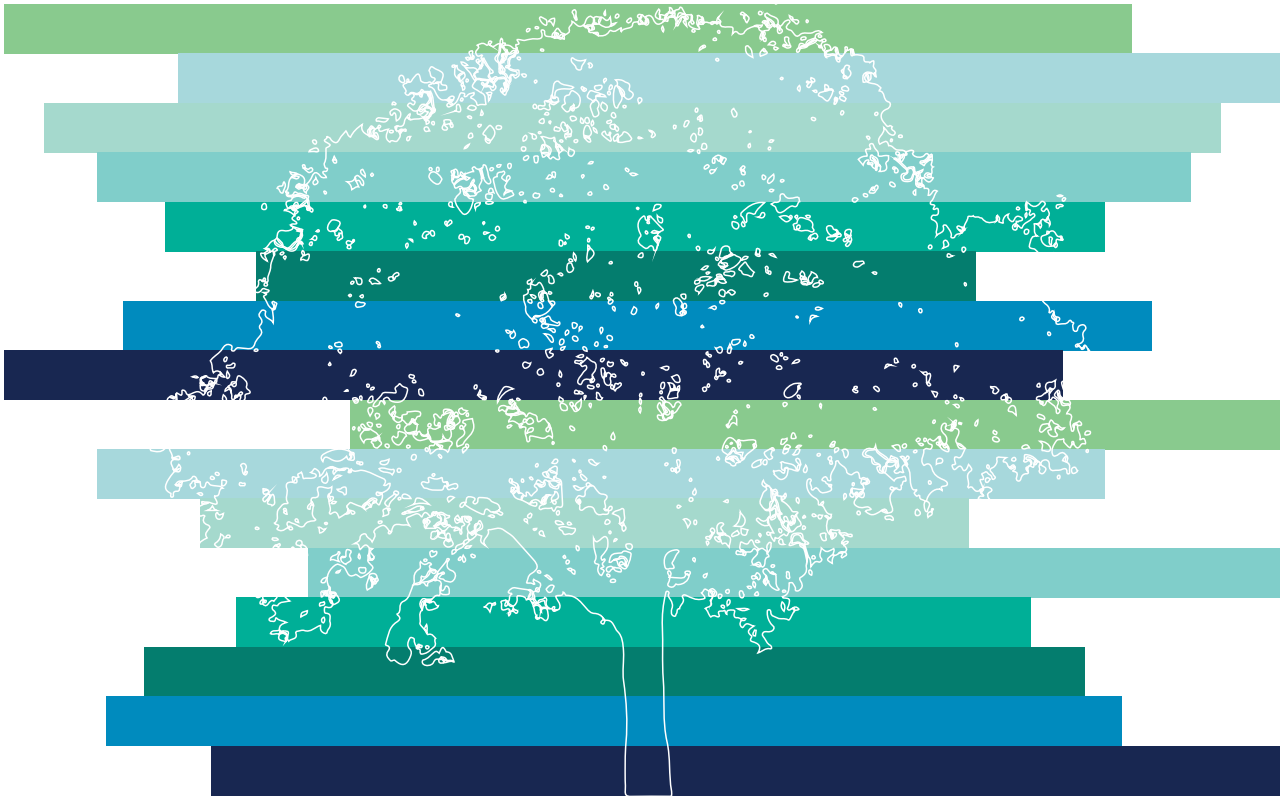
ICA 2016

11th International Conference on Agrophysics: *Soil, Plant & Climate*

BOOK OF ABSTRACTS



26th-28th September, 2016
Lublin, Poland

INSTITUTE OF AGROPHYSICS PAS

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Soil, Plant & Climate

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Conference Organisers:

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CONFERENCE PROGRAMME

Sunday, 25 September 2016

18.00 – 22.00 *Welcome Party (hotel Victoria)*

Monday, 26 September 2016

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09.00 – 09.20 **Opening Ceremony – prof. Cezary Sławiński, prof. Jan Gliński**

09.20 – 10.00 Plenary lecture: **Paolo Nannipieri**
Soil as biological system, soil quality and the role of omics techniques
10.00 – 10.40 Plenary lecture: **Harry Vereecken**
Soil moisture and hydrological fluxes in terrestrial systems: from observation to prediction

10.40 – 11.10 *Coffee break*

11.10 – 13.00 Session 1A – Soil and plant management for resilient crops
Chairman: Dick van Elsas

11.10 – 11.40 Keynote lecture: **Andrzej Jerzmanowski**
Chromatin mechanisms enabling phenotypic plasticity and stress adaptation in plants

11.40 – 12.00 **Anna M. Gajda:** *A comparison of effects of an organic and a conventional farming system on some parameters of soil quality*
12.00 – 12.20 **Giorgia Pertile:** *Assessment of the impact of isoproturon, tebuconazole and chlorpyrifos on soil microbial abundace and functions using a lab-to-field tiered approach*
12.20 – 12.40 **Marek Rodný:** *Biochar influence on soil hydrophysical properties: field vs. lab experiments*
12.40 – 13.00 **Mykola Miroshnychenko:** *Sustainable crop production in Ukraine needs quick, precise and affordable soil testing methods: result of a comparative study*

13.00 – 14.00 *Lunch*

14.00 – 15.50 Session 1B – Soil and plant management for resilient crops
Chairman: Paolo Nannipieri

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The soil microbiome – diversity and implications for soil function

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15.10 – 15.30 **Viliam Novák:** *Physiological drought and its quantification*
15.30 – 15.50 **Maciej Chowaniak:** *The effect of tillage system and the plant cover on the intensity of the erosion process and carbon losses*
15.50 – 16.05 **Marcin Kafarski E-TEST sp. z o.o.:** *Monitoring devices of soil physical parameters from E-Test, Ltd.*

16.05 – 16.30 *Coffee break*

16.30 – 18.40 Session 2A – Agriculture and climate change
Chairman: Andrzej Jerzmanowski

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17.20 – 17.40 **Michael Herbst:** *The effect of sieving on soil heterotrophic respiration response to water content in agricultural topsoils*
17.40 – 18.00 **Klaudia Ziemblińska:** *Climate extremes impact on forest carbon balance*
18.00 – 18.20 **Piotr Baranowski:** *Multifractality of agro-meteorological time series*
18.20 – 18.40 **Urszula Norton:** *Greenhouse gas fluxes and global warming potential in three winter wheat systems during drought*

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08.30 – 15.00 Registration – opening hours

08.30 – 10.20 Session 2B – Agriculture and climate change
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Soil surface properties and their changes in degradation processes

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09.20 – 09.40 **XingKai Xu:** *Effect of carbon and nitrogen addition on the fluxes of N_2O and CO_2 during thawing of frozen temperate forest soils with different moisture levels*

09.40 – 10.00 **Lutz Weihermüller:** *On the information content of incubation experiments*

10.00 – 10.20 **Muhammad J. Khan:** *Carbon-sequestration as influenced by land use management using natural abundance (13C isotopic technique)*

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Chairman: Notburga Gierlinger

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11.40 – 12.00 **Yukiyoshi Iwata:** *Soil physical properties for effective use of geothermal heat pump system with horizontal ground heat exchanger*

12.00 – 12.20 **Agnieszka Medyńska-Juraszek:** *Water properties of biochar derived from wheat straw*

12.20 – 12.40 **Monika Mierzwa-Hersztek:** *Influence of wheat straw and Mishantus gigantus straw and biochars derived from them on soil microbial parameters in field conditions*

12.40 – 12.55 **Jarosław Grodowski INTERTECH POLAND**: *Soil GHG flux measurements with PICARRO CRDS field spectrometers*

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14.00 – 15.00 Poster Session

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19.00 – 22.00 *Conference Dinner in Kazimierz Dolny*

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08.30 – 10.00 Session 3B – Biomass based products and energy

Chairman: Bart Van Droogenbroeck

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Revealing plant composition and structure on the micro and nano scale by Raman and Atomic Force Microscopy

09.00 – 09.20 **Monika Szymańska-Chargot:** *Influence of pectins and xyloglucan on structure of bacterial cellulose membranes*
09.20 – 09.40 **Agnieszka Kasprzycka:** *Fertilization of arable crops with pellets of digestates of agricultural biogas plants*
09.40 – 10.00 **Arkadiusz Dyjakon:** *Life cycle assessment of the use of apple pruning residues for energetic purposes*

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10.30 – 12.40 Session 4A – Plant food quality

Chairman: Pieter Verboven

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Integrative and multiscale study of fleshy fruit texture

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11.20 – 11.40 **Wojciech Skierucha:** *Application of open-ended dielectric probes for identification of dielectric dispersion effects in apples*
11.40 – 12.00 **Stefany Cardenas-Perez:** *Color analysis method to evaluate apple ripening and its correlation with nanomechanical properties*
12.00 – 12.20 **Piotr Pieczywek:** *Application of the biospeckle method for early detection of fungal disease of apple fruit*
12.20 – 12.40 **Rafał Kobyłka:** *Evolution of the characteristics of bulk material due to the discharge initiation of the storage silo*

12.40 – 14.00 Lunch

14.00 – 15.50 Session 4B – Plant food quality

Chairman: Marc Lahaye

14.00 – 14.30 Keynote lecture: **Pieter Verboven**
Effects of microstructure on gas and water exchange in fruit

14.30 – 14.50 **Vlasta Vozárová:** *Edible vegetable oil thermal behaviour*
14.50 – 15.10 **Monika Chylińska:** *Investigation of adsorption kinetics, equilibrium and isotherm of xyloglucan on cellulose*
15.10 – 15.30 **Petrović Ana:** *Monitoring of freezing and defrosting of wheat bread dough by DSC method*
15.30 – 15.50 **Agnieszka Wójtowicz:** *Application of extrusion-cooking for utilization of various cereal waste-bran in snacks*

15.50 – 16.30 Closing Ceremony

PLENARY LECTURES

SOIL MOISTURE AND HYDROLOGICAL FLUXES IN TERRESTRIAL SYSTEMS: FROM OBSERVATION TO PREDICTION

Vereecken H.

Agrosphere Institute, Forschungszentrum Jülich GmbH, Jülich, Germany

Quantification and prediction of hydrological processes requires information on the spatial and temporal distribution of soil water fluxes and soil water content. The access to spatially and temporally highly resolved soil water content and fluxes is needed to validate hydrological models. In this presentation we will discuss new developments for the determination of soil water content and hydrological fluxes based on hydrogeophysical measurement techniques and novel ground- and satellite based sensing platforms. At the field scale, ground penetrating radar and passive microwave methods are presently being developed which provide the possibility to map soil water content with a high spatial and temporal resolution, also in the subsurface environment. Recent developments show that the application of full wave form inversion methods is a unique technique to derive soil water and soil hydraulic parameters from on- and off-ground systems with high spatial resolution. At the small catchment scale, wireless sensor networks are presently being developed providing soil moisture content values with a high spatial and temporal resolution. Stochastic theories have been used to interpret the relationship between average soil water content and its standard deviation. Cosmic ray sensors are presently being deployed within the TERENO observatories. These sensors provide soil moisture content values with a high temporal resolution at a scale of several hundred meters, thereby bridging the gap between local scale measurements and remote sensing platforms. Cosmic ray probes are extremely valuable for the determination of soil water content in agriculturally managed soils. Data assimilation methods provide a unique approach to fully exploit the value of spatially and temporally highly resolved soil water content measurements for the prediction of hydrological fluxes. Recently, particle filter methods have been used to predict the evolution of soil water content and to estimate soil hydraulic parameters from soil moisture measurements. Finally, a combination of hydrological and regional weather models in a data assimilation framework provides the opportunity to derive three-daily forecasts of key hydrological fluxes and soil water content.

SOIL AS A BIOLOGICAL SYSTEM, SOIL QUALITY AND THE ROLE OF OMICS TECHNIQUES

Nannipieri P.

Department of Agrifood Production and Environmental Sciences, University of Firenze, Italy

Soil as a biological system is characterized by: i) the presence of a huge microbiological diversity and microbial biomass; indeed thousands of bacterial genomes can be present in one gram of soil; ii) only a minor proportion of the available space is occupied by microorganisms in soil (microbiological space); iii) soil colloids can adsorb important biological molecules such as proteins and nucleic acids; iv). soil components show enzyme-like activities. Unfortunately there is no methods to distinguish enzyme from enzyme-like reactions but these methods are needed to quantify both contributions; v) virus are more abundant than in other systems such as aquatic ones.

The book “Omics in Soil Science” (Nannipieri et al 2014) presents the state-of-the-art of omics in soil science. Omics (mainly metagenomics, metatranscriptomics, proteomics and proteogenomics) techniques can provide useful information and integration of omics methods may provide insights into ecosystem functioning. In particular, the potential for omics to provide comprehensive coverage of genes and genes products make them well-suited for the study of general soil microbiological phenomena, such as decomposition, response to water stress, etc. I shall discuss the primary role of soil properties in shaping soil microbial diversity and the redundancy of species involved in soil processes like organic C mineralization. Despite the various omics approaches hold much promise further refinement (for example, to compare omics approaches to methods that have become standards for soil microbiology research) is needed before they are ready for widespread adaptation. Each method to become standard should provide useful information quickly and inexpensively. As an example of using both molecular and classical techniques to get insights on soil functioning, data are presented linking β-glucosidase activity and composition of fungal and bacterial communities inhabiting both rhizosphere and bulk soil sampled from two maize lines with different nitrogen use efficiency; both the presence and transcription of β-glucosidase encoding genes are determined. In addition to promoting the link between classical and molecular methods future research should improve techniques for a better characterization of soil proteomics, promote hypothesis more than technology-driven research and propose molecular markers as indicators of soil quality.

THE SOIL MICROBIOME – DIVERSITY AND IMPLICATIONS FOR SOIL FUNCTION

van Elsas J. D., Dini Andreote F., Microbial Ecology, RUG, Groningen, NL, Andreote F. D., ESALQ, Piracicaba, Brazil, Salles J. F., Microbial Ecology, RUG, Groningen, NL

Department of Microbial Ecology, University of Groningen (Netherlands)

The health and quality of any soil, with respect to ecosystem and life support processes, lies to a major part in the constitution of the soil microbiome. Soil microbiomes, in particular the bacterial and fungal parts, can be characterized in terms of community structure, richness and diversity. A central dogma in ecology states that diversity is correlated with the redundancy level of the microbiome, which is congruent with the level to which the living system is buffered against disturbances. Conversely, a lowering of the redundancy level would be congruent with a decrease of the buffering capacity in the face of disturbance or stress, leading to a more vulnerable system.

Considering the capacity of soil systems to resist or tolerate invading (microbial) species, the reasoning indicates that higher levels of intrinsic diversity go with higher functional redundancy and niche occupancy, leading to a lower level of survival and colonization. In other words, highly-diverse systems have a higher resistance towards invasion than low-diverse ones.

In this study, we examine the invisibility – diversity relationship of soil, with a focus on the fate of the gut bacterium *Escherichia coli*. We then explore to what extent the intrinsic/established diversity in a soil system affects a key function in the soil, i.e. the level of colonization of host plants by mycorrhizal fungi. Remarkably, the effect was opposed to the one sketched above for invaded soil systems, indicating that other mechanisms lie at the basis of the mycorrhization – microbial diversity relationship. The findings of this novel study will be contrasted with theories on the *E. coli* invasion and placed in a theoretical/mechanistic framework.

ADAPTATION OF AGRICULTURE TO CLIMATE CHANGE

Rötter R.P.

Department of Crop Sciences, Georg-August-University, Göttingen, Germany

At all times there has been the need for agriculture and farming to adapt to climate and its variability. Yet, anthropogenic climate change with its unprecedented rapid shifts in temperature regimes and rainfall patterns creating novel climatic risks requires massive efforts to adapt crops, farming systems and agricultural landscapes to a changing change. Food production is very sensitive to weather and climate variations, and in many regions agriculture is already facing more frequent and severe extreme and adverse weather events. Many of the emerging new risks can be reduced through informed and versatile adaptation measures, which is the overarching topic and ambition of Phase II (2015-1017) of the "Modelling European agriculture with climate change for food security" (MACSUR) knowledge hub (www.macsur.eu).

MACSUR is conducting European-wide and regional climate change risk assessments for representative farming systems and develops tools for modelling climate change effects on crops and livestock and for integrated assessment of adaptation and mitigation options at regional and European scale. It addresses key questions such as "what would be the different contributions of different European adaptation strategies to global food security until 2050 at different scales (farm to EU) while keeping the GHG targets?"

Adaptation of crops to climate change in first instance has to be addressed locally because of the variability of soil, climate and management conditions and the specific socio-economic settings influencing farm management decisions. In this paper (i) I first present a short review on how assessments of climate change impacts and adaptation for agriculture till recently strongly relied on crop modelling, then (ii) discuss the capabilities and limitations of the "model chain" approach, (iii) show recent progress in applying trans- and interdisciplinary approaches to analyzing adaptation options using selected examples from MACSUR's integrated regional assessments, and (iv) give an outlook on required actions and improvements of methodologies and modelling tools for ex ante evaluation of various agricultural adaptation options - for different time horizons and spatial scales - in close interaction with key stakeholders.

CHROMATIN MECHANISMS ENABLING PHENOTYPIC PLASTICITY AND STRESS ADAPTATION IN PLANTS

Jerzmanowski A. [1,2]

[1] Department od Systems Biology, University of Warsaw, Pawinskiego 5A, 02-106 Warsaw, Poland, andyj@ibb.waw.pl
[2] Institute of Biochemistry and Biophysics, Polish Academy of Sci3nces, Pawinskiego 5A, 02-106 Warsaw, Poland, andyj@ibb.waw.pl

Plants have evolved remarkable ability to adjust development to adverse environmental conditions. At regards molecular mechanisms underlying this ability, results of numerous studies consistently point to critical role of regulation occurring at the level of chromatin. Linker (or H1) histones belong to major structural components of chromatin, conserved between plants and animals. They are also the most variable among histones, with numerous non-allelic variants co-existing in the same cell. Because of H1's ability to promote chromatin compaction, it has classically been seen as key element controlling accessibility of DNA to regulatory factors. This is consistent with observation that in animals (but surprisingly not in plants) H1 is essential for development. As plants possess an evololutionary conserved group of 'stress inducible' linker histone (H1) variants, we used a model plant Arabidopsis thaliana to test the hypothesis that these H1 variants play a role in adaptive response to environmental changes. This has led to discovery of a fascinating ancient mechanism linked with plants adaptive responses to simultaneously occurring multiple stresses, which is likely based on competition between the stable main variants and an environmentally controlled minor variant of H1 (Rutowicz et al. 2015). I will discuss the details of this mechanism as well as its wider biological implications.

Rutowicz K., Puzio M., Halibart-Puzio J., Lirski M., Kroteń M.A., Kotliński M., Kniżewski .L, Lange B., Muszewska A., Śniegowska K., Kościelniak J., Iwanicka-Nowicka R., Żmuda K., Buza K., Janowiak F., Jõesaar I., Laskowska-Kaszub K., Fogtman A., Zielenkiewicz P., Tiuryn J., Kollist H., Siedlecki P., Ginalski K., Świeżewski S., Koblowska M., Archacki A., Wilczyński B., Rapacz M., Jerzmanowski A. 2015. A specialized histone H1 variant is required for adaptive responses to complex abiotic stress and related DNA methylation in Arabidopsis. Plant Physiology, 169: 2080-2101.

UPCYCLING OF UNDERUTILIZED BIOMASS FRACTIONS FROM THE AGRI-FOOD CHAIN

Van Droogenbroeck B., Kips L., Bernaert N., De Paepe D., De Loose M.

Technology & Food Science Unit, ILVO, Burg. Van Gansberghelaan 115, 9820 Merelbeke, Belgium

A study published by the EU in 2010 revealed that almost 90 million tonnes of food waste, or 179 kg per capita, are expelled from the food manufacturing industry every year (agricultural food waste not included). Worldwide, approximately 1.3 billion tonnes or one third of all food produced for human consumption is lost or wasted annually (FAO, 2011). Most of these agri-food waste and by-product fractions are usually only partially valorized (e.g. spread on land, animal feed, composting, bio-energy), whereas the main volumes are treated as waste of environmental concern (landfilling, burning), with relevant negative effects on the overall sustainability of the food processing industry. Currently, there is an increasing demand towards the entire Agri-Food chain for a more efficient use of basic resources (water, energy, biomass) and a better closure of the resource loops (EU Bioeconomy 2012; EU Circular Economy Package 2015; United Nations Sustainable Development Goals, 2015). Many of the underutilized Agri-Food chain biomass fractions have however the potential to be converted into higher-added-value products then the applications most of them have been used for up till now (bio-energy, feed and composting in best case) and hence represent relevant opportunities to be used as feedstock for bio-based product development. The increased awareness of consumers and their demand for health-promoting foods also contributed to the exploration and incorporation of ingredients from such natural sources in food production. In the presentation different examples of process and product development, starting from underutilized biomass fractions from the Agri-food chain will be illustrated, with specific attention towards recycling in the food chain.

REVEALING PLANT COMPOSITION AND STRUCTURE ON THE SUBMICRON SCALE BY CONFOCAL RAMAN MICROSCOPY

Gierlinger N.

University of Natural Resources and Life Sciences, Institute for Biophysics, Muthgasse 11/II, 1140 Vienna, Austria, burgi.gierlinger@boku.ac.at

During the last years Confocal Raman microscopy evolved as a powerful method to get non-destructively insights into chemistry and structure of plant tissues and cells with a spatial resolution on the submicron level (e.g. Gierlinger et al. 2012). Two-dimensional spectral maps can be acquired of selected areas and chemical images calculated by integrating the intensity of characteristic spectral bands or by using multivariate data analysis methods, like vertex component analysis (VCA). By this the variability of cell wall composition at the micro and nanoscale are revealed in order to understand the quite many different cell wall functionalities (e.g. stiffening, pathogen resistant, conducting water and nutrients). Changes in the orientation of the cellulose microfibrils, the most important parameter for mechanical properties, are visualised as well as the spatial variation of lignin amount and composition in context with the cell structure (Gierlinger et al. 2010). Especially in combination with VCA even tiny changes are elucidated, e.g that the lumen sided secondary cell wall layer has a different lignin composition than the main part of the S-layer (Gierlinger 2014). The different lignin composition of the surface layers is of relevance for plant cell wall processing and in the living tree for water conduction. Currently the whole process of hydrophobisation of plants through aromatic and lipidic polymers is studied in detail, e.g. following in-situ the lignification of cell walls or heartwood formation or deposition of the cuticular layer.

References

Gierlinger, N., Keplinger, T. & Harrington, M. 2012. Imaging of plant cell walls by confocal Raman microscopy. Nature Protocols 7, 1694-1708.

Gierlinger N.; Luss, S.; Konig, C.; Konnerth, J.; Eder, M.; Fratzl, P. 2010. Cellulose microfibril orientation of Picea abies and its variability at the micron-level determined by Raman imaging, Journal of Experimental Botany, 61, 587 (2010)

Gierlinger, N. 2014. Revealing changes in molecular composition of plant cell walls on the micron-level by Raman mapping and vertex component analysis (VCA). Frontiers in Plant Science doi: 10.3389/fpls.2014.00306

Acknowledgement

The work is financed by the Austrian Science Fund (FWF): START Project “Plant surfaces and interfaces: Lignin, Suberin and Cutin [Y-728-B16].

INTEGRATIVE AND MULTISCALE STUDY OF FLESHY FRUIT TEXTURE

Lahaye M.

INRA, UR1268 Biopolymères Interactions Assemblages, Nantes, France

Fleshy fruit texture is a key quality trait that determines consumer preferences and food processing. It encompasses different descriptors, which depends on structural elements at the tissue and cell levels, such as cell wall characteristics, tissue architecture and water distribution. In this presentation, our recent work on apple texture will be reviewed.

Expression of cell wall and turgor related genes was analysed along with cell wall polysaccharides composition and structure as well as mechanical properties and sensory texture evaluations. Beside cell wall pectin modifications, changes in hemicellulose structure and expression of turgor pressure related genes were observed during apple development and ripening. The results showed that mealiness, which is a major texture defect for consumer and processing, could be associated with different cell wall chemical characteristics and likely involve distinctive water flux in cells.

Non-destructive assessment of tissue architecture and water distribution in apple tissue by quantitative magnetic resonance imaging was combined with analysis of mechanical, histological and biochemical changes in texture-contrasted varieties during storage. The results revealed that soft to mealy fruit had different air space volumes and water cellular distributions.

The outcome of these studies emphasize that the control of apple texture requires taking into account complex combinations of cell wall, tissue architecture and water distribution determinants. This complexity makes genetic improvement for this key quality trait challenging as well as the development of non-destructive measurements of specific texture descriptors.

EFFECTS OF MICROSTRUCRURE ON GAS AND WATER EXCHANGE IN FRUIT

Verboven P.

BIOSYST-MeBioS, Katholieke Universiteit Leuven, Belgium

Insight in transport of oxygen and carbon dioxide is critical to understand why some cultivars can be stored well in hypoxic conditions and others not. Water loss is mainly due to mainly diffusion through lenticels, stomata and only to a limited extent through the epidermis and cuticula. Inside the plant organ there are two main transport routes: the apoplast and the symplast. Transport of water in vascular bundles is mainly through vessels within the xylem.

As there are currently few experimental methods available to investigate in vivo transport processes at the cellular level, in silico modelling is essential. Since fruit are intrinsically multiscale assemblies with different features at multiple spatial scales, the multiscale modeling paradigm provides a comprehensive modelling approach to combine the relative simplicity of continuum-type models defined at the macroscale level with the level of detail of models incorporating microscale features. Numerical experiments are carried out at the smallest scale under consideration to compute apparent parameters, which are then used in a model which operates at a coarser scale. in 3-D a strongly connected network of intercellular spaces has been observed in plant organs with pores of various sizes and shapes interconnected in different arrangements. We, therefore, developed a 3-D model based on X-ray computed tomography. In this presentation we review how fruit microstructure is measured and analysed, used in models and how microstructure affects transport properties of tissues.

SOIL SURFACE PROPERTIES AND THEIR CHANGES IN DEGRADATION PROCESSES

Józefaciuk G.

Institute of Agrophysics, PAS, Doswiadczalna 4, 20-290 Lublin Poland, email: jozefaci@ipan.lublin.pl

Vast number of environmentally important processes occur on surface of soil solid phase. Solid phase of a soil is a mixture of different inorganic constituents of various degree of dispersion as nonporous materials of different size and shape, porous materials, phyllosilicates with the interlayer structure, as well as organic species, mainly plant residues and specific humus substances. Many soil constituents carry electric charge, mostly negative (clay minerals and organic matter) and frequently positive (silica and sesquioxides below their point of zero charge). Due to such complex composition soil surface build-up is extremely complex. The extent (area) of the surface, their energetic and geometric properties (nanoporosity and roughness) are responsible for sorption, wettability, water retention and/or catalytic soil properties, whereas surface charge govern soil aggregation, ion exchange and buffering. Surface and charge of soil constituents markedly change under various environmental factors and are very sensitive against soil degradation processes. Their alteration induce changes in properties of the bulk soil.

The methods used for estimation of surface geometric and energetic properties from experimental adsorption-desorption isotherms and for estimation of surface charge properties using back titration method will be briefly presented. Changes of soil surface properties under some degradation processes as acidification, alkalization, salinity, humus lost will be shown and discussed on the background of changes in soil composition.

ORAL PRESENTATIONS

A COMPARISON OF EFFECTS OF AN ORGANIC AND A CONVENTIONAL FARMING SYSTEM ON SOME PARAMETERS OF SOIL QUALITY

Gajda A.M. [1], Czyż E.A. [2], Dexter A.R. [1]

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The effects of an organic farming system were compared with a traditional farming system in a long-term experiment that was started in 1994. The effects on the soil environment were measured in terms of selected parameters of soil physical, chemical and microbiological properties. The experiment was on a loamy sand at the Osiny Experimental Station (Lublin voivodeship) of IUNG-PIB. The farming systems studied differ in crop rotation and in management practices including tillage. The organic system used non-inversion tillage to 10 cm depth whereas the traditional system used inversion tillage with a mouldboard plough to 20 cm depth. Soil samples were taken twice each year from fields under winter wheat. Soil analyses included estimations of: OM content, microbial biomass C and N content using F-E methods, respectively, activity of dehydrogenases with the method of Casida et al. (1964), activity of FDA hydrolysis using the method of Dick et al. (1996), the content of POM using the Cambardella and Elliott (1992) method as modified by Gajda et al. (2001), contents of hot and cold water extractable carbon by the Haynes and Francis (1993) method, and stability of soil in water based on clay dispersion measurements (Czyż and Dexter, 2015). The experimental results showed that the studied parameters of soil quality reached 15-35% greater values, on average, in soil under the organic than under the traditional farming system. The differences were statistically significant at $p \leq 0.05$. The reduced soil disturbance under organic farming improved the soil environment favoring the maintenance of the ecological balance of microorganisms inhabiting the soil, as reflected in the values of the parameters studied. This showed the significant effects of the farming system on the microbiological status of soil, which is extremely important for all aspects of soil quality.

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ASSESSMENT OF THE IMPACT OF ISOPROTURON, TEBUCONAZOLE AND CHLORPYRIFOS ON SOIL MICROBIAL ABUNDACE AND FUNCTIONS USING A LAB-TO-FIELD TIERED APPROACH

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Pesticides are applied to protect crops against pests and diseases. Following their application, they can persist in soil and induce toxic effects on non-target soil organisms including soil microorganisms which have a pivotal role in soil ecosystem functioning. However, the pesticides registration in EU evaluates their impact on the soil microbial community through the application of two simple C and N mineralization tests which do not provide a comprehensive view of their soil microbial ecotoxicity of pesticides. In the IAPP Marie Curie project "LOVE TO HATE", we propose the development of a tiered lab-to-field approach to assess the soil microbial toxicity of pesticides. Following this tiered approach, we studied the impact of three pesticides (isoproturon, tebuconazole, chlorpyrifos) commonly used at EU level.

In the laboratory study (Tier I) the application of tebuconazole and chlorpyrifos have induced a significant effect on the abundance of the 11 microbial groups analysed and the structure of bacterial community although these effects did not show a clear time-dependent pattern. In contrast, the ammonia-oxidizing microorganisms (AOA and AOB) were most responsive to tebuconazole and chlorpyrifos. No significant effects on denitrification genes were seen. In the field study (Tier II), AOA and AOB abundance was reduced in response to all three pesticides tested. No significant effects on the denitrification genes was observed in Tier II.

In conclusion, the application of the three pesticides did not appear to induce clear toxic effect on the soil microbial community. The only exception was the significant reductions in the abundance of microbial nitrifiers which appeared to be the most sensitive at this type of abiotic stress.

References

Papadopoulou E. S., Karas P. A., Nikolaki S., Storck V., Ferrari F., Trevisan M., Tsiamis G., Martin-Laurent F., Karpouzas D. G. 2016. Dissipation and adsorption of isoproturon, tebuconazole, chlorpyrifos and their main transformation productis under laboratory and field conditions. Science of The Total Environment 569-570, 86-96.

Petric I., Philippot L., Abbate C., Bispo A., Chesnot T., Hallin S., Laval K., Lebeau T., Lemanceau P., Leyval C., Lindström K., Pandard P., Romero E., Sarr A., Schloter M. Simonet P., Smalla K., Wilke B.-M., Martin-Laurent F. 2011. Inter-laboratory evaluation of the ISO standard 11063 "Soil quality-Method to directly extract DNA from soil samples". Journal of Microbiological Methods 84 (3), 454-460.

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BIOCHAR INFLUENCE ON SOIL HYDROPHYSICAL PROPERTIES: FIELD VS. LAB EXPERIMENTS

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The presented results were obtained during the first biochar field experiment in Slovakia, conducted at the experimental site of SAU Nitra, Malanta (lat. 48°19´00´´; lon. 18°09´00´´) which has been used for crop production over the last 20 years. The soil type was classified as Orthic Luvisol and, on average; it contained 36% of sand, 49 % of silt and 15% of clay. The 45 trial plots (6m x 4m) laid out in a randomized block design were sampled (n=3) twice a year and biochar influence on soil water retention was investigated using the pressure plate apparatus. Alongside the field works we conducted several complementary experiments in which the water retention characteristics of soil/biochar and sand/biochar mixtures were analyzed in detail. After two years of experiments we could conclude that incorporation of 20 $t.ha^{-1}$ of biochar into the loamy soil under study has only minor effect on its water retention properties, especially in the range of plant available water.

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SUSTAINABLE CROP PRODUCTION IN UKRAINE NEEDS QUICK, PRECISE AND AFFORDABLE SOIL TESTING METHODS: RESULT OF A COMPARATIVE STUDY

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Sustainable crop production requires information on the actual soil nutrient status. Soil testing can provide this info. However, routine methods of "wet" chemical analysis are rather costly and time consuming. Moreover, soil testing is often done once a year, so farmers are unaware of plant nutritional problems that may occur during the growing season. There is a need for precise, quick and affordable soil testing methods in Ukraine. SoilCares is developing and testing a new concept of soil testing using Mid-infrared and XRF sensor technology. In a joint project we have tested if SoilCares soil testing methods can be interpreted in terms of Ukrainian soil testing methods and recommendations. In total 100 agricultural locations have been identified which represent main Ukrainian soil types and soil fertility levels.

The comparison of soil testing methods showed similar results or good relationships for pH, total Carbon, mineral Nitrogen and soil potential cation exchange capacity (correlation coefficient r=0,85-0,96). Available Phosphorus and Potassium by the method Mehlich 3 (pH 2.5), the method Chirikov (pH 2.5) and Machigin (pH 9.0) give similar results when soils with different fertility levels were compared: low, moderate and sufficient (r = 0.87-0.92). The biggest difference between the results of the method Mehlich 3, Chirikov and Machigin are observed in soils with low fertility where fertilizers were not applied for a long time (r = 0.54-0.61). The result looks promising but further soil chemical research is needed to understand behaviour of deviating soils and to test SoilCares soil testing results for other soil parameters. It is concluded that the results of SoilCares and Ukrainian soil testing methods are comparable or strongly related to each other.

CLIMATE RESILIENCE IN NON-IRRIGATED WHEAT-BASED PRODUCTION SYSTEMS OF THE SEMIARID US HIGH PLAINS

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Studies of soil organic carbon (SOC) may underestimate losses in non-irrigated wheat production systems of the High Plains region of the western United States. Starting ~50 yr ago, use of non-inversion tillage, fertilizers, and herbicides began to replace intensive tillage in wheat-fallow systems, leading to reduced disturbance and increased residue production that may have initiated recovery of SOC depleted during previous decades. This paper compiles findings from studies of soil quality, including total and labile SOC and nitrogen (N) at 14 sites in two rain-fed production areas in southeastern Wyoming, USA. Farming systems include historic inversion-tillage-based winter wheat-fallow with no inputs, conventional winter wheat-fallow, minimum- and no-till continuous rotations, permanent grass cover, and native grasslands. Soils beneath historic wheat-fallow were the most depleted, with 13.8 and 17.6 Mg SOC ha^{-1} in the upper 30 cm at the two study areas, or 37% of the SOC under the two native sites. Soil OC contents were statistically similar across conventional, minimum-till, and no-till systems, ranging from 64 to 78% of native SOC levels, and significantly higher under permanent grass, with both sites having 90% of native SOC levels. Free light fraction OC contents were lowest beneath the historic system, but increased in systems with fewer disturbances. When normalized by SOC and total N, the labile C and N pools increased with increasing disturbance, especially microbial biomass C and dissolved organic C. Soils from deeper depths revealed that SOC levels increased just below 30 cm in intensively tilled systems and then rapidly dropped to near zero below 60 cm. In contrast, SOC levels under reduced and zero disturbance systems decreased continuously with increasing depth. Soil disturbance frequency and inorganic C levels were positively correlated, suggesting that heavy tillage may facilitate OC fixation as calcium carbonate, increasing C storage but not agricultural productivity.

USE OF INFRARED AND X-RAY FLUORESCENCE SENSOR TECHNOLOGY FOR ROUTINE SOIL TESTING : RESULTS OF A 3 YEAR LASTING RESEARCH PROGRAM

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The soil quality of agricultural fields is often unknown and as a result soil nutrient management and crop yields are not optimal. Three years ago SoilCares Research (http://www.soilcares.com/en/research/) started a research program focusing on the development and implementation of a quick, precise and affordable soil quality testing method using Infrared and X-ray fluorescence (XRF) sensor technology. One of the major challenges was the derivation of reliable prediction models.

The research program comprised projects on i) identification of optimal soil calibration sample locations, ii) the optimization of sampling, transport, pretreatment and storage of soil calibration, iii) protocols on determination of sensor spectra and wet chemistry soil parameters, iv) concepts of data handling and interpretation, and v) the derivation and quality testing of the soil parameter prediction models.

So far, more than 10,000 geo-referenced sample locations have been identified in more than 15 countries. Mid 2016 about 50% have been sampled and about 3000 have been analyzed. NIR, MIR and XRF spectra have been determined as well as 90 soil quality parameters. Data mining and machine learning techniques have been applied to derive prediction models for each soil parameter based on MIR/XRF sensor fusion. Mid 2016 the research program has resulted in 18 till 33 reliable soil parameter prediction models between countries.

The presentation summarizes the results of the research program focusing on the soil parameter prediction model of kraine, The Netherlands and some African countries. It is concluded that sensor technology is promising for precise and affordable routine soil testing. Further expansion of the soil calibration data set is foreseen.

A GOLDEN STANDARD LABORATORY FOR PREPARING A WORLDWIDE NIR- AND MIR-INFRARED CALIBRATION DATASET TO TEST SOIL SAMPLES

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In soil testing, between- and within-laboratory variation is well-known. The first source of variation can be uncovered by participating in between-lab studies (e.g. WEPAL, www.wepal.nl). However, where different methods are applied it can be difficult to generate comparisons. Within-laboratory variation is linked with quality of laboratory workers and with the preprocessing of samples.

Near- and mid-Infrared techniques are becoming increasingly available for the analysis of soil traits. The general approach is that spectra are calibrated against wet-chemical soil test data. To obtain proper calibrations, an assumption is that the wet-chemical data are unbiased and exact (i.e. without standard error). In practice, this means that these data should have a negligible standard error. Therefore, we decided that for our worldwide database a top-quality "Golden Standard Laboratory" had to be set up. By performing all analyses at a single laboratory, we omitted the between-laboratory variation.

To obtain unbiased estimates, procedures have been automated as much as possible and carried out according to internationally accepted norms using top-end quality analytical equipment like IPC-MS, HPLC, XRF, elemental analyzers and pH and EC meters. Furthermore, using standard samples and participation in WEPAL is part of our standard procedures. To arrive at as much as possible low standard errors, special attention has been paid to the process of sub-sampling, which is done using proper dividers instead of the still widely used, error-prone scooping procedures. Notably the rotary riffling technique we introduced allows to separate samples of 6, 12 and 30 g even from a heterogeneous bulk sample of 1 kg in a single shift.

We will present details on the organization of our Golden Standard Laboratory and the quality of our measurements. The laboratory has been set up only for preparing the MIR and NIR calibration database and is not designed to perform service analyses.

PHYSIOLOGICAL DROUGHT AND ITS QUANTIFICATION

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Physiological drought can be defined as a state of plant (canopy) when soil dehydration (and plant as well) can decrease biomass production. This definition is based on numerous empirical information demonstrating linear relationships between transpiration and photosynthesis. On the production basis, there were published linear empirical relationships between seasonal transpiration rates of particular canopy and biomass production (yield). In this study, the physiological drought is defined on the basis of the critical soil water content (SWC), or soil matric potential, dividing the range of potential transpiration rate and the range of subpotential transpiration rate. The critical SWC is specific for particular soil and strongly depends on transpiration rate. Higher transpiration rates means higher critical SWC and could indicate the onset of physiological drought followed by the decrease in the biomass production. Therefore, by keeping the root zone SWC at the levels higher than estimated by the critical SWC approach we could help to prevent maximum biomass production.

THE EFFECT OF TILLAGE SYSTEM AND THE PLANT COVER ON THE INTENSITY OF THE EROSION PROCESS AND CARBON LOSSES

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Soil erosion in arable land is a serious problem not only because of decreasing yield on such areas but also in environmental aspect of water loss and contamination of water reservoirs with sediments eroded from fields. Main factors which can decrease the intensity of erosion in agriculture areas are plant cover and tillage system.

A two-factor field experiment was conducted at the Experimental Station in Mydlniki near Kraków, in the years 2007 – 2013. The objective of the research was to determine the impact of tillage system and plant cover on soil, water and carbon losses by erosion. In the experiment, the first factor was a tillage system (conventional system - CT and direct sowing system - NT); the second a plant cover (horse beans, spring wheat, and winter rapeseed). The experimental plots were sized 22 m x 2 m. Modified Słupik bag catchers were placed at the bottom border of each plot for the purpose of catching the material washed down. Carbon losses were calculated based on the content of those elements in the soil washed down and in the runoff water. Carbon was determined in liquid and solid fraction of eroded material (COD chromate method and elementary analysis). Also from the plots soil samples were collected to determine water retention parameters and characterization of soil pores. During vegetation and after crop harvest the water infiltration was measured.

The studies showed that the losses of soil was about 5 times greater on plots with CT than in NT similarly carbon losses were higher in CT. Opposite situation were found in case of water losses in NT losses of water represented by runoff were from 10 to 20 % higher than in CT. This was related with infiltration process in NT cumulative infiltration was reduced to 80 % compared to CT. Soil analysis showed that soil pore system under CT has more of large flow-active pores compared to NT and it has influence on infiltration and runoff but still soil losses were smaller in NT and this anti-erosion effectiveness was related with protective function of stubble which covered soil in this system in periods: before sowing and after harvest. Of all the plants analyzed, the value of winter rapeseed as a soil protection agent was the highest for both soil loss and runoff.

FROM IN SILICO MODELING TO COMPREHENSION OF AGROECOSYSTEMS: TOWARDS A COMPLEX INDEX TO STUDY OF MICROBIAL DIVERSITY AND ITS RELATION OF SOIL HEALTH

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To the extent that increased the understanding of the properties that determine the quality of the soil, the concept of soil health has evolved constantly. From the perspective of agroecology, the soil is considered as a living ecosystem, with attributes of health not only in the framework of the production, but also from the sustainability. The soil quality cannot be measured directly, although they can be used certain specific properties (e.g. organic matter) and the status of the soil (e.g. fertility) as strategic indicators. Microbial diversity is a quantitative expression that is used to understand how the communities of microorganisms that inhabit soils are structured and organized. This structure and organization is related to soil health, which is necessary to help farmers understand the connections between the soil health, productivity and crop health. The modeling and computational simulation enable the study of complex systems; such as in fact, microbial ecology and its implications for soil health [1]. Microbial communities are considered complex, dynamic assemblies with large phenotypic diversity and a high adaptive capacity.

These "complex adaptive systems" are made up of individual agents, whose non-linear localized interactions have consequences to higher levels of organization, and these levels greater feedback and affect individual behaviors and local interactions. There is a huge effort to link the microbial diversity to soil health and quality, although it has been weak and little progress has been made [2]. It is our interest to address this issue through complexity modeling of the soil microbial diversity using systems biology approaching. With the information from a case study [3] is built a network of microbial structure (nodes) and the physicochemical parameters of the soil (links) and it were obtained the macrostatistics of the reconstructed network. Then parameters were analyzed (shortest path length, characteristic path length, network centralization, network heterogeneity, average distance, clustering coefficient, betweenness centrality, closeness centrality, centroid value, eccentricity). From these parameters, we propose the construction of new indexes of complex nature both for the soil health and microbial diversity. This would allow us to study the health and diversity as emergent properties of the system soil-plant, as well as predict its resulting stability, resilience and sustainability under perturbations induced by agricultural practices.

References

Levin S.A., Bonachela J.A., Nadell C.D. 2012. Mathematical and computational challenges in the study of complex adaptive microbial systems, In:The Social Biology of Microbial Communities: Workshop Summary.

Faust K., Raes, J. 2012. Microbial interactions: from networks to models. Nature Reviews, Microbiology, 10, 538-550.

Landazábal G. 2013. Comparación de la estructura y diversidad de las comunidades de bacterias y hongos rizosféricos de cuatro zonas arroceras de los departamentos Tolima y Meta, Colombia. Tesis Maestría, Universidad Nacional de Colombia. Facultad de Ciencias, Instituto de Biotecnología. Bogotá, Colombia.

STUDY ON AGRO-ENVIROMMENTAL INDICATORS FOR DETERMINING LAND DEGRADATION AND THEIR IMPACT (PHYSICAL, CHEMICAL, BIOLOGICAL)

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In the town of Tissemsilt, the techniques of tillage those are mechanizedhave shown theirlimits for the sustainable managementofsoil resourcesfor two reasons, the insufficient matrix of the erosion and the loss of the stock in soil organic matter.In other words, these techniques aren't adapted to the pedoclimatic constraints of our study area. The techniques of tillage those are mechanized engender excessive fragmentation, soil compaction, erosion, runoff, impoverishment and dryinglands that don't allow a Sustainable Agricultural Development. The challenge is double, the culture system should permits the productions amelioration and at the same time the preservation of natural resources in the soil and the environment. This challenge can't becompletely satisfied unless the no-tillage is performed at a high technological level. This technological development must concernto the management of harvesting residues and at the seedling time, the crops implantation, the fertilization of fundus and the weeding practices (type of herbicide, dose and application). This technological development ofcropschessin relation to the edaphicconditions. The direct seeding preserves the environment by reducing the loss soil and nutrient elementsand practice the treatmentproducts for the improvement the quality of the water and the air. The no-tillage is the privileged mean to combatwater erosion and wind. In point of factthe cover by crops residues control the losses in Water byrunoff and by wind.

SIMULATED WARMING AND DROUGHT IMPACT ON CARBON FLUXES-CLIMATE MANIPULATION EXPERIMENT IN W POLAND

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Central European peatlands are highly vulnerable regarding climate change induced C losses to the atmosphere. To assess how warming and drought may impact carbon balance, vegetation and water chemistry, we carried out the WETMAN field manipulation experiment at Rzecin peatland in Poland. The field site consists of three treatments with repetitions (control, CO; warming, W; drought, D and warming & drought, W+D). Temperature (T) was increased throughout the year using infrared heaters (400W×4 per site). Drought was simulated by reduced precipitation using an automatic curtain during the nights of the growing season. Warming and drought simulation was successful, increasing air (30 cm height) and soil (5 cm depth) temperatures by up to 0.4^{o}C and 1.0^{o}C, respectively, and reducing precipitation by 35 % (in 2015). To study the C exchange we developed an automatic mobile platform for measuring CO_2/CH_4/H_2O fluxes (LGR) as well as for $^{13}CO_2$ and $^{13}CH_4$ fluxes (PICARRO CRDS G2201-*i*) with dynamic ecosystem chambers (for NEE and Reco). Gap filling of the fluxes was done according to Hoffmann et al. 2015. In the very dry year 2015, Rzecin peatland was a net source of CO_2 to the atmosphere (80 gC·m^{-2}yr^{-1}). Warming and drought considerably diminished the source strength (7 gC·m^{-2}yr^{-1} at the W+D site), due to lower cumulative respiration (Reco the smallest, 610 gC m^{-2}yr^{-1}, at W+D site). The highest CO_2 emissions were measured at the warmed site (W site, Reco 680 gC·m^{-2}yr^{-1}), emphasizing the importance of drought in inhibiting respiration. Temperature increase also provoked the productivity (highest GPP at W site, -620 gC·m^{-2}yr^{-1}), while drought yielded to the lowest productivity (lowest GPP at D site, -550 gC·m^{-2}yr^{-1}).

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THE EFFECT OF SIEVING ON SOIL HETEROTROPHIC RESPIRATION RESPONSE TO WATER CONTENT IN AGRICULTURAL TOPSOILS

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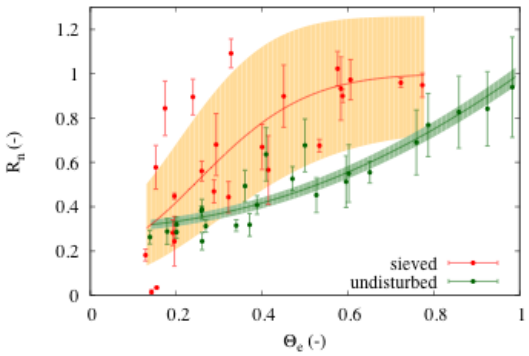
Soil respiration causes one of the largest terrestrial carbon fluxes and its accurate prediction is still a matter of on-going research. Understanding the functional link between soil heterotrophic respiration and soil water content is relevant for the estimation of climate change impacts on soil CO_2 emissions.

In order to quantify the effect of air-drying and sieving with 2mm meshes on the soil heterotrophic respiration response to water content we incubated intact cores and sieved samples of two loamy and two sandy agricultural topsoils for six levels of effective soil water saturation. We further measured soil textural properties and the soil water retention characteristics of the soils with the aim to identify potential correlations between soil physical parameters and moisture sensitivity functions of heterotrophic respiration.

The incubation of sieved and intact soils showed distinct differences in the response of soil heterotrophic respiration to soil water saturation (see Fig.). The sieved soils exposed threshold-type behaviour, whereas the undisturbed soils exposed a quadratic increase of heterotrophic respiration with increasing effective soil water content. Additionally, we found significant correlations between the moisture response functions of the undisturbed soils and soil textural properties.



From the comparison of intact and sieved soil incubations we conclude that the destruction of soil structure by sieving hampers the transferability of measured soil moisture response of heterotrophic respiration to real-world conditions. For modelling purposes we suggest the use of a quadratic function between relative respiration and effective saturation for soils with a clay fraction < 20%.

CLIMATE EXTREMES IMPACT ON FOREST CARBON BALANCE

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Forest ecosystems are constantly exposed to a range of disturbances- both anthropogenic (massive deforestation) and natural (insects outbreaks, droughts, fires or severe storms), which in the past few years took an unprecedented scale in many parts of the world. These kind of damages have a great impact on the carbon balance of forest ecosystem. Increase in the intensity and frequency of extreme weather events such as tornadoes or hurricanes are associated with global climate change. As reported by Panerov et al. (2009) the damages caused by wind are the main source of disturbances occurring in forests. To assess the impact of extreme weather events on carbon balance in forest ecosystems various direct measurements techniques can be used. However, it should be noted, that this type of research, mainly due to the technical difficulties, are (were) carried out in only few places in the world.

Unique measurements of CO_2 exchange (NEE) by eddy covariance method (EC) are conducted over pine forest destroyed by tornado in Poland (Tlen I station). The occurrence of tornado in the area of Trzebciny Forest District (53 ° 38 'N, 18 ° 15' E, 87m a.s.l.) in July 2012 resulted in the devastation of nearly 500 hectares of middle-age pine forest. From scientific point of view windthrows are extremely valuable research objects, so that in April 2013 EC measurements of CO_2 and H_2O exchange between this disturbed area and the atmosphere has started.

The initial analysis of 3-year-long continuous NEE measurements revealed that devastated forest area is a large carbon source, emitting on average up to 15t of CO_2 per ha. However, the emission rate is decreasing by ca. 2t of CO_2 every year. As compared to the undisturbed pine forest (Tuczno forest station) at similar age as pre- windthrow stand in Tlen, the amount of CO_2 released to the atmosphere as a result of tornado damages, constituted almost 90% of CO_2 absorbed duringthe same time by Tuczno forest.

References

Panferov O., Doering C., Rauch E., Sogachev A., Ahrends B. 2009. Feedbacks of windthrow for Norway spruce and Scots pine stands under changing climate. Environ. Res. Lett. 4 045019

MULTIFRACTALITY OF AGRO-METEOROLOGICAL TIME SERIES

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The multifractal analysis is a powerful method to characterize long-range correlations within the time series through calculation of different scaling exponents for different parts of the series. The temporal fluctuations of a time series can be expressed through the power spectral density, which describes the frequency distribution of the signal power. The presence of long-range correlated structures in the process is expressed by a power-law shape of the power spectrum, being linear if plotted on log-log scales. The objective of this study was to: a) verify whether and to what extent multifractality occurs in the time series of basic agro-meteorological conditions; b) compare the singularity spectra of the time series coming from different stations in Europe; c) check what was the source multifractality of agro-meteorological time series; d) analyze temporal and spatial aggregation influence on multifractal properties. The multifractal detrended fluctuation analysis (MFDFA) was used for daily and hourly air temperature, wind speed, relative air humidity, global radiation and precipitation data coming from meteorological stations in Finland, Germany, Poland and Spain [1]. The multifractality of the studied series was confirmed. The singularity spectra parameters were examined indicating considerable differences in the dynamics and development. The source of multifractality was also examined by analyzing the q-dependence of the generalized Hurst exponent with the use of the shuffled and surrogate time series. It was found that for most studied quantities, the multifractality is due to different long-range correlations for small and large fluctuations. For precipitation, the multifractality results mainly from broad probability function. It was also confirmed that spatial and temporal aggregation of ago-meteorological data strongly influence their multifractal properties [2,3].

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References
[1] Baranowski, P., Krzyszczak, J., Sławiński, C. et al. (2015). Climate Research 65, 39-52.
[2] Hoffman, H., G. Zhao, L.G.J. Van Bussel et al. (2015). Climate Research 65, 53-69.
[3] Zhao, G., Siebert, S., Rezaei E. et al. (2015). Agricultural and Forest Meteorology 200, 156-171.

GREENHOUSE GAS FLUXES AND GLOBAL WARMING POTENTIAL IN THREE WINTER WHEAT SYSTEMS DURING DROUGHT

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Lack of precipitation has significant ramifications on restorative processes of soil organic matter (SOM). This issue is of particular importance in semi-arid regions, such as United States central High Plains where where SOM is low and annual cummulative precipitation rarely exceeds 900 mm. Winter wheat (*Triticum aestivum,* L.) is the most important dryland cash crop but increased periods of low precipitation have recently become the main challenge. Better understanding of the effects of drought on SOM is much needed in order to ensure long-term agricultural sustainability. Greenhouse gas (GHG) fluxes are indices sensitive to changes in soil biotic and abiotic conditions and hence, can provide important information on SOM during drought. The main objective of this study was to monitor carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) fluxes, and yield-scaled estimates of global warming potential (GWP) in no-till (NT), conventional tillage (CT), and frequently tilled organic (CF) winter wheat systems between May 2011 and July 2013. The two-year drought started in June 2011. During the first year, soils generated low CO_2, high N_2O fluxes and high CH_4 uptake. Low plant residue returns to the soil after the first year harvest not only further reduced CO_2 but also decreased N_2O fluxes and CH_4 uptake. Net GWP and Greenhouse Gas Intensity (GHGI) indices revealed that all systems were net carbon (C) sinks in the first year, but became C sources in 2012, as the drought continued. No-till helped protect soil from excessive dry down during the first year only. Of all three systems, NT demonstrated the lowest overall negative impact on GWP indices, which suggests that reducing tillage has the greatest potential to mitigate negative impacts of drought on agroecosystem performance and should be a recommended practice for low precipitation regions facing increased climate variability.

SLUDGE C STABILIZATION AND MINERALIZATION IN SOIL AS ASSESSED BY ^{13}C NATURAL ABUNDANCE

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Soil organic matter (SOM) is protected from decomposition by three main mechanisms: (i) physical stabilization, i.e., spatial inaccessibility of SOM to microbes, (ii) biochemical stabilization through the accumulation of recalcitrant SOM compounds by selective decomposition of organics, and (iii) chemical protection of OC through interaction with minerals and metal oxides. The latter mechanisms suggests that added organic substances (i.e. sludge as an organic fertilizer) can be stabilized by metal oxides to increase C sequestration in soil. The objective of this study was to investigate the effects of Fe_2O_3 - one of the dominant metal oxides in soil - on the sequestration of sludge in soil by separately tracing the decomposition of sludge and of SOM to CO_2.

The sludge with and without Fe_2O_3 was added at rates of 286 µg C g^{-1}. The soil was incubated at 22 ^oC over 30 days. Using ^{13}C natural abundance of the soil (which originated under C_3 vegetation, $\delta^{13}C$ = -25.5‰) and of the sludge (produced from maize residues, $\delta^{13}C$ = -17.9‰), we partitioned the total CO_2 efflux for the two C sources. This allowed quantification of the changes in SOM turnover due to addition of sludge (priming), and its dependence on sorption to Fe_2O_3.

Addition of sludge to the soil increased CO_2 production by ~15% compared to soil without sludge. The $\delta^{13}C$ of CO_2 revealed that Fe_2O_3 slightly suppressed sludge decomposition, and therefore increased C sequestration in soils. Further, Fe_2O_3 addition decreased SOM decomposition over 30 days by 17%.

We conclude that sorption of SOM and added organics (e.g. sludge) on Fe_2O_3 can contribute to C sequestration in soil, but this C is not very stable under increasing microbial activities. These effects of Fe_2O_3 have important implications for biogeochemical cycles and C stabilization. Such results were only possible by Violka by partitioning of total CO_2 into its sources, using the isotopic approach of ^{13}C natural abundance.

EFFECT OF CARBON AND NITROGEN ADDITION ON THE FLUXES OF N_2O AND CO_2 DURING THAWING OF FROZEN TEMPERATE FOREST SOILS WITH DIFFERENT MOISTURE LEVELS

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Packed soil-core incubation experiments were done to study the effects of carbon (glucose, 6.4 g C m^{-2}) and nitrogen (NH_4Cl and KNO_3, 4.5 g N m^{-2}) addition on the fluxes of nitrous oxide (N_2O) and carbon dioxide (CO_2) during thawing of frozen temperate forest soils with two moisture levels (55% and 80% WFPS, water-filled pore space) collected from a mature broadleaf and Korean pine mixed forest (BKPF) and an adjacent secondary white birch forest (WBF). With increasing soil moisture, the magnitude and longevity of the flush N_2O flux from the two soils was enhanced during the early period of thawing, which was accompanied by the great NO_3^--N consumption by denitrification, especially in the WBF soil. With increasing soil moisture, the cumulative CO_2 flux and microbial metabolic quotient (qCO_2) decreased in the WBF soil but increased in the BKPF soil without C and N addition. The glucose-induced cumulative CO_2 fluxes from the two soils ranged from 9.61 to 13.49 g CO_2-C m^{-2}, which was greater than the dose of added C as glucose. The glucose-induced microbial biomass C (MBC) in the two soils ranged from 3.65 to 27.18 g C m^{-2}, while glucose addition had little impact on soil dissolved organic C pool. Thus, the extra C released upon addition of glucose may result from the decomposition of soil native organic C. The addition of glucose significantly increased N_2O fluxes from the two soils during the early period of thawing. With increasing soil moisture, the glucose-induced cumulative CO_2 fluxes from the two soils were significantly increased, whereas the responses of the glucose-induced cumulative N_2O flux to soil moisture varied with the addition of N souces and soil types. The addition of N sources can differently affect the glucose-induced cumulative CO_2 flux and the glucose-induced MBC of the two soils.

References

Xu X.K., et al. 2016. Effect of intensity and duration of freezing on soil microbial biomass, extractable C and N pools, and N_2O and CO_2 emissions from forest soils in cold temperate region. Science China: Earth Sciences, 59, 156-169.

Wu, H.H., et al. 2015. Effect of vegetation type, wetting intensity, and nitrogen supply on external carbon stimulated heterotrophic respiration and microbial biomass carbon in forest soils. Science China: Earth Sciences, 58, 1446-1456.

ON THE INFORMATION CONTENT OF INCUBATION EXPERIMENTS

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The measurement of the production of CO_2 from soils in incubation studies has been used for many years to gain information about the influence of different soils types, changing temperatures and water contents, as well as the addition of amendments on the soil respiration. While in the early years the kinetic modelling (or fitting) was restricted to the single or one pool model due to the possibility of solving the problem by log-transforming the observed data and using a linear regression for the estimation of the rate constant (by doing so an analytical solution can be applied), more recent publications chose multi-pool models (2, 3, and even 4-pools), which can will be fitted iteratively using appropriate computer software. In general, there are different methods used in literature to estimate the kinetic parameters resulting in different kinetic parameter values even for the same data set. Additionally, screening of existing literature revealed that the 2-pool model (or even higher pool models) were sometimes obviously wrong fitted or over fitted.

In our presentation, we will show how different constrains in the fitting process will influence the results of the kinetic parameter values, how obviously wrong fitting and overfitting can be easily detected, and how the information content of the incubation data can be easily judged prior any fitting. Finally, we will provide recommendations how to extract information from incubation experiments.

CARBON-SEQUESTRATION AS INFLUENCED BY LAND USE MANAGEMENT USING NATURAL ABUNDANCE (^{13}C ISOTOPIC TECHNIQUE)

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The increase in atmospheric concentration of carbon dioxide (CO_2) by 31% since 1750 from fossil fuel combustion and land use change requires sequestering carbon (C) to mitigate the negative effects of rising global warming. Soil may act as a source or sink for carbon (C) depending on different land use management and farm practices. To understand C-sequestration as influenced by soil fertility, cropping patterns, land use management, and tillage practices, we collected soil samples from 5 depths (i.e. 0–10, 10–20, 20–30, 30–40 and 40–50 cm) and six field sites under different crop, land use and management practices during 2010-2011. Soil samples were analyzed for ECe, pH, bulk density, mineralizable N, total organic C, total nitrogen, and CO_2 evolutions. Our results showed that soil physical and chemical properties varied with soil depths and sites. The effect of different land use management and tillage on sequestering C was only observed in the top 20 cm soil depth. The highest value of both organic C and total organic C was found at Site 5 (Jhok Dhap) with the value of 0.443 and 0.591 % followed by Site 4, Site 6 and Site 3 compared with other sites with intensive tillage and chemical fertilizers application. The sites with high C are under vegetables, sugarcane, wheat and fodder cultivation for a longer period of time and receive organic wastes such as sewage sludge and farmyard manure at regular intervals; which could have improved the soil health through addition of both OC and TOC in these sites.

ENERGY CHARACTERISTICS OF PASSIVE INDIRECT SOLAR DRYING FOR AGRICULTURAL PRODUCTS

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This study discusses the performance and energy analysis of passive indirect solar dryer. The study rig that used for the drying experiments consists of three main parts: flat plate air solar collector, dryer cabin and chimney. This system has been installed in the laboratory of Szent István University, Gödöllő, Hungary. The dryer is facing to the south with 45^{o} tilt angle, to get on the maximum amount of solar irradiation. Drying chamber was made with support several trays where the product has been placed. Drying chamber has been insulated and painted with black paint to decrease the losses by radiation to the surrounding. The movement of air was by bouncy force with using a long chimney which permits to have a good air speed by free convection and homogeneous distribution of the heated air inside the drying chamber which allows also having better control of the drying process.

Different products drying results was used to achieve the objectives of this study. Drying process with using solar heater, depends on the temperature and moisture content difference between an air stream and product items inside the insulated chamber. In this paper it is aimed to study different type of the products and to estimate the temperature range that is suitable to save them from damaging during drying process.

References

Romano, G., Kocsis, L., Farkas, I. 2009. Analysis of energy and environmental parameters during solar cabinet drying of apple and carrot. Drying Technology Journal, Vol. 27, pp. 574–579.

Mahendra, S., Narendra, K., Kumar, A., Pradeep, K., Malik, M.A.S. 1987. Solar crop drying, CRC press, Florida, USA.

Fudholi, A., Sopian, K., Ruslan, M.H., Alghoul, M.A., Sulaiman, M.Y. 2010. Review of solar dryers for agricultural and marine products. Renewable and Sustainable Energy Reviews Journal, Vol. 14, pp. 1-30.

SOIL PHYSICAL PROPERTIES FOR EFFECTIVE USE OF GEOTHERMAL HEAT PUMP SYSTEM WITH HORIZONTAL GROUND HEAT EXCHANGER

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Geothermal greenhouse heating is one of the essential means to save energy in agriculture (e.g., Van Nguyen et al., 2015). A geothermal heat pump is one of the available types of equipment to use ground heat effectively. There are some case studies that show the effectiveness of geothermal heat pumps to heat or cool greenhouses. However, the most suitable soil physical properties for the use of geothermal heat pumps have not yet been fully discussed, particularly for the heat pump system with a horizontal ground heat exchanger. To identify the favorable physical properties of soil surrounding the heat exchanger, we first determined the thermal properties of some undisturbed soil samples that were obtained from some fields in Japan. In most of the soil samples, the thermal conductivity and heat capacity did not change considerably when soil water content was changed within a range of possible soil moistures conditions for the surface soil layer. In contrast, those of sandy soils decreased remarkably with a decrease in soil water content. Second, numerical simulation was conducted using these soil parameters. During early winter when the pump is used to heat a greenhouse, heat capacity is a dominant factor in determining the rate of decrease in soil temperature around the heat exchanger. Furthermore, thermal conductivity influences the rate of soil temperature loss during late winter when the difference in soil temperature between the soil layer near the heat exchanger and deep soil layers considerably increases. Because thermal conductivity and heat capacity of sand increase under saturated conditions, sand may be one of the best substrates to effectively use geothermal heat pumps in regions where the ground water level is very shallow. However, other soils should perform much better in regions where the ground water level is relatively deep.

References

Van Nguyen, M., Arason, S., Gissurarson M., Pálsson, P.G. 2015. Uses of geothermal energy in food and agriculture-Opportunities for developing countries. Rome, FAO.

WATER PROPERTIES OF BIOCHAR DERIVED FROM WHEAT STRAW

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Water consumption in greenhouse production is high, generating higher cost of production than outdoor cultivation. Water use by crops is of increasing concern as demands are growing while supplies are shrinking. Implementation of new water saving technologies in crop production is necessary. Biochar (BC) is the charcoal product from pyrolysis of biomass and has been reported to increase crop production. Biochar physical properties have received less attention than chemical properties, however the incorporation into the soil may modify the physical and hydraulic properties of the porous medium, such as bulk density, water retention, hydraulic conductivity, porosity and penetration resistance. Here we study, under laboratory and greenhouse conditions water properties of biochar derived from wheat straw at 550° C in context of its use as substrate for greenhouse vegetable production. Water drop penetration time, pF curve (available water capacity - AWC, field capacity—FC, permanent wilting point—PWP) and onsite substrate humidity measuring during vegetation period were made, to describe potential role of biochar in decreasing water demand of greenhouse vegetable production. Biochars derived from wheat straw were slightly hydrophobic (water drop penetration time 60-180s), average field capacity at pF 2.0 (FC) was 32%, while available water content (AWC), calculated as a difference between water content at pF 2.0 and pF 4.2 was 24,5%, showing biochar affinity towards water retention compared to other growing media eg. perlite and mineral wool. Addition of biochar into perlite can increase water retention reducing water percolation from the pot. Average humidity of growing medium containing biochar and perlite (1:1) measured under permanent irrigation, during vegetation period in greenhouse, showed almost 30% increase compared to control on perlite. Presented results show that addition of biochar to growing medium can reduce water consumption in greenhouse production.

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INFLUENCE OF WHEAT STRAW AND *MISHANTUS GIGANTUS* STRAW AND BIOCHARS DERIVED FROM THEM ON SOIL MICROBIAL PARAMETERS IN FIELD CONDITIONS

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The farmland tillage practices changed the soil chemical properties, which also impacted soil microbial parameters and soil carbon conservation. In order to assess the effect of organic amendments to the soil, it is necessary to understand and describe the relationship between microorganisms and environment by assessing the functional activity of microorganisms [Spohn 2015, Wang et al., 2015]. The aim of this study was to evaluate the influence of wheat straw and *Mishantus gigantus* straw and biochars derived from them on changes in the biological properties of soil, such as: soil respiration activity, microbial biomass, and nitrifying bacteria activity. Conducted research indicates, that biochar added to soil in 5 t D.M.·ha^{-1} doses contributed to a significant increase of microbial biomass (Cmic) compared to treatment with only mineral fertilisation applied, by 53% and 47% respectively, and by 27% and 22% relative to the control treatment. The significantly highest basal respiration value was determined in soils of the treatment with 5 t D.M.·ha^{-1} *Mishantus gigantus* straw biochar and 2.25 t D.M.·ha^{-1} wheat straw biochar introduced. The lowest microbial respiration activity was reported in soil with mineral fertilisers applied, in which the value of this parameter was reduced by 34%, compared to the control. The research proved also that the addition of organic materials before and after thermal conversion had significant effect on nitrifying bacteria activity.

References

Spohn M. 2015. Microbial respiration per unit microbial biomass depends on litter layer carbon-to-nitrogen ratio. Biogeosciences 12, 817–823.

Wang Z., Zong H., Zheng H., Liu G., Chen L., Xing B., 2015. Reduced nitrification and abundance of ammonia-oxidizing bacteria in acidic soil amended with biochar. Chemosphere 138, 576–583.

INFLUENCE OF PECTINS AND XYLOGLUCAN ON STRUCTURE OF BACTERIAL CELLULOSE MEMBRANES

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Cellulose itself is the most abundant natural polymer. Cell wall of every plant on Earth is made from polysaccharide composite with cellulose as a scaffold. This polymer has unique properties: high mechanical strength and relatively low density. Tensile strength of cellulose fibril is 7.7 GPa which is two times higher than that of steel wire or Kevlar fibre. For nanocomposite technologies to processed forms of native cellulose are used: microfibrilated cellulose, cellulose nanocrystals or nanocellulose. Furthermore, currently, cellulose I, the native crystalline morphotype of cellulose, is receiving an increased attention due to its potential use in bioenergy.

Cellulose microfibrils are heterogeneous. A schematic model of cellulose microfibrils involves a high crystalline core surrounded by less crystalline region and interrupted by amorphous form of cellulose. Physicochemical behaviour, i.e.: accessibility for chemical derivatization, swelling and water binding and also mechanical properties of cell wall, which directly influence textural properties of plant tissue depends on degree of cellulose crystallinity. Whereas, bacterial cellulose (BC) which are produced by some bacteria as biofilm and therefore its properties are different then the plant one. BC microfibrils achieve microns in length, have a large aspect ratio with a morphology depending on the specific bacteria and culturing conditions.

Nanocomposites of bacterial cellulose produced by Acetobacter xylinus are consider to mimic cellulose composites to be found in natural plant cell walls. A model materials composed of bacterial cellulose cultured in medium with addition apple pectin and tamarind xyloglucan were used. The aim of investigations was to determine the influence of various concentration of non-cellulosic polysaccharides (pectins and xyloglucan) on cellulose microfibrils structure and arrangement. The cellulose structure, microfibrils diameters and mechanical properties of bacterial cellulose membranes were obtained.

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FERTILIZATION OF ARABLE CROPS WITH PELLETS OF DIGESTATES OF AGRICULTURAL BIOGAS PLANTS

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Introduction: In agricultural biogas plant technology digestate is treated as cumbersome and expensive to recycle waste. Polish obligations to reduce the amount of CO_2 emissions into the atmosphere it is necessary to look for alternatives to coal- based energy, which still forms the basis of the Polish economy Digestate from anaerobic digestion process is a valuable fertilizer for agriculture. Digestate sludge contains significant amounts of minerals - nitrogen, phosphorus and potassium. In terms of speed of action (nutrient uptake by plants) is similar to the mineral fertilizer, because the components of N, P and K are readily available to plants. On the other hand, the fermented pulp also contains a part of the organic matter, which has a positive effect on the physicochemical properties of soil fertilized (like natural fertilizers). The aim of the study was the investigation into possible use of methane fermentation digested pellets as fertilizer.

Methods: Pellets of digested sludge was obtained from agricultural biogas plant in Siedliszczki (province Lublin), Poland. The physicochemical composition of pellets was carried out. The pot experiments with yellow lupine and maize were conducted in the years 2013-2014. Three doses of nitrogen (kg ha-1) N1-80, N2-120, N3-160 was included. The effect of pellets as nitrogen fertilization on yield and concentration of dry matter and height of plants were conducted. Furthermore, after harvest, roots mass yields was determined for each pot separately.

Results: Significant yield increase of test plants was observed. Maize was characterized by a higher dry matter content than winter wheat. Increasing levels of nitrogen fertilization of maize reduced the accumulation of dry matter, but had little effect on the concentration of this component in yellow lupine.

References

Goberna M., Podmirseg S.M., Waldhuber S., Knapp B.A., Garcia C., Insam H. 2011. Pathogenic bacteria and mineral N in soils following the land spreading of biogas digestates and fresh manure. Applied Soil Ecology 49, 18–25. doi:10.1016/j.apsoil.2011.07.007

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LIFE CYCLE ASSESSMENT OF THE USE OF APPLE PRUNING RESIDUES FOR ENERGETIC PURPOSES

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Agricultural residues (pruning residues) coming from permanent plantations and orchards constitute a significant and largely unused potential for renewable energy. The EuroPruning project aims to turn pruning residues into a valuable fuel source by developing solutions for their harvesting, transportation and storage that will contribute to increase the share of renewable sources in the total energy supply. To determine the environmental consequences of the Pruning-to-Energy (PtE) logistics chain, a Life Cycle Assessment (LCA) study has been performed. In this study the newly developed PtE scenario is compared to a mulching scenario which is a usual technology used to get rid off the cut branches from the orchard. Both alternatives have advantages and drawbacks from an environmental point of view. However, the results for the PtE scenario showed, that the environmental burdens are significantly lower in comparison to mulching technology.

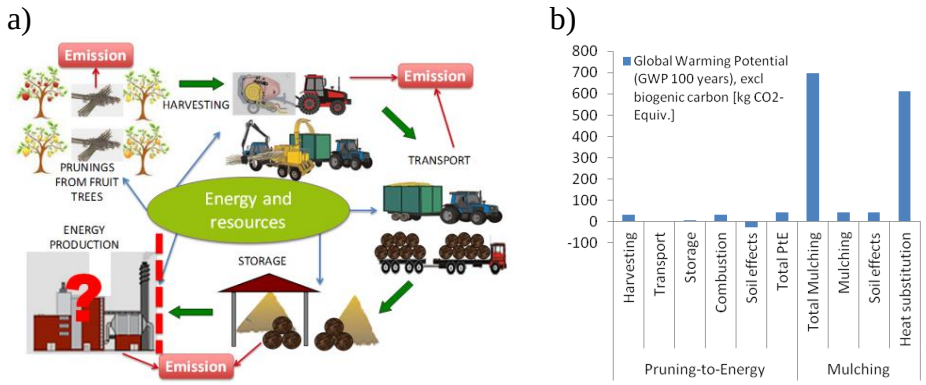

Fig. 1. Pruning to Energy chain: life cycle scope (a), GWP of PtE and mulching (b)

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DETECTION OF FRESHNESS IN FROZEN FISH USING FRONT-FACE FLUORESCENCE SPECTROSCOPY

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Fiber-optic fluorescence spectroscopy was used to predict different freshness indices in frozen fish (Higashi et al., 2016 ; ElMasry et al., 2016). Four models using partial least square (PLS) were developed using all excitation-emission (Ex-Em) wavelengths, filter method, wide filter method and discrete Ex-Em wavelengths to relate fluorescent intensities with actual values of freshness indices. A searching algorithm was proposed as a smart wavelength selection method to find the optimized excitation-emission wavelength combinations. Results revealed that indices of early freshness deterioration could be robustly predicted with coefficient of determination (R2) of 0.84, 73, 0.83, 0.88 for the four models respectively. The best excitation-emission wavelengths were found as Ex: 250/ Em: 350, Ex: 260/ Em: 340, Ex: 260/ Em: 400, Ex: 260/ Em: 450, Ex: 270/ Em: 410 & Ex: 270/ Em: 430 yielding R2 of 0.88 and RMSE of 0.97 with only 6 latent variables. The results indicated that fluorescence spectroscopy technique supported with fiber-optic probe could be a very efficient tool for a direct and rapid detection tool of fish freshness at early stage after harvesting.

References

Higashi, H., ElMasry, G. & Nakauchi, S. (2016). Sparse regression for selecting fluorescence wavelengths for accurate prediction of food properties. Chemometrics and Intelligent Laboratory Systems, 154: 29-37.

ElMasry G., Nakazawa N., Okazaki E. & Nakauchi S. (2016). Non-invasive sensing of freshness indices of frozen fish and fillets using pretreated excitation–emission matrices. Sensors & Actuators, 228, 237-250.

APPLICATION OF OPEN-ENDED DIELECTRIC PROBES FOR IDENTIFICATION OF DIELECTRIC DISPERSION EFFECTS IN APPLES

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The objectives of presented research were: to test the performance of two types of open-ended dielectric probes, with and without an antenna in the frequency range 10 MHz – 20 GHz using VNA measurements of liquid reference materials (distilled water, ethanol and methanol) and apples with skin not removed, and to test the change of dielectric properties of ripe apples at the time when they are starting to lose their commercial value. Also, we intended to find out the dielectric indicators of apples' quality at the time of reaching final the stage of their commercial value by correlating the measured physicochemical parameters with the parameters of the multiple Debye dielectric model.

The observed dielectric spectra of ripe apples were analyzed using a multiple dielectric relaxation model, which assumes three active relaxation processes: primary α-process (free water relaxation) and two secondary processes caused by solid-water-ion interactions α' (bound water relaxation) as well as β (Maxwell-Wagner effect). The tested coaxial open-ended probe with an antenna performed better because of increased measurement volume and consequently the range of applications other materials like granulated agricultural products, soils or liquid suspensions. However its upper measurement frequency range is limited to 1.5 GHz as compared to 20 GHz for the tested coaxial open-ended probe.

Dielectric probe without an antenna did not show correlations of the tested Debye model parameters with the apples' shelf life, ie. firmness. The only parameter with linear trend corresponding with the shelf life is the relaxation frequency in the range of 16-18 MHz, attributed to Maxwell-Wagner effects.

Dielectric probe with an antenna shows much better correlation of Debye parameters. Especially the low frequency conductivity is strongly negatively correlated with firmness of apples.

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COLOR ANALYSIS METHOD TO EVALUATE APPLE RIPENING AND ITS CORRELATION WITH NANOMECHANICAL PROPERTIES

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Currently, agroindustry seeks for effective and economical methods to evaluate and monitor the structural changes that climacteric fruits experienced during storage and processing. For this reason, this work evaluates the color changes occurred during apple (Golden delicious, Chihuahua) ripening and correlated with the nanomechanical properties. To assess the color change, during maturation kinetics, a Computer Vision System (CVS) was used, which allowed to capture RGB images, from which the CIELab space parameters were obtained by image analysis with ImageJ software as already reported by Velez-Rivera et al., (2013). In order to obtain the corresponding curves of strength, the Young's modulus (YM) was obtained and atomic force microscope (AFM) was used to evaluate the nanomechanical properties (Cárdenas-Pérez et al., 2016). The results obtained, showed a visible color change with a ΔE from 66 to 71. The Young's modulus was calculated from the force curves by adjusting them with Sneddon model. The values of YM for the tissue decrease from 0.94 ± 1.04 MPa to 0.04 ± 0.02 MPa. Finally, a Pearson analysis was performed to determine the correlation between color parameters (external) and internal parameters such as cell stiffness. A high correlation values was found for the YM versus color parameters a * and b * as 0.91. Thus one can conclude that the external color change is intrinsically linked to the structural changes at the cellular level. So this approach could be extended to address relevant issues, such as extending the storage life of other climacteric fruits and predicting the microstructural modifications of the cells when they are physically modified.

References

Vélez-Rivera, N., Blasco, J., Chanona-Pérez, J., Calderón-Domínguez, G., Perea-Flores, M.J., Arzate-Vázquez, I., Cubero, S. Farrera-Rebollo, R. (2013). Computer Vision System Applied to Classification of “Manila” Mangoes During Ripening Process. Food Bioprocess Technology.

Cárdenas-Pérez, S., Chanona-Pérez, J.J., Méndez-Méndez, J.V., Calderón-Domínguez, G., López-Santiago, R., Arzate-Vázquez, I. (2016). Nanoindentation study on apple tissue and isolated cells by atomic force microscopy, image and fractal analysis. Innovative Food Science and Emerging Technologies, 34, 234–242.

APPLICATION OF THE BIOSPECKLE METHOD FOR EARLY DETECTION OF FUNGAL DISEASE OF APPLE FRUIT

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Biospeckle imaging is a non-invasive technique based on optical phenomenon which occurs during the illumination of a samples surface by coherent light such as laser. The wavefronts of scattered rays interfere with each other and form random, granular patterns consisting of dark and bright spots, visible on the observation plane. The diffraction pattern depends on the geometry of the system, the wavelength of the laser and the aperture of lens of capturing device. In biological samples, the intensity of biospeckle pattern evolves and fluctuates in time. It was shown that processes such as cytoplasmic streaming, organelle movement, cell growth and division during fruit maturation and biochemical reactions are responsible for certain biospeckle activity. So far, applications of biospeckle technique in agriculture include determination of quality and maturation degree of fruits and vegetables, analysis of seed or detection of plant roots bioactivity changes.

In this study we propose new method for early detection of fungal infection of apple fruit. Currently, the most common and most effective methods of biospeckle activity analysis are the Laser Speckle Contrast Analysis and the method developed by Fujii. These methods are based on a quantitative evaluation of local changes in the brightness of pixels, measuring the biospeckle activity in terms of the amount of changes rather than their dynamics. here we propose the frequency analysis, which allows the mapping of activities associated with specific biological or physical processes that only occurs at certain frequencies in the sample. In the proposed method, the biospeckle activity is determined on the basis of the frequency spectrum of temporal changes of brightness of individual pixels. The resulting spectrum shows the amplitude of the signal components at different frequencies. Decomposition of the signal into frequency bands allows studying the biospeckle activity for individual biological processes.

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EVOLUTION OF THE CHARACTERISTICS OF BULK MATERIAL DUE TO THE DISCHARGE INITIATION OF THE STORAGE SILO

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Evolution of bulk material properties inside the storage silo, such as mobilization of coefficient of particle-particle (particle-wall) friction, lateral-to-vertical pressure ratio, stress tensor etc., is an inherent effect in dynamic operations of handling of granular materials. Sudden increase in lateral pressure with ramp down of vertical pressure, which takes place at the opening of discharge gate, may create severe pulsations of silo structures and can lead to its damage. Due to discontinuity and heterogeneity of granular systems, mechanism of generation and propagation of stress waves is very complex and not yet completely understood, but required for the silo design. With an increase in availability of affordable computing power, numerical methods became promising solution for examination of such and similar problems.

In the reported study, numerical simulations of the discharge initiation of the grain silo was performed. Discrete Element Method (DEM) modeling was carried on in a flat-bottomed cylindrical bin, having diameter of 0.12 m and height of 0.5 m. 118 000 spherical particles, with diameter of 3.79±0.05mm and material parameters of wheat, were used. Based on DEM modeling, the propagation of the stress wave and its influence on the loads on construction members and the most commonly used bulk material characteristics inside the silo were estimated. DEM was proven promising tool allowing insight into mechanisms of stress transmission inside the granular solids and on the silo wall.

EDIBLE VEGETABLE OIL THERMAL BEHAVIOR

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Physical properties of food, including edible vegetable oils, and impact of temperature on the food properties are well described by many authors (Gunstone, 2002; Sahin & Sumnu, 2006; Figura & Teixeira, 2007 etc.). Study of thermal behaviour of food or food components is necessary for quality insurance in whole food chain.

The present work deals with thermal behaviour of edible vegetable oils – sunflower oil, rapeseed oil and olive oil. The brief characterization of investigated material is presented – chemical composition and physical characterization. Comparative study of vegetable oil thermophysical properties – thermal conductivity, thermal diffusivity and specific heat (volume heat capacity) and the effect of temperature on thermophysical properties are introduced.

Information on thermal effects in the oil sample subjected to temperature programme is provided by differential scanning calorimetry (DSC) (Haines, 1995). Monitoring of crystallisation and melting behaviour and enthalpy of transitions is provided by DSC method. Study of thermal stability and decomposition behaviour of oil by thermogravimetric analysis (TGA) is also introduced. Method give information on the content of volatile components e.g. water, on decomposition behaviour and on the ash or filler content (Haines, 1995).

Results of experiments showed that in the measured temperature interval linear regressions for temperature dependency of thermal conductivity and thermal diffusivity for each vegetable oil sample are used. Obtained results indicate significant impact of the temperature on oils thermal properties. Based on the results of DSC and TGA analysis of oils is defined temperature interval of oils thermal stability, as well as comparison of crystallisation and melting behaviour and enthalpy of transitions of individual oil samples.

References

Figura, L. O., Teixeira, A. A. 2007. Food Physics, Physical Properties – Measurement and Application, Springer - Verlag, Berlin Heidelberg, 550 p.

Gunstone, F.D., Ed. 2002. Vegetable Oils in Food Technology. Blackwell Publishing, 2002

Haines, P., J. 1995. Thermal Methods of Analysis, Blackie Academic & Professional, London, 1995.

Sahin, S., Sumnu, S. G. 2006. Physical properties of Foods, Springer Science + Business Media, LLC., New York, 257 p.

INVESTIGATION OF ADSORPTION KINETICS, EQUILIBRIUM AND ISOTHERM OF XYLOGLUCAN ON CELLULOSE

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Interactions among cellulose, hemicellulose and pectins are important for plant cell wall assembly and properties, and as well for industrial applications of these polysaccharides. Therefore, binding of xyloglucan on microcrystalline cellulose was investigated in this experiment by adsorption isotherms, zeta potential and scanning electron microscopy (SEM).

Analysis of three isotherm models (Langmuir, Freundlich and Fowler-Guggenheim isotherms) showed that the experimental adsorption isotherm was well described via Fowler-Guggenheim model which includes lateral interaction between adsorbate. Adsorption isotherm and zeta potential measurement showed that in temperature 25°C xyloglucan adsorbed on the microcrystalline cellulose. In case of xyloglucan on cellulose the equilibrium was reached in about 3-4 hour and the kinetics of adsorption were well described by multiexponential equation. Analysis of the model suggests that two steps can be distinguished: diffusion and reconformation in an adsorbed layer. SEM study showed that xyloglucan may prevent cellulose form aggregation.

MONITORING OF FREEZING AND DEFROSTING OF WHEAT BREAD DOUGH BY DSC METHOD

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Frozen bread dough has been extensively studied in the last few years, and its growing economic interest is due to centralized manufacturing and standardization of product quality (Selomulyo & Zhou, 2007). The quality of frozen products depends on the raw materials and on the technology process; particularly important is the time required for freezing the dough (Šmitalová & Bojňanská, 2014). An alternative to minimize the negative effects of frozen storage on dough quality is to use of mixes of hydrocolloids, such as Xanthan and Guar gums. Due to their high water retention capacity, they provide stability to the products that undergo consecutive freeze–thaw cycles.

The present work deals with monitoring of freezing and defrosting of wheat bread dough by DSC method. Samples that was measured were standard dough (SD), than dough with Xanthan Gum (XG) and dough with Guar Gum (GG). Positive effect of the addition of XG or GG was found to be particular the volume, texture and sensory characteristics of bakery products (Šmitalová & Bojňanská, 2014). For monitoring of freezing and defrosting processes of dough and enthalpy of transitions by DSC method was used device DSC 1 (METTLER-TOLEDO).

The aim of this work was to verify the influence of GG or XG on freezing and defrosting process and enthalpy of transitions. The addition of GG or XG resulted among others reduction in enthalpy during the freezing process. This result in accordance with Guinoza Matuda et al. (2008) indicate an interaction of both gums on water binding capacity during the freezing process. The results obtained by DSC method showed that minimal changes were observed during frozen storage, and the most influential factor was the freezing process.

References

Guinoza Matuda T., Chevallier S., Alcantara P.F.P., LeBail A., Tadini C. 2008. Impact of guar and xanthan gums on proofing and calorimetric parameters of frozen bread dough. Journal of Cereal Science 48, 741–746.

Selomulyo, V. O., Zhou, W. 2007. Frozen bread dough: Effects of freezing storage and dough improvers. Journal of Cereal Science 45, 1–17.

Šmitalová, J., Bojňanská, T. 2013. Influence of long lasting freezing to baking quality. Journal of Microbiology, Biotechnology and Food Sciences 3 (3), 223-225.

APPLICATION OF EXTRUSION-COOKING FOR UTILIZATION OF VARIOUS CEREAL WASTE-BRAN IN SNACKS

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Cereal bran are the waste by-products after milling and cleaning of flours. However, bran are nutritionally valuable and could be used for enrichment of food products. The outer layer of cereals, separated as bran, consist high amount of dietary fiber, phytochemicals, minerals and vitamins. Application of bran as food additive may bring some health benefits, as cardiovascular disease or cancer prevention, lowering bad cholesterol or glucose level, and improve intestinal tract functions. Bran addition also affects on physical properties, texture and sensory of enriched products. Extrusion-cooking seems to be useful technique for utilization of food by-products. The aim of the study was an evaluation of selected characteristics of waste-bran enriched food snacks processed by extrusion-cooking.

Single screw extruder TS-45 was applied for processing of expanded corn-based snack and potato-based pellets with configuration of L/D=12 (125 rpm) and L/D=18 (80 rpm), respectively. Wheat, rye, and oat bran were added at 5, 10, 15 and 20%. Expanded products were shaped with circular die 3 mm; snack pellets were formed as ribbon on flat die 0.4x30 mm, cut for squares 30x30 mm, dried, and expanded by deep frying in oil for 10 sec. Snacks were tested for expansion ratio, bulk density, hardness and crispness, and sensory acceptability.

An expansion ratio of snacks, both expanded and fried, decreased with increased amount of bran used. Rye bran application affected on increased bulk density of expanded snacks, while wheat and oat bran addition lowered bulk density. Hardness of corn-based snacks lowered if wheat and oat bran were added, application of rye bran increased the hardness. Fried crisps enriched with rye bran characterized lower hardness compared to products with wheat and oat bran. All tested samples were acceptable in sensory evaluation, so cereal bran may be used as additive for supplementation of extruded snacks.

POSTER PRESENTATIONS

PARTICLE SIZE DISTRIBUTION AND MICROAGREGATE COMPOSITION OF SELECTED ANTARCTIC SOILS

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Soils of Antarctic are quite different from typical zonal soil of Northern Hemisphere. They characterizes by increased coarse fraction content and low water holding capacity. Contents of clay and humified organic matter are low, but in some Sub-Antarctic soils these indexes are comparable with those in tundra soils. The objective of this study was to assess the role of soil detrite organic matter in formation of granulometric and microagregate fractions distribution in selected soils of Antarctic Peninsula. Different size fraction distribution was determined by laser difractometry. Soils fine earth were grounded with adding of sodium pyrophosphate (granulometric fractions), of just suspended with sodium pyrophosphate without grounding (microagregate composition) and, additionaly, by adding of hydrogen peroxide with aim to remove soil organic matter. Data obtained show essential differences in experiments scenarios. Namely, removing of organic matter from soil fine earth resulted in disappearing of essential differences between granulometric and microagregate composition. This means that organic matter play a key role in aggregation of Antarctic soils. Moreover, increased content of undecomposed detritus organic matter were fixed for all soils in fraction of sand 1,00-0,25 mm. This means, that sandy texture of soils investigates was not caused by size of individual mechanical elements, but by increased undercomposed organic matter content.

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ASSESMENT OF ACTIVE LAYER SPATIAL DYNAMICS AND PERMAFROST BORDER DEPTH OF POLAR SOILS BY VERTICAL ELECTRIC RESISITVITY SOUNDING

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Active layer thickness and the depth of the permafrost layer are the basic features of soil cover of the Polar regions and can be assessed by different direct or indirect methods. Nowadays, direct-current resistivity (DC resistivity) methods have been used for the identification of permafrost depth and soil profile heterogeneity. Geophysical methods have many advantages and have been widely used for permafrost identification. This is a quantitative method, which allows make quick measurements of ER along the different soil profiles and the permafrost layer. ER values can be only about 10-30 Ohm*m in clay textured substrata's, about 500 Ohm*m in dry sand or even up to 40000 – 80000 Ohm*m in permafrost layers. That is why ER measurements and visualization were used for permafrost mapping and identification of soil-lithological heterogeneity in vertical scale in polar environments of Arctic and Antarctic. It has been shown that the depth of permafrost variates from 30 cm in Northern part of Yamal peninsula (Arctic deserts) to 200 cm in the central part of Yamal region (forest tundra zone). Key plots on Antarctic Peninsula show different depth of permafrost table as well. Soils of King George Island characterizes by active layer depth about 100-200 cm, while soil of Argentinian Islands shows the permafrost table depth about 30-40 cm in average. Key advantage of vertical electric resistivity sounding is possibility to identify current permafrost border without diging, drilling or pushing of a sharpened steel bar into the ground until the frozen ground is encountered. This is especially important while permafrost occurs in massive crystallic rock, which is quite typical for Antarctic environments.

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THE RESPONSES OF POSTHARVEST QUALITY CHARACTERISTICS OF WASHINGTON NAVEL ORANGE TO EXTRACT AND AGAR FROM TWO ENDEMIC PERSIAN GULF SEAWEEDS

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In recent years the use of natural compounds is common to increase the storage life and postharvest quality of fruits. This study was conducted on Washington Navel orange fruits during 2015 and 2016 in University of Hormozgan, Bandar Abbas, Iran, to evaluate the effects of different concentrations of extract and agar from two seaweeds (endemic of Persian Gulf), Ulva flexuosa and Gracilariopsis persica, essential oil from Zataria moltiflora (Shirazi thyme) on postharvest quality and storability of Washington Navel fruits under cold storage 5±1°C at 85-90% RH for 60 days of storage conditions (the postharvest characteristics were evaluated four times with 15 days interval). Obtained results indicated that fruit weight loss %, fruit decay%, juice%, TSS (Total Soluble Solids) content and TSS/acid ratio increased as storage period prolonging. On the other hand, postharvest quality of Washington Navel fruits significantly improved when fruits were immersed in seaweed extract and agar. The most effective treatment in maintaining quality characteristics of Washington Navel fruits during cold storage for 60 days was 0.94 gr Ulva flexuosa extract per liter, so that this treatment could improve antioxidants capacity, ascorbate peroxidase activity and TSS. After 60 days, maximum vitamin c was obtained with orange fruit immersion for about 5 minutes in Shirazi thyme essential oil. As well as, treating Washington Navel fruits by immersing it in Gracilariopsis persica agar at 5 gr per liter was maintained fruit quality longer time comparing to control treatments. Over all these results indicated that the seaweed extract and agar can use as a bioactive agents for increasing the postharvest quality of orang fruits.

UNSATURATED HYDRAULIC CONDUCTIVITY AND CONDUCTIVITY POTENTIAL AS MODELED TO CULTIVATED SOILS OF THE NILE DELTA

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The unsaturated hydraulic conductivity, K(θ), and the relationships between water content (θ), pressure head (h) and soil pore size are important to quantify the rate of water flow and transport through the soil profile. The aim of this study was to propose equations to estimate unsaturated hydraulic conductivity K(θ)[LT-1], water diffusivity D(θ) [L2T-1] and intrinsic permeability, k [L2] in plant-root zone depending on soil water filled pores. Three alluvial clay soils located at middle and northern Nile Delta were used to apply the assumed equations. Two soils were planted with cotton yield during 2012 season and the third was uncultivated. The soil profiles were different in their salinity, clay % and source of irrigation water. The equations which assumed to predict soil water movement parameters considered only the matric potential as a driving force in capillary pores, and gravitational potential that is critical for the large, non-capillary pores. A new suggested equation for so called potential conductivity, Kp(θ) was predicted in units [M L-1T-3] (erg. cm-3.sec-1 or joule. m-3 sec-1). The calculated Kp(θ) values were obtained in relation to soil water filled pores for each pore size class. Pore size distribution (PSD) for the investigated soil profiles was obtained using water retention data. The calculated K(θ), D(θ) and k values as related to PSD were conformable to the common measured ranges, indicating the applicability of the proposed equations for predicting water movement parameters in agricultural clay soils.

THE IMPACT OF THE TORREFACTION PROCESS ON THE ENERGY PROPERTIES OF BIOMASS

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Waste biomass from plant production is an important raw material for the production of energy from renewable sources in Poland. Capabilities and technologies of processing are still being improved and modernized in order to achieve the most favorable energy efficiency. The study assesses the energy properties of wheat straw, rape and willow grown. The test was heat treated biomass - torrefaction process at temperatures between 220 and 300°C for 60, 75 and 90 minutes. A comparison of biomass raw and manufactured torrefied. Materials analyzed and compared to the moisture content of biogenic elements N, C, H, calorific value and ash and volatiles. There has also been studied to assess the composition of biomass particle size and chemical composition, which have a significant impact on the alternative, in relation to energy, the possibilities of using torrefied. The studies compared the gases produced during the combustion of the biomass material forms the torrefaction process, which allows the resulting fuel rate in terms of environmental impact. Analysis of the results was able to determine the optimum parameters for carrying out the torrefaction process in order to reduce costs in the best results of the process. This information will enable the development of biomass thermal treatment technologies towards the use of waste biomass from agricultural production, better management of agricultural waste and lower operating costs farms.

CROWN FORMATION ON SOIL SURFACE DURING SPLASH PHENOMENON

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Soil as a top layer of the Earth's crust undergoes continuous degradation induced by a variety of different factors: chemical, biological and physical. One of the physical degradation types is water erosion which covers a broad spectrum of processes: from the splash, through the movement of the soil and water mixture on the soil surface, to the soil loss in streams and rivers. Splash phenomenon as a first stage of water erosion process should be deeply recognized and understood to develop methods of soil protection. The crown formation on soil surface is one of the phenomena which occurs during raindrop splash. It appears on thin liquid layer collected on saturated soil surface after few water-drop impacts.

The aim of this study was to determine parameters describing crown on soil surface during raindrop impact.

The measurements were conducted on *Fluvic Endoglevic Cambisol* saturated soil samples. 10 subsequent water-drops were released from 1.5m height on each soil sample and recorded with high-speed cameras at 3260fps. The splash images with crown formation recorded after the fall of the 10^{th} drop were analyzed using Vision Assistant (National Instruments) software. Five first consecutive frames (the start of the counting of the frames was from the moment when water drop contacted with the soil or water surface) were analyzed for every image in order to present the dynamics of calculated parameters.

The choose of the adopted method allowed to determine parameters for crown formation on soil surface: time of crown's growth up and breaking up, the maximal linear spread measured at the top of the crown, the maximal height of the crown. Presented results could be used to model this phenomenon which is important in attempt to determine the effects of water erosion.

Acknowledgement

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ALTERATIONS IN FOREST DETRITUS INPUT INFLUENCE SOIL ELEMENTS

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Within the framework of Síkfőkút DIRT (Detritus Input and Removal Treatments) Project, we have been examining the extent to which elements of soils are influenced by detritus inputs of diverse quantities and qualities. The experimental site is located in the south part of the Bükk Mountains in North Eastern Hungary.

The general purpose of the project is to reveal the connection between modifications of detritus production and changes of climatic conditions and land use (Fekete et al., 2014). It also studies how the modifications, decreases or increases in detritus production influence organic material and some soil elements (Mg, Zn) content, and physical, chemical or biological processes of soils.

The soil elements is affected among others by the quality of litter input i.e. the kind of litter material that is deposited on soil surface. Leaf, root and wood litter addition and removal were applied and the effect of these treatments on soil. Treatments at the Síkfőkút DIRT experimental site include adding (by doubling) of either leaf litter (DL) or wood (DW) (including branches, twigs, bark), and removing all aboveground litter (NL), all root inputs by trenching (NR), or removing all litter inputs (NI).

We studied how change the soil element contents in different soil layers and detritus treatments. Significant differences were found between each of the layers and detritus treatments. However, the degree of change was different for each element. The quantity of soil element contents increased in the adding treatments (Dl, DW) and decreased in the removal treatments especially in the upper soil layer.

References

Fekete I., Kotroczó Zs., Varga Cs., Nagy P. T., Várbíró G., Bowden R. D., Tóth J. A., Lajtha K., 2014. Alterations in forest detritus inputs influence soil carbon concentration and soil respiration in a Central-European deciduous forest. SOIL BIOLOGY & BIOCHEMISTRY 74: pp. 106-114.

RELATIONS BETWEEN RAW AND COOKED PROPERTIES OF PASTA – NEW INDICES FOR QUALITY EVALUATION

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Pasta is one of the most important cereal foodstuffs. Quality evaluation of pasta includes the series of tests, based on the determination of physicochemical and cooking properties.

The aim of the work was to suggest the new indices, with can be used to evaluate the quality of pasta. Besides, the analysis between physicochemical and culinary properties of pasta was performed.

For test 15 samples of commercial spaghetti, produced with semolina and common wheat flour were used. Samples of pasta were evaluated for moisture content and chemical composition. The bending test was performed for evaluation strength properties of pasta and the following parameters were determined: maximum deflection of the center of the spaghetti, maximum force, wok of the deformation and flexural strength. The color parameters of pasta in the CIE Lab system were also evaluated. Pasta cooking test included evaluation optimum cooking time, weight increase index, and cooking losses. Single samples of cooked spaghetti were cut and compressed, and the parameters described pasta texture were determined. All mechanical tests of pasta were performed by use universal strength testing machine Zwick ZN20/TN2S.

Statistical analysis showed significant correlations ($\alpha = 0.05$) between color parameters (L* and a*) and pasta ash content ($r = -0.85$ and 0.78, respectively). The destructive force of raw spaghetti during the bending test was significantly and positively correlated with shear force and compression force of cooked pasta. Besides, the compression force of cooked pasta was significantly and negatively correlated with weight increase index and cooking losses. Most importantly, positive correlation was proved between pasta protein content and compression force of cooked spaghetti. The study showed important relations between physicochemical properties of pasta. These relations are helpful in the pasta quality evaluation and make the evaluation more objective.

EFFECT OF MIXTURE OF PLANT COMPONENTS ADDITION ON THE MECHANICAL PROPERTIES OF THE CRUMB AND CRUST OF WHEAT BREAD

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Instrumental methods of measuring mechanical properties of bread can be used to determine changes in the properties of bread during storage, as well as to determine the effect of various additives on the change of the texture attributes.

The aim of this study was to investigate the effects of the mixture of plant components (MPC) on the mechanical properties of the crumb and crust of wheat bread. The MPC included: carob fiber, milled grain red quinoa and black oat (1:2:2) added at 0, 5, 10, 15, 20, 25 % into wheat flour. A straight dough process was carried out to prepare bread. Before baking test the water absorption of flour and mixtures was evaluated. All of the bread was subjected to volume and sensory evaluation. Mechanical parameters of crumb (TPA test) were determined and the mechanical properties of crust were assessed, using a specially constructed attachment cooperating with the strength testing machine.

The results showed that the increase the addition of MPC significantly increased the water absorption of flour mixtures. The use of the MPC above 5%, as a partial replacement of wheat flour, resulted in the increase of bread volume and decrease of crumb density. The addition of MPC significantly affected the mechanical properties of bread crumb. Hardness of crumb decreased as a result of MPC addition. The highest cohesiveness was obtained for bread with 10% of additive and the lowest for bread with 25% of MPC. Most importantly, the enrichment of wheat flour with MPC significantly reduced the crust failure force and crust failure work. The results of sensory evaluation showed that addition of MPC up to 10% had little effect on bread quality. The higher addition of this component especially negatively influenced on crust surface of bread (matt crust with less attractive appearance).

ANALYSE OF PERIODS WITHOUT PRECIPITATION AND THEIR INFLUENCE ON SOIL WATER STORAGE AT ZÁHORSKA LOWLAND

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The aim of study is to analyze the soil water content at Záhorska lowland in regards to periods without precipitation (PWP) in years 2009, 2010, 2011 and 2012. Rainfall in years 2009 and 2010 were above average oposit to years 2011 and 2012, where rainfall dropped below average compared with long-term average from period 1961-2010.

The soil moisture monitoring and measuring of groundwater level were done by neutrone proge at locality Jakubov. Periods without precipitation were classified into four precipitation categories, according to the methodology described in article Šútor a kol. (2011). The precipitation categories are as following: 5-9 days, 10-14 days, 15-19 days and time period longer than 20 days with no precipitation. PWP were interrupted, if the rainfall totals exceeding 3 mm. Obtained values were compared with long-term 50-year average PWP (period 1961-2010).

Soil drought has been evaluated for horizon 0-100 cm based on these hydrolimits: wilting point, point of decreased availability and field water capacity.

Throughout the measured period between 2009-2012 was horizon 0-100 cm sufficiently supplied with water, despite the fact that during the main growing season occurred several longer periods without any rain especially in 2009 and the 2012th.

With the start of extreme weather events is vital soil moisture monitoring and analyzing the onset of the hydrological and soil drought in order to timely respond to the moisture requirements of crops, or developing appropriate adaptation measures for vegetation cover.

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References

Šútor, J., Šurda, P., Štekauerová, V. 2011. Effect of the time periods without precipitation on water storage dynamics in the aeration zone of the soil. Acta Hydrologica Slovaca, Vol. 12, No. 1, 22-28.

PHYSICOCHEMICAL PROPERTIES AND GRINDING CHARACTERISTICS OF SPRING WHEAT FROM DIFFERENT FARMING SYSTEMS

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Many studies are focused on the differences in nutritional values between organic and conventional cereals. Compared with conventional products, organic products generally have a lower content of macronutrients, especially proteins, but also a higher concentration of secondary metabolites. There are few studies on the interaction between the cropping system and the wheat products in terms of physicochemical properties and milling process. Thus the aim of this study was to investigate the effect of origin of wheat grown by different farming systems on the physicochemical properties and grinding characteristics of grain. Four varieties of spring wheat from two growing years and cropped under organic (OR), integrated (IN) and conventional (CO) managements were taken into investigation.

Grain from IN farming characterized by the highest values of grain weight and diameter, and the lowest values of grain hardness, average particle size and grinding energy requirements. The values of these parameters obtained for wheat from OR and CO farming systems were similar. Grinding energy indices shoved that grain from IN farming system was characterized by the lowest grinding energy requirements, whereas the energy requirement for size reduction of grain from OR and CO cropping was similar. Besides, the IN farming caused the increase of milling efficiency index and amount of phenolic acids in flour. The crop year had little influence on antioxidant activity of wheat flour. The data showed that studied farming systems by modifying of physicochemical properties of wheat grain during plant growing influenced the impact grinding and milling results.

POSSIBILITIES OF THE USE OF ACOUSTIC TECHNIQUES TO EVALUATE WHEAT GRAIN QUALITY

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The aim of the study was the assessment of possibilities of the use of acoustic techniques to study the technological properties of wheat grain. It was assumed, that the results will allow for identification of the new research methods, that will be used for evaluation the technological usefulness of the wheat grain.

Investigations were carried out on 14 wheat cultivars. The grain came from the field experiment conducted in 2012-2014. The SKCS was used to determine the hardness index, kernel weight, moisture and diameter from the analysis of individual kernels. Besides, the hardness, vitreousness, weight of 1000 grains and test weight were evaluated. The assessment of the chemical composition of the grain included determination of total protein and total ash contents. The acustic properties of the grains were evaluated using a texturometer TA-HD cooperating with system to for registration of acoustic signals during grains crushing.

The results showed significant differences between physical and chemical properties of the grains of individual wheat varieties. Physical properties of individual kernels the same variety were also significantly differ. The acoustics effects recorded during the cracking of kernels were strongly dependent form the cultivar and method of acoustic signal registration. The signal registered by a microphone method had several times less acoustic events than the signal registered by a contact method. The correlation analysis between physical properties, chemical composition of the grain and the acoustic signals showed, that the acoustic events detection and an average energy of single event were significantly correlated with technological indices of what grain. On the basis of the study it was found, that the applied acoustic techniques may be useful for the wheat grain quality evaluation.

STUDY OF MECHANICS AND COMPOSITION OF MANGO CELL WALL DURING RIPENING PROCESS

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Mango is an important crop that is marketed on a large scale around the world. The degree of ripeness of mango is an important quality attribute. It is characterized by a series of biochemical changes, loss of pectin and increase in soluble galacturonide (Yashoda et al., 2006). However, few studies have been evaluated the changes occurring on the structure at subcellular level as well as its correlation with macroscopic indicators such as firmness. Thus, the aim of this study is to evaluate the mechanical properties of mango cell walls and how they correlate with firmness as well as with biochemical changes. Mangoes were picked at unripened stage and stored during 16 days (at room temperature). The experimental kinetic measurements were performed at six stages (day 1, 2, 5, 8, 12 and 16th). Batches of 15 mangoes of similar size without visible damages were selected. These mangoes were used first for firmness determination, and then mashed for collection of cell wall material (CWM) and for biochemical analyses. CWM stiffness was measured by means of atomic force microscopy (AFM). Pectins were isolated during sequential extraction according to the method proposed by Redgwell et al. (1988) and change in the galacturonic acid content was determined in the pectin fractions (water soluble pectin WSP, chelator soluble pectin CSP, diluted alkali soluble pectin DASP and insoluble fraction) during the kinetic of ripening as long as the enzymatic activity data obtained according to Wei et al. (2010) method. Finally a correlation matrix among all variables studied for mango was performed. This study could lead to a better understanding of the ripening process in mango and it could provide valuable information to preserve and manage the quality of climacteric fruits.

References

Redgwell, R.J., Melton, L.D., Brasch, D.J. 1988. Cell-wall polysaccharides of kiwifruit (Actinidia deliciosa): chemical features indifferent tissue zones of the fruit at harvest. Carbohydr Res 182:241–258

Yashoda, H.M., Prabha, T.N. and Tharanathan, R.N. 2006. Mango ripening: changes in cell wall constituents in relation to textural softening. Journal of the Science of Food and Agriculture, 86, 713–721.

Wei, J., Ma, F., Shi, S., Qi, X., Zhu, X., Yuan, J. 2010. Changes and postharvest regulation of activity and gene expression of enzymes related to cell wall degradation in ripening apple fruit. Postharvest Biol Tech 56:147–154

PHYTO-ASSIMILATION OF ELEMENTS IN SOILS IN THE ORGANIC FARMING SYSTEM

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Organic farming system is a form of production, which aim is obtain a high quality product while minimizing the impact on the environment. The process of producing such products is an advanced set of rules. From the point of view of crop cultivation the significant problem in organic production are limited sources of nutrition elements in soil. The basic fertilizers used In organic farming are natural fertilizers and slow soluble mineral fertilizers. Thus, the model organic farm should be based on crop production associated with animal production. In organic farms in Poland, the majority (80% - IJHARS 2015) producers leads only crop production. Question must be asked: how production takes place in such farms and what is the influence of such production on the soil and the quality of the final product. With analyze the structure of crops it can be found that the largest share (36% - IJHARS 2015) have plants for feed purposes, among which is dominated by perennial legume mixture with grasses, which should supply the raw material containing the appropriate amount of macro and micronutrients necessary for proper development of the animals. The aim of the study was to evaluate phyto-assimilation of macro and micronutrients in the soil of organic farms in the multiyear-crop grass mixtures with legumes. Within the realization of purpose, were collected samples of plants and soil from 55 organic farms, 25 of which had animal production. In the soil samples pH value, humus content, the content of available phosphorus, potassium, mineral nitrogen, hydrolytic acidity and content of movable aluminum content were determined. Also in collected material (soil and plants) the content of the selected macro (Ca, Mg, Na) and microelements (Fe, Zn, Cu, Mn, Se) were determined. Furthermore were calculated bioaccumulation factors of individual elements and estimated their quantity taken with field. Based on the results, it was found that the tested soils are characterized by low content of macro and micronutrients which influenced in their low content in the tested plant material. Material collected from farms with livestock in relation to the material collected from the farms without animals showed significantly higher contents of analyzed elements.

References

IJHARS 2015. Report about condition of organic farming in Poland between 2013 and 2014. Warszawa

THE EFFECT OF WEATHER CONDITIONS ON COLONIZATION OF WINTER WHEAT GRAIN BY FUSARIUM SPECIES

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Fusarium head blight (FHB) is a significant threat to wheat production worldwide. Under weather conditions favourable for the growth of Fusarium spp. in the field, FHB causes heavy yield losses and reduces grain quality, especially due to the presence of mycotoxins which have adverse effects on animal and human health. Various Fusarium species produce different toxins. Therefore, the purpose of the study was to investigate which Fusarium species (and to what extent) internally colonize winter wheat kernels in different weather conditions.

The grains of winter wheat was harvested in two years (2014 and 2015) in 5 localities in Poland (Borusowa in Lesser Poland, Werbkowice and Osiny in Lublin Region, Żelisławki in Pomerania and Wielichowo in Greater Poland) with 4 winter wheat cultivars ('KWS Dacanto', 'Bamberka', 'Astoria' and 'Oxal').

The randomly selected wheat kernels were disinfected by sodium hypochlorite solution (2% of active chlorine) and put on CZID medium. The isolated from CZID medium Fusarium fungi were identified after growing on PDA and SNA media.

The proportions of wheat kernels from Borusowa, Werbkowice and Osiny infected by Fusarium fungi were higher than those from Wielichowo and Żelisławki in both years. Higher sums of precipitation in the former localities during the pre-flowering and the flowering periods in May were the main reason of the observed phenomenon. Due to the low sum of precipitation after flowering, during June, F. poae was the main species colonizing wheat grains in all the localities in 2015 and in Wielichowo and Żelisławki in 2014. The high sums of precipitation in Borusowa, Werbkowice and Osiny, during the post-flowering period in June of 2014, caused that F. graminearum was the main Fusarium species infecting this wheat grain.

The distinct differences between the wheat cultivars were observed only in 2014. The grain of 'KWS Dacanto' and 'Bamberka' was more strongly colonized than that of 'Astoria' and 'Oxal'. In 2015 the differences were diminished.

EXOPOLYMER FROM *RHODOCOCCUS RHODOCHROUS* AS A POTENTIAL SOIL CLARIFIER

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Flocculation had become an important phenomena which could be applied in many fields such as wastewater treatment, textile, pharmaceutical, food and chemical industry. This process also occurs spontaneously in soil, playing important role in water transport and plants vegetation. Therefore, its application seems to be appropriate in soil treatment. Substances which could effectively support the flocculation are extracellular polymeric substances (EPS) excreted by microorganisms in response to environmental changes. The flocculation abilities of EPS can be applied for removing metal ions, which are derived from industrial processes such as petroleum, mining, metallurgy and chemical industry and tend to accumulate in soil. Moreover, the EPS can support the flocculation of soil particles, which leads to efficient water flow and fertilizers transport. The excretion of the EPS by microorganisms depends on multiple factors such as carbon and nitrogen sources, the pH value of medium, the presence of metal ions and the temperature of microbial growth. The optimization of culture conditions plays the major role in the EPS production and influences their use as flocculants.

In the present work, *Rhodococcus rhodochrous* bacterial strain was analyzed for its flocculating activity. Supernatant obtained from *R. rhodochrous* culture broth was analyzed for flocculating activity using mixture of kaolin and calcium chloride as the equivalent standard suspension corresponding to soil structure. Different variants of culture parameters, such as carbon and nitrogen sources, the values of temperature and pH during the growth, and the speed of shaking were tested to determine the optimum conditions for *Rhodococcus rhodochrous* growth. Additionally, the optimization of respective steps of the exopolymer purification was carried out and the crude exopolymer was obtained for further analysis. Moreover, the surface morphology of exopolymer was observed by scanning electron microscope.

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EMISSIONS OF CARBON DIOXIDE AND METHANE FROM FIELDS FERTILIZED WITH DIGESTATE FROM THE AGRICULTURAL BIOGAS PLANT

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The anaerobic digestion of biomass for biogas production becomes popular solution for reduction fossil fuels consumption. Digestate from biogas plants can play important role in agriculture by providing nutrients, improving soil structure (Nkoa, 2014) and reducing the use of mineral fertilizers (Alburquerque et al., 2012). Less is known about GHG emissions from soil during and after digestate application.

The aim of the study was to estimate the emissions of carbon dioxide and methane from the field, which was fertilized with digestate. The study was conducted in the period covering various phases of triticale growth and tillage operations on the test field: the time of triticale harvest, the moment of digestate application and the time after plowing. The gas fluxes were measured with eddy covariance method using CO_2, H_2O and CH_4 analyzers and sonic anemometer. Each test day, analyzers set was installed in various places of field, depending on the dominant wind direction, so that each time the results were obtained from an area where digestate was used. Data were recorded every 0,5 hours, but they were recalculated for periods of 5 minutes using the EddyPro5 software package.

The results showed relatively low emissions of studied greenhouse gases. The maximum of the CO_2 and CH_4 fluxes, 34,01 and 0,8 μmol s^{-1} m^{-2} respectively, were observed just after digestate spreading on the surface of the field. On the same day, digestate was mixed with the top soil layer using a disc harrow. This resulted in a decrease of studied gases emission, especially methane. Its concentration fell almost immediately to the values observed before fertilization. In case of carbon dioxide, the increased emission remained the following day, and then decreased to a level that was observed on the field after triticale harvest.

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References

Alburquerque J.A., de la Fuente C., Campoy M., Carrasco L., Nájera I., Baixauli C., Caravacaa F., Roldán A., Cegarra J., Bernal M.P., 2012. Agricultural use of digestate for horticultural crop production and improvement of soil properties. Europ. J. Agronomy 43, 119–128

Nkoa, R., 2014. Agricultural benefits and environmental risks of soil fertilization with anaerobic digestates: a review. Agronomy for Sustainable Development 34, 473-492.

EFFECT OF REDUCED TILLAGE ON SOME PROPERTIES OF A SILT SOIL UNDER MONOCULTURE OF MAIZE (*ZEA MAYS* L.)

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The aim of this research was to determine the effects of different tillage systems on selected soil properties: physical (soil stability in water), chemical (organic matter) and microbiological (soil enzymatic activity, microbial biomass C and N content). Soil properties were measured on samples taken from on a long-term field experiment (2006-2015) in Dąbrowa Nowa (Podkarpackie voivodeship) on silt soil. Maize (*Zea mays* L.*)* was grown in monoculture under two tillage systems: conventional tillage (CT) based on the moldboard plough (to 25 cm depth) and traditional soil tillage equipment with the field surface mulched with chopped maize straw, and reduced tillage (RT) based on soil crushing-loosening equipment and rigid-tine cultivator (to 10 cm depth) also with the surface mulched with chopped straw based. Soil properties were measured on samples collected (from 0-15 and 15-30 cm depths) from the field throughout the growing season. Soil stability was measured in terms of the content of readily-dispersible clay in soil samples. Microbiological analyses of soil included: microbial biomass C content by the F-I (fumigation-incubation) method; microbial biomass N content by the F-E (fumigation-extraction) method; the rate of CO_2 evolution by the titration method; the dehydrogenase activity using the TTC as a substrate. Total organic C and N were also measured.

Significant effects of different tillage systems on the values of soil physical, chemical and microbiological properties were observed at $p \leq 0.05$. RT decreased the amount of readily-dispersible clay by half and therefore increased soil stability in comparison with TT. The populations of soil microorganisms were significantly greater in RT than in CT at both depths. The microbial activity in the silt soil was on average 25% greater in RT than in TT.

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EFFECTS OF CONVENTIONAL AND REDUCED TILLAGE ON SOIL WELLNESS

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There is growing interest in reduced tillage (RT) with mulching (conservation tillage) as an alternative to conventional tillage (CT) to reduce emissions of greenhouse gases whilst producing good conditions for plant growth in monoculture. The aim of the research was to compare the effects of CT and RT on soil physical (density, water content, stability) and microbiological (enzymatic activity, microbial biomass) properties.

The long-term field experiments (started 2002) were at the IUNG-PIB Experimental Station in Grabów (Mazowieckie voivodeship) on a sandy soil (Eutric Fluvisol). Soil properties were measured on samples collected (2009-2015) from the fields at harvest of winter wheat. grown in monoculture. CT was based on the mouldboard plough and traditional equipment with the field surface mulched with chopped straw. RT was based on soil crushing-loosening equipment with a rigid-tine cultivator also mulched. Physical measurements included soil water content and bulk density measured at: 2-8, 13-18, 28-33, 47-53 and 67-73 cm depths. Soil stability in water was measured in terms of readily-dispersible clay (RDC) for samples from 5-10, 15-20 and 30-35 cm depths. Microbiological analyses (0-15 and 15-30cm depths) included: microbial biomass C content using the F-I (fumigation-incubation) method; microbial biomass N content using the F-E (fumigation-extraction) method; the rate of CO_2 evolution using the titration method; the activity of dehydrogenases using the TTC as a substrate. Effects of tillage system on the physical and microbiological properties of soil were significant at $p<0.05$.

RT increased water content throughout the soil profile and bulk density in the 2–8 cm and 13–18 cm depth layers relative to CT. RT reduced the content of RDC and therefore increased soil stability, in comparison with CT. The populations of soil microorganisms estimated from biomass C and N were significantly greater in RT than in CT in both depth ranges: 0–15 and 15–30 cm. The rate of CO_2 evolution, ammonification and nitrification strength of soil and the potential for N mineralization were greatest in RT. RT increases microbial activity and accumulation of organic matter, which are both indicators of soil wellness.

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THE INFLUENCE OF SOIL COLLOIDS ON CARBARYL RETENTION

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Carbaryl is a commonly used insecticide, which is toxic, moderately mobile and vulnerable to leaching in soil environment. For that reason there are certain legal requirements for its maximum residue level (MRL) in soil. The soil colloidal components influence the carbaryl behaviour (sorption/desorption and degradation) changing its concentration in soil solution which can modify plants and water quality.

The aim of the research was to study the affinity of different soil colloidal components to retain carbaryl. The sorption and desorption experiments were conducted on natural soil (S1) and the soil amended with inorganic or organic soil colloids (kaolinite, montmorillonite, illite, goethite, humic acids) for three doses of carbaryl: 50, 25 and 10 $mg \cdot dm^{-3}$ in 5 mM $CaCl_2$. The samples were prepared in 5:10 ratio (m:v) and equilibrated for 24h. As a reference the soil sample from Ap horison (S1) and additionally the same soil (4g) with the pure sea sand (1g) (S2) were used.

Among the experimental variants the highest sorption affinity towards carbaryl was observed for S1 and for S2. The lowest desorption obtained for S1 and S2 suggest the strongest carbaryl retention capability in these samples. Clay minerals added to the natural soil (S1) modified the sorption behaviour of carbaryl causing its reduced retention, particularly in the cases of lower doses of insecticide 25 and 10 $mg \cdot dm^{-3}$. The lower activity in decreasing of carbaryl sorption has montmorillonite, while kaolinite and illite show a stronger influence on the sorption of carbaryl. Goethite - the mineral soil colloid representative of iron hydroxide - followed KGa and I pattern. Humic acids used in the experiment are the most active among the used colloidal components in limiting the carbaryl retention, probably due to the competition with other soil ingredients for the potential sorption sites.

INTENSITY OF WATER INFILTRATION FROM THE ATMOSPHERE DURING NON RAINFALL PERIODS UNDER CONDITIONS OF VARIED SOIL MOISTURE

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Water infiltration from the atmosphere during non rainfall periods is defined as the volume of water that supplies the surface layer of soil as a result of formation of dew, hoarfrost, fog, condensation of water vapour contained in the soil air, and water adsorption from the atmosphere. One of the methods that allow precise description of the process makes use of TDR sensors and aluminium barriers, impermeable to water, placed beneath soil surface (Janik et al., 2014). Another method consists in the use of a TDR probe equipped with a water collector in the form of a porous plate, the volumetric moisture of which varies as a result of condensation and infiltration of water vapour contained in atmospheric air (Nakonieczna et al., 2015). The intensity of effective non rainfall water flux is affected by the state of the atmosphere, terrain relief conditions, and by the state and physical properties of the surface layer of soil, represented by the volumetric moisture, temperature and material functions. Volumetric moisture has an impact on both the ability of soil to absorb water from atmospheric water deposits, and also on the thermal properties of soil – thermal capacity and conductivity. These properties determine the temperature of the surface layer of the soil and, in consequence, the amount of water vapour condensing on the surface. In the literature that aspect is not taken into consideration. As a result of as field experiment it was demonstrated that the intensity of effective non rainfall water flux decreases with increase of the volumetric moisture of the surface layer of soil.

References

Janik G., Skierucha W., Błaś M., Sobik M., Albert M., Dubicki M., Zawada A. 2014. TDR technique for estimating the intensity of effective non rainfall. International Agrophysics 28(1), 23–37.

Nakonieczna A., Kafarski M., Wilczek A., Szypłowska A., Janik G., Albert M., Skierucha W. 2015. Detection of Atmospheric Water Deposits in Porous Media Using the TDR Technique. Sensors 15, 8464-8480.

EFFECT OF SALINITY ON TRACE ELEMENTS MOBILITY IN GLEYIC PHAEOZEMS

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Soil salinity causes a number of changes such as destabilization of soil structure, increased susceptibility to crusting, deterioration of soil hydraulic properties and also affects trace elements mobility. In the study the effect of the anthropogenic salinity from soda industry plant on the mobility of zinc, copper, manganese, iron and lead in Gleyic Phaeozems (black earths) was investigated.

The study area is located in Kujawy region, in the vicinity of Soda Polska Ciech plant. Soils being under the impact of byproducts – alkaline slurry consisting mainly of $Ca(OH)2$, CaO, $CaCO3$ and $NaCl$, are potentially fertile, but the impact of collected soda waste, is a source of excess soluble salts.

A comparison was made of the availability of trace elements in saline and non saline soils. Soil salinity was estimated by salt contents measured as the electric conductivity (EC) concentration of Na, Ca and Mg cations in soil solution, sodium adsorption ratio (SAR) and exchangeable sodium percentage (ESP). The mobility and concentration of bioavailable fractions of metals were evaluated with the use of DTPA extraction technique. Total metal contents were measured after the mineralization of soil samples in a mixture of concentrated $HNO3$ and $HClO4$ and analyzed using AAS spectrometry. In order to characterize metal speciation and to evaluate strength of metal association with the solid soil phase, soil sequential extraction was used.

The chemical analyses of soil samples showed that calcium-sodium-chloride salinization with elevated alkalinity prevailed in the studied soils. The process of salt accumulation is associated with the change of trace elements mobility, particularly copper , manganese and lead. High pH values of soils influence negatively on availability of essential nutrients such as iron and manganese. Negative statistical correlation was observed between the electrical conductivity and the content of DTPA – extractable Cu and Mn. It was found that high salinity enhance the mobility of lead. This implies that risk related to lead contamination of plants is real in soils with elevated Pb level content.

RAPID ASSESSMENT OF SOIL TEXTURE USING DIFFUSE REFLECTANCE SPECTROSCOPY

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Diffuse reflectance spectroscopy covering the visible and near-infrared ranges is a rapid and nondestructive method to estimate various physical and chemical soil properties (Debaene et al., 2014 a, b). The potential of the method to build a national spectral library for soil texture prediction was evaluated. The spectral library of polish mineral soils was acquired in the 350-2220 nm range of the electromagnetic spectrum with the Veris® spectrophotometer. More than 2500 samples have been scanned and incorporated in the library but only 1500 were used for the present study due to over or low representation of specific soil types. Samples are coming from several IUNG-PIB monitoring projects and experimental stations. The combination of soil spectral and textural data with chemometrics allowed the prediction of sand, silt and clay (according to PTG 2008) with r2 = 0.68; 0.66; 0. 68 and RMSEP = 6.0, 3,9, 1.9 respectively. The results are in accordance with other studies (e.g. Viscarra Rossel & Webster, 2012) proved that diffuse reflectance can be used to predict soil texture at a national scale providing that every type of soil samples are well represented in the soil spectral library.

References

Debaene G., Niedźwiecki J., Pecio A., Żurek A. 2014a. Effect of the number of calibration samples on the prediction of several soil properties at the farm-scale. Geoderma 214-215, 114-125.

Debaene G., Pikuła D., Niedźwiecki J. 2014b. Use of VIS-NIRS for land management classification with a support vector machine and prediction of soil organic carbon and other soil properties. Ciencia e Investigación Agraria 41(1), 21-32.

Viscarra Rossel R.A., Webster R. 2012. Predicting soil properties from the Austalian soil visible-near infrared spectroscopic database. European Journal of Soil Science 63, 848-860.

BIOCHAR OF GRAPE VINE TRUNKS: EFFECT ON WATER PROPERTIES OF MEADOW-CINNAMONIC SOIL

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The potential of biochar to improve soil water retention properties is questionable according to some studies (Jeffery et al., 2015; Ojeda et al. 2015). Lack of effect was related to the properties of biochar materials (e.g. hydrophobicity) and to the technology of their production. The aim of this study was to investigate the effect of biochar produced by pyrolyzing of the grape vine trunks on hydraulic properties of loamy sand meadow-cinnamonic soil. The biochar was produced by double-barrel "Bio-Char" method. After grinding and sieving of the biochar material two size fractions (<1mm and 1-3 mm) were applied in soil samples at two concentrations - 3 $g.kg^{-1}$ и 6 $g.kg^{-1}$. These concentrations correspond to rates of application 4.2 $t.ha^{-1}$ and 8.5 $t.ha^{-1}$. The data for water retention at different suctions and the coefficient of filtration were determined by laboratory methods. The biochar particles did not contribute for formation of soil aggregates which explained the lower values of water retained at suctions -0.25 kPa and -33 kPa (field capacity) in the studied mixtures than in the control variant. The result of applying high rates of studied biochar material with larger particles was 1% lower available water holding capacity due to slightly increasing of water unavailable for plants. The total porosity of the mixtures increased with the application rate on the account of pores with drainage functions. This effect was best pronounced in the variant with application rate 6$g.kg^{-1}$ of biochar (size 1-3 mm). Consequently, the coefficient of filtration in this variant was two times higher than in control variant (2.7 $cm.h^{-1}$). This effect could be beneficial in field conditions for facilitating water transfer in the deeper soil layers.

References

Jeffery, S., Meinders, M.B.J., Stoof, C. R., Bezemer, T. M., van de Voorde, T. F.J., Mommer, L., van Groenigen, J.W. 2015. Biochar application does not improve the soil hydrological function of a sandy soil. Geoderma 251–252: 47–54.

Ojeda G., Mattana St., Àvila A., Alcañiz J.-M., Volkmann M., Bachmann J. 2015. Are soil–water functions affected by biochar application? Geoderma. 249–250: 1–11.

BIOCHAR OF GRAPE VINE TRUNKS - CHARACTERISTICS AND EFFECT ON THERMAL PROPERTIES OF MEADOW-CINNAMONIC SOIL

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The aim of this study was to determine some basic characteristics of biochar produced by pyrolyzing of the grape vine trunks and to evaluate the effect of the amended biochar at different rates on thermal properties of meadow-cinnamonic soil. The studied properties of the biochar material were: pH (9.4), organic carbon content, bulk and particle densities, porosity, hygroscopic water content at 75% relative humidity of the air ($Wh_{75\%}$), water retained at suction -1500 kPa (wilting point) and the energy equivalent (25.9 $kJ.g^{-1}$). After grinding and sieving of the biochar material, two size fractions (<1mm and 1-3 mm) were applied in soil samples at two concentrations - 3 $g.kg^{-1}$ и 6 $g.kg^{-1}$. The thermal properties of the studied variants were estimated using de Vries model (de Vries, 1963). The biochar of grape vine trunks is light material (bulk density 0.275±0.059 $g.cm^{-3}$) with high porosity (83%). The hygroscopic water content ($Wh_{75\%}$) of the biochar was 9.5%, and of studied meadow-cinnamonic soil – about 2% at the same conditions. The water hold at wilting point by biochar was very high – 52.8%w/w (for grinded biochar with size <1 mm) and 165.5%w/w (for size 1-3 mm). The applied rates slightly increased the water retention at this potential in the mixtures (from 4.7%w/w in control to 5.1%w/w for variant 6 $g.kg^{-1}$ biochar with size 1-3 mm). Both estimated thermal properties of the mixtures – thermal conductivity and heat capacity decreased (relatively by 8%) with increasing the rates of biochar application. These changes of thermal properties, due mainly to high porosity of the biochar can reduce to some extent heating of deeper soil layers at field conditions and hence diminish the soil evaporation rates.

References

de Vries D.A. 1963. Thermal properties of soil. In: Physics of Plant Environment (ed. W.R. van Wijk) North-Holland, Amsterdam, 210-235.

TECHNO-ECONOMIC ANALYSIS OF THE PRUNED BIOMASS HARVESTING IN APPLE FRUIT ORCHARD FOR ENERGETIC PURPOSES – A CASE STUDY

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Poland is covered by almost 350 000 hectares of orchards, in which more than 50% are apple trees orchards. It results with the highest apples production in Europe and third place in the world. To maintain high productivity of fruits, the trees must be pruned regularly during the winter-spring period. During that operation some wooden biomass is created, which is treated as a by-product or waste. The owners of the orchards must put some effort to remove these cut branches. Usually, the pruned biomass is mulched or just burned on site. Such treatment is costly and apart of material removal itself, it does not bring any direct financial profits for the farmer. The alternative solution for pruning residues in the apple orchard is their harvesting and selling to the local heat plant. As a result, the farmer obtains additional benefits that supports his main fruit production chain, and the heat producer uses for energy production the renewable source of energy (biomass) coming from regional resources of the community. In the paper a case study for the 100 ha fruit orchard is presented, where the farmer follows the pruning to energy strategy. The harvesting of the pruning residues is realized through out their baling by the baler machinery. The economic analysis based on the NPV and IRR indices indicated that after 10 years the NPV=6150 EUR, and the IRR=13,69%. The calculated payback time (NPV=0) is 7-8 years. The performed sensitivity analysis revealed that the most influencing parameters on the economic analysis are pruning potential, orchard area and pruning residues price at the final user gate. The distance to the final user (up to 20 km) and the labor costs in the orchard have lower impact on the final economic result.

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INFLUENCE OF PULPING AND FREEZE-DRYING TEMPERATURE ON THE PROCESS KINETICS AND SELECTED PHYSICOCHEMICAL PROPERTIES OF KALE

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Vegetables are important source of phytochemicals known to provide health benefits. However, these compounds generally undergo significant degradation during drying because of their sensitivity to heat, oxygen and light. Thus, increased attention should be given to the concerns regarding the quality degradation of kale during drying. Freeze-drying, also denoted as lyophilization, has long been known as the best drying method for preserving the original properties of the dried product. Freeze drying, in particular, preserves higher levels of total bioactive compounds in comparison with air-drying.

The aim of the work was to study the influence of freeze-drying temperature and pulping on the drying kinetics and physicochemical properties of kale (*Brassica oleracea* L. var Acephala). The process of freeze-drying was performed at 20, 40 and 60°C and with a constant pressure in the drying chamber for whole pieces of leaves and pulped leaves. Kinetics the freeze-drying both leaves and pulp of kale was the best described by the Page model. The increasing freeze-drying temperature from 20 to 60°C caused a decreasing the drying time about twofold. The freeze-drying of kale significantly increased the lightness (L*), delta Chroma (ΔC) and browning index, and had little influence on hue angle (HU). The highest increase of L* or and ΔC was observed in the case of pieces of leaves freeze-dried at 20°C. Increasing in the drying temperature caused a slight decrease L*, ΔC and the total color difference. Pulping decreased the L* and the HU, and increased browning index. Freeze-drying caused a slight decrease both total phenolics content (TPC) and antioxidant activity (AA) in comparison to fresh leaves. Temperature of the process and pulping of kale before drying had little influence on TPC and AA. The best quality of freeze–dried kale was obtained at temperature 20° and for unpulped leaves.

PHYSICAL AND ANTIOXIDANT PROPERTIES OF GLUTEN-FREE BREAD ENRICHED WITH CAROB FIBER

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Carob fiber combines two positive nutritional ingredients, namely polyphenols and dietary fiber. There are no reports relating to the production of gluten-free bread (GFB) containing carob fiber. Recent studies were only focused on the production of GFB containing carob flour obtained from bean germ.

The aim of work was to determine the influence of carob fiber addition directly into GFB recipe on physical (including crumb color), and sensorial properties of bread. The antioxidant properties of bread were also studied.

The control bread formulations used in this study were based on: corn, rice and buckwheat flour (35:35:30%). Carob fiber was added in the amounts of 0, 1, 2, 3, 4 and 5 % of the total flour content.

In comparison with control gluten-free bread a significantly larger volume was obtained using 2% of carob. There were no significant differences in the volume of GFB with 2, 3, 4 and 5% share of carob. With an increased content of carob fiber, significant and favorable changes were noted in the color of bread. Lightness and yellowness of bread crumb decreased and redness increased with the addition of carob. Favorable changes in the texture (firmness, elasticity and chewiness) of gluten-free bread crumb under the influence of different quantities of carob fiber were also observed. Elasticity of crumb significantly increased and firmness decreased with 2% carob addition. With respect to the sensory evaluation an acceptable GFB can be obtained by adding 1 or 2% of the carob. The carob fiber addition on the level of 2% in GFB formulation, significantly improved physical properties including volume, texture and color of bread. Besides, carob fiber addition increased antioxidant activity of bread.

The results of the study confirm the possibility of the use of carob fiber in the production of GFB.

EFFECT OF DIFFERENT EDIBLE COATINGS ON THE QUALITY AND SHELF LIFE OF APRICOT DURING COLD STORAGE

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Different edible coatings (Sodium alginate, Chitosan and Gellan gum) with different concentrations were tested individually for shelf-life extension of apricot (*Prunus armeniaca*) during cold storage (4° C ± 0.5 °C) for 21 days. The developed coatings were found to be effective in extending the shelf-life of Apricot. The control samples showed a higher weight loss compared to coated ones. The coated samples showed significantly ($p < 0.05$) higher retention of ascorbic acid, firmness and chlorophyll content, whereas, total phenolic content was found to be significantly ($p < 0.05$) higher in uncoated samples after storage. Gellan gum based coating with a concentration of 0.5% was found to be the most effective treatment in maintaining the quality of fresh apricot fruits during the whole storage period compared to the other coatings.

ESTIMATION OF SATURATED HYDRAULIC CONDUCTIVITY COEFFICIENT USING PORE NETWORK MODELLING

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Three-dimensional modelling has been widely used for fluid flow analysis in porous media (Wildenschild & Sheppard, 2013). Pore network modelling (PNM) as simplified method in comparison to physically valid pore scale modelling is less computationally demanding. Although pore scale phenomena modelling is widely used, validation of these methods are rare. The aim of the study is to compare pore network modelling method with physically accurate modelling - based on real pore media structure and Navier-Stokes model describing saturated flow.

Soil samples have been scanned using X-ray microtomograph to give information about pore space. The samples of soil (of 10mm length and 5mm diameter) were scanned using GE/Phoenix Nanotom 180 X-ray microtomograph with following scan parameters: voxel size – 2,5 µm, X-ray source voltage – 100 kV, X-ray source cathode current – 90 µA.The acquired data was than processed in order to obtain mesh for FVM calculations and pore network for PNM calculations. The FVM calculations were carried out using OpenFOAM software – the open source computational fluid dynamics modelling environment. For physical modelling was used solver based on the Navier-Stokes equations for laminar, incompressible flow. The pore network was extracted from CT images using maximal balls extraction algorithm. The further calculations was made with help of two and single phase pore network modelling code by Valvatne (2004).

In order to compare both modelling methods and validate them experimentally the saturated hydraulic conductivity coefficient was calculated.

References

Wildenschild D., Sheppard A. P. 2013. X-ray imaging and analysis techniques for quantifying pore-scale structure and processes in subsurface porous medium systems. Advances in Water Resources 51, 217–246.

Valvatne H. 2004. Predictive pore-scale modelling of multiphase flow (Doctoral dissertation), retrieved from http://www3.imperial.ac.uk/pls/portallive/docs/1/11280.PDF)

BIOCHEMICAL CHARACTERISTICS OF SILT SOIL UNDER WINTER WHEAT GROWN IN A LONG-TERM SIMPLIFIED TILLAGE

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Soil enzymes continuously playing an important role in maintaining soil ecology, physical and chemical soil properties, and soil health and fertility. Their essential functions in the soil made them an important indicators which have been introduced as a good measure of changes in soil quality. The aim of this research was to evaluate changes in soil under long-term simplified tillage using measurement of soil microbial biomass and enzyme activities in comparison with ploughed soil. Samples of silt soil from long-term experimental fields under winter wheat grown in simplified tillage to 10 cm and conventional tillage with moldboard plough to 25 cm at a private farm in Rogów (Zamość region, Eastern Poland) were collected twice at each vegetation season from the depth of 0-15 and 15-30 cm in the years 2009-2014.

The analyses of soil microbial and biochemical environment included estimations of: microbial biomass C content using F-I method, dehydrogenase system activity (TTC as a substrate), arylsulfatase activity (p-nitrophenyl sulfate as a substrate), and hydrolyzing activity of the soil (FDA as a substrate). Total organic C (Tiurin method) and POM content (Cambardella and Elliott, 1992 modified by Gajda et al., 2001) were estimated once a year. All analysis were made in three replicates. The ANOVA method was used for statistical analysis. Differences were considered as significant at $p<0.05$. The Pearson's correlation coefficients among some properties of soil were calculated. Changes in soil tillage as required for simplified tillage reflected the increase of biochemical activity in silt soil. The trends in microbial population with both tillage treatments were closely paralleled by soil enzyme activities and were also regulated by level of soil organic C. The less disturbing tillage system as simplified tillage enhanced significantly ($p<0.05$) the increase of soil biochemical activity by 25-40%, on average, as compared with ploughed soil. The obtained significant correlations between soil microbial biomass, enzyme activities and total organic C content indicate that resources of organic C in soil environment play an extremely important role in enhancing the microbial population counts, their stabilization and activity, and protection of an extracellular enzymes.

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THE USE OF SEQUENTIAL EXTRACTION FOR ASSESSING ENVIRONMENTAL RISK OF SEWAGE SLUDGE

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The total metal content only reflects the degree of contamination of a particular element of the environment and should not be used as an indicator of risk of biotic part of the ekosystem. Comprehensive assessment of environmental risk by solid industrial waste with containing heavy metals involves examining and evaluating the contribution of different forms and fractions that make up the total content of the metal. Research in the field of fractionation metals, functional speciation and mobility could be possible with procedures of sequential extraction (Zimmerman & Weindorf, 2010).

The sequential extraction of industrial waste from Screw Factory in Łańcut (Poland) was carried out in accordance with the procedure BCR. The content of manganese, copper and zinc was marked in the following fractions, defined as: exchangeable and souble in acids F(1), reducible F(2), oxidizable F(3), residual F(4). The results of the analyses of chemical fractions of metals were compared to the total contents of metals in the studied waste from single-step mineralization process. Determination of metals were performed by the flame atomic absorption spektrometry (FAAS). It was found dominant participation of fraction exchangeable and soluble in acids Mn and residual for Pb and Zn. Evaluation of mobility of studied metals in systems waste – solution was caried out. Metals fractions which are able to migrate in environmental conditions (exchangeable and soluble in acids fraction) comprise from 11.2% (Pb), 11.9% (Zn) to 39.5% (Mn).

References

Zimmerman A. J. and Weindorf D. C. 2010. Heavy Metal and Trace Metal Analysis in Soil by Sequential Extraction: A Review of Procedures. International Journal of Analytical Chemistry 1-7.

MICROWAVE-ASSISTED SEQUENTIAL EXTRACTION AND SPECIATION OF SELECTED METALS FROM THE ASH FROM BIOMASS COMBUSTION

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In recent years, there has been an increased interest in the possibility of using microwave-assisted extraction techniques (MAE) in environmental studies. The MAE process utilizes the phenomenon of direct absorption of microwave radiation by particles of the substance. The use of techniques MAE in the sequential extraction allows to reduce amount of reagents used, costs, amount of waste produced and significant shortening of analysis time, depending on the subject of research (Reid et al., 2011).

The sequential extraction of industrial ash from biomass combustion from power station in Arłamów (Poland) was carried out in accordance with the conventional procedure according to Tessier (Tessier et al., 1979) and microwave-assisted extraction. The content of Cu, Mn and Zn was marked in the following fractions, defined as: soluble in water, exchangeable, carbonate, oxide, organic and residua. The results of chemical fractions analyses were compared with the total content of metals in analyzed ash received with one-step mineralization. Determination of metals was performed with the use of atomic absorption spectrometry with atomization in flame (FAAS). In order to determine the effect of microwave radiation on the course of sequential extraction the results of conventional method and microwave-assisted extraction were compared. It has been found that the use of MAE technique shortens the time of analyses speciation of metals in the ash from biomass with simultaneous higher extraction efficiency and reducing the effects of unfavorable phenomenon of readsorption extracted metals on the surface of the ash.

References

Reid M. K., Spencer K. L., Shotbolt L. 2011. An appraisal of microwave-assisted Tessier and BCR sequential extraction methods for the analysis of metals in sediments and soils. Journal of Soils and Sediments 11, 518-528.

Tessier A., Campbell P. G. C., Bisson M. 1979. Sequential extraction procedure for speciation of particular trace metals. Analytica Chemica Acta 51, 844 – 851.

DETERMINATION OF STRUCTURAL BIODIVERSITY AND METABOLIC PROFILES IN SOIL UNDER LONG-TERM MONOCULTURE OF MAIZE

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Microbial diversity in soil may be limited under natural conditions by inappropriate environmental factors such as: limited food resources, environmental and physical factors, tillage system and interspecies interactions prevent the occurrence or maintenance of the species in the environment (UNEP…2003; Kozich & al. 2013). The aim of this work was to determinate structural biodiversity and functional microorganisms in in soil under long-term maize monoculture. The reaction of maize cultivated in perennial monoculture for the direct sowing was investigated and compared to full tillage monoculture and crop rotation full tillage cultivation in the following phases: six leaves, twelve leaves, flowering phase, before harvest and after harvest. Three objects were included into this research: maize cropped continuously monoculture - zero tillage, maize monoculture cropped continuously – full tillage, crop rotation (spring barley, winter wheat, maize) – full tillage. The evaluation of the structural biodiversity of the soil was based on the PCR-DGGE methods and next-generation sequencing (NGS). The functional and metabolic profiles in soil were determined by Biolog EcoPlate System. The research methods used in this subject have contributed to a better understanding of genetic diversity and composition of the population of microorganisms in the soil environment under the influence of the changes that have taken in soil under long-term maize monoculture.

References

UNEP/CBD/SBSTTA/7/12. 2003. Developing indicators for national-level monitoring of biodiversity. Montreal.

Kozich, J.J., S.L. Westcott, N.T. Baxter, S.K. Highlander and P.D. Schloss. 2013. Development of a dual-index sequencing strategy and curation pipeline for analyzing amplicon sequence data on the MiSeq Illumina sequencing platform. Appl Environ Microbiol 79: 5112-5120.

Bartram, A.K., M.D. Lynch, J.C. Stearns, G. Moreno-Hagelsieb and J.D. Neufeld. 2011. Generation of multimillion-sequence 16S rRNA gene libraries from complex microbial communities by assembling paired-end illumina reads. Appl Environ Microbiol 77: 3846-3852.

CHANGES OF ENZYMATIC ACTIVITIES AND MICROBIAL COMMUNITIES IN SOIL UNDER LONG-TERM MAIZE MONOCULTURE AND CROP ROTATION

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Cultivation of plants in monoculture can lead to adverse changes in the soil environment, related to the reduction of soil microbial diversity, as well as limiting the impact on crop yield (Adamiak & Adamiak 2015). Long-term crops plants in monoculture induces and accelerates soil degradation processes that can lead to a reduction in the number of micro-organisms of the soil environment and the decline in organic matter (Bowles i in. 2014). The cultivation of maize in monoculture in no-tillage system in the conditions of our country is a good alternative but requires further systematic research on system factors: climate-soil-plant. The aim of this work was to examine effects of long-term maize monoculture and crop rotation on biological activities of soil especially soil enzymatic activities and microbial communities. The reaction of maize cultivated in perennial monoculture for the direct sowing was investigated and compared to full tillage monoculture and crop rotation full tillage cultivation in the following phases: six leaves, twelve leaves, flowering phase, before harvest and after harvest. The results of the experiment conducted from 2004 to 2012 in Experimental Station in Grabów (mazowieckie voivodship) on podzolic soil – very good rye soil, were the basis for this elaboration. Three objects were included into this research: maize cropped continuously monoculture - zero tillage, maize monoculture cropped continuously – full tillage, crop rotation (spring barley, winter wheat, maize) – full tillage. The evaluation of the biological activity of the soil was based on the determination of the number of basic groups of soil microorganisms and enzyme activities. The maize was sown with the use of seed drill. The statistically significant increase in soil enzymatic activity and total number of bacteria and actinomycetes in soil where the direct sowing in monoculture was implemented.

References

Adamiak E., Adamiak J. (2015): Changes of the chosen chemical properties of soil as a result of long-term cereal cultivation in crop rotation and monoculture. Acta Scientarum Polonorum Agricultura, 14(1): 3-10.

Bowles T.M., Acosta-Martínez V., Calderón F., Jackson L.E. (2014): Soil enzyme activities, microbial communities, and carbon and nitrogen availability in organic agroecosystems across an intensively-managed agricultural landscape. Soil Biology and Biochemistry, 68: 252–262.

ZINC AND STRONTIUM IONS AS CROSS-LINKING AGENTS OF PECTINS

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Pectins belong to a group of polysaccharides which can be found in the middle lamella and the primary cell walls of higher plants (Cybulska et al., 2015). One of the most important properties of pectins is binding ability of divalent metal ions, for example calcium ions. The low methoxy pectins (DE<50%) gel in the presence of these ions. Mechanism of gel formation is connected with the "egg-box" model. Formation of junction zones is related to the interactions between calcium ions and non-esterified galacturonic acid residues (Ngouémazong et al., 2012). It can be assumed that other divalent metal ions bind to galacturonic acid residues of pectin chains according to the "egg-box" model. The aim of this study was to present the results of rheological measurements and analysis of FT-IR spectra of system composed of diluted alkali soluble pectins (DASP) fraction and zinc or strontium ions. A significant increase of viscosity of pectin solutions with addition of zinc ions and strontium ions compared to pectin solution without these ions (the control) was observed. According to parameters of power law model these solutions have been classified to pseudoplastic fluids. Analysis of the FT-IR spectra showed shifts of bands connected with the stretching vibrations of C-C and C-O in ring, C-O in carboxyl group and asymmetric stretching vibrations of COO^- in zinc ions (strontium ions)-pectins system in comparison with the control. These results may indicate cross-linking of pectins by zinc and strontium ions.

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References

Cybulska J., Zdunek A., Kozioł A. 2015. The self-assembled network and physiological degradation of pectins in carrot cell walls. Food Hydrocolloids 43, 41-50.

Ngouémazong D. E., Tengweh F. F., Fraeye I., Duvetter T., Cardinaels R., Van Loey A., Moldenaers P., Hendrickx M. 2012. Effect of de-methylesterification on network development and nature of Ca^{2+}-pectin gels: Towards understanding structure-function relations of pectin. Food Hydrocolloids 26, 89-98.

INFLUENCE OF ORGANIC ADDITIVES AND PLANT CULTIVATION ON SURFACE LAYER OF LANDFILL AFTER THE OZOKERITE PROCESSING IN BORYSŁAW, UKRAINE.

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The unsuitability of the ground for the plants of landfill waste of ozokerite in Borysław is caused not only by direct occurrence of PAHs and other petroleum substances, but also by unfavorable water and air conditions (Puchalski et al., 2014). As a result of destabilization of soil colloids and poor structure the density of the solid phase is increased. The three-factorial three-year field experiment was established by means of sub-blocks (split-plot) in triplicate, the organic additives were introduced into the ground only ones before foundation of the experiment in 2013 – preliminary experiment and and consequent experiment in 2014 and 2015. Experimental objects – micro-plots were square-shaped with an area of 1 m^2.

The examined factors were:

I – type of additive: bovine manure (OB), subsoil after champignon cultivation (PP), sewage sludge from municipal treatment plant (OK), sawdust of deciduous trees (T). II - level of additive applied: 4,8 and 12 % v/v against control object.

III- test plant species: (yellow lupine - *Lupinus luteus L.,* ryegrass - Arrhenatherum elatius L., cocksfoot - Dactylis glomerata L. and white clover - Trifolium pratense L.). During the vegetation plants observations and measurements were carried out and collected plant material and soil were subjected to laboratory analysis. Furthermore, in the autumn of each year of the study soil compaction was determined under field conditions. Used additives and crops have improved soil characteristics that enabled the growth and development of plants in some combinations of experiment, but their vegetation differed from plants cultivated on agricultural soils. The addition to the landfill ground sawdust caused a small effect compared to the control only in a preliminary experiment, perennial plants in the objects with sawdust and on the control objects did not resume spring vegetation. Other additives clearly affected the condition of the soil, vegetation and the production of plant biomass.

References

Puchalski Cz., Wołoszańska S. J., Gąsior J., Senkiw W. 2014. Reclamation of landfill from potassium fertilizers production in Stebnik and mining the deposit and ozokerite (earth wax) cleaning in Borysław. Wyd. KGChŚiH UR, 55

DETECTION OF POLLUTANTS IN APIARY PRODUCTS USING RADIOLOGICAL METHODS FOR THE NATIONAL ENVIRONMENTAL MONITORING NETWORK IN HUNGARY

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It is it well knows that apiary products contain numerous elements of the periodic system. The biological role of most of them is not clear. The main reason for this is that these elements are found in very small amounts (microelements). Therefore the traditional chemical laboratory procedures are inadequate to determine the quality of apiary products and it is necessary to turn to the significantly more reliable methods of radiological measuring. The uncovering of external pollutions and their elimination is independent of the direct pollutions. This task requires the setting of environmental issues. The fact that bees are rarely farther than 5km from their hives, the environment, and the position of the hives are all issues that affect both the quality and the quantity of the honey produced. Thus far studies show that the bee, serving as a special biological indicator, is suitable for the establishment of a monitoring network in order to control environmental pollution.

ANTHROPOGENIC AND CLIMATE FACTORS EFFECTS ON CARBON POOLS IN FEN PEATLANDS IN THE GRÓJECKA VALLEY (CENTRAL POLAND) – A CASE STUDY OF 10 YEARS OBSERVATION

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The Grójecka Valley is located in the eastern part of the Wielkopolska Voivodeship, central Poland. At the turn of 60-s and 70-s fen peatlands occurs here, were drained for agriculture use, pastures and meadows in particular. Additionally the aggravation of local hydrological conditions since 1980, were caused by brown coal open-cast mining industry (KWB Konin). As a result of brown coal mining, large area of fen peatlands in the Grójecka valley are within the impact of the depression cone. Moreover, the Grójecka Valley is located in the zone of the most unfavorable weather conditions in terms of precipitation in Poland. The aim of this study was to improve knowledge about current state of peatland affected by human impact and enhancing our understanding of the links between climate change and anthropopressure effect on carbon losses from agro-managed peatlands. The research transect (twelve study sites) were established along the Grójecka Valley. Field study included the climatic conditions observation, soil morphology, hydrological conditions and soil samples collection for laboratory analysis took place in the year 2005 and 2015. Obtained results showed significant decreases of the carbon pools in the surface soil layers. Moreover, a clear decrease in the thickness of the organic soil layers even up to 20-30 cm, during the 10 years observations was noticed. Also, complementary soil physicochemical analysis confirmed progressive degradation of the study soils. This situation might be stimulate by the external factors like, groundwater level and climatic factors. In the time period from 2005 to 2015 very low rate of precipitation was observed in the study area (296 - 546 mm). Low external income of water might affected the groundwater level, which dropped even by 1 meter in the study period of time. Observed changes in hydrological conditions might also be caused by brown coal mining (cone of the depression).

INFLUENCE OF EXTRACTION METHOD ON THE QUANTITY AND QUALITY OF ESSENTIAL OILS FROM SELECTED HERBAL RAW MATERIALS

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In recent years the usefulness of the new methods of isolating essential oils from plant materials is verified. Use of microwaves to extract essential oil from the raw material is a new and promising innovative technology. Currently several modifications of this method such as Compressed Air Microwave Distillation, MicroWave HydroDistillation, Microwave Steam Distillation, Solvent-Free Microwave Extraction, Microwave Hydrodiffusion and Gravity are known.

The aim of the study was to determine the impact of different essential oil isolation methods from four species of aromatic plants (basil, caraway, sage and thyme) on the quantity and quality of the obtained essential oils. Two extraction methods were used: hydrodistillation and solvent-free microwave extraction (SFME). The objective of the studies was also the preliminary optimization of SFME (diversified extraction time and the power of the microwave irradiation). The chemical composition of the obtained essential oils was examined by gas chromatography and high performance thin layer chromatography (HPTLC). The extraction yield and composition of essential oils from selected aromatic plants depended on the method and parameters of SFME.

Efficiency of extraction of essential oils from aromatic plants selected and their composition depend on the method and parameters of the extraction solvent-free microwave. The use of different parameters of extraction can be used for profiling the composition of the essential oil. Solvent-free microwave extraction allows much faster isolation of essential oils.

THERMOGRAPHY AND HYPERSPECTRAL IMAGING OF THE TOBACCO MOSAIC VIRUS INFECION

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Tobacco mosaic virus (TMV) infects plants of Solanaceae family. The infection may cause characteristic patterns on the leaves which are caused by local necrosis. The aim of the study was to evaluate the thermography and hyperspectral imaging as a non invasive methods for the detection of presymptomatic changes caused by tobacco mosaic virus (TMV) on three genotypes of *Nicotaiana tabacum*, which differ with the levels of resistance to infection. This methods are especially valuable for early detection of biotic stresses (Baranowski et al., 2009). The material consisted of 30 plants at the same stage of development (8 weeks). In the experiment two variants were created: 1) non inoculated plants, 2) plants inoculated with TMV. The thermography analysis were performed using the camera SC620, MWIR range (8-13µm), (FLIR Systems, Inc., USA); hyperspectral imaging was done using VNIR camera (400-1000 nm) with spectrometer ImSpector V10E and SWIR camera (1000-2500nm) with spectrometer N25E 2/3", (SPECIM, Finland).

Thermography imaging differentiated tobacco plant due to TMV infection. The method of hyperspectral imaging enables us to observe the rate of pathogen expansion. The differentiation of VNIR spectra within infected and healthy tissues of the leaves were found to be a good indicator of the physiological status of the plant and can be used to early detect the occurrence of TMV infection.

References

Baranowski, P., Mazurek, W. 2009. Temperature changes of oilseed rape (*Brassica napus*) leaves infected by fungi of *Alternaria* sp., Oilseed Crops, 30, 21-33.

THE INFLUENCE OF ORGANIC MATRIX PRESENT IN ENVIRONMENTAL SAMPLES ON DETERMINATION OF BISMUTH AND INDIUM IN SUCH SAMPLES

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One of the crucial factors affecting agriculture is quality of soils, and consequently quality of environmental water, which dynamically influences movement of pollution. Contaminants in environmental water samples can have different chemical characteristics and, in a preliminary classification, they can roughly be divided into organic, inorganic and metal species pollutants. Monitoring of each of them is necessary to full control and estimation of quantity of natural water samples. Unfortunately, the determination of one of them is very often disturbed by another one. In this paper attention will be focused on influence of organic substances on trace elements determination.

Stripping voltammetry is one of the most favorable techniques for the determination of trace elements because it offers highly sensitive detection with low-cost portable instrumentation and is simple, reliable and easy to use. It is known that the main disadvantage of voltammetric measurements is connected with the presence of organic substances in the matrix of natural samples. During the voltammetric measurement even low concentration of organic substances can cause a decrease or total decay of the analytical signal.

In this communication, we report how the organic matrix, such as surface active substances and humic substances influence the simultaneous bismuth and indium voltammetric determination. Additionally the influence of other ions potentially present in natural samples on bismuth and indium determination was precisely studied.

SINGLE PIECE ALL SOLID STATE CO(II) ION-SELECTIVE ELECTRODE FOR COBALT MONITORING IN REAL SAMPLES

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Cobalt is essential for life element widely distributed in nature. It is component of vitamin B_{12} and only in this form it is desirable for human body. The maximum dietary tolerable level of it for common livestock species is 10 ppm, whereas the toxic intake is 500 mg. The range of concentration between the essentiality and toxicity of cobalt is narrow, and hence rapid and selective methods of its monitoring are needed.

In this work single piece all solid state ion-selective electrode (SPISE) sensitive to Co(II) ions is described. SPISE refer to a type of ISEs in which the electroactive membrane is in direct contact with the internal reference electrode and contains no internal solution. Proposed electrode is based on the concept second kind Ag/AgCl electrode. In order to determine and stabilize potential of this electrode ionic liquid in chloride form is used. The electrode with the membrane composition: ionophore: ionic liquid: PVC: plasticizer in the percentage ratio of (wt.) 1:3:33:63 exhibited the best performance, having a slope of 31.8 mV/decade in the concentration range 1×10^{-7}-1×10^{-1} M. The limit of detection is 5.6×10^{-8} M. It has a fast response time of 5-7 s and exhibits stable and reproducible potential. The response of proposed sensor does not depend on pH in the range 3.8-8.0 and shows a good discriminating ability towards Co^{2+} ion in comparison with some alkali, alkaline earth, transition and heavy metal ions. Described Co-SPISE was successfully applied as an indicator electrode in potentiometric titration of Co^{2+} ions and for direct determination of cobalt in beer and natural water samples.

STIMULATORY IMPACT OF VARIOUS APPLICATIONS OF INNOVATIVE BIOLOGICAL AGENTS APOL-HUMUS AND STYMJOD ON DEVELOPMENT AND PHYSIOLOGICAL ACTIVITY OF JERUSALEM ARTICHOKE GROWN FOR ENERGY BIOMASS

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The effects of the new generation biostymulators, Apol-Humus (Poli-Farm Sp. z o.o.) and Stymjod (Jeznach Sp.J.), applied to bulbs or soil on germination, growth of roots and shoots and physiological activity in Jerusalem artichoke (topinambour; *Helianthus tuberosus* L.) plants were studied, in order to elaborate the ecological technology of this species cultivation for energy biomass.

Apol-Humus and Stymjod, applied to bulbs or to soil in modified Phytotoxkit plates, increased germination, growth of roots and shoots and activity of several physiological events having the crucial impact on plant development and biomass production: activity of dehydrogenases, RNase, acid or alkaline phosphatase and nitrate reductase. The improved growth of roots, shoots and leaves was associated also with the increased physiological activities in leaves, such as: index of chlorophyll content, net photosynthesis, transpiration and stomatal conductance, coupled with a decreased intercellular CO_2 concentration. These advancements were depended on applied biological compound and their dosages. Once soil application of Apol-Humus to soil was more beneficial than its application to bulbs. Stimulating effect on the plant growth could be caused by humic acids and chitosan polymers contained in Apol-Humus, and by iodine, macro- and micronutrients included in Stymjod. The obtained results indicate the possibility to increase the biomass production of Jerusalem artichoke using Apol-Humus and Stymjod, although the elaboration of their ecological treatment technology needs a further research including evaluation of its effectiveness in different field condition, as it was also found in corn production (Grzesik et al 2016).

References

Grzesik M., Romanowska-Duda Z., Janas R. 2016. Apol-Humus, Stymjod and microalgae as a source of biologically active compounds for enhancing physiological activities, germination and growth of plants. Proceedings of the 13th International Conference Microelements in Agriculture and Environment. Kudowa -Zdrój, 21-24.06.: s.97.

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INFLUENCE OF LIMING AND MINERAL FERTILIZATION ON MOLYBDENUM CONTENT IN POTATO TUBERS *(SOLANUM TUBEROSUM L.)* AND GREEN MATTER OF FODDER SUNFLOWER *(HELIANTHUS ANNUUS L.)* CULTIVATED ON LOESSIAL SOIL

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The influence of liming and mineral fertilization on molybdenum content in potato tubers and green mass of fodder sunflower cultivated in four and three rotations respectively on loessial soil in a static experimental field on Rzeszow Foothills were studied. Before establishment the experience (1986), bulk density of soil amounted 1.405 Mg m^{-3}, porosity 45.33 m^3 (100 m^3)$^{-1}$, water content at $pF_{2.0}$: 24.17 kg (100 kg)$^{-1}$, content of Mo soluble in 1 mol HCl dm^{-3}: 0.07 mg kg^{-1}. Mineral NPK fertilizing was used on a background of constantly fertilizing Mg or Ca and Mg (liming). Basic doses of mineral fertilizers were as follows: N1 = 120 kg N, P1 = 43.6 kg P, K1 = 132.8 kg K ha^{-1} - potato and N1 = 100 kg N, P1 = 34.9 kg P, K1 = 99.6 kg K ha^{-1} - fodder sunflower. Liming was applied at a dose of 4 Mg CaO ha^{-1}. The content of molybdenum in plants was determined colorimetrically using thiocyanate.

The average content of molybdenum in potato tubers was 0.29 and 0.32 mg kg^{-1} DM in the not limed and limed object, in the green mass of sunflower: 0.98 and 1.57 mg kg^{-1} DM respectively. Liming increased molybdenum content in the green mass of sunflower, but did not affect the content of this element in potato tubers. Positive impact of liming on the Mo content in plants may be due to increased solubility of this element with increasing pH (Chaney, 2012, Gupta et al., 2008). Mineral fertilization increased the molybdenum content in the green mass of fodder sunflower in most cases and often in potato tubers, compared to the subject without NPK fertilization. The interaction of liming and mineral fertilization revealed an increase in the molybdenum content in the green mass of fodder sunflower grown on limed objects.

References

Chaney R.L. 2012. Food Safety Issues for Mineral and Organic Fertilizers. Advances in Agronomy 117, 51-116.

Gupta U.C., Kening W.U., Siyuan L. 2008. Micronutrients in Soils, Crops, and Livestock. Earth Science Frontiers 15(5), 110–125.

SELECTED PHYSICAL PROPERTIES OF VARIOUS DIESEL BLENDS

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For biofuels quality determination is necessary to know basic chemical and physical parameters. From physical parameters are very important rheological, thermal and electrical parameters. Methods and results of direct thermal properties measurements of biofuels are presented by many authors, e.g. Machado et al. (2012). Temperature dependences of density and kinematic viscosity for petrol, bioethanol and their blends were measured by Kumbár & Dostál (2014). The electrical conductivity can be used at the content of some components, impurities and other parameters in liquid fuels determination (Prieto et al., 2008). Samples of fuels had RME (Rapeseed Methyl Esters) content in the range from 3 % to 100 %. There were measured basic thermophysical parameters as: thermal conductivity, thermal diffusivity by two different transient methods – Hot wire (HW) method and Dynamic plane source (DPS) method. Every thermophysical parameter was measured 100 times by HW method and DPS method for each sample of diesel with different RME content.

Dynamic viscosity was measured during heating process in temperature range (20 - 80) °C. For dynamic viscosity detection was used digital rotational viscometer Brookfield DV 2T. The principle of viscometer measurement is based on dependency of sample resistance against the probe rotation.

Electrical conductivity was measured by Digital conductivity meter Model 1152 in temperature range (-5 ÷ 30) °C.

The highest values of thermal parameters had sample of diesel with the addition of highest content of RME. Dynamic viscosity of samples increasing with higher concentration of bio component RME. Also the electrical conductivity of blends increases with the content of biodiesel.

References

Kumbár, V., Dostál, P. 2014. Temperature dependence density and kinematic viscosity of petrol, bioethanol and their blends. Pak. J. Agri. Sci. 51(1), 175 – 179.

Machado, F.A.L., Zanelato, E.B., Guimarães, A. O., E da Silva, C., Mansanares, A.M. 2012. Thermal properties of biodiesel and their corresponding precursor vegetable oils obtained by photopyroelectric methodology. Int. J. Thermoph., 33 (10), 1848 – 1851.

Prieto, L.E.G., Sorichetti, P.A., Romano, S.D. 2008. Electric properties of biodiesel in the range from 20 Hz to 20 MHz. Comparison with diesel fossil fuel. International Journal of Hydrogen Energy, 33, 3531-3537.

DISTRIBUTION OF STATIC LOAD OF GRAIN BEDDING ON BOTTOM OF SHALLOW MODEL SILO

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The profile of wall pressure in the shallow silo is nearly linear, and consequently it is recommended to be calculated as the hydrostatic pressure. Contrary to widely accepted assumption the vertical pressure on silo bottom is not constant and may depend on filling procedure.

The objective of reported study was to determine experimentally the effects of the filling method on the radial distribution of the vertical pressure on the flat floor of a shallow model silo. The model silo was 0.61 m in diameter and 0.6 m high. The flat bottom was divided into five concentric rings of equal surface area, each of them supported on three load cells with angular separations of 120°. The experimental setup allowed for determination of the distributions of the vertical pressure on the bottom rings and the vertical tangent stress on the wall. Three filling methods were applied: central, circumferential and distributed. Seeds of five varieties were used: horse bean, field pea, heat, vetch, and rapeseed. Vertical pressure on the bottom of shallow bin was found to be influenced by filling method and seed variety. A significant dip of vertical pressure in middle radial location was observed for all bigger seeds. In the case of the smallest seed (rapeseed) the almost linear increase in vertical pressure with increasing proximity to the wall for central filling, and the decrease in the case of circumferential filling was observed. Wall friction was mobilized in the highest degree in the case of central filling and in the lowest degree in the case of circumferential filling.

BIOMETRIC AND PHYSIOLOGICAL TRAITS OF SELECTED BREEDING LINES AND SPECIMENS OF ROYAL PAULOWNIA (*PAULOWNIA TOMENTOSA* STEUD.) AS A POTENTIAL RENEWABLE ENERGY WOODY CROP

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Royal paulownia (*Paulownia tomentosa* Steud.) is native to western and central China. It is fast-growing deciduous tree, which is characterized by high biomass production. Because of the unique plant advantages like rapid growth, low humidity of biomass and high ability of shoots regeneration this species is cultivated in south and west Europe now. However, almost nothing is know about the possibility of its cultivation in Poland.

The aim of the presented study was to evaluate plant growth, winterhardiness and then to assess the suitability of royal paulownia as an energy crop in south-east Poland. Thirteen breeding lines (each consisted of 36 specimens) obtained from seeds of different origin were compared in field experiment established on organic low peat soil in Świlcza near Rzeszów in 2014. The significant differences in the growth intensity of studies lines and specimens were found. Two-year old plants of strongest breeding lines ('LuP', 'We', 'LuD') developed approximately 3 shoots of a length close to 2 m and diameter of the shoot base about 3 cm. However, the specimens with much stronger growth were found. The 10 biggest plants developed approximately 5 shoots (> 2,5 m) and ca 5 cm base shoot diameter. The length of the leaf blade of these specimens was about 44 cm whereas width – 55 cm. The length and diameter of shoots were significantly and positively correlated with fresh weight of shoots and leaves. Most of the plants (about 80%) well wintered. However, strong differences among breeding lines were found as, depending on the line, the number of dead plants ranged from 3 to 39%. Nevertheless, due to the mild last two winters it is difficult to assess the real winterhardiness of plants. In order to evaluate the physiological state of the plants the measurements chlorophyll fluorescence and the content of chlorophyll a and b were made.

As the tested breeding lines and specimens were different in the respect of growth intensity and winterhardiness it is should be feasible to select the valuable genotypes well adapted to the polish climate. Thus in the near future the royal paulownia has a chance to become an alternative source of energy crop in Poland.

NITROGEN TRANSFORMATIONS IN ECTOHUMUS HORIZONS OF FOREST SOILS AFTER CLEAR-CUTTING

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Clear cutting can cause very strong disturbance in the functioning of the forest ecosystem. This type of management leads to reduction the thickness of organic levels and increases organic matter transformations, particularly C and N cycling. Coniferous stands are generally N-limited ecosystems, but there is a risk of nutrient leakage after clear-cuting (Hedwall et al., 2013). Nitrogen mineralization results in accumulation of ammonium–N and nitrate– N, due to stopping their uptaking by roots. Increased ammonium level in the soil favor forming easily leachable nitrates, which can be transported to groundwater (Bergholm et al., 2015; Smolander et al., 1995). The aim of this study was to evaluate the effect of clear-cutting in coniferous forest on the changes of mineral forms of N in the ectohumus horizons of soils from the lowlands and mountain areas. The investigations were carried out in a laboratory incubation experiment in the controlled conditions (temperature 16^{o}, and humidity 50%). Soils in the experiment were described as podzols in the lowland and acid cambisols in the mountain region. In both regions they had acid reaction. Samples for analysis were taken form the fresh material, directly after sampling and after 30, 60 and 90 days of incubation. Significant increase of N-NO3 in Oie horizons was observed in the soils from the mountain regions after clear-cutting till the end of the experiment. An increase of ammonia N was also observed in these samples but only till 60th day of the incubation. In the lowlands initially a decrease of nitrates was observed and while after 60th day of the experiment an increase of the N-NO3 content was observed.

References

Bergholm J., Olsson B.A., Vegerfors B., Persson T. 2015. Nitrogen fluxes after clear-cutting. Ground vegetation uptake and stump/root immobilisation reduce N leaching after experimental liming, acidification and N fertilisation. Forest Ecology and Management, 342, 64-75.

Hedwall P.-O., Grip H., Linder S., Lövdahl L., Nilsson U., Bergh J. 2013. Effects of clear-cutting and slash removal on soil water chemistry and forest-floor vegetation in a nutrient optimised Norway spruce stand. Silva Fennica, 47, no.2, article id 933.

Smolander A., Kitunen V., Priha O. and Malkonen E. 1995. Nitrogen transformations in limed and nitrogen fertilized soil in Norway spruce stands. Plant and Soil, 172, 107-115.

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IMPACT OF THE SUGAR INDUSTRY WASTE ON CONTAMINATION OF JERUSALEM ARTICHOKE TUBERS BY PATHOGENIC MYCOFLORA

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Jerusalem artichoke (*Helianthus tuberosus* L.) is one of the promising crops grown for energy biomass, as well as for food and medicine purposes. One of the most feared disease of this plants grown in Poland and other countries of the temperate zone is *Sclerotinia sclerotiorum*. The perpetrator of this disease is a fungus *Sclerotinia sclerotiorum* (Anamorph. Whezelinia scleriotiorum). The symptoms of this disease can occur on all parts of plants, causing premature dying of plants. Therefore, a lot of research are conducted round the world to find the effective methods of protection against this disease in plantations of Jerusalem artichoke (Royle & Hubbes 1992, Royle & Ostry 1995. Rodriguez et al. 2000, Koike 2004).

The presented study assessed the effect of the application of selected methods of waste from the sugar industry on the qualitative and quantitative composition of mycoflora on Jerusalem artichoke grown in laboratory, greenhouse and field conditions. Preliminary results indicate the colonization of the aboveground parts of Jerusalem artichoke and tubers by mushrooms of the genus *Sclerotinia*, *Fusarium*, *Alternaria* and *Botryti*s. The spectacular protective effects were obtained for Jerusalem artichoke tubers, after the application of the waste from the sugar industry which have been used as a bio-fertilizer. The effects were dependent on the waste concentration and the method of application.

References

Koike S.T. 2004. Sauthern blight of jerusalem artichoke caused by *Sclerotinia rolfssi* in California. Plant Dis. 88, s. 769.

Rodriguez M.A., Venedikian N., Godeas A. 2000. Fungal populations on sunflower (*Helianthus annuus*) anthosphere and their relation to susceptibility or tolerance to *Sclerotinia scleritiorum* attack. Mycopathologia 150: 143–150.

Royle D.J., Hubbes M. 1992. Diseases and pest in energy crop plantations. Biomass and Bioenergy 2: 45–54.

Royle D.J., Ostry M.E. 1995. Disease and pest control in bioenergy crops poplar and willow. Biomass and Bioenergy 9: 69–79.

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CHANGES IN THE COMPOSITION OF THE PERIPHYTON IN LUBLIN WWTP DEVICES

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The activated sludge work is supported by periphyton organisms expanding in all main devices of the wastewater treatment plant (WWTP). Until now, no comprehensive analysis of the occurrence of morphological groups in the periphyton of wastewater treatment devices has been performed.

The aim of this study was to identify the organization of periphyton in the successive stages of the WWTP in Lublin (Poland). The research material was taken from 11 points - devices of the municipal "Hajdów" WWTP (Figure 1.): 1. pre-screen chamber, 2. post-screen chamber, 3. pre-grit separator chamber, 4. post-grit separator chamber, 5. primary clarifier, 6. anaerobic bioreactor chamber, 7. anoxic chamber, 8. aerobic bioreactor chamber, 9. bioreactor outlet, 10. secondary clarifier, 11. channel discharging to the receiver.

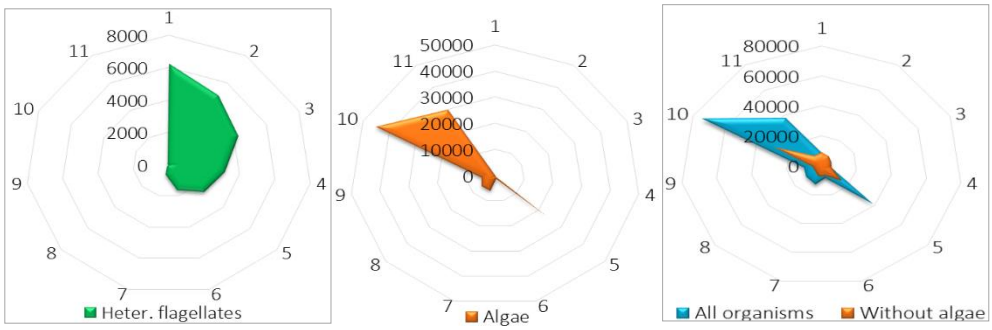

Figure 1. Number of specimen of organisms WWTP in Lublin (individuals/cm^3)

The structure of the periphyton changes in the devices of the technological wastewater treatment system was observed. Heterotrophic flagellates are the dominant organisms in the periphyton present in the mechanical treatment parts (no. 1-4). The dominance of algae is the specificity of the periphyton in the no. 5, 10 and 11. In devices with small turbulence of the sewage stream, the periphyton abundance was higher than that in facilities characterized by turbulent flow.

CLIMATE CHANGES AND IMPACT ON YIELDING OF SELECTED PLANTS

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Climate changes create serious problems for agriculture, which is, like no other economic sector, vulnerable to climate impacts, especially in relation to temperature and precipitation. This results from the biological character of production processes in agricultural economy. Every climate change leads to serious problems in agriculture, necessitating the search for new solutions and new production methods.

Analysis of agroclimatic conditions in the last few years as well as the conditions predicted for Europe for the next decades shows that agriculture is subjected to a growing climatic risk. There is a danger of increasing frequency of years with unfavourable climatic conditions and thus - of increasing yield changeability. It poses a major challenge for proper farming and stability of agricultural markets.

In Poland the research on climate changes influence on yields was conducted mainly with the use of empirical statistical models developed for Polish conditions, taking into account the threats to agriculture caused by extreme natural phenomena. Such models do not require detailed data regarding environmental conditions or cultivation technology, but only agrometeorological characteristics correlated with the yield obtained. Prognostic models are widely used as an assessment tool for the expected climate changes as well as their global, national and regional impact. Application of the selected (local) scenarios would enable the assessment of the positive and negative climate change influence on development and productivity of plants and may provide a basis for creating a realistic programme of adaptation to climate changes at farm level (e.g. treatment schedule).

ENZYMATIC ACTIVITY IN THE SOIL DEGRADED BY THE SULPHUR INDUSTRY, IN THE SECOND YEAR OF TREATMENT WITH VARIOUS WASTES

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An example of strong anthropopressure exerted by humans on the soil is the sulphur borehole mining with the Frasch underground recovery method.

The investigations were conducted in order to assess of the biological effects of two-year remediation of soil degraded by sulphur mining. We evaluated the trend and intensity of changes in the activity of some enzymes induced by the effect of post-floatation lime, sewage sludge, and mineral wool.

The experiment was set up in the area of a former "Jeziórko" Sulphur Mine (Poland, Podkarpacie region) on a soil-less substrate with a particle size distribution of slightly loamy sand. The experimental variants consisted in application of different reclamation agents into the soil-less substrate i.e. post-flotation lime, sewage sludge and mineral wool (5cm·50cm^{-1}and 500m^3·ha^{-1}). Soil material was sampled two times during the 2nd year of the experiment, i.e. in spring and autumn. The analyses consisted in determination of the activity of the following enzymes: dehydrogenases, protease, urease, acid phosphatase and FDA hydrolytic activity.

The investigations have demonstrated that the action of the wastes applied resulted in stimulation of the analysed enzymatic activities in all objects with sewage sludge. In the case of protease, urease, and FDA hydrolytic activity, the application of sewage sludge in combination with post-floatation lime appeared more beneficial than the activity of the sewage sludge alone.

In objects treated with mineral wool in addition to sewage sludge, the mode of application thereof proved important. Greater activity of all the enzymatic parameters analysed was noted in the object with application of mineral wool at a dose of 5cm·50cm^{-1}.

In the combinations without application of sewage sludge, there was no effect or only slight stimulation of the activity of dehydrogenases, urease, and proteases and a slight decline in these parameters in the case of acid phosphatase and FDA hydrolytic activity.

MICROBIAL FUNCTIONAL DIVERSITY IN THE SOIL DEGRADED BY SULPHUR MINING, SUBJECTED TO RECLAMATION WITH VARIOUS WASTE

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The present research was undertaken to address the importance of recycling waste for environmental protection and the soil degradation problem.

The aim of the study was the evaluation of microbial functional diversity changes in soil degraded by sulphur mining, subjected to reclamation with various waste.

The experiment was set up in the area of a former "Jeziórko" Sulphur Mine (Poland, Podkarpacie region) on a soil-less substrate with a particle size distribution of slightly loamy sand. The experimental variants consisted in application of different reclamation agents into the soil-less substrate i.e. post-flotation lime, sewage sludge and mineral wool (5cm $50cm^{-1}$ and $500m^3$ ha^{-1}). Soil material was sampled twice during the 1st year of the experiment (in spring and autumn) and once in the 2nd and 3rd year of the experiment (in spring).

The functional diversity (catabolic potential) was assessed using such indices as Average Well Color Development (AWCD) and Richness (R). These indices were calculated, following the community level physiological profiling (CLPP) using Biolog Eco Plates.

The results indicated an increase in metabolic activity (AWCD) and in substrate richness (R) with increasing time of incubation. Significant increase of these parameters were observed after 48 of incubation hours. In addition, there was revealed a decrease of metabolic activity (AWCD) in treatment with sewage sludge from the third term. Whereas, in other treatments it increased over time. The results showed the increase of richness index (R) in treatments with mineral wool applied separately and together with sewage sludge. However, the application of wool together with sludge caused a reduction of number of utilized substrates than the use of same wool.

Based on cluster analysis there was observed that the treatments from particular terms were clustered in three groups. First cluster included half of objects from the first and all objects from the third term of analysis. Second cluster consisted of objects from the second term of analyses. However, the third one was represented by the rest objects from the first and the last term of the study.

On the basis of heat map analysis, it was found that microorganisms utilized the most extensively the following substrates: D-Mannitol, Pyruvic Acid Methyl Ester and L-Serine.

GLOBAL WARMING POTENTIAL AND GHG BALANCE OF SELECTED CROPS IN WIELKOPOLSKA REGION, POLAND

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Greenhouse gases (CO_2, CH_4 and N_2O) fluxes were measured with chambers on plots with winter rye, winter wheat, potato and alfalfa in Brody, Poland. The mineral fertilization level for all crops was the same (N_{min}-90kg). No catch crops were cultivated between the main crops. CO_2 fluxes had been measured monthly with dynamic chambers, while N_2O and CH_4 fluxes were measured weekly with static chambers. In order to estimate yearly balances of GHG fluxes, the carbon net ecosystem exchange (*NEE*) and ecosystem respiration (R_{eco}) had been modelled for the entire period, while N_2O and CH_4 fluxes were linearly interpolated between campaigns. Taking into account the yearly cumulative fluxes, the global warming potential (GWP) for all crops was calculated based on the IPCC 2013 default GWP values for all GHGs. Whereas, taking into account the cumulative NEE and CH_4 fluxes as well as carbon export (with yield) and import (with seeds), the Net Ecosystem Carbon Balance (NECB) was calculated. Analyses were performed for the 12-month period between 1st of February 2012 and 31st of January 2013.

The cumulative NEE fluxes varied from -0.4-0.5 tCO_2-C ha^{-1} for alfalfa and winter wheat to -1.7 tCO_2-C ha^{-1} for winter rye. N_2O fluxes for winter rye, winter wheat and alfalfa varied from 2.1 to 2.5 kgN_2O-N $h^{-1}y^{-1}$, and for potato reached half of this value. CH_4 was absorbed by soils in the amount from -1.2 kg CH_4-C $h^{-1}y^{-1}$ for alfalfa to -2.4 kg CH_4-C $h^{-1}y^{-1}$ for winter rye. GWP for winter crops and alfalfa was negative reaching values from -380 for alfalfa to -5292 $kgCO_2$-eq. $ha^{-1}y^{-1}$ for winter rye, indicating potentially positive impact of these crops on climate, while for potato GWP was positive (4092 $kgCO_2$-eq. $ha^{-1}y^{-1}$). Nevertheless, if yield exported from filed was considered, the NECB was positive for all crops indicating the losses of soil organic carbon in the amount of 3 to 5 t C-eq. ha^{-1} y^{-1}.

TDR SYSTEM TO DETERMINE SALINITY INDEX AT VARIABLE TEMPERATURE

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Excessive salinity of soil pore water is regarded as one of the soil threats. Soil pore water salinization is caused by natural factors and human practices. Determination of the soil pore water salinity is helpful in maintaining soil salt content at appropriate level and to control soil quality. Soil salt content in a soil described by the Salinity Index term was introduced by (Malicki & Walczak, 1999) and further developed by (Wilczek et all., 2012). Salinity index is defined as a first derivative of bulk electrical conductivity with respect to bulk dielectric permittivity.

To determine salinity index, eight custom TDR cells were made. Each cell was made from a copper tube inside of which a stainless steel rod was placed. Each TDR cell was filled by tested material and salinity index was determined based on measurements of bulk electrical conductivity and dielectric permittivity. Moistened glass beads with diameter of 0.26 mm were measured. There were several series of measurements. At each series the TDR cells were filled by glass beads moistened by KCl solutions of different conductivity. Each cell contained glass beads of different moisture. The cells were placed inside a climatic chamber at various temperatures between 0 ^{o}C and 40 ^{o}C.

Based on bulk electrical conductivity and dielectric permittivity, salinity index was calculated for each mixture at different temperatures. Temperature dependence of salinity index was parabolic for each solution with R^2 larger than 0.99.

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References

Malicki M. A., Walczak R. T., 1999, „Evaluating soil salinity status from bulk electrical conductivity and permittivity," European Journal of Soil Science, vol. 50, pp. 505–514.

Wilczek A., Szypłowska A., Skierucha W., Cieśla J., Pichler V., Janik G., 2012, "Determination of Soil Pore Water Salinity Using an FDR Sensor Working at Various Frequencies up to 500 MHz," Sensors, vol. 12, pp. 10890–10905.

ESTIMATION OF THE WATER RETENTION CURVE IN SOIL-BIOCHAR MIXTURES

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Biochar is a charcoal-like material produced by the pyrolysis of biomass resources. Application of biochar with fine pore structures to agricultural soils can enhance soil water retention. However, the ameliorating effect of soil water retention by biochar can be affected by the physical properties of biochar and soil and biochar application rate. Several studies have shown that water retention in mixtures of different constituents can be calculated as the weighted sum of the water content of these two constituents separately measured at the same water pressure head (Garnier et al., 2004). The relative equation, termed as the 'additive model', does not consider interaction between each constituent. In this study, we applied the additive model for the estimation of water retention curves in soil–biochar mixtures. Sand and clay soil were used as the soil sample. Biochar were produced from sugarcane bagasse at three different pyrolysis temperatures (400, 600 and 800°C) (Kameyama et al., 2016). Water retention curves estimated by the model were close to the measurements for biochar (600°C)- and biochar (800°C)-amended soils with a mixing rate of 3% (w/w). However, the model underestimated the water retention near saturation for biochar (400°C)-amended soil. These results demonstrate that the model can be applied for biochar with low hydrophobicity. Estimation accuracy of the model decreased with increasing biochar mixing rate for biochar (800°C)-amended soil with a mixing rate of 1%–10% (w/w), suggesting that the effect of interaction between biochar and soil on water retention is increased with increasing biochar mixing rate. Therefore, the model can be successfully applied for biochar with low hydrophobicity at a mixing rate of less than 5% (w/w).

References

Garnier, P., Ezzine, N., De Geyze, S., Richard, G. 2004. Hydraulic properties of soil-straw mixtures. Vadose Zone Journal 3, 714–721.

Kameyama, K., Miyamoto, T., Iwata, Y., Shiono, T. 2016. Effects of biochar produced from sugarcane bagasse at different pyrolysis temperatures on water retention of a calcaric dark red soil. Soil Science 181, 20–28.

EFFECT OF LIMING AND MINERAL FERTILIZATION ON THE MOLYBDENUM CONTENT IN WINTER WHEAT AND SPRING BARLEY CULTIVATED ON LOESSIAL SOIL

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A molybdenum is one of more important microelements in cereal crops. Is a component of several enzymes (e.g. nitrate reductases). Is increasing seed protein content and seed yield (Modi 2002).

This abstract presents research on the molybdenum content in grain of winter wheat and spring barley cultivated on grey-brown podzolic soils developed from loess (static fertilization experiment) underlying a field located in the Rzeszów Foothills. Before establishment the experience (1986), bulk density of soil amounted 1.405 Mg m^{-3}, porosity 45.33 m^3 (100 m^3)$^{-1}$, water content at $pF_{2.0}$: 24.17 kg (100 kg)$^{-1}$ and content of Mo soluble in 1mol HCl dm^{-3}: 0.07 mg kg^{-1}. The experiment was set up by the random sub-block method, on a field under a static fertilization trial composed of a four-year crop rotation system and the NPK Mg or NPK Mg Ca fertilization system. The first variable was liming (A) and the second one consisted of different mineral fertilization variants (B). The basic level of fertilization ($N_1P_1K_1$) was 80 kg N ha^{-1}, 100 kg P_2O_5 ha^{-1} and 120 kg K_2O ha^{-1} under spring barley and 90 kg N ha^{-1}, 80 kg P_2O_5 ha^{-1}, 100 kg K_2O ha^{-1} under winter wheat. Liming was applied at a dose of 4 Mg CaO h^{-1}. The molybdenum in the dry plant material was determined colorimetrically with tiocyanate method. Liming increased the molybdenum content in grain of winter wheat and spring barley. The availability of the molybdenum for cereal crops is mainly dependent on the pH of the soil (Hamner & Kirchmann 2015). Mineral fertilization increased the molybdenum content in grain of winter wheat. The interaction liming and mineral fertilization increased the molybdenum content in grain of spring barley, but did not influence the molybdenum content in winter wheat grain.

References

Hamner K., Kirchmann H. 2015. Trace element concentrations in cereal grain of long-term field trials with organic fertilizer in Sweden. Nutrient Cycling in Agroecosystems 103, 347-358.

Modi A.T. 2002. Wheat seed quality in response to molybdenum and phosphorus. Journal of Plant Nutrition 25 (11), 2409-2419.

INFLUENCE OF DIFFERENT TILLAGE ON CROP YIELD AND SELECTED SOIL PHYSICAL PROPERTIES

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Field experiment was established in Research Station Borovce (NAFC – RIPP Piešťany, Slovak republic) in growing seasons 2013 – 2015. Experiment was conducted in four different soil tillage technologies: conventional, minimization, mulch and no-till technology. We watched two crops – maize and soya bean and influence of soil tillage on their yield.

The highest yield of maize we observed in the minimization technology (8.86 t ha^{-1}). Soya bean reached the highest seed yield of 1.82 t ha^{-1} in the conventional technology. The highest porosity during the experimental period was observed in no-till technology in depth of 0 – 0. 10 m (51.69%). This was the highest value from the point of view of technology and sampling depth. The highest soil bulk density in the depths of 0.0 to 0,1 m was in conventional technology, 0.10 – 0.20 m in no-till, 0.20 – 0.30 m was in minimization technology (1.46 $t.m^{-3}$, 1.50 $t.m^{-3}$ and 1.54 $t.m^{-3}$ respectively).

The average of soil moisture was the highest in depth of 0 to 0.10 m, the most favorable value was reached in no-till technology (18.15%) in this sampling depth. It was also the highest value throughout the whole soil profile (0 to 0.80 m).

SURFACE ACTIVITY OF THE FOLIAR POTASSIUM SUPPLIER STABILIZED BY RHAMNOLIPID

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The solutions, which are used as fertilizers, contain not only the macro- and micronutrients but also the surface active agents (surfactants), which i.a. lower the interfacial tension. Over the Critical Micelle Concentration (CMC) the surfactants create aggregates and can solubilize different compounds, becoming their carriers (Rosen & Kunjappu, 2012). Biosurfactants, which are synthesized by some microorganisms, are the promising group, according to the advances in respect to the classical surfactants. They are highly biodegradable and are characterized by low CMC. Rhamnolipids belong to biosurfactants and represent the glycolipids group (Zajic & Seffens, 1984).

The aim of investigations was to determine the surface activity of the rhamnolipid solution, containing K^+ ions, on the *Cissus rhombifolia* leaves.

Research was done for the control and tested plant, growing in the same conditions (soil composition, moisture and light intensity). Rhamnolipid solution was characterized by particles size distribution and electrophoretic mobility measurement. Sessile drop technique was applied for determination of contact angle (water, diiodomethane and formamide) and the surface free energy of leaves was calculated using van Oss et al. (1987) method. Next, the hydrophobicity of the leaves surface was determined (van Oss, 2007).

It was found that the amphihilic molecules of biosurfactant are specifically oriented on the leaves surface. The covering of leaves by them caused the lowering of hydrophobicity in respect to the control. Additionally, the water content in plant material decreased. It confirms the significance of the oil phase in the nutrient suppliers, which are used in foliar feedings.

References

Rosen M.J. , Kunjappu J.T. 2012. Surfactants and Interfacial Phenomena (4th ed.). Hoboken, New Jersey: John Wiley & Sons.

Van Oss C.J., Chaudhury M.K., Good R.J. 1987. Monopolar surfaces. Advances in Colloid and Interface Science 28, 35-64.

Van Oss C.J. 2007. Development and applications of the interfacial tension between water and organic or biological surfaces. Colloids and Surfaces B: Biointerface 54, 2-9.

Zajic J.E., Seffens W. 1984. Biosurfactants. CRC Critical Review in Microbiology 1, 87-101.

AN INFLUENCE OF K^+ CONTENT ON THE PHYSICOCHEMICAL PROPERTIES OF THE FERTILIZER STABILIZED BY BIOSURFACTANT

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Surface active agents (surfactants) are the components of fertilizers which are applied to soil or directly to plant (foliar feedings). Biosurfactants (and rhamnolipids among them) are produced by microorganisms. These substances have similar properties to classical surfactants. However, they are better biodegradable and create the micelle at much more lower concentration than classical surfactants (Özdemir & Sezgin, 2006**;** Sachdev & Cameotra, 2013).

Rhamnolipids belong to glycolipid biosurfactants which are synthesized by *Pseudomonas aeruginosa*. The molecules of these substances possess the acidic functional groups, the dissociation of which can influence the aggregation and stability of micellar solution (Akintunde et al., 2015, Özdemir & Sezgin, 2006).

The aim of research was to determine the influence of concentration of the potassium (K^+) macronutrient on physicochemical properties of the liquid fertilizer stabilized by rhamnolipid.

The particles size and electrophoretic mobility of dispersed phase were determined at different pH.

It was obtained that the modification of ionic strength strongly affected the size of the biosurfactant micelles as well as their electrokinetic properties. That can be very important at the planning of the fertilizer composition.

References

Akintunde T.A., Abioye O.P., Oyeleke S.B., Boboye B.E., Ijah U.J.J. 2015. Remediation of Iron Using Rhamnolipid-Surfactant Produced by Pseudomonas aeruginosa. Research Journal of Environmental Sciences 9, 169-177.

Özdemir G., Sezgin Ö.E. 2006. Keratin–rhamnolipids and keratin–sodium dodecyl sulfate interactions at the air/water interface. Colloids and Surfaces B: Biointerfaces 52, 1-7.

Sachdev D.P., Cameotra S.S. 2013. Biosurfactants in agriculture. Applied Microbiology and Biotechnology 97, 1005–1016.

THE ENZYMES ACTIVITY IN ANTHROPOGENICAL SALNITED SOILS

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There a little information with the effect of salinity on enzymes activity in anthropogenical salnited soil. Frankenberger and Bingham (1982) reported some observations from laboratories studies which indicted the activities of some enzymes are reduced with decreasing osmotic potential of soil water**.** The aim of the study was to determine the soil content of sulfur and phosphorus, and the activity of enzymes participating in cycle of this biolements in soils. The study soil samples were collected in Inowrocław Chemical Plant Soda Mątwy SA. Arylsulfatase (EC 3.1.6.1), alkaline (EC 3.1.3.1) and acid (EC 3.1.3.2) phosphatases activity was determined by the method of Tabatabai and Bremner (1969, 1970), while rhodanase (EC 2.8.1.1) according to the method of Tabatabai and Singh (1976). Determination of total sulfur in the soil and sulphates were made according to the method developed by Bardsley-Lancaster.

The investigation revealed a significant effect of location research facilities on the contents of total sulphur, sulphates, phosphorus and the activity of enzymes participated in the transformation of this elements in the soil. The high content of sulphates (VI) in soil from the area of Inowroclaw Soda Plant proves the anthropogenic stress on adjacent lands and contamination of soils analyzed sulphates. The activity of arylsulfatase, phosphatase and rhodanase also significantly dependent on the location of the sampling of soil indicating anthropogenic pressure on the biochemical processes of sulfur in soils.

References:

Frankenberger W.T., Bingham F.T. 1982: Influence of salinity on soil enzymes activities. Soil Sci. Soc. AM. 46:1173-1177.

Tabatabai M.A., Bremner J.M. 1969: Use of p–nitrophenol phosphate for assay of soil phosphatase activity. Soil Biology Biochemistry. 1: 301-307.

Tabatabai M.A., Bremner J.M. 1970: Factors affecting soil arylsulfatase activity. Soil Sci. Soc. Am. Proc., 34, 427,.

Tabatabai M.A., Singh B.B. 1976: Rhodanese activity of soils. Soil Sci. Soc. Am. J. 40: 381-385

THE ACTIVITY OF ARYLSULPHATASE AND RHODANESE IN TECHNOGENIC SOIL OF FORMER SULPHUR MINES

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Since the early 1990s XX, sulfur industry suffered from the increased production of sulfur from recovered sources and a low profitability of ore extraction (Ober, 2000). Exploitation ceased, but several ecological problems remained to be solved. Characteristically, when waste containing sulfur minerals are exposed to oxygen and water, sulfur is oxidised to sulfates, and strong acidification takes place: $2S + 3O_2 + 2H_2O \rightarrow 2SO_4^{2-} + 4H^+$ (Melgar-Ramírez et al., 2012). As a consequence, soil organic matter, nutrients, biota and plants can dramatically be destroyed.

The aim of this research was to assess the influence of pollution emitted about thirty-years old exploitation of sulphur deposits on the sulphur and sulphates content and the enzymes activity were participating in transformation sulphur in soils. The investigated soils taken from the vicinity of two Sulphur Mines: “Jeziórko” and “Machów” and from the areas situated in neighboring forests.

Tested soils showed high sulfur content and ranged from 0.18 g kg^{-1} from the forest to 69.98 g kg^{-1} near “Machów” mine. The sulphate sulphur share in total sulphur amount was from 5 % to 94%. Like in earlier research (Levyk & Brzezińska 2008) high sulphur content and afterwards strong soil acidification caused the decrease of soil respiration and then it caused the decrease of arylsulphatase and rhodanese activity.

References

Ober J.A. 2000: Sulfur. U.S. Geological Survey Minerals Yearbook, 76.1-76.24.

Levyk V., Brzeźińska M. 2008: The effect of pH on the soil respiration processes of technogenic territories of former sulphur mines in Nemiryv(Ukraine) and Jeziórko (Poland). BioPhys Spring- 2008(7th International Workshop for Young Scientists), Prague, 40-41.

Melgar-Ramírez R., González V., Sánchez J. A., Garcíai. 2012: Effects of application of organic and inorganic wastes for restoration of sulphur-mine soil. Water Air Soil Pollut., 223: 6123- -6131. DOI: 10.1007/s11270-012-1345-8

EFFECT OF NEUTRALIZING SUBSTANCES ON REDUCING THE INFLUENCE OF COBALT ON THE CONTENT OF SELECTED ELEMENTS IN SOIL

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The objective of this study has been to determine the effect of cobalt on the content of selected elements and the C:N ratio in soil, following an application of neutralizing substances. The experiments were carried out on acid soil, in a greenhouse, at the University of Warmia and Mazury in Olsztyn (north-eastern Poland). The effect of cobalt in doses of 0, 20, 40, 80, 160 and 320 mg Co · kg^{-1} of soil was tested on oat (*Avena sativa* L.). In order to limit the effect of cobalt, the soil was enriched with neutralizing substances: manure, loam, charcoal, zeolite and calcium oxide, added in amounts corresponding to 2% of the soil mass in a pot or, in the case of CaO, in a dose equal 1 hydrolytic acidity (HAC). Additionally, the soil was mixed with identical quantities of nutrients, responding to the plants' nutritional requirements. Cobalt was introduced to the soil as cobalt chloride. Soil batches (9 kg) were transferred to polyethylene pots and cropped with oat. During the growth of oat plants, soil moisture was maintained at 60% capillary water capacity. Soil samples for laboratory analyses were collected during the full ripeness stage of the test plant.

The values of the analyzed soil properties depended on the degree of soil contamination with cobalt and the application of a neutralizing substance. In the series with no neutralizing substance, cobalt had a relatively weak influence on soil properties, as the increasing doses of this metal only caused an increase in the amount of available potassium, and the highest Co dose favoured an increase in organic carbon content and a wider C:N ratio in soil. All the substances affected the content of available potassium in soil, with charcoal and especially manure contributing to its elevated accumulation, while the other substances decreased its soil content. Besides, manure favoured the growth in the soil content of available phosphorus, charcoal – the content of organic carbon and available potassium, zeolite – the total nitrogen content while calcium oxide promoted a higher content of total nitrogen and available phosphoprus. Zeolite and calcium oxide had a reeverse effect on the content of available potassium in soil. Loam and charcoal (unlike zeolite) caused the widening of the C:N ratio in soil.

SOIL SEALING IN A CONTEXT OF URBAN SOILS PROPERTIES DEVELOPMENT

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The exponential increase in the number of cities inhabitants results in need for urban expansion and building densification. The growth of residential area results in seizure of large areas of land which has been developed naturally, often in an uncontrolled manner (*urban sprawl*). In addition it means that areas for manufacturing facilities, service facilities, transport routes and hard infrastructure are needed. Soils in urban areas show a significant mechanical transformation, that affect their physical, chemical and biological properties [Greinert et al., 2013]. One of the main forms of mechanical degradation of urban soil is soil seal [COM(2006) 231]. This involves covering the soil with impermeable material or a material with strongly reduced permeability (eg. concrete or asphalt). Such a layer strongly reduces the infiltration of rainwater into the soil profile and interferes with gas exchange between the soil and the atmosphere.

The paper presents an analysis of selected areas in the metropolitan area of Zielona Gora. The study was conducted at the settlement area dominated by multi-family buildings and housing estates of detached houses. The analysis of cartographic maps and aerial photos from 1964 and 2008 is also included. On selected points soil samples were taken (*Ekranic Technosols*) on which field and laboratory analysis were carried out.

The increase in sealing of soil is noticeable. The multi-family housing by the years increase by nearly 15% and single-family housing area increased by approx. 10%. In areas adjacent to the multi-family buildings afforestation increased by approx. 10%, while for residential area only by approx. 2%. Under the roads, sidewalks and parking lots typical structure of soil profiles has been noticed. Under solid surface layers human-transported-material can be found (substructure of the road) and the following layers of bedrock of different genesis and degree of transformation.

References

Greinert A., Fruzinska R., Kostecki J., Urban soils in Zielona Gora. P. Charzynski, M. Markiewicz, M. Switoniak (ed.) Technogenic soils atlas. Torun, Poland, Polish Society of Soil Science, 2013, p. 31-54.

COM(2006) 231 Soil Thematic Strategy of the European Commission

URBAN DEVELOPMENT AND URBAN SOIL DEGRADATION - CASE STUDY IN ZIELONA GORA, POLAND

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In terms of transformations of soils resulting from their use, usually the following categories are distinguished: areas used as gardens, parks, cemeteries, housing estates and communication routes. The frequent occurring deposits on the soils are communal wastes. These, generally, adversely alter the properties of the soil, but also provide a plurality of components, some of which can be used by micro and macro organisms. Unfortunately, among municipal waste, the significant part are glass and plastic, with a low susceptibility to degradation. The construction wastes deposition effects in most far-reaching changes in soil properties. This is due to their high reactivity due to the presence of lime and large size of individual parts [Greinert et al., 2013; Greinert, 2015].

The research was carried out in Zielona Gora. Site areas were selected in areas illustrating particular stages of human impact on the natural environment. Samples from each of the morphological layers or genetic horizons of soil profiles up to depth of 150 cm and some surface samples were taken for further analysis. Sorption properties were determined by the Kappen method, pH in 0.01M $CaCl_2$ – by the potentiometric method, TOC content using a Shimadzu analyzer, particle size distribution – using hydrometer method.

It has been shown that 1) waste materials affect the properties of urban soils. Technosols constructed from waste materials containing carbonates have different properties than technosols without carbonates. 2) Technosols from Zielona Gora vary comparing the content of soil skeleton, carbon and soil reaction. Considerable importance was found also in the built-up age and the purpose of each building types. 3) The presence of technogenic materials is the factor that differentiates urban soils the most. The variability in that regard is both of qualitative and quantitative nature.

References

Greinert A., 2015. The heterogeneity of urban soils in the light of their properties. J Soils Sediments 15: 1725–1737.

Greinert A., Fruzinska R., Kostecki J., Urban soils in Zielona Gora. P. Charzynski, M. Markiewicz, M. Switoniak (ed.) Technogenic soils atlas. Torun, Poland, Polish Society of Soil Science, 2013, p. 31-54.

THE EFFECT OF LONG TERM NPK FERTILIZATION AND LIMING ON THE SOLUBLE ZINC CONTENT OF SOIL AND THE ZINC CONTENT OF MAIZE

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The effect of NPK fertilization and liming on the soluble zinc content of soil and the zinc content of maize was studied in a long-term experiment of Karcag Research Institute. The small plot field experiment was established in the 1967 with 20 kinds of NPK doses in four replications. The sequence in the crop rotation is: winter wheat–maize–maize–winter wheat. In the 20th and 32nd years of the experiment 14.5 and 11.05 t ha^{-1} of lime was used on the plots of replications I. and III. In 2009 the soluble zinc content of the soil plots (n=80) from the 0–20 cm soil layer was characterized with two extractants: $CaCl_2$-DTPA-TEA and KCl-EDTA solution (Hungarian standard). Moderate positive correlation was found between KCl-EDTA-Zn and $CaCl_2$-DTPA-TEA –Zn. The KCl-EDTA extractant dissolved more zinc than DTPA solution. Liming decreased the $CaCl_2$-DTPA-TEA soluble zinc content significantly as well as KCl-EDTA soluble zinc content. The $CaCl_2$-DTPA-TEA extractant indicated the effect of liming more sensitively. The effect of NPK fertilizers can not be proved on soluble Zn content of soil, but the influence of P fertilization reflected in the Zn content of maize. Leaf samples of maize were collected twice during the growing season: the first sampling was at the 6th leaf stage of maturity. the second sampling was at early silk. At the first sampling the plant Zn content decreased versus P fertilizer doses. This tendency could not be observed at early silk. During the growth of maize its roots reached the deeper soil layers. in which P excess did not occur, as P is an immobile element. Thus the Zn availability was restricted much smaller extent by phosphorus at the time of 2nd sampling. The decreasing effect of liming for plant zinc content was proved statistically at the 2nd sampling.

YIELD AND FRUIT QUALITY RESPONSE OF SWEET PEPPER (*CAPSICUM ANNUUM* L.) GROWN ON TWO SOIL TYPES UNDER DIFFERENT FERTIGATION MANAGEMENTS

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Yield of sweet pepper, changes of plant available nutrients of humic sandy and chernozem soils were analyzed under two significantly different fertigation (nutrient supply) methods. The pot experiment was carried out in the greenhouse of Institute of Agricultural Chemistry and Soil Science at the University of Debrecen in Hungary. The study included the following treatments with four replications: 1. control untreated soil, 2. F1 fertigation process: the concentration of nutrient solution was constant and based on the nutrient absorption of plant 3. F2 fertigation process: the concentration of nutrient solution has changed over the growing season based on the continuous monitoring of the quantity of nutrients in specific 1:2 soil extract (Sonneveld and De Bes, 1990). Fresh weight, dry matter accumulation, nutrient uptake, water and C vitamin content and photosynthetic parameters of sweet pepper, and the quantity of NO_3-N, K, Ca, Mg in specific soil extract were measured. Data were analyzed statistically by one way ANOVA technique. LSD were calculated at $P < 0.05$. The results showed that F1 and F2 fertigations increased the yield parameters and altered the nutrient uptake of fruits. The highest fresh weights, dry matter accumulation and photosynthetic parameters were registered by F2 fertigation method, followed by F1 fertigations one either in sandy or in chernozem soils. By the end of the experiment the NO_3-N, K, Ca, Mg content of 1:2 soil extract were significantly higher in both fertigations compared to control, but F1 fertigation with constant concentration of nutrient solution resulted in higher nutrient accumulation in soil. Both fertigation processes increased the C vitamin content of fruits, but there were no differences between values of two methods. On the basis of our results it can be concluded that F2 fertigation that based on continuous soil monitoring seems good nutrient management practice of soil grown pepper.

References

Sonneveld C. Van den Ende J. and De Bes S. S., (1990) Estimating the chemical composition of soil solutions by obtaining saturation extracts or specific 1:2 by volume extracts. Plant Soil 122. 169-175

INFLUENCE OF VARIOUS LAND USE SCENARIOS ON SOIL LOSS IN THE MĄTNY STREAM BASIN IN THE GORCE, WEST CARPATHIAN REGION

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The paper presents the results of simulated investigations on change of soil loss as a result of water erosion, connected with various scenarios of land use. Investigations were carried out for mountain basin of the Mątny stream, located in the West Carpathians. The basin area amounts 1,47 km^2. It is the basin of agricultural use, with mean slope of 16,28% and mean height a.s.l. 582,66. Soils on the investigated area regarding texture cover mostly sandy clay loam, loam, clay loam and sandy loam. In the basin prevail grasslands - 73,5%, arable land occupied 14,3% and forests - 9,5%. The rest of the total area is occupied by built areas. For determination of soil loss the program SWAT (Soil and Water Assessment Tool) was used. Program was calibrated based on series of experimental data, carried out in the years 2012-2014, that included suspended sediment concentration. The model calibration indices showed satisfactory adjustment of model to experimental data. There were assumed three variants of basin use. The first one concerned actual structure of land use, in the second one the area occupied by spring oat was replaced by potatoes In the third variant it was assumed that the total area is occupied by grassland. In the first variant the mean yearly soil loss was 8,01 $Mg \cdot ha^{-1}$, in the second one 16,99 $Mg \cdot ha^{-1}$ and in the third one 6,02 $Mg \cdot ha^{-1}$.

ANALYSIS OF CROP MODELS RESPONSE TO ADAPTATION MEASURES UNDER CLIMATE CHANGE USING ARS

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Climate change uncertainty largely complicates adaptation and risk management evaluation at the regional level, therefore new approaches for managing this uncertainty are required. In this study three crop models (DNDC, WOFOST and DSSAT) were used to explore the utility of adaptation response surfaces (ARS) for investigating winter wheat (WW) yield responses at Dikopshof (Germany) and Jokioinen (Finland) locations under a various adaptation measures and a large range of changes in climate. Our methodology has been adapted from Pirttioja et al. (2015), where impact response surfaces (IRS) were constructed. To build ARS, the sensitivity of modelled yield in the used models was tested to systematic increments of changes in temperature (-1 to +8°C) and precipitation (-30 to +50%) by modifying values of baseline (1981 to 2010) daily weather. Four levels of CO_2 (representing future conditions until 2070), two actual soil profiles and two genotypes of WW (one for each location) were considered. The adaptation options were: shortening or extending a 15 % the crop cycle of the standard cultivar, sowing 15 days earlier and 30 days later than the standard date, supplementary irrigation with 40 mm at flowering date and full irrigation. Our preliminary ARSs indicate that yields decline with higher temperatures and decreased precipitation and increase with higher precipitation. Yields are more sensitive to temperature than precipitation changes at the Finnish site while sensitivities are mixed at the German site. Also, our results suggests that some adaptation options allow for increase of the yield up to 1500 kg/ha. This study exemplifies how adaptation options and their impacts can be analyzed and evaluated in a context of high regional uncertainty for future conditions.

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References

Pirttioja, N., T. Carter, S. Fronzek, M. Bindi, H. Hoffmann, T. Palosuo, M. Ruiz-Ramos, F. Tao, M. Acutis, S. Asseng, P. Baranowski, B. Basso, P. Bodin, S. Buis, D. Cammarano, P. Deligios, M.-F. Destain, B. Dumont, R. Ewert, R. Ferrise, L. François, T. Gaiser, P. Hlavinka, I. Jacquemin, K.C. Kersebaum, C. Kollas, J. Krzyszczak et al. (2015). A crop model ensemble analysis of temperature and precipitation effects on wheat yield across a European transect using impact response surfaces. Climate Research 65, 87-105, doi:10.3354/cr01322.

COMPRESSIVE PROPERTIES OF APPLE CULTIVAR GOLDEN DELICIOUS

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The study dealt with the experimental and numerical evaluation of the apple cultivar Golden Delicious (*Malus domestica L.*) at compressive loading in lateral direction. Mechanical properties such as failure stress and strain as well as modulus of elasticity can be used to evaluate the behaviour of the fruits mechanically under the static loading. The instrumental firmness of apples changes significantly during shelf life, whereas the sensory attributes do not change significantly for each cultivar or for each attribute. It confirms advantage of the instrumental firmness measurements compared to the sensory evaluation (Zdunek, 2010). A testing machine Andilog Stentor 1000 (Andilog Technologies, Vitrolles, France) was employed for compression tests. The behaviour of the hemisphere of fruit was studied between two parallel plates and with the cylindrical intender of diameter 8 mm with flat end. The samples of the apples have been tested at the different strain rates (Severa, 2008). The experiments were performed at twelve velocities from 10 to 350 $mm.min^{-1}$ in order to achieve the different strain rates. Compression test of the fruits at the different strain rates corresponds to the quasi – state loading. The influence of strain rate on the stress was studied. The material exhibits viscoelastic behaviour. A Maxwell model with increasing modulus of elasticity can be considered as a simple so called explanatory model, which can explain the stress-strain curves (Csima et al., 2014). Apparent moduli of elasticity were determined on the base of elastic Hook theory and Hertz theory (ASAE, 2004).

References

ASAE 2004. Standard S368.4: Compression Test of Food Materials of Convex Shape. American Society of Agricultural Engineering, 2950, Niles Road. ST. Joseph, MI, USA.

Csima Gy., Dénes L., Vozáry E. 2014. A possible rheological model of gum candies. Acta Alimentaria, 43, 36 – 44.

Severa L. 2008. Behaviour of the peach under uderwater shock wave loading. Acta universitatis agriculturae et silviculturae mendelianae brunensis, 17, 151 -159.

Zdunek A., Cybulska J., Konopacka D., Rutkowski K. 2011. Inter-laboratory analysis of firmness and sensory texture of stored apples. Int. Agrophys, 25, 67 – 75.

EVALUATION OF MISCANTHUS GIGANTEUS (J.M. GREEF & M. DEUTER) SUITABILITY FOR AGRICULTURAL BIOGAS PRODUCTION

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The aim of the study was to evaluate of Miscanthus giganteus (J.M. Greef & M. Deuter) suitability for biogas production. The assessment was based on the analysis of the size and quality of the biomass yield, susceptibility to preservation through ensilaging and biogas yield in the process mono- and co-digestion with different type of plant biomass.

In the years of study 2011-2014 biomass of miscanthus was harvested twice a growing season: in early summer and autumn and ensilaged with the addition or not (controls) of silage inoculant which consists lactic acid bacteria species. The silages from the mixture of miscanthus with maize or apple pomace were also prepared. Methane fermentation of experimental silages was carried out at 39 °C for at least 21 days.

From the summer and autumn harvest average 19,3 t and 5,1 t of total solid were obtained respectively. Time of harvesting influenced on chemical composition of biomass. Biomass from the autumn harvest characterized by higher C/N ratio and total solid content compared to biomass from the summer harvest. Miscanthus was susceptible for ensiling. Addition of bacterial inoculant improved the quality of silages by inhibiting the butyric fermentation. After monofermentation of miscanthus silages average 623,7 m3·t-1vs of biogas were obtained with the content of methane 56,5%. From the silages prepared with lactic acid bacteria addition higher amount of biogas was obtained compared to the control silages but the difference was not statistically significant. After methane fermentation of silages prepared from miscanthus with maize or apple pomace 657,0 and 635,0 m3·t-1vs of biogas were obtained respectively.

High biomass yield, which could be harvested twice a year, susceptible for preservation by ensiling and high biogas productivity during mono- and co-fermentation with maize or apple pomace makes biomass of Miscanthus giganteus suitable, non-food or feed alternative source of biomethane.

THE COMMUNITY-LEVEL PHYSIOLOGICAL PROFILE OF MICROORGANISMS INHABITING SOIL CONTAMINATED BY HEAVY METALS

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The heavy metals are naturally presented in the soil, however the anthropogenic activities of human lead to increase the concentration of these elements to the amounts that are harmful to both plants and animals (Chibuike & Obiora 2014; Hu et al. 2013).

The aim of this work was to assess the differences of the physiological profiles of the bacterial communities inhabiting of soil contaminated by heavy metals. The contaminated soil (CT) was originated from surrounding area of non-ferrous metal smelter Szopienice (Silesia Region, Poland). As the reference soil (R) was chosen unexposed to heavy metals basing on the wind directions in Katowice (Silesia Region, Poland). The community level physiological profile (CLPP) was assessed by using the Biolog EcoPlateTM system.

The mean concentrations of heavy metals as Pb, Zn, Cd in the CT soil samples were in range from 147.27 to 12265.42 $mg \cdot kg^{-1}$, respectively. Whilst, in the R soil level of these heavy metals were definitely lower (from 0.19 to 43.59 $mg \cdot kg^{-1}$) . Our results showed that there are diversity of the physiological profiles of microorganisms inhabiting in CT and R soil, therefore it have been divided into two clusters. The cluster I included R soil samples in which microbial communities utilized most substrates. The cluster II created by CT soil samples in which smaller number of tested substrates was utilized. The averages utilization of substrates in CT soil were lower than R soil, especially in the deepest soil layers. The amines/amides and the amino acids groups were the most intensively metabolized in CT soil, while in R soil were the carbohydrates and the polymers.

Reference

Chibuike G.U., Obiora S.C. 2014. Heavy Metal Polluted Soils: Effect on Plants and Bioremediation Methods. Applied and Environmental Soil Science, doi.org/10.1155/2014/752708.

Hu Y., Liu X., Bai J., Shih K., Zeng E.Y., Cheng H. Assessing heavy metal pollution in the surface soils of a region that had undergone three decades of intense industrialization and urbanization. Environmental Science and Pollution Research 20, 6150–6159.

THE INFLUENCE OF SOIL TYPE AND WAY OF ITS CULTIVATION ON BIODIVERSITY OF MICROORGANISM IN SOILS FROM LUBLIN PROVINCE

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We tackled the problem of the role of way of soil usage on soil microbial activity and diversity in soils characteristic for Lublin province. We aimed on finding factors (both physicochemical properties and way of its usage) responsible for observed microbial biodiversity.

Basing on Lublin province's soil data base and previous studies (Bieganowski et al., 2013) we selected representative for this region soil types and sampled top soils from cultivated (C) and adjacent non exploited sites (NC). The following soil types were studied: *Albic Luvisol*s (AL), *Haplic Luvisols* (HL), *Mollic Gleysols* (MG), *Rendzina Leptosols* (RL), *Haplic Phaezoem* (HP), *Eutric Fluvisol* (EF) and *Eutric Histosol* (EH).

We estimated basic soil properties (moisture, density, Eh, pH, EC and the contents of main N and P forms, as well as TC, Mg, Ca and Fe and determined microbial diversity and activity.

Molecular studies revealed the presence of the following microbial groups: *Alphaproteobacteria*, *Betaproteobacteria*, *Gammaproteobacteria*, *Deltaproteobacteria*, *Flavobacteriales*, *Sphingobacteriales*, *Acidobacteria*, *Actinobacteria*, *Firmicutes* and *Elusimicrobia*.

We found significant differences in soil physicochemical properties clearly related to soil usage. A greater numbers of OTUs in N soils were stated (1/D=3.38) compared to agricultural soils (1/D=1.22), showing nearly 30% reduction of dominant bacterial OTUs.

The key chemical factors affecting identified microbial groups were evidenced depending on the way of land use. In agricultural soils (C) the most conducive for microbial community factors are Eh and NO_3-N. In non cultivated (NC): moisture, pH, TC and PO_4-P were the most important.

References

Bieganowski A., Witkowska-Walczak B., Gliński J., Sokołowska Z., Sławiński C., Brzezińska M., Włodarczyk T. 2013. Database of Polish arable mineral soils: a review. Int Agrophys 27, 335-350.

Acknowledgement

This project was financed by the National Science Centre (Poland), granted on the basis of decision DEC-2013/09/D/NZ9/02482.

ACTIVITY OF PHOSPHATASE AND THE CONTENT PHOSPHORUS IN SOIL AFFECTED BY LONG-TERM EXPOSURE TO THE EFFECTS OF THE SODA PLANT

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The occurrence of salt-affected soils (SAS) in Poland is connected with the impact of different natural and anthropogenic factors (Hulisz et al., 2010). High salinity suppresses the phosphorus uptake by plant roots and reduces the available phosphorus by sorption processes. One of the indices of changes in the content of phosphorus in soil can be the measurement of the activity of soil phosphatases, especially phosphomonoesterases which take part in the process of mineralization of organic phosphorus (Lemanowicz & Krzyżaniak, 2015). The objective of this study has been to determine the content of available phosphorus (P) and the activities of alkaline (AlP) [EC 3.1.3.1] and acid (AcP) [EC 3.1.3.2] phosphomonoesterase exposed to the effects of the soda plant. Soil was sampled from eight sampling locations on the premises of the Inowrocław Chemical Plant Soda Mątwy and the control sampling location 0-20 cm deep. There were also determined pH in KCl and pH in H_2O as well as salinity ($EC_{1:5}$). The statistical analysis has demonstrated significant differences in the content of phosphorus and phosphatase activity of Mollic Gleysols. Th soil pH ranged from 7.20 to 7.90 (pH in KCl) as well as from 7.10 to 7.95 (pH in H_2O). The highest value $EC_{1:5}$ (43.91 mS/cm) was recorded in the soil sampled from the stand exposed to three degrading sources. The lowest phosphorus content was found in the soil sampled from the location which, by 2000, had been flooded with post-soda sludge, and where, today, a natural plant sequence occurs (0.30 mg kg^{-1}) as well as in the soil sampled in the vicinity of the Soda Plant, Municipal Waste Disposal Plant and the City Sewage Treatment Plant (0.25 mg kg^{-1}). It was the salinity (EC) which was the factor which affected the changes in the activity of alkaline and acid phosphatases, which was seen from significant negative values of the coefficient of correlation. The results point to the need of further research of soil exposed to the effects of the soda plant.

References

Hulisz P., Charzyński P., Giani L. 2010. Application of the WRB classification to salt-affected soils in Poland and Germany. Polish Journal Soil Science 43(1), 81-92.

Lemanowicz J., Krzyżaniak M. 2015. Vertical distribution of phosphorus concentrations, phosphatase activity and further soil chemical properties in salt-affected Mollic Gleysols in Poland. Environmental Earth Science 74, 2719–2728.

A ROBUST TECHNIQUE FOR THE IDENTIFICATION OF MULTIPOLE DEBYE DIELECTRIC MODEL FROM MEASUREMENT DATA

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Interpretation of measured dielectric spectra is essential for the development of non-destructive measurement techniques of biological materials. A common approach to this interpretation is to fit a dielectric model, such as the Debye, Cole-Cole, or Havriliak-Negami model to the measurement data, and then correlate parameters of the model with the biological and physical parameters of the material under test.

In this work, we present a robust numerical technique for the identification of the classical multipole Debye dielectric-relaxation model from measured dielectric spectra. Our technique consists of three steps. First, we estimate the conductivity σ and ϵ_∞ of the material from a low- and high-frequency approximation of the dielectric spectrum, respectively. At low-frequencies we assume that the products $\omega\tau_n$ in the Debye model are small, while at higher frequencies we assume a single-pole approximation of the dielectric spectrum. In the second step, based on the estimates of σ and ϵ_∞, we fit the multipole Debye model by use of the vector-fitting technique proposed by Gustavsen & Semlyen. In the last step, the results of the first and second step are used as a starting point of constrained nonlinear least-squares fitting.

We tested our technique with dielectric spectra of soil measured in the frequency range 0.05-3 GHz in a coaxial transmission-line cell, and with dielectric spectra of apples measured in the frequency range 10 MHz – 20 GHz with an open-ended probe. The fitting results showed very good agreement with dielectric parameters of the materials under test, confirming thus the validity of our approach.

Acknowledgement
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References

Gustavsen B., Semlyen, A. 1999. Rational approximation of frequency domain responses by vector fitting. IEEE Trans. On Power Delivery, vol. 14, no. 3, July 1999.

ASSESSMENT OF SOIL QUALITY UNDER DIFFERENT FARMING SYSTEM BASED ON SELECTED MICROBIOLOGICAL AND PHYSICAL PROPERTIES

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Soils provide various functions which guarantee the provision of the essential ecosystem services. The capacity of the soil to perform these functions is impacted by types of land use and management practices. Assessment of soil quality is challenging and based on recent study it is known that a set of chemical, biological and physical indicators is needed in combination to characterise soil quality.

Therefore the aim of the study was to evaluate soil quality based on selected microbiological and physical properties. The study site was located in the region of Podlasie, in commune Trzebieszów (N 51° 59' 24", E 22° 33' 37") (Usowicz et al., 2004). We evaluated the selected properties in arable soil and pasture/grazing, in four soil layers (0-10 cm; 10-20 cm; 20-40 cm; 40-60 cm) and in three field transects (red points) with various moisture content. The soil microbiological and physical properties used to describe soil quality were as follows: dehydrogenases activity, β-glucosidase activity, basal respiration, methanogenic potential, soil pH, bulk density, total plant-available water and total porosity.

Based on the investigation we found that soil microbial activity, especially dehydrogenases and β-glucosidase activity decreased in deeper soil layers. The pastures soil were characterized by higher activity of soil enzymes than arable soil.

References

Usowicz B., Hajnos M., Sokołowska Z., Józefaciuk G., Bowanko G., Kossowski J. 2004. Spatial variability of physical and chemical soil properties in a field and commune scale. Acta Agrophysica, Monograph 103, 1-90, ISSN 1234-4125 (in Polish with English summary).

Acknowledgement

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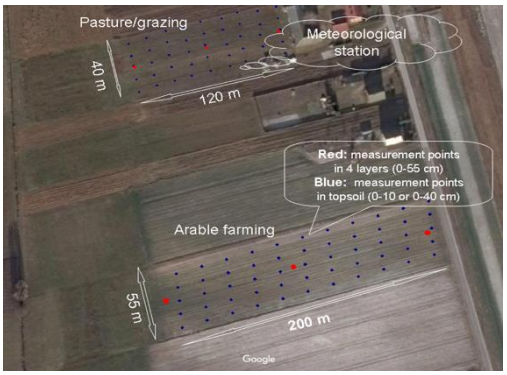

ASSESSMENT OF ENERGY PARAMETERS FORECROPS BIOMASS OF SELECTED PLANT SPECIES

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The need to increase the share of renewable energy in the overall energy balance of the country and the EU enforces to seek new sources of energy, including biomass. Therefore, in the paper attempts to evaluate the energy potential of biomass of selected species of plants cultivated as forecrop. In this study, have been assessed plant species of the family *Fabaceae* and *Poaceae* grown in permanent and controlled conditions.

The experiment was set in glass vases (height. 30 cm, diameter 16.5 cm), in a complete randomized (three repetitions), according to the root exudate recirculating system. The experiment was conducted under controlled conditions with a daily 12-hour high-pressure artificial light lamp SON-T. Room temperature varied between 22-25°C. In each vase, filled with quartz sand (3 kg), placed 10 seeds of plant species tested. Plants were watered daily with a solution of distilled water and the Hoagland-2 nutrient. Controls accounted objects watered with distilled water (every 24 h.) and once a week with a solution of distilled water and the Hoagland-2 nutrient.

The plant biomass was assessed moisture content, ash and volatile matter in the test samples of solid biofuels using thermogravimetric analyzer TGA701 LECO. Moisture was determined according to PN-EN 14774-1: 2010 and the ash content on the basis of PN-EN 14775: 2010. Evaluation of the content of volatile matter was based on the determination of loss on heating of the material for seven minutes under a nitrogen atmosphere at a temperature of 900 ° C, without air (PN-EN 15140: 2010). The heat of combustion and calorific value was determined according to PN-EN 14918, using a calorimeter LECO AC 600. The studies evaluated the content of heavy metals in the ash on a Shimadzu EDX-7000 Energy. The resulting energy performance allowed us to assess the energy potential of biomass acquired.

ELEMENTARY ANALYSIS AND EVALUATION OF THE CONTENT OF HEAVY ELEMENTS IN SELECTED SPECIES PLANTS IN FORECROP

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Due to the need to reduce carbon emissions to the environment and the introduction of nitrogen compounds in the process of fertilization, it is useful to assess the degree of absorbency of these compounds in the process of growing plants in cultivation forecrop (bioyeld). In this study, the content of carbon, hydrogen, nitrogen and sulfur has been analyzed in the seeds of selected plants (before the process of growing), and comparing their contents in above-ground and underground parts (in the roots) of selected plants after harvesting.

The experiment was set in glass vases (height. 30 cm, diameter 16.5 cm), in a complete randomized (three repetitions), according to the root exudate recirculating system. The experiment was conducted under controlled conditions with a daily 12-hour high-pressure artificial light lamp SON-T. Room temperature varied between 22-25°C. In each vase, filled with quartz sand (3 kg), placed 10 seeds of plant species tested. As experimental material selected plant species of the family *Fabaceae* and *Poaceae*. Plants were watered daily with a solution of distilled water and the Hoagland-2 nutrient. Controls accounted objects watered with distilled water (every 24 h.) and once a week with a solution of distilled water and the Hoagland-2 nutrient.

After the end of the test plants were dried, weighed and separated part per above-ground and roots. Air-dry plant material subjected to determination of the content of C, H, N in test samples, according to PN-EN 15104: 2011. Methodological basis for the determination of S in the samples, accounted the PN-EN 15289: 2011. The study was conducted at the elementary analyzer LECO CHN628, and to assess the content of S uses device LECO S628. In addition, the contents of heavy metals in test material has been determined by using energy dispersive spectroscopy X-ray Shimadzu EDX-7000 Energy apparatus. The obtained results allow to assess the elemental composition of the test plants, and to estimate the amount of carbon and nitrogen brought from forecrop crop of plants to soil.

PARTICLE SIZE DISTRIBUTION MEASUREMENTS BY LASER DIFFRACTION METHOD IN PRACTICAL SOIL PHYSICS

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In recent years laser diffraction method (LDM) is beginning to replace sedimentation procedures as the standard technique for particle size distribution (PSD) analysis in soil physics. However, LDM for PSD analysis still requires evaluation of its reliability. There are intentions all around the world to harmonize soils' PSD data measured by LDM and traditional sedimentation methods. Experiences show that success of harmonisation depends on the applied standards and LDM settings.

In this study, the sieve-pipette method (SPM-MSZ) according to the Hungarian standard (MSZ-08. 0205: 1978) and the LDM (according to Ryżak & Bieganowski, 2010) were used to measure the particle size distribution of 155 soil samples representing the North-Hungarian Tokaj Region. Applying usual clay/silt and silt/sand LDM fraction boundaries, clay fraction was highly under- and silt fraction was overestimated compared to the SPM-MSZ, as it is described in the literature many times. According to different statistical optimization techniques LDM clay/silt and silt/sand fraction boundaries were changed to 7 and 50 □m, respectively. These modified LDM fractions were more comparable with SPM-MSZ fractions. Although higher correspondence were found between SPM-MSZ and LDM PSD data using modified LDM fraction boundaries and the proposed method can be a tool of harmonization, the modified LDM PSD data are not necessarily true. According to experiences, sedimentation techniques are also overestimating the extent of clay fraction and these data should therefore not be used as reference. Statistical analyzes between the PSD data and other soil physical soil properties (BET specific surface; water vapour adsorption) were used to find the most realistic LDM PSD data. It was find that the 'optimal' clay/silt boundary, in its physical sense, is about between 4 and 5 □m.

References

MSZ-08. 0205:1978. A talaj fizikai és vízgazdálkodási tulajdonságainak vizsgálata.

Ryżak, M., Bieganowski, A., 2010. Determination of particle size distribution of soil using laser diffraction—Comparison with areometric method. Int. Agrophys. 24. 177–181.

EXPLORING POSSIBILITIES TO FORTIFY HYDROPONICALLY GROWN BABY VEGETABLES WITH FE AND ZN

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Micronutrient malnutrition, primarily the result of diets poor in bio-available vitamins and minerals, affects more than half of the world's population. Two micronutrients that are widely recognized by the World Health Organization (WHO) as limiting are iron and zinc.

In order to screen 5 botanically distinct vegetable species with respect to their reactions to increased supply of Fe and Zn, an experiment was set up under semi-controlled conditions. Seeds were sown in the mixture of agroperlite (AGROPERLIT EXTRA, Termika Zrenjanin) and sand. About 100 seeds of chard, onion, red beet, kohlrabi or lettuce were sown and grown hydroponically using Hoagland nutrient solution (HS, control). After emergence, three treatments were introduced: HS with doubled concentration of Fe, HS with doubled concentration of Zn and HS with doubled concentrations of Fe and Zn. Experiment was set in three replications and treatment lasted up to 30 days. Aerial plant parts were harvested and analyzed for Fe, Zn, ash, photosynthetic pigments and vitamin C content.

In lettuce, concentration of photosynthetic pigments and vitamin C increased in the presence of added Fe and Zn whereas concentration of Fe declined. In chard, concentration of photosynthetic pigments also increased, but to a smaller extent as compared to the lettuce. Concentration of Zn increased in chard to which it was added. In red beet, concentration of Fe increased over 75% but yield concomitantly decreased 35% upon addition of Fe. In onion, concentration of vitamin C and photosynthetic pigments increased in all treatments with respect to control, whereas percentage of ash, Zn and Fe declined. In kohlrabi yield increased in the presence of additional Fe. Concentration of chlorophylls significantly increased whereas concentration of carotenoids declined.

Concentration of both Fe and Zn increased only in red beets and of Zn in chard. All three treatments increased biomass production only in kohlrabi.

TECHNOLOGICAL QUALITY OF THE GRAIN OF SOME SPRING WHEAT CULTIVARS DEPENDING ON STORAGE TIME AFTER HARVEST

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Technological quality of grain depends on storage condition parameters like temperature, humidity or exposure to light, both during the short-term and long-term period of storage. Storage of the grain is necessary because of the cereal production surpluses or prices fluctuations in the markets.

The aim of this study was to determine the effect of the cultivar factors and the storage times on some technological quality parameters of grain of several Polish spring wheat cultivars. The following grain yield traits were evaluated: moisture, protein, starch, and gluten content, resistance to the mechanical damage (pressure), falling number and the Zeleny sedimentation value . After milling the content of wet and dry gluten, gluten quantity, Gluten Index, water absorption (WA) and dough mixing flour characteristics such as: the dough development time (DDT), the dough stability time (ST) and the degree of softening (DS12) were conducted.

The storing of the crop by 15-27 months resulted in a decrease of the grain protein content of 0.38-0.62% in comparison with the samples under control, but had no significant effect on the starch content. Extending the shelf life after harvest of spring wheat grain had a significant negative effect on the falling number of the grain. Regardless of variety, wheat grain stored by 3 months was characterized by the most favorable average falling number 298 s, and by 15 and 27 months, by 57 s and 31 s less, but had no significant effect on the formation of the average values of sedimentation rate of spring wheat grain. There was no linear correlation between storage time of wheat grains and the farinograph parameters of dough made from these grain, but a tendency to decrease the quality and quantity of gluten in the dough was noted.

FRACTAL DIMENSION AND RHEOLOGICAL PROPERTIES OF THE STARCHES OF VARIOUS BIOLOGICAL ORIGIN

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The physicochemical properties of starch are varied depending on the plant species, the variety, and even habitat conditions during the vegetation period. The diversity of the starch is not limited to the morphology of the granules, but there are also at the molecular level and relates to the structure of the polysaccharide. There are pores on the surface of the starch granule with the size in nano and micro scale. The surface pore together with the geometric surface of granule create the specific surface area of granules differed with fractal dimension and are characterized by different rheological properties, susceptibility to chemical modifications and amylolytic activity.

The aim of this study was to calculate and specify the differences in the fractal dimension of starch granules and also to correlate them with the rheological features of the solution of the starches. Starches isolated from mung bean , cassava, sweet potato, American kudzu, rice (KSS 7) Indica variety, rice (TNU 67) Japonica variety and wheat were used for testing. Determination and calculating of the fractal dimension, thixotropy, viscosity, pasting and gelling temperature and amylase content of these starches were performed.

The starches had fairly smooth surface because they were characterized with a fractal dimension of edge line close to 1.0. The biggest differences in fractal dimension was observed between cassava, American kudzu and bean mung starches with the value from 1.1 to 1.068. The highest fractal dimension suggested that the edge line of the granules of that starch was more irregular. Definitely the highest thixotropic properties were found in the case of the wheat starch whose thixotropic coefficient amounted to 9.84, while the lowest was found in the rice TNU67 starch with a coefficient of 0.066. Increase in the size of the starch granules caused a decrease in the thixotropic properties of the starch.

EFFECT OF WHEAT STRAW AND *MISHANTUS GIGANTUS* STRAW AND BIOCHARS DERIVED FROM THEM ON SOIL ENZYMATIC ACTIVITY, ECOTOXICITY AND PLANT GROWTH

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Diversity of technological conditions and of raw materials from which biochar is produced is the reason why its soil application may have a varied effect on ecotoxicological and biological properties of soil and soil ecotoxicity [Arthur et al., 2014; Ducley et al., 2015]. The aim of this study was to evaluate the effect of the addition of wheat straw and *Mishantus gigantus* straw (5.00 t DM · ha^{-1}) and biochar obtained from this materials in doses of 2.25 t and 5 t DM ha^{-1} on soil dehydrogenases activity, soil ecotoxicity and grass crop yield (pasture grass mix). The research was carried out under field conditions with the granulometric composition of loamy sand. Soil samples were analysed for changes in biological and ecotoxicological properties. Significant effect of biochar amendment on soil enzymatic activity was observed. The biochar-amended soil was toxic to *Vibrio fischeri* and low-toxic to *Heterocypris incongruens*. Application of wheat straw biochar (SB) and M. gigantus straw biochar (MSB) in doses of 2.25 t and 5 t DM ha^{-1} contributed to an increase in plant biomass production respectively by 14% and 24% for SB and by 38% and 40% for MSB compared to the control. Biochars had more adverse effect on soil enzymatic activity and soil ecotoxicity to *H.incongruens* and *V. fischeri* than non-converted wheat and *M. gigantus* straw, but it significantly increased the grass crop yield.

References

Arthur E., Tuller M., Moldrup P., De Jonge L.W. 2015. Effects of biochar and manure amendments on water vapor sorption in a sandy loam soil. Geoderma 243–244, 175–182.

Ducey T.F., Novak J.M., Johnson M.G., 2015. Effects of Biochar Blends on Microbial Community Composition in Two Coastal Plain Soils. Agriculture, 5, 1060-1075.

ASSESSMENT OF CADMIUM, LEAD, ZINC AND COPPER CONCENTRATIONS IN ARABLE ROADSIDE SOILS IN TERMS OF DIFFERENT TRAFFIC IMPACT

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Traffic has been becoming one of the most important source of environment contamination including heavy metals. From the other side building of motorways, expressways and ring roads is minimisation of traffic emission.

The aim of the study was to estimate of the influence of time and intensity of road traffic on heavy metal contents (Cd, Cu, Pb, Zn) in arable topsoils. Vicinity of Jędrzejów (Central Poland) which is a traditional agricultural area was selected. An old expressway S7 (JKE-Jędrzejów-Kielce roadsection), a Jędrzejów east ring road (JERR-a new section in S7, several years in use), and a brand new north Jędrzejów ring road (JNRR-a section of national road DK 78, one year in use). Heavy metal contents was assessed with a Kabata-Pendias method. Topsoil (0-0,2m) was sampled in selected cross-sections (five for each road) in following distances: 6, 11, 21, 38, 70 and 120m symmetrically both sides of the road. Close to total contents of metals were determinated also pH in water and KCl, organic matter and contents of fine silt, clay, coarse clay and fine clay. The data were compiled using Principal Component Analysis to find out the gradient of habitat factors influencing the metal contents. Anova was used to calculate the differences between mean metal contents. Anova reviled lack of influence of the factors for copper contents. Unlike copper for cadmium, lead and zinc the significant impact was observed for factors and interactions between them. The highest concentrations of cadmium, lead and zinc, regardless of the distance from the road were observed at JKE respectively: 0,58 mgCd*kg^{-1} d.m., 41,96 mgPb*kg^{-1} d.m. and 63,97 mgZn*kg^{-1} d.m. The lowest concentrations were observed JERR respectively 0,21 mgCd*kg^{-1} d.m., 13,60 mgPb*kg^{-1} d.m., 40,34mg Zn*kg^{-1} d.m. In case of increasing distance from the road generally the contents of lead, zinc and cadmium are decreasing.

INFLUENCE OF DISTANCE FROM A STEELWORK AND WAY OF CULTIVATION ON HEAVY METAL CONTENTS IN PEPPER (*CAPISCUM ANNUUM*) FRUITS

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The quality of plant food depends on: cultivated plant, soil and its properties, potential contaminates, cultivation way, harvest, storage and preparation to eat.

The aim of the study was to evaluate the influence of distance from a steelwork, way of growing and harvest time on heavy metals (Cd, Cr, Cu, Mn, Ni, Pb and Zn) in pepper fruit.

Two vegetable farms were selected in two different distances to the steelworks. The same pepper variety was cultivated in two systems: in folic tunnels and in ground. The others agronomic factors were standardized. The fruits were harvested in three consecutive terms at consumer maturity stage. In a laboratory, seeds were removed, fruits weighed, dried and again weighted. Total n=144 samples were collected. Dry mineralisation was conducted and FAAS method applied to determinate metal levels. Together with plant samples soil samples were taken (n=32). Close to total and soluble contents of metals were determinated. Every plant and soil sample were mineralised in duplicate.

Lead contents were lower than used spectrophotometer detection threshold i.e. 100 times lower than permissible by European Low content. Maximum cadmium contents were three times lower than permissible. Zinc, copper, nickel and chromium contents were at physiological levels. Manganese content was lower than physiological. In order to estimate the influence of ecological factors Principal Content Analysis (PCA) was applied. The differences between mean concentrations were estimated by Anova. There were no influence of distance from the steelworks and the ways of cultivation for cadmium and lead concentrations. For zinc and manganese there were influence of both studied factors, however interaction was not significant. For copper, nickel an dry matter content both factors and interaction were significant. Finally for chromium distance and way of cultivation were not significant but interactions were statistically significant.

EFFECT OF LIMING AND MINERAL FERTILIZATION ON THE NICKEL CONTENT IN POTATO TUBERS AND GREEN BIOMASS OF FODDER SUNFLOWER CULTIVATED ON LOESSIAL SOIL

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The aim of the study was to determine the influence of liming and mineral fertilization on nickel content in potato tubers and green mass of fodder sunflower grown respectively in four and three rotations on loessial soil located at the Rzeszów Foothills. Before establishment the experience (1986), bulk density of soil amounted 1.405 Mg m^{-3}, porosity 45.33 $m^3 \cdot (100\ m^3)^{-1}$ and water content at $pF_{2.0}$: 24.17 $kg \cdot (100\ kg)^{-1}$. The experiment established by randomized block design use a four-year crop rotation, which included potatoes, spring barley, fodder sunflower, and winter wheat. Mineral NPK fertilization was used on a background of constant Mg as well as Ca and Mg fertilization (liming). Basic level of nutrition ($N_1P_1K_1$) for potatoes was: 80 kg N ha^{-1}, 43.6 kg P_2O_5 ha^{-1} and 132.8 kg K_2O ha^{-1}, whereas for fodder sunflower: 100 kg N ha^{-1}, 34.9 kg P_2O_5 ha^{-1} and 99.6 kg K_2O ha^{-1}. Liming was applied at the rate of 4 t $CaO \cdot ha^{-1}$. Nickel content in crops was determined by means of FAAS technique (Hitachi, Z 2000) after samples digestion in mixture of HNO_3:$HClO_4$:H_2SO_4 at 20:5:1 ratio. Decrease of nickel concentration in potato tubers and in green matter of fodder sunflower due to liming was observed. Mineral nutrition (regardless of liming) did not considerably affect the element content in potato tubers, yet it was significant for the metal content in green mass of sunflower. The mineral NPK fertilization enhanced the nickel amount in tubers of potato grown on alkaline soil (Pakhnenko et al. 2009). Studies by Šrek et al. (2010) showed substantial increase in nickel content in potato tubers cultivated on the soil developed from loess due to the influence of increasing NPK rates in combination with straw addition as well as resulting from high phosphorus and potassium doses along with natural fertilization.

References

Pakhnenko E.P., Ermakov A.V., Ubugunov L.L. 2009. Influence of Sewage Sludge from Sludge Beds of Ulan-Ude on the Soil Properties and the Yield and Quality of Potatoes. Moscow University Soil Science Bulletin 64 (4), 175-181.

Šrek P., Hejcman M., Kunzová E. 2010. Multivariate analysis of relationship between potarto (*Solanum tuberosum* L.) yield, amount of applied elements, their concentrations in tubers and uptake in a long-term fertilizer experiment. Field Crops Research 118, 183-193.

ASSESSMENT OF UTILIZATION POSSIBILITIES OF BY-PRODUCTS FROM FISH PROCESSING IN THE CONTEXT OF THE RATIONALIZATION OF NON-RENEWABLE RESOURCES

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Fish processing generates significant amounts of waste. That pose a potential threat to the environment. Guts, heads, fins and skin can be a valuable source for obtaining fats and feed, but transporting this waste to distant facilities is problematic (Bougatef, 2013). Under the conditions of functioning of small fish processing most common method of disposing of industrial waste is handing out to specialized companies. From the economics point o view and environmental reasons, it is desirable to seek methods of waste disposal that allow energy recovery and reuse of chemical elements. The aim of the study was to evaluate the possibility of using waste from the fish farming for biogassing and use the resultant digestate as fertilizer. As part of the study the chemical composition of the waste from carp farming proces and digestate conducted after the methane fermentation process was determined. In the samples dry matter, organic nitrogen atoms and the other major elements: Ca, P, Na, K, and Mg and trace elemets contents (Cu, Zn, Fe, Mn, Cr, Ni, Pb, Cd, Sr, Ba, Hg and B was determined. The dry matter content in the tested waste was 40%. The nitrogen content in the test samples was about 5%, phosphorus about 1.7%, calcium 3.8%, while the average potassium content was 0.48%. Organic carbon content was 60%. Conversion of the methane fermentation was a decrease in nitrogen content of 2,5 % and increasing the number of all elements. High levels of trace elements and heavy metals were found, but their number does not exceed the limit values for organic fertilizers. Tested material can be use as a component for the production of fertilizers which would reduce the dissipation of biogenic elements and returning them to circulation in agriculture.

References

Bougatef A. 2013. Trypsins from fish processing waste: characteristics and biotechnological applications – comprehensive review. Journal of Cleaner Production 57, 257–265.

ASSESSMENT OF SOIL DEGRADATION RISK IN ORGANIC FARMS IN POLAND

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The aim of organic agriculture, in terms of plant production, is the production of high quality crop which at a minimum impact on the environment. The idea of organic farming requires a thorough knowledge of the farmer in the field of biological, agronomic and environmental aspects. Basically, plant organic production should be related to animal production in order to enable the delivery of plant nutrients with natural fertilizers. The results published by Cupiał et al. 2013], indicate that the majority of organic farms in Poland does not conduct animal production, which translates into a lack of fertilization. This is due to the system of subsidies related to the implementation of agro-environment schemes. Keeping crop production in the absence of fertilization leads to soil degradation, which is contrary to the principles of organic farming. The aim of the study was to evaluate soil properties in selected organic farms in the context of the general and specific objectives of organic farming. The aim of the study was to evaluate soil properties in selected organic farms in the context of the general and specific objectives of organic farming. In the study 55 farms were selected, of which 25 with plant and animal production. From each farm samples of the soil were taken. In the soil samples pH value, humus content, the content of available phosphorus, potassium, mineral nitrogen, hydrolytic acidity and content of movable aluminum content were determined. Results of this study indicate that for most of the tested soils it is necessary to liming. Low soil pH can cause heavy metals availability. Content of available potassium and phosphorus are generally low and very low. Content of available aluminum in most of the soils indicate the possibility of toxicological effects on plants. In the group of farms with livestock production properties of soils were more favorable from the point of view of plants production. In most of the surveyed households method of cultivation does not pursue the idea of organic agriculture. Results of this study indicate a real threat to the degradation of soils under organic farming.

References

Cupiał M., Klimas A., Szląg-Sikora A. Niemiec M., Szląg-Sikora A. 2013. Problem of management of nutrients in orgaic farms. Proceedings of ECOpole 7, 2, 553-559.

TERRESTRIAL CARBON AND NITROGEN EIGHT YEARS AFTER LARGE SCALE BEETLE-CAUSED FOREST MORTALITY

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Bark beetle (*Dendrococus ponderosae*) epidemics triggered by increased regional climate variability and drought have decimated at least 12 million hectares of lodgepole pine, Engelmann spruce and subalpine fir forests in western North America. This outbreak has resulted in significant changes to forest health and specifically, a shift in belowground biogeochemical processes, retention of terrestrial carbon (C) and nitrogen (N) in tree biomass, soil and surface litter and understory vegetation biomass. Little is known about long-lasting effects of the beetle epidemics and the return of terrestrial C and N and vegetation succesion in different forest vegetation types infested or not infested by bark beetle. The monitoring was conducted in the Snowy Range Mountains in southeastern Wyoming, USA between June and October 2015. Plots were established in three slope locations (toeslope, footslope and shoulder) and within, in clusters of dead and live trees, all replicated five times. Results suggest that three unique forest types associated with slope locations have transitioned to more dense tree stands dominated by shade tolerant tree species. Lodgepole pine has disappeared from previously mixed stands in toeslope and footslope locations. Terrestrial N was more affected by the beetle infestation than by the slope position, which was demonstrated as 25% more litter biomass, 12% more N in understory vegetation and 30 % more litter N in dead tree clusters compared with live tree clusters. Shoulderslope originally dominated by lodgepole pine is the only forest type that has continuously elevated terrestrial C and N pools (32% more C and 35% more N) suggesting that this forest type has not returned to the pre-beetle infestation status eight years after the infestation and may continue to be a potetnial source of C and N export via hydrological processes especially following the snowmelt.

APPLICATION OF BUCKWHEAT FOR GLUTEN-FREE PRECOOKED PASTA PRODUCTS PROCESSED BY THE EXTRUSION-COOKING

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The aim of the study was to evaluate nutritional value and selected physical properties of precooked gluten-free pasta made with the extrusion-cooking.

As the raw material roasted buckwheat seeds were used. Buckwheat was ground to flour and moistened to obtain a moisture content of the dough at 30, 32 and 34%. Pasta was obtained using a modified single-screw extruder TS-45 with L/D = 18:1, compression ratio 3:1 at temperature ranged from 90 to 110°C in the plasticizing zone and 65-75°C in the cooling section of the extruder. Buckwheat pasta was processed at different screw speeds of 60, 80, 100 and 120 rpm and shaped for spaghetti at 0,8 mm die.

Selected physical properties and chemical composition of buckwheat pasta were evaluated. The expansion ratio, minimal preparation time, and water absorption capacity were tested for dry pasta. Texture characteristics, as hardness of dry and hydrated products, and firmness, adhesiveness and chewiness of hydrated ready to eat buckwheat pasta were evaluated. Sensory analysis was also performed.

Pasta characterized of 11.83% of proteins, 1.06% of fat, 1.65% of ash, and 6.73% of fiber (3.94 and 2.79% of insoluble and soluble fractions, respectively). The best physical properties, confirmed by sensory analysis, were determined for buckwheat pasta processed at 80-100 rpm and 30-32% of raw materials moisture content.

Moreover, accelerated solvent extraction (ASE) of active polyphenols and quantitative analysis of phenolic acids (using reversed-phase high-performance liquid chromatography and electrospray ionization mass spectrometry - LC-ESI-MS/MS) was performed.

The phenolic acids composition of precooked buckwheat pasta was as follows: gallic, protocatechuic, gentisic, 4-OH-benzoic, vanillic, trans-caffeic, cis-caffeic, trans-p-coumaric, cis-p-coumaric, trans-ferulic cis-ferulic, and salicylic.

QUANTITATION OF PHENOLIC COMPOUNDS IN GLUTEN-FREE PRECOOKED RICE PASTA

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The aim of the work was to determine selected polyphenols in gluten-free precooked rice pasta. Phenolic compounds are an important chemical group of compounds possess antiradical properties, therefore their content is highly correlated with antioxidant activity of plant food.

Extrusion cooking seems to be one of the best methods for obtaining the maximum nutritive value of several plant materials. It is a high-temperature, short-time process, which combines the respective sequences of mixing, heating, shearing, forming, and shaping. Pasta was obtained using a modified single-screw extruder TS-45 at different screw speeds of 60, 80 and 100 rpm.

For extraction of active compounds from gluten-free precooked rice pasta ultrasound assisted extraction (USAE) was carried out. Quantitative analysis of phenolic acids was performed using reversed-phase high-performance liquid chromatography and electrospray ionization mass spectrometry (LC-ESI-MS/MS). Protocatechuic, gentisic, 4-OH-benzoic, vanillic, trans-caffeic, cis-caffeic, syryngic, trans-p-coumaric, cis-p-coumaric, trans-ferulic cis-ferulic, salicylic, trans-synaptic and cis-synaptic acids were identified in extracts.

It could be attractive precooked rice pasta products ready for consumption after few minutes of hot water hydration, especially for consumers with a gluten-free diet.

THE EVALUATION OF WOLF'S FOOT CLUBMOSS (*LYCOPODIUM CLAVATUM* L.) SPORE VITALITY *IN VITRO*

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Wolf's foot clubmoss is a perennial, evergreen, spore-bearing plant once used in folklore medicine. In the past, lycopodium spores were used as a treatment for wounds and diseases of the skin such as eczema, but recently this plant has been discovered as a source of acetylcholinesterase inhibitory substances and as such, could be used as a medicine in Alzheimer's disease therapy (Orhan et al., 2003; Rollinger et al., 2005). Unfortunately, in many countries this species is endangered because of devastation of its natural habitats and very long life cycle, which can take up to 22 years (Pacyna, 1972) Consequently it cannot be harvested from the wild and therefore there is a need to develop a method of cultivation for this species.

The aim of presented study was to determine the influence of storage, scarification, stratification and two temperatures in which the cultures were kept on vitality of wolf's foot clubmoss (*Lycopodium clavatum* L.) spores, which could be used as an initial explant in micropropagation of this species. Vitality of spores was determined using staining method with 2% solution of acetocarmine. The highest rate of stained spores was observed in nonscarified and non-stratificated population of spores harvested in 2012 and cultured in 20°C. According to statistical analysis interactions between factors were confirmed, especially between scarification, stratification and culture temperature.

References

Orhan, I., Terzioglu, S., Sener, B. 2003. Alpha-onocerin: an acetylcholinesterase inhibitor from Lycopodium clavatum. Planta medica 69(3), 265-267.

Pacyna A., 1972: Zarodniki i przedrośla widłaków. Wiadomości Botaniczne 16, 57-63.

Rollinger, J. M., Ewelt, J., Seger, C., Sturm, S., Ellmerer, E. P., Stuppner, H. 2005. New insights into the acetylcholinesterase inhibitory activity of Lycopodium clavatum. Planta medica 71(11), 1040.

THE INFLUENCE OF DIFFERENT CULTIVATION METHODS OF *STEVIA REBAUDIANA* (BERT.) BERTONI ON THE YIELD AND QUALITY OF RAW MATERIAL

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Stevia rebaudiana is a perennial herb belonging to *asteraceae* family. It is indigenous to South America but is now widely cultivated around the world. It gains popularity because of sweet steviol glycosides which can be even 300 times sweeter than table sugar (Prakash et al. 2008; Geuns 2003).

The aim of this study was to determine the influence of different cultivation methods of *Stevia rebaudiana* in Polish climate conditions, on the yield and chemical composition of its dry leaves. The factors of the study were as follows: place of cultivation (high tunel, open field), cultivation technique (on flat land, on raised beds) and type of soil (loosened with composted pine bark or non-loosened). Investigated factors had significant impact on plants' yield parameters (height, diameter, fresh and air dry weight) as well as on chemical composition of raw material (leaves) – stevioside and rebaudioside A (the most important biologically active compounds) and chlorophyll a and b content. The highest yield of leaves was obtained from plants grown in high tunel, on flat land with loosened soil (19,71 g/plant). The highest yield of steviol glicosides (taking into account their ratio) was obtained from plants grown on raised beds with loosened soil, regardless of place of cultivation.

References

Geuns J. 2003. Stevioside. Phytochemistry 64(5): 913-921.

Prakash I., DuBois G., Clos J., Wilkens K., Fosdick L. 2008. Development of rebiana, a natural, non-caloric sweetener. Food and Chemical Toxicology 46(7): 75-82.

THE CATABOLIC PROFILES SCREENING OF COMPOSTS FUNGAL COMMUNITIES

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Organic wastes, including composts, might be a source of microfungi strains with recognized properties for biotechnology, to develop new technologies and products. It is because of the enormous biodiversity of microorganisms inhabiting those materials. Screening catabolic abilities of whole fungal communities inhabiting organic waste can be considered as a stage of materials selection.

The goal of this study was to recognize how tested materials might differ as the potential source of the microbial isolates or community producing valuable metabolites, for example thermally stable enzymes with catabolic effectiveness.

Three types of composts were subjected to catabolic abilities of fungal communities screening. These were as follows: 1) "Agrohum" (Ag) on the basis of manure, straw, sawdust and litter, 2) "Rabio" (Rb) - on the basis of sewage sludge, sawdust, wood waste from parks and gardens, soil, residues of medicinal plants 3) industrial compost "Digestate waste" (Dw) - based on kitchen waste, food debris, waste from parks and soil. The analyses were carried out using the Biolog FF plates system. The dilution (100x) of composts samples in peptone water were submitted to the heat shock treatment (80°C, 30 min). The controls were samples without heat shock. Next, 100 µl of suspension was placed into each well of the FF plate. This step was followed by 216 h of incubation at 27°C, both in microaerophilic and aerobic conditions. Optical density (OD) was recorded every 24 hours during incubation time at 750 nm. Fungal community response was expressed by average well-density development. The evaluation of results was performed by the analysis of variance and the cluster analysis.

Clear differences were revealed in catabolic abilities of fungal communities of all types of composts (Ag, Rb and Dw). Our results may suggest that if the heat and microaerophilic treatment is established, there is a greatest possibility to isolate strains with recognized properties from compost based on kitchen waste, food debris, waste from parks and soil. Moreover, the method can be used for fast detection of heat-resistant fungi in composts and other organic waste.

INTERACTION OF WHEAT AND SILO WALL OF CORRUGATED STEEL. MEASUREMENTS AND MODELLING OF SHEAR BEHAVIOR

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Friction between grains and walls of storage silos is an important factor in the design and operation of such structures. Measurements of friction of grain against corrugated wall pose difficulties and experimental results are often not easy for interpretation. New tester was constructed and measurements were performed to examine the friction between wheat and galvanized corrugated steel. Numerical model of the apparatus was developed and simulations were conducted in order to get insight into the role of friction on the grain level and to validate numerical Discrete Element Method.

Laboratory tests were conducted at three different normal pressures 6.9, 27.6 and 48 kPa and two different shear speeds of 0.1 and 1 mm/s. The test material was soft red winter wheat at moisture content of 11.2% and bulk density of 740 kg/m^3. The sheet of galvanized steel had corrugations of 13 mm depth and 67.5 mm period.

Numerical simulations were carried out using the Discrete Element Method as implemented in the EDEM software package. Wheat grain was treated as a spheroid of volume equal to volume of the real seed. Multisphere method was used to approximate the spheroidal shape.

The coefficient of friction was found to vary as function of both, sliding speed and normal pressure. Experimental results showed that coefficient of friction increased with increasing velocity of shear and, in the studied range, decreased with an increase in the normal pressure.

Numerical simulations clearly reproduced sliding plane and typical friction force-displacement dependence were mimicked.

DEGRADATION OF ATRAZINE AND BENTAZONE IN PROFILES OF POLISH LUVISOLS

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Approved currently in the European Union (EU) pesticides, can contaminate soil, surface and ground water, as well as food. However, exceeding the permissible contents is sporadic. The reason is usually very effective decomposition of pesticides and their metabolites by soil microorganisms and their retention in topsoil thorough adsorption on organic and mineral surfaces. On the other side, the use of pesticides affects the microbial activity of a soil. Organic matter is a soil component that largely determines the content of microorganisms that are the main source of soil enzymes. Therefore, the biological activity of the soil depends on the content of organic matter. Meanwhile, approximately 52% of agricultural lands in Poland consist of soils developed from sand, and sandy or light loam. Subsoil horizons of these soils often contain low organic matter contents and, therefore, their microbial activity is low.

The aim of the study was to determine the ability of the three typical profiles of Polish grey-brown podzolic soils (Luvisols) with different organic matter content and other physicochemical properties, towards degradation of atrazine (reference hydrophobic pesticide not authorized in the UE due to the slow degradation) and bentazone (example of acidic compound authorized in the EU). Degradation parameters were determined using four kinetic models. Values of determined biodegradation coefficients clearly indicate that subsoils of investigated profiles exhibit lesser degradation ability than it is commonly assumed in the EU during the registration process. The study shows that if in subsoil the organic carbon content is much less than 0.3-0.5%, microbial activity can be too small in this layer to sufficiently prevent the translocation of pesticides into the groundwater.

FIELD RECOGNITION AND FERTILIZATION RATES IN PRECISION AGRICULTURE

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Investigations were conducted at IUNG-PIB Experimental Station (78,5 ha) in Puławy. The purpose of the study was to define spatially differentiated fertilization rates of winter wheat based on soil and winter wheat yield spatial variability recognition using traditional and innovative on-the-go methods. The rates were calculated according to precision agriculture and traditional recommendations. The first method assumes fertilization rates differentiation according to grain yield and soil spatial variability and the second one assumes similar mean rate application on the whole field area. Maps of soil spatial variability, fertilizations rates and yields were created for the two methods.

Precise fertilization rate appointments enables field area identification with a potential for reduced fertilization rates and areas in needs of increased rates, with a view to increase yields. More than half nitrogen fertilization measurement points of field 6 and from 25% to 32% points of fields 5 and 7 respectively showed smaller nitrogen fertilizer requirements than the whole field mean. At these points, fertilization according to precision system was more beneficial than the traditional one. As an average of three rotation fields, the number of points with beneficial and optimal nitrogen fertilization was similar. Precise fertilization with phosphorus, potassium and magnesium was beneficial in more measurement points than unfavorable and optimal ones.

In comparison to traditional method of calcium rate calculation, (excluding liming), the precise agriculture method specified fertilizer requirements from 2,85 to 21,3 t ha^{-1}. The precise fertilization of other macronutrients, except phosphorus, did not reduce fertilizer requirements on the whole field. However, it might be better to align yields as a result of fertilization balanced with crop fertilization requirements in each field area.

SCREENING OF TOLERANT GENOTYPES OF SPRING BARLEY FOR TERMINAL DROUGHT STRESS BASED ON GRAIN YIELD AND YIELD COMPONENTS

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The pot experiment with spring barley was carried on in 2011 and 2013-2014 years at the glasshouse of Grabow Experimental Station of the Institute of Soil Science and Plant Cultivation - State Research Institute in Pulawy, Poland. The total number of 263 genotypes was tested against short-term drought stresses introduced at the tillering stage for 11 days or at full flag leaf stage for 14 days. At the control treatment, plants were grown at the optimal soil moisture level of 13-15% weight by weight for the whole vegetation period and in the stress treatments, the moisture was maintained at the level of 5-6% weight by weight. After harvest at full maturity stage and the grain and straw yields, and yield components i.e. number of productive tillers, number of grains per spike and weight of 1000 grains were determined. Spring barley showed a higher tolerance to the drought stress at tillering stage than at flag leaf stage. Barley genotypes differed in their response to terminal drought stresses due to diverse ability for regenerating after the stress removal. The resistance and tolerance of the genotypes to the drought stress imposed at tillering stage resulted from their ability to produce additional fertile tillers and to the stress at flag leaf stage by compensation of the reduced grain number per spike through increasing the weight of 1000 grains. The grain yield of tolerant genotypes named as MCAM: 85, 86, 102, 128 and 129 was stable independent on water supply and the most suitable for breeders in Poland.

CHANGE GEOCHEMICAL PARAMETERS OF AGRICULTURAL LANDSCAPES OF DIFFERENT CLIMATIC ZONES OF UKRAINE DUE TECHNOGENESIS

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As a result of the work done in different climatic zones of Ukraine (arid - Donbass, humid - Polesie) established that observed a clear zonation and retention elements on certain of accumulative horizons. At insignificant violations soil structure of plants adapted to these soil geochemical parameters. A completely different situation is observed in anthropogenic (agricultural) landscapes in the affected of technogenesis zone. When plowing (to a depth of 25-40 cm) is overturning the lower horizons of the soil surface. In the arid conditions of Donbass as a result of plowing, heavy, toxic and other metals were accumulated on geochemical barriers were removed out of further migration and re-enter the upper horizon of the soil, there is an imbalance of various forms of heavy metals and their compounds in soil cut. This leads to that except anthropogenic impact outside going on an additional burden on the upper layer of soil these elements and their compounds, which in turn adversely affects of agriculture, because:

- steppe landscapes have very thin layer of humus horizon, which plowing completely.
- in the area of power supplies plant received items that accumulated on the barrier of sulphurated hydrogen (Pb, Ni, Cu, Zn, Hg, As, Co) and are located in soil in the form of sulphides, are not capable of ion exchange;
- the top layer of soil is also enriched by carbonates and metals that accumulated in alkaline geochemical barrier - Cr, Ni, Co, Zn, Ag, Cd, Sr, V, Sr, Cu, etc .;
- the additional receipt of heavy metals leads to inhibition of viable elements for plant growth as N, P, Ni, O, Cu and others;
- the advantage evaporation of rainfall causes continuous annual increase in the concentration of trace elements in these agricultural landscapes.

Considering the above, possible to say that the ground will be able to fully regenerate itself during the year under the conditions of agricultural cultivation.

Result of the action the flow from the waste pile and spoil bank the geochemical parameters of alluvial and downslope landscape, namely:

- Association of paragenetical elements Mo - Hg - As - Zr - Sc - Si - N - P are capable of free migration in the Donbass, changes to Mn - Pb - Cu - Co - Fe - Ge- Be - U - Li - Sr - Ba - Br;
- Type of ground hydrocarbonate calcium water goes into sulfate-calcium chloride water;
- PH 7-8,5 changes in pH 3,4-4,5.

Addition to the gradual degradation of soil, in agriculture and a load of heavy metals (from permanent sources of pollution) are salted ions SO42 +, Cl-, Ca2 +, which in turn contributes to the appearance of neoplasms in these particular CaSO4. Continuous mixing of soils (with topsoil work), their enrichment and toxic heavy metals, the formation of carbonates and gypsum plates - all this leads to the depletion layer of humus, reduced of fertility and quality of the food grown crops.

In humid conditions of Ukrainian Polesie in anthropogenic landscapes pH changes from 4,5-5 to 6-7,4 decreases the amount of exchange cations Ca2 + and Mg2 + by one third, a characteristic feature humid lithogenesis of Ukraine is the accumulation in the upper horizon of the soil profile A Be 1, 2 mg / kg i Ge to 10-12mh / kg, which is toxic.

Subsequent studies patterns of behavior of trace elements and their redistribution in rhizosphere zone is especially needed in areas of great influence technogenesis.

A PARTICLE SYSTEM APPROACH TO STRUCTURAL MODELLING OF PLANT TISSUES

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Particle systems are well known way of discrete representation of mechanical systems, where interactions between particles approximate various properties of simulated material. Such approach provides conceptually simpler and easier to implement framework when compared, for instance to an finite element method. However, simplicity is a trade-off for less accurate solution.

In this study we present a new numerical approach for structural modelling of plant tissue based on the mass-spring system and discrete element method (MSS-DEM), coupled with novel algorithm of 3D virtual tissue generation. The three dimensional structure of tissue was described by collection of particles which defined the cell walls surfaces. Interactions among particles were modeled via dynamic triangular mesh. The structure of virtual tissue was generated using self-developed algorithm based on Poisson-disc sampling in 3D space, combined with Voronoi tesselation. The Poisson-disc sampling is a procedure that produces tightly-packed, stochastically arranged patterns of points. In the proposed method the Poisson-disc sampling populated three dimensional space with points that in the next step were used to generate the Voronoi cells.

The proposed approach of modeling of plant tissue structure allows simulation of large mechanical deformations, cell wall failure, dynamic turgor changes and contact among cells. Moreover, plasticity and viscous components are also included in the model.

INFLUENCE OF NATURAL BIOSTIMULATORS ON GROWTH AND PHYSIOLOGICAL ACTIVITY OF WILLOW PLANTS (*SALIX VIMINALIS* L.) IN THE CONDITIONS OF GLOBAL CLIMATE CHANGE

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Unpredictable and uncontrollable climate changes are a global force for the development of new green technologies of cultivation of agricultural and energy crops. It is expected that the use of natural products, produced on the basis of organic matter, will significantly increase the resistance of plants to adverse stress conditions and also reduce the use of chemical fertilizers (Piotrowski et al. 2015, 2016).

In the presented experiment, the impact of biostimulator Biojodis (produced on the basis of extract of biohumus) and Asahi SL (containing the active compounds from the nitrophenol group, occurring in plants) and diatoms (a source of several nutrients) on growth and physiological activity of willow cultivated in adverse conditions were studied. Willow plants were grown under optimal environmental conditions (temp. 20°C, soil moisture content 30%) and in adverse conditions, temperature ranging from -5°C up to + 40°C and soil moisture content changing periodically from 20% to 60%. During the growing season Biojodis, Asahi SL and diatoms were applied to the soil and to plants three times, in three-week intervals and in various concentrations.

The results indicated a beneficial effect of the used compounds on growth and physiological activity of willow. Suitable concentration and application method of the used biostymulators significantly reduced the insufficient influence of environmental stress and improved resistance of plants to unfavorable conditions which occurs at present in our climate.

References

Piotrowski K., Romanowska-Duda Z., Grzesik M. 2016. How Biojodis and C*yanobacteria* Alleviate the Negative Influence of Predicted Environmental Constraints on Growth and Physiological Activity of Corn Plants. Polish Journal of Environmental Studies 25/2, 741-751.

Grzesik M., Romanowska-Duda Z, Piotrowski K., Janas R. 2015. Diatoms (*Bacillariophyceae*) as an effective base of a new generation of organic fertilizers. Przemysł Chemiczny 94/3, 391-396.

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ASSESSMENT OF USEFULNESS OF CI-600 DIGITAL ROOT IMAGER TO MONITORING OF LEGUMES ROOTS GROWTH

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Studying of root systems belongs to basic methods of plants growth evaluation but their leading is difficult and laborious. Detailed measurements of roots are most frequently performed by two various methods: invasive (roots removing from the soil) and noninvasive (roots are observed when plants are cultivated in the rhizoboxes) but these methods does not show natural growth and placement of roots.

The aim of researches was evaluation of usefulness of CI-600 Digital Root Imager to assessment of some legumes root parameters.

An experiment was established on the field of Agricultural Experimental Station in Grabów where pea, faba bean and blue lupine were cultivated. CI-600 Digital Root Imager was used to evaluation of roots growth and development. Special transparent tubes with 56,8 mm diameter and 1 m length were installed in the soil after the sowing. Photos of roots were performed at 5 BBCH phases with use of minirhizotron camera linked with a computer and analyzed in the RootSnap. In these terms 10 plants were dug from the soil in the aim to evaluation of weight.

Root parameters (dry matter, area, length and diameter) had growing tendency up to the stage BBCH 75 and then were observed their lowering. A little slower decline showed lupine. The greatest values were obtained by faba bean and the lowest by pea plants.

Conclusions:

1. It was found dependences between dry matter estimated by traditional method and parameters of roots obtained with use of CI-600 Digital Root Imager.
2. The great similarity of results indicates on usefulness of this device to monitoring of growth and development of roots.

RESPONSE OF CORIANDER (*CORIANDRUM SATIVUM* L.) TO LOW CONCENTRATIONS OF NACL

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Coriander (*Coriandrum sativum*L.) is rich in essential oils, proteins, vitamin C and organic acids. It is widely used spice plant, but it is also well known for its medicinal features. In that sense, the whole plant of coriander is effective, and the experts claim that coriander is a good antioxidant, antiseptic, antispasmodic, diuretic and aphrodisiac. Because salinity may change biochemical properties of plant tissues, the aim of this experiment was to explore the effect of low concentration of NaCl (which can often be found in irrigation waters) on biomass production and some biochemical parameters.

The seeds of coriander (obtained from the collection of the Institute of Field and Vegetable crops in Novi Sad) were sown in shallow, round dishes filled with previously sterilized sand and watered with deionized water. After germination, plants were transferred to pots containing ½ strength Hoagland solution. After 14 days, different amounts of NaCl were added into nutrient solution (0-control, 0.2, 0.6 or 1.2 g NaCl/l). There were 7 replications of each treatment, with 8 plants per replication. Analyses were done 21 days after the beginning of the treatment. Biomass production (of leaves, stems and roots separately), concentrations of vitamin C, free proline and MDA (as a measure of lipid peroxidation) were measured.

Leaf biomass statistically significantly differed between treatments. Increasing salt concentration induced increase in the content of vitamin C. Addition of 0.6 and 1.2 g NaCl/l led to an increase in the content of vitamin C about 25%. The concentration of free proline increased significantly only at a concentration of 1.2 g NaCl/l. Similarly to the content of vitamin C, the highest concentrations of the salts significantly changed amount of MDA compared to the control, suggesting that even relatively low concentrations of NaCl provoke significant changes in coriander herb.

DEPTH OF SOIL SOLUM AS AN INTEGRATED INDICATOR OF SOIL QUALITY IN LOESS AREAS

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Long-term arable land use and erosion have affected a soil cover in loess areas. Profiles of brown-grey soil (Haplic Luvisol) have been truncated or overbuilt by depositional material, and original profiles preserved only in places of balance between erosion and accumulation. The changes in the structure of profiles resulted in redistribution of soil properties within the fields. Studies with moldboard tillage showed that crop yield decreased with reduction of topsoil. The drop of yield on the shallowest soils with the plowed layer developed from calcareous loess decreased up to 30% for cereals and 50% for maize and root crops in comparison to yield on non-eroded soil. Application of soil conservation practices limits the rates of water erosion, however there is no information if the practices could restore the negative effect of reduction of topsoil on crop yield. The purpose of the studies was an evaluation of depth of soil solum as an indicator of soil quality under strip tillage in the loess area. In this study, soil quality was regarded as a crop response to the variation in soil cover.

The studies were performed in the loess area of Działy Grabowieckie (Lublin Upland, Poland). The strip tillage with direct drilling has been performed there by 8 years, and crop rotation included rape, winter wheat and maize. Fertilizers are applied to the soil at the depth of 15 and 25 cm (N, P, and K at the rate of 25, 30 and 50-70 kg/ha, respectively). Additionally, N is applied in the form of water solution at two rates of total amount of 140 kg/ha in the spring. Structure of soil profiles and basic soil properties (particle size distribution, soil organic carbon – SOC) were studied in a grid of 20 x 20 m (4 ha) and 40 x 40 m (8 ha). Plant growth was monitored in the area of 4 ha, and yield of maize and winter wheat was collected from 1 m2 plots. Soil water content (SWC) was measured in 1-m depth of soil profiles during the growth of maize in two week periods. The studies showed that soil cover was largely transformed during about 300 years of arable land use of the studied area. Soils with non-eroded, eroded profiles and depositional soils were represented by 13, 55 and 32% cores, respectively. Depth of soil solum (Ap-BC) ranged from 0.23 to 4.04 m, and concentration of SOC from 0.43 to 1.68%, and clay from 84 to 222 g/kg. The changes in the structure of profiles resulted in variation of soil moisture content that was the largest on non-eroded and depositional soils, and the smallest in severely and very severely eroded soils. The difference of 5-8% of SWC was maintained during the whole growing season. Biometrical measurements showed that plants were uniform at the initial phases of plant growth, and started to differ from the beginning of flowering when plant biomass decreased with the increase of soil profile truncation. Yields ranged from 6.1 to 11.5 Mg/ha (wheat) and from 4.9 to 16.8 Mg/ha (maize). Both years, the largest yields at similar level were observed on non-eroded and depositional soils. The relative yield on slightly, moderately, severely and very severely eroded soils was 99, 92, 70 and 74% (wheat) and 76, 57, 62 and 52% (maize), respectively. The yield on eroded soils was linearly related to the depth of soil solum. In conclusion, introduction of strip tillage did not restore the negative effect of reduction of topsoil that was inherited by previous land use, and depth of soil solum was an integrated indicator of soil quality in loess areas.

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ENHANCEMENT THE PRODUCTION OF *LEMNACEAE* BIOMASS WITH THE USE OF EXOGENOUS GROWTH PROMOTER STYMJOD FOR ENERGY PURPOSES

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The progressive growth of the people population favors development of the agricultural sector. In addition to pesticides, biostimulators have gained increasing popularity in crop production. Despite the fact that they are produced from natural ingredients they may have a different impact on environment, particularly on water reservoirs. Plants of the family *Lemnaceae* are often used as bioindicators in toxicity testing and play an important role in restoring water reservoirs. Macrophytes can also be used in the production of renewable energy and play important economic and environmental role. The study hypothesized that the new biostimulant STYMJOD (Jeznach Sp.J.), will stimulate growth and development of macrophytes (*Lemna minor* L. and *Spirodela polyrhiza* Schleid). In order to examine this hypothesis, the analysis of morphological and physiological parameters were made, including growth kinetics, plant fresh weight, index of chlorophyll (a+b) content, measurements of gas exchange parameters in leaves (net photosynthesis, stomatal conductance, transpiration, the concentration of intercellular CO_2) and studies on water use rate. The study showed the positive effect of biostimulator STYMJOD on growth of macrophyte *Lemna minor* L. and *Spirodela polyrhiza* Schleid. The used parameters of bioindication proved to be suitable to monitor the toxicity of inland waters caused by substances used in agro crops. It was also shown that the use of STYMJOD reduce the cost of macrophyte biomass production and increase their productivity (Grzesik et al. 2016).

References

Grzesik M., Romanowska-Duda Z., Janas R. 2016. Apol-Humus, Stymjod and microalgae as a source of biologically active compounds for enhancing physiological activities, germination and growth of plants. Proceedings of the 13th International Conference Microelements in Agriculture and Environment. Kudowa -Zdrój, 21-24.06.: 97.

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EFFECT OF PYROLYSIS PROCESS PARAMETERS IN THE CONTENTS OF SELECTED MACRO-ELEMENTS IN BIOCHAR OBTAINED FROM WASTE BIOMASS

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Pyrolysis is a decomposition process occurring in matter exposed to high temperature in the absence of oxygen. One of its products is biochar (carbonization product) – a material similar in properties and composition to charcoal. In addition to relatively stable carbon, biochar contains macro- and micro-elements, as a result of which the wide range of its applications include those useful for agricultural sciences. Chemical composition of biochars is varied and depends on the chemical composition of the utilized substrates, the temperature of pyrolysis and duration of the process. The study was designed to examine the influence of the parameters of pyrolysis (duration, temperature) on the contents of magnesium, phosphorus and potassium in the biochars.

The research material was biomass of three species of domesticated plants (rapeseed straw, oat straw, wood chips from fruit trees). The process was carried out with the use of thermogravimetric analyzer, at 400 and 500 °C for the duration of 5, 10 and 15 minutes. Samples of the obtained material were mineralized with the use of concentrated nitric acid at elevated pressure in microwave mineralizer. The contents of elements were determined with the use of inductively coupled plasma optical emission spectrometry (ICP-OES). The concentrations of the elements were calculated with the use of calibration curves based on external single-element models.

All the examined biochars were found with high contents of the relevant macro-elements, however observed differences in their contents. The parameters of pyrolysis resulting in the highest concentrations of P, K, Mg are: temperature of 500 °C and the duration of 10 min. at this temperature.

SOIL CONDITIONING INDEX IN CONVENTIONAL AND CONSERVATION MAIZE CROPPING

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In the temperate climate, soil inversion is often associated with the soil organic carbon (SOC) losses and there are several options for the tillage adjustment. Soil Conditioning Index (SCI) has been widely used for asscesing the SOC in different soil management systems. The aim of this study is to evaluate SCI if mouldboard tillage is replaced with the non-inversion soil management. SCI prediction is based on crops, climate, tillage, erosion and SOC decomposition. Negative SCI rating indicated SOM depletion, a zero steady state and a positive value an increase in SOM. Data were acquired from the long-term experiment at the Rimski Šančevi experimental station established on a Haplic Chernozem (CHha) on loess, loamy textured, calcareous and neutral pH reaction. The analyzed management systems were: maize monoculture, 2-year rotation and 3-year rotation with mouldboard tillage versus projected conservation tillage (chisel and direct sowing). Evaluation of the mouldboard maize-based cropping systems resulted with negative SCI. The maize monoculture showed lowest SCI -0.42, the 3-year rotation had -0.30 and the 2-year rotation -0.24. In the projection with chisel tillage negative scores were also observed but involved less SOC decrease compared with the mouldboard plowing. In the maize monoculture SCI was -0.11, at the 2-year crop rotation -0.04 and at the 3-year rotation -0.06. Assessment of direct sowing management demonstrated negative SCI values in the maize monoculture -0.04 and at the 2-year rotation -0.02. Conversely, the 3-year maize rotation with direct sowing showed positive SCI values that indicated lower soil disturbance and steady or improved SOC conditions. This study showed that no tillage in a multiyear rotation with legumes and addition of external carbon (ie. manure) can positively impact SOC. Obtained result could help in explaining SOC change related to the cropping management and to propose management practices toward SOC preservation.

BIOLOGICALLY REDUCED NITROGEN BY FABA BEAN PLANTS

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Legumes provide the major nitrogen input into the biosphere as a result of their ability to convert atmospheric N2 to a form that can be uptake by the plant. This results from symbiotic association with soil bacteria *Rhizobium*. Nodulated legume have the potential to provide almost all the nitrogen required for their growth from symbiosis. However, in field conditions, unfavorable factors (i.e. water content, temperature, mineral forms of nitrogen level, pH, rhizobium abundance) may negatively affect the potential of nitrogen reduction (Mastrodomenico et al., 2013, Lira et al., 2005). The aim of this study was to assess the amount of N derived from the atmosphere, mineral fertilizer and soil by faba bean (*Vicia faba*) plants. The field experiment was performed on Orthic Luvisol. ^{15}N isotope was applied into the soil in the form of ammonium sulfate and isotope dilution method was used. Nitrogen content was analyzed in different plant parts harvested at flowering and maturity stage. At flowering the highest and the lowest values of %Ndfa (N derived from the atmosphere) were noted for nodules (85) and stems (45), respectively. The amount of N derived from the soil ranged from 12 to 42% in total plant N, and from fertilizer 3 - 13%, depending on plant parts. At maturity, the amount of N derived from the atmosphere was from 57 in leaves to 72% in seeds. The assessment of biologically reduced nitrogen by legumes is of great importance for establishing nitrogen balance and estimating the amount of nitrogen fertilizer in agricultural production.

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References

Mastrodomenico A.T., Purcell L.C., King C.A. 2013. The response and recovery of nitrogen fixation activity in soybean to water deficit at different reproductive developmental stages. Environmental and Experimental Botany 85, 16-21.

Lira Jr. M. de A., Lima A.S.T., Arruda J.R.F., Smith D.L. 2005. Effect of root temperature on nodule development of bean, lentil and pea. Soil Biology and Biochememistry 37, 235-239.

WHEAT PERFORMANCE UNDER DROUGHT AS ACCOMPANIED BY ALUMINIUM TOXICITY OR HEAT STRESS

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Increasing frequency of extreme weather events will increase probability of exposure of crops to more than one abiotic stress. Heat and drought are stresses that in field conditions often affects crops simultaneously (Lipiec et al., 2013). Co-occurrence of abiotic stresses is very probable for crops growing on acid soils that are the source of at least one persistent abiotic stress – aluminium toxicity. The aim of the study was to evaluate how drought perceived by wheat can be altered by one additional co-stressor: high temperature (HT) or aluminium toxicity (AL).

The intensity of heat stress and drought induced similar reduction of photosynthesis, at the same time heat stress alone caused significant increase of transpiration. The reduction of photosynthesis rate due to combined action of heat and drought was stronger than a sum of the reduction of photosynthesis due to single stresses. This effect observed in the plants affected by heat and drought was caused by the increased evapotranspiration lowering soil water potential and increased temperature of leaves resulting from lower transpiration.

The response of wheat to aluminium toxicity was strongly affected by specific cultivar resistance to aluminium. Aluminium reduced root length of Al sensitive cultivar (ES8) in comparison to tolerant (ET8) increasing sensitivity of the former to drought stress. At moderate drought significant differentiation of photosynthesis in response to growth conditions was observed only in Al sensitive cultivar ES8.

The overall crop response to drought as affected by other abiotic stressor is very difficult to predict as it depends on their timing, intensity, specific and complex specie or cultivar responses to both acting stresses.

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References

Lipiec J., Doussan C., Nosalewicz A., Kondracka K. 2013. Effect of drought and heat stresses on plant growth and yield: a review International Agrophysics 27, 4, 463-477

EVALUATION OF WATER STRESS EFFECT ON GROWTH AND YIELD OF WINTER WHEAT IN LOESS SOILS UNDER MODIFIED STRIP TILLAGE

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Water stress appears not only in the periods of lower water supply by rainfall, but it is also a result of huge water uptake by plants under intensive crop production. It seems that water deficit is the main reason of yield variation in the soils of loess areas that had been largely transformed by tillage and water erosion. The aim of the studies was an evaluation of water stress effect on growth and yield of winter wheat in the loess area.

Studies were performed in the loess area of Działy Grabowieckie (Lublin Upland, Poland). The experimental site is cultivated from the beginning of the 18th century, and strip tillage has been performed for the last 8 years. Winter wheat (var. Magic) was sieved on the 9th November 2015. Tillage was limited to one cultivator operation with direct application of fertilizers to the soil at the depth of 15 and 25 cm (N, P, and K at the rate of 25, 30 and 50-70 kg/ha, respectively) in the autumn 2015. Additionally, N was applied in the form of water solution at two rates of total amount of 140 kg/ha in the spring 2016. The experimental field is of the area of 3 ha. The structure of soil profile and soil properties were studied in 108 points in a regular grid of 20 x20 m. In the same points, measurements of biomass and LAI of wheat were performed in two-week periods. A relative water and chlorophyll content in flag and older leaves as well as soil water content were measured to characterize water stress in selected points within the field.

Studies showed that the profiles of Haplic Luvisol were largely truncated or overbuilt due to erosion and moldboard plow in the past. Solum depth ranged from 0.2 to 3.6 m (mean=1.29 m, CV=64%), and soils with the non-eroded, slightly, moderately, severely, very severely eroded and depositional profiles represented 13, 32, 10, 5, 8 and 32% of total number of cores, respectively. In a result of modification of profiles, clay content ranged from 84 to 222 (145; 16%) in the layer of 0-15 cm, whereas SOC concentration remained on relatively low level and ranged from 4.3 to 16.8 g/kg (9.1; 21.4%). Studies showed that wheat growth was uniform at the initial phases of plant development and the effect of water stress appeared from the phase of flowering (16th June 2016). Biomass of wheat and LAI were smaller on the shallowest soils, and larger on deeper soils.

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RAPID DETECTION OF FUNGI INFECTIONS IN STRAWBERRY FRUITS USING HYPERSPECTRAL IMAGING

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Pathogenic detection is important for production of high quality fruits. Early detection of fungi infection directly in packaged fresh vegetables can be useful to prevent the intake of contaminated products. The spectroscopic and imaging techniques are unique monitoring methods that have been used to detect diseases in plants (Baranowski et al., 2015) as well as mechanical injures such as bruises (Siedliska et al., 2014).

This research reports on the use on hyperspectral imaging technique as rapid and non invasive method for identifying *B.cinerea* infected fruits.

Experiment was performed on two strawberries (*Fragaria ananassa)* cultivars: 'Senga Sengana' and 'Haneoye'. Strawberry fruits were divided into two groups: one was kept as control (non inoculated), while the second was inoculated by spraying *Botrytis cinerea* conidial suspension. In total 200 inoculated and non inoculated fruits were tested by a hyperspectral imaging setup working in the visible and near-infrared (400-1000 nm) wavelength range. In order to assess the real quality parameters of fruit (soluble solid content, dry mass content, firmness, phenolic and anthocyanin content) were determined using destructive tests.

The significant differences between spectral characteristics of inoculated and non inoculated fruits were observed throughout the whole spectral range. Infected fruits showed lower spectral reflectance than healthy fruits, even when symptoms are still not visible. Moreover, infected fruits were characterized by lower phenolic content, soluble solid content and firmness than control fruits.

The results obtained using hyperspectral imaging system was used to develop classification models for identification gray mold in strawberry fruits.

References

Siedliska A., Baranowski P., Mazurek W. (2014). Classification models of bruise and cultivar detection on the basis of hyperspectral imaging data. Compututer and Electronics in Agriculture, 106, 66-74.

Baranowski, P., Jedryczka, M., Mazurek, W., Babula-Skowronska, D., Siedliska, A., Kaczmarek, J. (2015). Hyperspectral and thermal imaging of oilseed rape (Brassica napus) response to fungal species of the genus Alternaria. PloS one, 10(3), e0122913.

HYPERSPECTRAL IMAGING ANALYSIS COMBINED WITH MACHINE LEARNING CLASSIFIERS FOR SOLUBLE SOLID CONTENT AND PIT DETECTION IN CHERRIES

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The hyperspectral imaging technique is fast and non destructive method, which was successfully used for identification mechanical injures such as bruises (Siedliska et al., 2014).

The objective of this research was to examine the applicability of hyperspectral imaging in the VNIR wavelength range for detecting pits in fresh drilled cherries.

Experiment was performed on three cherries (Cerasus Mill.) cultivars: 'Łutówka', 'Panda', 'Groniasta'. Cherries were collected from fruit and vegetable cold storage plant. The cultivars were selected to obtain wide spectrum of physical properties, especially soluble solid content. Before the experiment fruits were divided into three groups: cherries with a pit, cherries with pit fragments, and cherries without a pit. As reference method the soluble solid content (SSC) was measured using a pocket refractometer. The principal component analysis and second derivative pre-treatments of the hyperspectral data were used to construct the supervised classification models. In this study, five classifiers were tested for pit detection. From all the studied classifiers the best prediction accuracies for pit detection were obtained by the backpropagation neural networks (BNN) model (87.6 % of correctly classified instances for training/test set and 81.4 % for validation set). These results showed that hyperspectral imaging technique in transmittance mode is an accurate and objective tool for pit detection in cherries and may be applicable to on-line sorting systems.

References

Siedliska A., Baranowski P., Mazurek W. (2014). Classification models of bruise and cultivar detection on the basis of hyperspectral imaging data. Compututer and Electronics in Agriculture, 106, 66-74.

POTENTIAL OF BIOGAS RECOVERY FROM WASTE MASS LEFT OUT AFTER CARP FILLETING

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Managing waste from fishery is a significant issue. Although they include considerable amount of organic matter and macro-elements a considerable part of them is still utilised irrationally. The most popular method of waste utilization is composting or disposal of sewage into the sewage treatment plant. The need to search for alternative energy sources and the natural fertilizers substitute on the areas with low livestock draws attention to the potential of these wastes with regard to recovering energy on account of high initial saturation seems to be a proper base for methane fermentation. The use of this waste for biogas production and then using the obtained post-ferment for fertilization may constitute an appropriate method of mass management after fish filleting. The objective of the paper was to assess the amount and the quality of the produced biogas during methane fermentation on the substrates composed of mass left out after carp filleting for smoking. Waste which were generated during carp filleting: head, fins, scales and the entire content of the abdominal cavity were accepted for the research. Material was ground on the laboratory mill. Dry mass and ash content were measured in the so prepared samples. Based on the content of dry mass the size of the sample for making a fermentation base in the reactor with the volume of 2 $dm^3$was determined. On the so prepared base, static fermentation was carried out according to the German standard DIN 38 414/S8. Waste raw materials from special-purpose crops and other were used for biogas production.

Biogas recovery from the base with the complicated base of fish filleting waste was at the level of 475 ($Ndm^3 \cdot kg^{-1}$d.m.). In the first days of fermentation delay in biogas production caused by high content of fat in the batch was reported. This delay did not have the inhibition nature because gas was emitted at the level of 6.22 $Ndm^3 \cdot day^{-1}$ and during appropriate fermentation (after the 6th day) the gas recovery was reported at the level of 23.28 $Ndm^3 \cdot day^{-1}$. The average content of methane in the emitted biogas was 67.45%, carbon dioxide 28.31% and hydrogen sulfide 180 ppm. Research results prove that waste mass left out after fish filleting may be successfully used as a substrate for biogas plants. This mass on account of problems with management may constitute a proper batch for co-fermentation in biogas plants.

SPECIFIC SURFACE AREA OF ARCTIC ZONE SOILS (SPITSBERGEN)

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The recent climate change started about the half of 19th century. The observed warming has been greater over land than that over oceans. The rise is very small in the equatorial regions and it increases with latitudes, both north and south. The rise of average temperature, especially in the arctic zone, and specific periglacial conditions, was the reason for the start of many scientific investigations in this terrain. One of such place is Svalbard Archipelago and its the largest island – Spitsbergen. In arctic zone the main processes are cryogenic ones i.e. frozen segregation processes, swelling, shrinking and cracking, cryostatic stresses, frozen and gravitational slope movements. Consequently there are a diversity of micro-relief surface forms as the result of above mentioned processes and the varied grain size distribution and water properties. The good conditions for biosphere development allowed to start for soil–forming processes, especially on the flat surfaces with small inclination.

Many investigators have attempted to measure surface area as means of describing better the solid body under study or understanding better particular processes or reactions. The specific surface area characterize both quantity and quality of mineral and organic components and also their physical and physicochemical properties. These properties treated separately do not give such exact information about the state of the soil as specific surface area.

The aim of this paper was to determine the specific surface area of the arctic soils derived in different micro-relief forms. The research was conducted for two layers of soil profiles: 0 - 5 and 10 - 15 cm. The specific surface area of soils was measured of BET method (H_2O vapour and N_2).

The soil profiles were described according to the WRB classification system and represented following:

- Turbic Cryosols (Skeletic) in sorted circles,
- Turbic Cryosols (Siltic, Skeletic) in mud boils,
- Turbic Cryosols (Siltic, Skeletic) in cell forms.

SOIL STRUCTURE OF ALLUVIAL MEADOW SOILS ON FLOODED AND NON-FLOODED TERRACES

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Alluvial soils are formed along river valleys as a result of accumulation of sediments carried by the river. For these reason they show high vertical and horizontal heterogeneity which affects their basic functions. Observed spatial variability depends on different quality of alluvial sediments, regime of deposition, age of formation, as well as management practices. In order to monitor soil status and its evolution, knowledge of physical characteristics is required. Soil structure is one of the main indicators of the physical condition of the soil. It is represented by solid components and system of pores that allow for the assessment of potential changes caused by natural and anthropogenic factors. Therefore the main aim of this study was to compare the pore size distribution of pristine Alluvial-meadow soils on flooded and non-flooded terraces using four different measurement techniques.

The study area was situated along the Maritsa River on the territory of Tsalapitsa village, Plovdiv region, Southern Bulgaria. The soil was classified as Haplic Fluvisol (IUSS Working Group WRSB, 2006). Samples were taken from three soil profiles covered with grass and acacia trees with groundwater table ranged from 4 to 6 m under Profiles 1 and 2, and 0.7 m under Profile 3. Four different methods were used for soil porous system characteristics: method of soil water retention curve, mercury intrusion porosimetry, nitrogen adsorption isotherms and water vapor sorption.

We observed that pore size distribution of non-flooded and flooded terraces differed from one another with higher peaks of textural and structural pores under more humid conditions. We concluded that characteristics of humic horizons of Alluvial-meadow soils on non-flooded and flooded terraces can be effectively used for evaluating impact of various factors on soil structure.

References

IUSS Working Group WRSB, 2006. World reference base for soil resources 2006. A framework for international classification, correlation and communication. Worlds Soil Resources Reports No 103. FAO, Rome.

A STUDY OF EXTRUSION COOKING PROCESS OF CEREAL BLENDS WITH ADDITION OF HATCHERY WASTE

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Hatchery waste (HW) is a valuable feed material, rich in proteins, fat, minerals, and calcium in particular (Sathishkumar & Prabakaran, 2008; Al-Harthi et al., 2010). An alternative and simpler method of processing hatchery waste is the extrusion cooking technology. The application of suitable extrusion parameters (temperature, material retention time, and moisture content of raw material) permits to achieve a totally sterile product with attractive physicochemical properties and high nutritional value (Glatz et al., 2011).

The purpose of the present study was to examine the possibility of processing HW using a counter-rotating twin-screw extruder 2S 9-5 (Metalchem Gliwice, Poland). The effect of waste component addition on the physical properties and chemical composition of the extrudates was examined. The study demonstrated that extrusion cooking permits the processing of blends with HW content of up to 30 %. At a higher level of HW there appeared problems with the dosage of the material (material sticking to the feeder screws), which resulted in destabilisation of the process. The application of blend moisture at the level of 28% and extrusion temperature of 120/140/180/180/130°C permitted to achieve products with moisture not exceeding 9%. Increase in the content of the waste material from 5 to 30% reduced the expansion ratio (ER), pellet durability index (PDI), water absorption index (WAI) and water solubility index (WSI) of the extrudates. The microstructure of the extrudates with HW addition is non-homogeneous. There can be observed the areas with densely packed and adherent granules, interwoven with fibrous structures. Increase the share of HW leads to a lowering of the levels of crude fibre, neutral-detergent fibre and total dietary fibre in the products. Moreover, a significant increase (Duncan test, $P \leq 0.05$) in the content of protein, crude fat and mineral elements such as calcium, sodium, magnesium and iron was observed.

References:

Al-Harthi M.A., El-Deek A.A., El-Din M.S., Alabdeen A.A. 2010. A nutritional evaluation of hatchery by-product in the diets for laying hens. Egypt. Poult. Sci. 30 (I), 339-351.

Glatz P.C., Zhihong M., Rodda B. 2011. Handling and Treatment of Poultry Hatchery Waste. Sustainability, 3, 216-237.

Sathishkumar A., Prabakaran R. 2008. Recycling of japanese quail hatchery waste on egg production performance of quail breeders. Tamil Nadu J. Veterinary Anim. Sci. 4 (4), 123-128.

EFFECT OF EXTRUSION COOKING PROCESS ON THE PHYSICOCHEMICAL PROPERTIES OF PLANT-MEAT EXTRUDATES

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A study was conducted on the extrusion cooking process of plant-meat blends. The materials used in the study were meat-bone pulp, and a plant filler: faba bean meal and wheat wholegrain meal. The process of extrusion cooking was performed using a twin-screw counter-rotating extruder 2S 9-5 (Metalchem, Gliwice, Poland). The aim of this study was to determine the effect of the percentage share of the meat component (5, 10, 15, 20, 25 and 30 %) and extrusion temperature (130, 150, 170, 190, 210, 230 and 250 ^{o}C) on the process run and on the physical properties and chemical composition of the extrudates.

It was demonstrated that extrusion cooking permits the processing of blends with meat material content of up to 30%. Variation in the material composition of the extruded blends permitted the obtainment of products with various microstructure, physical properties and chemical composition. The increase in the addition of the meat-bone pulp from 5 to 30 % caused a decrease of specific density, pellet durability index (PDI) and water solubility index (WSI) of extrudates. At the same time a significant increase in the expansion ratio (ER) and water absorption index (WAI) was observed. The microstructure of the products with meat bone-pulp, examined by scanning electron microscopy (SEM), has the form of a liquefied and set mass, with small pores less than twenty μm. There is an observable absence of a distinct cellular structure, characteristic for starch expanded products. Important role in shaping the physical properties of the plant-meat extrudates had a process temperature. Application of low temperatures (130 ^{o}C) resulted in the appearance of a loose, grits-like structure. Increase of extrusion temperature to 250 ^{o}C caused complete liquefaction of the raw material and increase of ER, PDI and WAI of the products. The addition of the meat-bone pulp to the wheat-faba bean blend caused also an increase in the content of protein, fat, ash, total dietary fibre (TDF), and mineral elements such as: calcium, iron and copper.

CHANGES IN YIELD AND GAS EXCHANGE PARAMETERS IN FESTULOLIUM AND WHITE CLOVER GROWN IN PURE SOWING AND IN MIXTURE UNDER DROUGHT STRESS

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The aim of the study was to compare the yields and gas exchange parameters of Festulolium and white clover depending on the level of soil moisture.

Two-factor pot experiment was performed in 2012-2014, in a greenhouse of the Institute of Soil Science and Plant Cultivation – State Research Institute in Poland (Mazowieckie voivodeship), in the completely randomized block method, with four replication. Festulolium hybrid (Festulolium braunii (K. Richt.) A. Camus) and white clover (Trifolium repens L.) were grown in pure stands and in mixture (50% grass + 50% legume). The treatments were evaluated at two levels of soil moisture: 70% FWC (well-watered condition) and 40% FWC (drought stress). Dry matter yield and physiological plant parameters were evaluated.

All measured parameters were affected by drought stress. Intensity of photosynthesis, transpiration rate, stomatal conductance and dry matter yield were significantly lower under drought stress than under well-watered conditions in all treatments. White clover grown in a pure sowing showed the strongest reaction to stress (the average yield reduction was 42.5%, intensity of photosynthesis – 15.9%, transpiration rate – 10.2%, and stomatal conductance – 19.6%), while hybrid Festulolium grown in a pure sowing – the weakest (11.4, 0.2, 2.5 and 6.8%, respectively). Higher water use efficiency (WUE) under drought stress was observed in Festulolium growing in a mixture with white clover in all years of utilization. The calculated values of determination coefficients and regression equations showed a significant, positive correlation between gas exchange parameters, and dry matter yield of white clover and Festulolium in all years of the study.

EVALUATION OF YIELD QUANTITY AND QUALITY OF MIXTURES OF YELLOW LUPINE (LUPINUS LUTEUS L.) WITH SPRING CEREALS GROWN FOR SEEDS

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The aim of the study was to determine the productivity and chemical composition of mixtures of yellow lupine with spring cereals depending on the species of grain component and its percentage in mixture.

A field experiment was carried out in the years of 2011-2013, using the method of random sub-blocks with a control treatment, in four replications. The study included three species of spring cereals: wheat, barley and triticale, as well as three percentages of yellow lupine in the weight of sown seeds: 40, 60 and 80%. The yield of mixture seeds, the yield and the structure of individual components as well as the chemical composition of cereal grains and lupine seeds were evaluated.

The studies showed that the highest yield was obtained from the mixture of yellow lupine with wheat. Increasing the percentage of lupine seeds at sowing resulted in lower mixture yields, regardless of cereal species. Yellow lupine grown in mixtures with cereals formed less pods, less seeds per pod and per plant and produced a lower seed weight compared with their counterparts grown in pure stands. Legume grown in mixture with cereals favorably affected morphological characteristics of cereals, contributing to their higher tillering and producing a higher number of grains per plant.

The grain of cereals grown in mixtures with lupine had higher contents of total protein and crude fibre than the grain of cereals grown in pure stands, while the cereals did not have a significant impact on the contents of protein and fibre in the seeds of legume.

CHARACTERISTICS OF GRANULAR BIOMASS DETERMINED IN VANE SHEAR TESTER

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Mechanical characteristics useful for design and process control of granular biomass used in firing and co-firing were determined. New vane shear tester was constructed for determination of shear characteristics of consolidated samples of granular biomass. Measurements were conducted in 40 cm in diameter and 40 cm high cylindrical chamber. Axially, near the bottom of the chamber rotating vane tool 8 cm high and 12 cm wide was located having four blades. The normal pressure was exerted by pneumatic system with rubber air spring and the yoke. The rotating vane impeller was assumed to shear only the material in the immediate vicinity of the blades. The torque of the vane, the yield strength and relaxation characteristics were determined. Experiments were performed on materials of moisture content ranging from 10% to 60% at consolidation pressure from 5 to 30 kPa. The material characteristics were found dependant of material, moisture content and consolidation pressure.

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ASSESSMENT OF N_2O EMISSIONS FROM RAPESEED CULTIVATION IN POLAND BY VARIOUS APPROACHES

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The aim of this study is to compare four tools for calculating nitrous oxide (N_2O) emissions under the Renewable Energy Directive (RED). All the tools follow the methodology of the International Panel on Climate Change (IPCC). The first calculations of N_2O fluxes were based on Tier 1 method using BioGrace tool. The second and the third ones follow the Tier 2 methodology, applying Global Nitrous Oxide Calculator (GNOC) and Lesschen emission factors (Lesschen-EF), respectively. The last assessment was performed in accordance with the Tier 3 approach by using Denitrification-Decomposition (DNDC) model. The N_2O fluxes were calculated for rapeseed. The same input data were applied in all methods. The average of N_2O emissions varied in the range of 1.99-3.78 kg nitrate (N) $\cdot ha^{-1} \cdot yr^{-1}$, whereas the total Poland N_2O emissions from 1767 to 3479 tonnes N per year depending on the approach used (Lesschen-EF > DNDC > GNOC > BioGrace). This paper illustrates that Lesschen-EF methods at regional level works as well as DNDC model. Therefore, it is recommendable that countries calculate N_2O emissions using Lesschen-EF methods. The advantage of this approach is the simplicity of collecting required data in contrast to process-based models. Moreover, the Tier 2 method provides mitigation measure similar to DNDC model related to crop type, climatic conditions and management practices.

Table 1. Comparison of N_2O emissions (kg N $ha^{-1} \cdot yr^{-1}$) in rapeseed cultivation between BioGrace, GNOC calculator, Lesschen emission factors and DNDC model.

Methods	Mean and standard deviation	Median	Min.	Max.
	N_2O emissions kg N $ha^{-1} \cdot yr^{-1}$			
BioGrace	3.78±0.15	3.68a	3.60	4.09
GNOC	3.55±0.27	3.52b	2.44	4.56
Lesschen-EF	1.99±0.46	1.99c	1.28	4.43
DNDC	2.04±0.70	1.81c	1.33	5.56

The different letters present the difference for median Dunn's test $p < 0.0001$

N_2O EMISSIONS FROM ARABLE FARM IN POLAND

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The purpose of the work was the calculation of nitrous oxide (N_2O) emissions in Błonie-Topola Experimental. The farm is located in the łódzkie region ($19^O15'E$, $52^O07'N$) on brown soil. The calculation was performed for 4-year crop rotation in 2010-2013 including winter wheat and sugar beets. The N_2O fluxes were calculated by using global nitrous oxide calculator (GNOC), an on-line tool developed to estimate soil N_2O emissions from the cultivation of biofuel crops (Köble R., 2014). The input data sets for GNOC include: crop yield, nitrogen (N) application in mineral and organic fertilzers, soil properties and climatic conditions. Total N_2O emissions in the studied crop rotation amounted to 13.39 kg N ha^{-1}, 46% of which were the N_2O fluxes from sugar beets. The share of direct emissions from N application and crop residues range from 71 to 81 % for particular plants. The results of our study confirm that the N dose is the main factor affecting N_2O emissions.

Table 1 Crop production data and N_2O emissions calculated by GNOC calculator

Year	Crop	N input in fertilizer	N input in manure	Yield	Direct N_2O emissions	Indirect N_2O emissions	Total N_2O emissions
		kg N ha^{-1} yr^{-1}		kg ha^{-1}	kg N ha^{-1} yr^{-1}		
2010	winter wheat	182.7	0	5660	1.63	0.66	2.29
2011	sugar beets	238.6	68.7	73790	5.05	1.15	6.20
2012	winter wheat	148.9	0	3860	1.55	0.60	2.15
2013	winter wheat	210.2	0	7030	1.99	0.76	2.75
	Total	780.4	68.7	-	10.22	3.16	13.39

Reference

Köble R. 2014. The Global Nitrous Oxide Calculator – GNOC - Online Tool Manual. JRC Technical Report, Ispra, Italy.

THE EFFECT OF NPK FERTILIZATION ON GRASS HAY YIELD AND NPK CONTENT, OBTAINED IN A LONG-TERM FIELD TRIAL, SET UP ON CALCAREOUS CHERNOZEM SOIL

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The effect of different NPK-supply levels on grass hay yield, NPK-content and -uptake were investigated on a calcareous chernozem soil with light loam texture, 3-5 % $CaCO_3$ content originally very well supplied with Mn, well supplied with Mg and Cu, moderately supplied with N and K and poorly supplied with P and Zn. The factorial NPK fertilizing long-term field trial was set up in the autumn of 1973. In the autumn of 2000, an eight-component grass mixture was sown. Among the components, there was now leguminous crop. Grass hay yields, hay NPK contents and -uptakes are presented in this paper for the period of 2001 to 2014.

With applying yearly 0, 100, 200 and 300 kg N ha^{-1}, and periodical 0, 500, 1000 and 1500 kg P_2O_5 ha^{-1}, or kg K_2O ha^{-1} dose build-up PK fertilization, last time in the autumn of 1999, poor, moderate, good, and excess soil NPK-levels were established in the trial.

Grass hay yields and NPK contents varied according to the time passed since grass mixture sowing as well as according to the different soil NPK supplies. From the results, we got information about the year-effects, as well as about the residual PK-effects.

Hay yields increased until N2-N3, P1-P2 and K1 levels. In the trial, grass hay NPK-contents could be affected by the time elapsed since grass mixture sowing, as well as by the changing grass composition, the latter one depending on soil NPK-supply as well. The vegetative grass hay showed significant NK luxury uptake, the amount of NK-uptake increased until N3K3 level. P “behaved” completely different: similarly to hay yields, P contents increased only until P1-P2 levels.

From the difference between applied NPK amounts and grass NPK uptakes, we can get information about the specialities of NPK turnover in the different NPK treatments.

THE EFFECT OF POTASSIUM SUPPLY AND PLANT DENSITY ON CORN YIELD AND NUTRIENT CONTENT

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The effect of potassium supply and plant density was investigated on corn flowering stage leaf weight, grain and stalk yield and their K, Ca and Mg contents, as well as grain yield components in a field trial, set up at Nagyhörcsök, Hungary, in a calcareous chernozem soil with medium potassium supply. Different potassium supply levels were achieved by initial build-up 0-240-460-960-1440 kg K_2O ha^{-1} application in autumn 1989. The present study was conducted in 1991. Adequate NP supplies were provided by yearly NP fertilization. The year of 1991 was favourable for corn growth and development. Pioneer SC 3732 (FAO 450) corn hybrid was sown with a plant density of 24-48-72-96 thousand per hectare.

The effect of different plant densities was more pronounced on grain yield than that of different K supplies. When increasing plant density from 24 to 72-96 thousand per hectare grain yield increased from 5.3 to 8.6-8.7 tha^{-1}. As an effect of K fertilization, grain yields increased only from 7.1 to 7.7-7.9 tha^{-1}. Stalk yields showed similar trends. On the other hand, the effect of plant density on flowering stage corn leaf weight was adverse: changed in an opposite way. While 81 g 20 $leaves^{-1}$ on the lowest plant density, only 48 to 54 g 20 $leaves^{-1}$ at the 72 to 96 thousand per hectare plant number.

K fertilization increased the K contents mostly in the vegetative parts (leaf and stalk), while increasing plant density had a reverse effect. K supplies and plant densities affected K / (Ca+Mg) ratios as well.

According to the results obtained in the field trial, it seems that in our grandmother's time food contained more minerals than in nowadays, because of the fact that plant density affects grain mineral composition more than mineral fertilization.

DEVELOPMENT AND OPTIMIZATION OF NEW MOLECULAR PCR TESTS FOR THE IDENTIFICATION OF *PUCCINIA RECONDITA* AND *PUCCINIA STRIIFORMIS*

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Puccinia recondita and *Puccinia striiformis* are major pathogens of cereals in Europe, including Poland. These pathogens are responsible for the outbreak of fungal diseases called brown and yellow rust, respectively. It should be emphasized that these pathogens can be transferred thousands of kilometers by the wind to new areas causing economic losses, especially in wheat production. Hence, it is important to design new molecular tests for its early identification.

After screening the available science literature concerning molecular identification of *P. recondita*, we noticed that there was only one identification procedure based on PCR. Therefore, the aim of this work was to develop a new PCR-based method for *P. recondita* and also *P. striiformis* identification.

The study was conducted on environmental samples – wheat leaves with visual symptoms of rust diseases from across the Poland, collected in the 2014/2015 season.

The first step in designing species-specific oligonucleotides was the analysis of genetic resources deposited in NCBI GenBank. On this basis, we selected genes suitable to design primers for the tested species. Subsequently, we analyzed the intraspecific genetic variability of selected genes. This analysis allowed us to choose regions in selected genes that were suitable for the identification using oligonucleotides. Short amplicons were designed, so that they could also be utilized in qPCR. The initial screening test showed that all primers were species-specific. The amplification conducted on environmental samples with rust symptoms indicated the presence of pathogen in 100% of them. In the second step, we will perform sequencing of selected amplicons.

New molecular tests will allow to identify the pathogens and determine their presence at an early stage of infection. In consequence, it will promote the preventive use of pesticides.

EFFECT OF CADMIUM AND ZINC ON SELECTED STRUCTURAL AND BIOCHEMICAL PROPERTIES OF CELL WALLS OF APIACEAE L. PLANTS

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The cell wall is thought to be a first barrier against heavy metals entering into cell wall's sensitive plasmalemma and cytoplasmic components. Acidic polisaccharides rich in carboxyl groups play a crucial role in accumulation of heavy metals in the cell wall.

Heavy metal stress may modify a structure of a cell wall. Synthesis of pectins could be increased or decreased, depending on a degree of plant's tolerance to a heavy metal. However, the change in the amount of pectin in the cell wall stress is not the only way that the plants can defend. A degree of methylation of cell wall pectin (DM) and pectin methylesterase (PME) are also a very important factor.

The aim of the study was to determine the effect of cadmium and zinc on content of pectin, degree of methylation and PME activity in the cell walls of roots of Apiaceae L. plants.

The research was carried out on cell wall isolated from root of two species Apiaceae L. plants: parsnip (variety Hollow Crown) and celery (variety Talar). Water (WSP), chelate (CSP) and diluted alkali (DASP) soluble pectins were studied, taken from parsnip and celery cell walls. Furthermore degree of methylation (DM) and pectin methylesterase (PME) was studied.

Cadmium and zinc stress caused an increase of the content of pectin in the cell wall of the roots of parsnip in comparison to a control. Simultaneously a decrease in the activity of PME and an increase in DM was noted. However, different trends were observed for the cell walls of the roots of celery. Stressors caused the decrease of pectin content, an increase of PME activity and the decrease in DM.

The collected data suggests that despite the fact that both plants belong to one a family, they react differently (content of pectin, DM, PME activity) to the cadmium and zinc stress.

THE EFFECT OF SEWAGE SLUDGE ON THE YIELD AND ENERGETIC VALUE OF JERUSALEM ARTICHOKE (*HELIANTHUS TUBEROSUS L.*) BIOMASS (POSTER)

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The aim of presented study was to evaluation of the effect of sewage sludge applied once in the form of soil inserts, on the crop and energetic value on above-ground parts of Jerusalem artichoke biomass.

The research were conducted during the period from 2006 to 2011. Univariate field experiment, made using the method of random blocks with four replications. On this experiment, long-term fallow silty soil, from the type of *Haplic Gleysol*, was improved by the introducing of the sewage sludge inserts, of varying thickness (0, 10, 20 and 30 cm). In this way prepared soil, Jerusalem artichoke *Albik* variety, were cultivated. The surface of each plot was 16 m^2. The field experiment was located in Nowa Wies. Sewage sludge were taken from biological water-treatment plant in the same village.

Yield of above-ground parts of Jerusalem artichoke were obtained twice a year (in July and the end of October). After harvesting, biometric measurements of plants were done. Also an analysis of the energetic value of plants (separated for leaves and steams) were made, according to PN-81/6/04513. Jerusalem artichoke tubers were left in the soil, to reproduce plantation.

The obtained results indicate, that use of sewage sludge insert especially for 20 and 30 cm thick layer of the insert, had a very positive impact on above-ground biomass yield of Jerusalem artichoke. The average value of the yield from soils with sewage sludge insert increased and in soil with 30 cm insert has reached 5-times higher compared to control soil (without insert). It was also observed that the yield of this plants, especially on soils with the larges inserts (20 and 30 cm), had increased in particularly years of this study. The heat of combustion of the above-ground of Jerusalem artichoke also increased mostly in relation to the thickness of the applied sewage sludge inserts.

SALINITY INDEX DETERMINATION OF GLASS BEADS OF VARIOUS SIZES

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Salinization is regarded as one of the main threats to soils. Accurate and easy to implement soil salinity determination methods are based on the measurements of soil bulk electrical conductivity (EC_b). However, EC_b depends not only on the amount of ions dissolved in soil pore solution, but also on soil moisture and a number of other soil properties (Rhoades et al., 1999). Salinity index model (Malicki & Walczak, 1999) enables the assessment of electrical conductivity of soil solution based on the measurements of EC_b and soil dielectric permittivity.

The aim of this work was the determination of salinity index of samples of glass beads of various diameters from 0.1 to 1.4 mm, which modelled soil material. Complex dielectric permittivity spectra were collected using a vector network analyzer and an open-ended coaxial probe equipped with an antenna. EC_b of the samples were extracted using a MATLAB procedure which fitted the multipole Debye model to the measured spectra. The obtained salinity indices were compared to the literature data. It should be noted that the results obtained even for relatively small glass beads (0.26 mm in diameter) corresponded very well with the salinity index model applied to pure sand.

Acknowledgement

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References

Malicki M.A., Walczak R.T. 1999. Evaluating soil salinity status from bulk electrical conductivity and permittivity. European Journal of Soil Science 50, 505-514.

Rhoades J.D., Chanduvi F., Lesch S.M. 1999. Soil Salinity Assessment: Methods and Interpretation of Electrical Conductivity Measurements, Food & Agriculture Organization of the UN (FAO), Rome.

EFFECT OF BIOCHAR PRODUCED FROM PIG MANURE AND POULTRY LITTER ON ENZYMATIC ACTIVITY IN SANDY SOIL

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Great interest in using biochar as a soil amendment is caused by the beneficial properties of biochar and the possibility to transform problematic materials in the process of biochar production. On the other hand, biochar properties are not always optimal for soil microorganisms. The aim of this research was to assess the effect of biochar produced from pig manure and poultry litter on enzymatic activity in sandy soil.

In order to produce two kinds of biochar, thermal conversion of pig manure and poultry litter was conducted in laboratory conditions (300±10ºC, 15 minutes, reduced air access). Incubation tests were carried out in 100 g analytical samples of soil amended with 0.5%, 1% and 2% of the organic materials: pig manure, biochar produced from pig manure, poultry litter, biochar produced from poultry litter. The control sample was without amendments. The soil samples were incubated for 150 days at 25^{o}C ± 0.10. After finishing the incubation, the soil catalase activity was determined by manganometry whereas the activity of dehydrogenase, calatase, arylsulphatase as well as acid and alkaline phosphatase by colorimetry (Allef & Nannipieri, 1995, Brzezińska & Włodarczyk, 2006).

Amendments of fertilizers and biochars (especially in higher doses) generally increased dehydrogenase, catalase, arylsulphatase and alkaline phosphatase activity in the soil. The effect of adding fertilizers was stronger than the effect of adding biochar produced from particular fertilizers. The acid phosphatase activity in the soil with fertilizers was higher than the activity in the soil with no amendments, but the direction of changes caused by increasing doses was not clear. Adding increasing doses of biochars diminished the activity of acid phosphatase; as a result, the activity in soil with the highest doses of biochars was similar to the activity in the soil without amendments.

References

Allef K., Nannipieri P. 1995. Methods in applied soil microbiology and biochemistry (enzyme activites). Academic Press, London.

Brzezińska M., Włodarczyk T. 2006. Methods of soil catalase and dehydrogenase activity measurement. [In:] Selected methodological aspects of soil enzyme activity tests. S. Russel (Ed.), A.I. Wyczółkowski (Ed.), A. Bieganowski (Ed.), Institute of Agrophysics Polish Academy of Sciences, Lublin, 59-74.

PROPERTIES OF STABILIZED WASTE OBTAINED AFTER MECHANICAL-BIOLOGICAL TREATMENT OF MIXED MUNICIPAL WASTE

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Mechanical-biological treatment of waste was introduced by Polish law in 2012 [Regulation 2012] and fundamentally changed waste treatment. The process of legal changes in this field has been dynamic in recent years. This regulation is no longer valid, and the process is governed by the act on waste [Act 2012] and the BAT (Best Available Techniques) Reference Document for waste treatment [BREF 2006], although government authorities analyze the need for further changes in that field. The aim of the research was to assess the properties of stabilized waste generated in two facilities for mechanical-biological treatment of mixed municipal waste. As a reference, composts generated in the same facilities were analyzed. The pH value of all materials varied between 6.18 and 7.69. Ash content in the waste, especially the one which came more from rural areas, was higher than in the composts. The value of AT_4 parameter (which indicates oxygen demand of material) of all the samples was low. Heavy metal content in the composts was below the acceptable values for organic fertilizers [Regulation 2008], whereas the content of Cd, Cr and Ni in some waste samples exceeded those values. Some waste and compost samples contained *Salmonella* sp. bacteria.

References

Act. 2012. Act of 14 December 2012 on waste. Journal of Laws 2013, item 21.

BREF. 2006. Integrated pollution prevention and control. Reference document on best available techniques for the waste treatments industries (Polish version).https://www.mos.gov.pl/fileadmin/introduction/images/BAT_dla_gospodarowania_odpadami.pdf [24.06.2016]

Regulation. 2008. Regulation of Minister of Agriculture and Rural Development of 18 June 2008 on implementation of certain provisions of the act on fertilizers and fertilization. Journal of Laws 2008, No. 119, item 765, as amended.

Regulation. 2012. Regulation of Minister of Environment of 11 September 2012 on mechanical-biological treatment of mixed municipal waste. Journal of Laws 2012, item 1052.

AGRINOSE – A DEVICE FOR MONITORING OF QUALITY OF AGROMATERIALS

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Agrinose (electronic nose) was built of eight metal-oxide semiconductor sensors (type MOS). Seven of them were TGS type produced by Figaro Engineering (Japan), one of them Micro Electro Mechanical Systems technology produced by Ams (USA). Agrinose (Food Volatile Compounds Analyzer) has been designed and built in Institute of Agrophysics, PAS. Sensors used in e-nose were selected with the following criteria: lower power consumption, the similar type and geometry sensors in an array, low susceptibility to humidity and temperature, gas sensors tested in a similar measurement device and commonly used. As a producers ensure the sensors strongly respond to the presence of ketones, fatty acids, esters, and alcohols that can be expected in spoilage rapeseed.

Quality of rapeseed during one-month-storage was measured as an example. Colony Forming Unit (CFU), Ergosterol content (ERG), Fourier Transform Infrared Spectroscopy (FT-IR) and Volatile Organic Compounds (VOC) using Agrinose were measured. A series of experiments of storage were performed in cabinets aimed at creating a library of sensor response to quality changes correlated with changes VOCs of spoiling rapeseed. At every experiments authors observed correlation between VOCs and ERG, CFU and type of microflora. Due to the type of fungi, a three phases of the storage were observed: (a) fungi characteristic for field microflora, (b) fungi mainly characteristic for field microflora and the beginning of growth of storage microflora, (c) storage microflora. In the case of CFU during period (a) of the first ten days values a little decreased. At that time, there was a slight decrease in the CFU number associated with its adaptation to new environmental conditions. In phase – (b) colony of fungi started strongly increase, next during the last phase (c) systematically increased up to the end of experiment. Level of ERG increased during all the days of experiment. The higher responses of sensors were obtained for first 11 days of period characteristic for field microflora. Generally, responses of all sensors had a similar tendency, maximum of the $\Delta R/R_{max}$ was reached in the first period and decreased in the next stages.

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STUDY OF THE PHYSICAL AND CHEMICALS DEGRADATION OF AGRICULTURE SOILS IN HIGH PLATEAUS "THE CASE OF THE PROVINCE OF ALGERIA TISSEMSILT"

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The plateau of Tissemsilt represents a case of most affected ecosystem in Algeria by degradation of its soil and water resources. It is a sandy coastal area covering over 78 100 hectares, characterized by a significant wind activity and thus a strong erosive power. Additionally to this erosive effect, the plateau is under strong urban concentration and economic activities: industry and port, which threaten as much its resources, that it's basic ecological balance. This work is a contribution to the diagnosis of the state of degradation of the plateau of Tissemsilt, subject to various industrial constraints that affected its agriculture soil. One important result of this approach is that the degradation of Tissemsilt plateau exists in several forms at the same time it remains undervalued because it has not benefited enough attention from scientists or even socio-economic operators. She half-opened, however, an investigation way of primary importance on ecological and environmental impacts of rapid development conducted in the region, in the medium and long term.

QUALITY OF DIFFERENT KINDS OF OILS

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Introduction: The quality requirements forced both by the oil industry and more health-conscious consumers continue to increase and this trend forces the oil producers to improve their technology. It is achieved through the application of the most advanced technological solutions in different fields in order to obtain fats with the best health, nutritional and utilitarian attributes. Moreover, the ecological and economic aspect of fat production should be emphasized.

In recent years there has been an increase in consumer interest in consumption of cold-pressed edible oils. The reason for this trend is the notion that these oils are superior in terms of nutritional oils-mane received by hot stamping, extraction and refining. On the Polish market there are an increasing number of domestic and imported cold-pressed oils produced mainly from rapeseed and sunflower. They are also more exotic materials, with special properties, for example: grapeseed, sesame, corn, safflower and others.

Methods: The aim of this work was to compare the quality of Kropla zdrowia® rapeseed oil with cold-pressed and fully refined oils. Fatty acid profile, acid number (AV), peroxide value (PV), anisidine value (LA), iodine value (LI), a general technique (BO), content of chlorophyll and carotenoid pigments, content of β-carotene, tocopherols and PC-8 were determined. The quality cold pressed oils: commercial rapeseed (RT), virgin olive oil (O), olive oil (OL) and grapeseed (W); and fully rafined rapeseed oil (R) and sunflower (S) were investigated in comparison to rapeseed Kopla zdrowia® rapeseed oil (KZ).

Results: Generally, quality of examined cold pressed oils was good. LK value amounted to from 0.25 to 2.1 $KOH \cdot g^{-1}$, LN value was from 1.2 to 1.57 meq $O_2 \cdot kg^{-1}$. Contain of carotenoid pigments was between 0.165 and 0.267. Sterols content was about 30% higher in cold pressed rapeseed oil in comparition to fully rafined oil.

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DIFFERENCES IN MEASURED VALUES OF SOIL MOISTURE AT AGRICULTURAL PLOTS WITH AND WITHOUT APPLICATION BIOCHAR

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Recently, in context of climate change, there has been much interest in black carbon often referred to as biochar or charcoal, a co-product of thermal degradation of lignocellulosic materials (trees, shrubs, grasses or organic wastes) which have traditionally been disposed of by burning and landfilling (Lehmann, 2007). The aim of this study was to investigate the effect of biochar application on dynamics of soil moisture values of cultivated land on locality Nitra - Malanta (Slovakia). At experimental area was geodetically set out 15 plots measuring 6x4 m separated by 0.5 m bands. On these 15 plots were conducted experiment variations: control - without adding biochar ("Control"), "B10" variant with the addition of biochar dose 10 t/ha and "B20" variant with a dose of biochar 20 t/ha. We made continuous measurement of soil moisture, temperature and matrix potential at two plots: Control and B20 in top soil layer 5-10 cm. The measurements were performed with sensors 5TM (4 pieces) and MPS-6 (4 pieces) from Decagon. During the experimental measurements the area was agriculturally used. Results were unexpected: the values of soil moisture at Control plot were higher than at B20 plot. The reason why it was so is a main object for our next research.

References

Lehmann, J. 2007. Bio-energy in the black. Front. Ecol. Environ. 5, 381 -387.

PREDICTION OF PENETRATION RESISTANCE BY ASSESSING OF EASILY MEASURABLE SOIL PHYSICAL PROPERTIES

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A soil used for agricultural purposes must have both an adequate structure for workability, root growth etc., and a structure which will persist for long periods of time (Dexter, 1988). Soil structure degradation, for example soil compaction, is the most serious form of land degradation caused by conventional farming practices. Soil physical parameters used to quantify the effects of soil compaction in this study were: bulk density, soil strength as quantified by penetration resistance and soil water holding capacity. In this study we propose a pedotransfer function for 9 Romanian soils collected from cultivated fields and pasture, located in South-Eastern part of the country within the floodplain of the Lower Siret River. We investigate the relationship between soil strength (as quantified by penetration resistance) and easily measurable soil properties, such as bulk density and soil water holding capacity. Also indices of soil physical quality (S) and of hard-setting (H) were calculated according to Dexter's theory (Dexter, 2004a,b). Good power regression equations were obtained between penetration resistance on one side, and bulk density and S index on the other side. Moreover, a statistically significant linear regression relationship was found between penetration resistance and H index. The increase in bulk density led to higher soil strength, as quantified by penetration resistance, by 26 times. Also in soils with high values for H index, the soil strength increases linearly. The effects of bulk density and soil physical quality quantified by S index on soil strength were estimated by a pedotransfer function, which was found for the investigated soils, but more measurements are needed to test its validity on other soils.

References

Dexter A.R. 1988. Advances in characterization of soil structure. Soil and Tillage Research Journal 11, 199-238.

Dexter A.R. 2004a. Soil physical quality: Part I. Theory, effects of soil texture, density and organic matter, and effects on root growth. Geoderma 120, 201-214.

Dexter A.R. 2004b. Soil physical quality: Part II. Friability, tillage, tilth and hard-setting. Geoderma 120, 215-226.

EVALUATION OF THE GREENHOUSE GAS EMISSIONS IN ROMANIA – CASE STUDY FOR SUNFLOWER CROP

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Use of renewable energy resources is regulated by EU Directive 2009/28/CE. The reduction of the greenhouse gas emissions coming from biofuels and bioliquids use is calculated according to Article 19 of Directive and is based on typical and default values. In this study the coefficients for sunflower crop (typical emissions of greenhouse gas) were evaluated at NUTS3 level (county) taking into account the pedoclimatic and technological conditions of Romania. Evaluation of greenhouse gas emissions and of energy consumptions within the whole production chain of biodiesel was done by using three different computing programs: Greenhouse Gas Calculator; Greenhouse Gas Calculator for bioethanol and biodiesel; Carbon Calculator. Aggregation of information on greenhouse gas emissions at NUTS3 level corresponding to the fourth levels of crop production was done as an average of emissions from each soil-terrain unit under arable land use. It was used the dependence between typical greenhouse gas emissions specific to sunflower crop and crop yield (optimum technology: multiannual average, multiannual average ± standard deviation; actual technology: multiannual average). Aggregation of results at NUTS3 level demonstrates that the default values for crop coefficients in case of production of biodiesel from sunflower cannot be achieved even when the optimum technology in context of favorable years for sunflower crop production (mean ± standard deviation) was used. The aggregation of these results at NUTS3 level showed that in case of optimum technology most of counties with arable land use have average values ranging within default values for typical emissions included in the Directive. In case of actual technology, the average counties values of greenhouse gas emissions for entire production cycle of biodiesel obtained from sunflower (based on the average production of sunflower at national level for the 1991-2008 period) are lower than the typical and default values given in Annex V/part A of Directive.

THE FORM OF THE BODY OF MOISTURE IN A LIGHT SOIL AT THE INITIAL STAGE OF PENETRATING INJECTION OF WATER

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Under the conditions of Central Europe, irrigation of field cultivations causes an increase of yields and, in consequence, allows an improvement of the economic effect [2,3]. The application of a method of irrigation of field cultivations that makes use of penetrating water injection permits the minimisation or total elimination of water losses. The losses result from evaporation from soil surface, evaporation of water deposited on leaf surface, and drainage of water beyond the reach of plant root systems. The penetrating injection, combined with the mobility of the system, is a unique solution [1] and causes that outlays on irrigation are borne only when necessary. The application of such a solution requires the supply of a dose of water to soil with the root system within a very short time – e.g. within 2 s. For this reason, the pressure in the injector should be very high.

The objective of the study was to identify the form of the body of moisture created in the soil at the moment fof water injection. Based on a pilot study it was demonstrated that the form of the body of moisture in a light soil is not symmetrical, and depends on the orientation of the injector holes and on the unit dose of water.

References

1. Mobile system of precision injection irrigation and fertilisation, meeting the individual requirements of plants. Application to the National Centre of Research and Development for financing within the framework of the Strategic Program – Biostrateg, 2015, Research consortium: Precision irrigation and fertilisation.
2. Kresovic B., Tapanarova A., Tomic Z. et al. 2016. Grain yield and water use efficiency of maize as influenced by different irrigation regimes through sprinkler irrigation under temperate climate, Agricultural Water Management, 169, 34-43.
3. Onder S., Caliskan M.E., Onder D., et al. 2005. Different irrigation methods and water stress effects on potato yield and yield components, Agricultural Water Management, 73, 3-86

CONCEPT OF INJECTION IRRIGATION

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The deepening world deficit of fresh water enforces the necessity of its rational use – also in agriculture during the irrigation of crops. There are two methods that are mainly used: pressure sprinkler systems and surface and sub-surface drip irrigation lines. The first type is a mobile system, but it generates significant losses of water. The drip irrigation lines are water-saving systems, but stationary.

In view of the above the authors propose a method that combines the benefits of both of those solutions and eliminates their shortcomings. A concept has been developed for a mobile system of injection irrigation and fertilisation of field cultivations. The water and fertiliser requirements will be satisfied individually for each plant. Such an approach is in compliance with the idea and solutions of “precision agriculture”.

The use of the mobile injection system will allow the application of water and liquid fertilisers precisely at the point where the main root mass is situated, without the need for costly irrigation installations. Depending on the technical solutions applied, the mobile system can be used in vegetable, orchard, ornamental plant, agricultural and forest cultivations with wide inter-rows.

THE CONTENT OF CHROME AND NICKEL IN SOILS OF ALLOTMENT GARDEN IN OCHLAIN LUBUSKIE. POLAND

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The work presented the results of monitoring Cr and Ni content in allotment gardens in Ochla (in Lubuskie. Poland). Soils samples were collected in 10 places in the gardens, and 2 samples of the neighborhood of the gardens of the gardens. The total content of Cr was from 48 to 66,7 $mg \cdot kg^{-1}$, and total content of Ni was from 0,5 to 3,3 $mg \cdot kg^{-1}$. The content of Cr the potentially available for plants from 30,1 to 39,5 $mg \cdot kg^{-1}$, and the content of Ni from 0,2 to 0,7 $mg \cdot kg^{-1}$. The metal content complies with the requirements of Polish law.

THE CONTENT OF CHROME IN SOILS AT DIFFERENT DISTANCES FROM THE PROVINCIAL ROAD IN LUBUSKIE. POLAND

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The paper presents total and phyto available form of Cr in soil located at different distances from the road nr 297 in Lubuskie. The soil samples were collected in 25 places: 5 samples were taken from the edge of the road, 5 samples from 5 m, 5 samples from 10 m, 5 samples from 50 m and 5 samples from 100m. The total content of Cr vary from 3,2 to 7,9 $mg \cdot kg^{-1}$, and the potentially available for plants from 0,4 to 1,4 9 $mg \cdot kg^{-1}$. The content of Cr does not exceed the threshold values by polish low.

THE DETERMINATION OF TITANIUM APPLIED TO IMPROVE CROPS PERFORMANCE IN ENVIRONMENTAL SAMPLES

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As reported in the literature, titanium has a beneficial effect on plant growth. Titanium content in the soil is 0.17 % and occurs principally in the form of insoluble compounds. Its content in plants is low and ranges from 10 to 120 mg/kg dry weight. Tytanit is a preparation that enables delivery of titanium to plant. The largest biological benefits brought by the application of Tytanit is to increase yields and the synthesis of assimilation pigments, activates metabolic processes during the growth and development of plants, increases the content of chlorophyll in leaves which has a positive effect on the yield of crops.

Due to the widespread use of Tytanite in the cultivation of plants, the titanium compounds get into the soil and next to the ground water and living organisms. Therefore there is a need to monitor trace levels of titanium in the natural environmental samples for the prevention of possible contamination with this element.

The purpose of the studies was to determination of titanium in different environmental water samples enriched with crop biostimulant Tytanit. The measurements were performed using adsorptive stripping voltammetry (AdSV). In our voltammetric procedure, titanium is connected with the chloranilic acid into complex and accumulated on mercury film silver based electrode (Hg(Ag)FE) (Grabarczyk & Wasąg, 2015). The analysis of natural water samples collected in the eastern part of Poland enriched with Tytanit confirms that the used procedure is fast, simple and sensitive for the determination of titanium in environmental water samples.

References

Grabarczyk M., Wasąg J. 2015. Sensitive adsorptive stripping voltammetric method for determination of trace concentration of titanium in the presence of chloranilic acid as a complexing agent. Talanta 139, 132-137.

THE INFLUENCES OF ORGANIC MATRIX ON THE DETERMINATION OF INDIUM IN ENVIRONMENTAL SAMPLES

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In recent years indium gained importance in the field of high-technology industries. Therefore it is necessary to develop procedures that will determine trace amount of indium in soil and environmental water samples. The aim of these studies was determination of indium in natural samples with complex organic matrix by adsorptive stripping voltammetry technique (AdSV).

It is well known that organic matrix can disturb analysis of metals ions using AdSV. These substances prevent conducting a proper analysis. In our measurements, to investigate the influence of organic matrix on indium determination, the different type of surfactants and humic substances were tested: cationic (CTAB), anionic (SDS), nonionic (Triton X-100), biosurfactant (Rhamnoplipids), humic acids (HA), fulvic acids (FA) and natural organic matter (NOM). The obtained result shown that organic substances in most cases caused total decay of indium peak. In order to eliminate negative influence of surfactants the adsorptive properties of polymeric Amberlite XAD-7 resin were exploited. The procedure with the use of preliminary mixing with resin gives a superb effect of elimination of interferences in environmental samples with organic-rich matrices.

The experiments were performed using AdSV procedure and two different types of solid electrodes as a working electrodes, bismuth film electrode and lead film electrode (Grabarczyk & Wasąg, 2016). The comparison how these electrodes affect the studied interference were performed.

References

Grabarczyk M., Wasąg J. 2016. Application of a lead film electrode in adsorptive stripping voltammetry for the determination of indium trace in water samples. J. Electrochem. Soc. 163, 465-468.

Grabarczyk M., Wasąg J. 2016. Adsorptive stripping voltammetry of In(III) in the presence of cupferron using an in situ plated bismuth film electrode. Anal. Methods 8, 3605-3612.

SOIL ORGANIC MATTER OF URBAN PARK

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Cycles of matter and energy flow are different in urban areas and areas outside the city. Properties of urban areas are often highly modified by human activity which result in a lack of similarity with suburban areas [Greinert 2000].

This is particularly visible within the soil of urban parks - differences can be seen in both, physical and chemical properties. Properties of soils of urban parks can vary depending on the origin of the parks. Organic matter plays an important role in maintaining the quality of soils in urban parks and affects their health. A higher content of organic matter in soil can significantly increase soil sorption, including heavy metals.

The object of the study was the Millennium Park (Park Tysiaclecia) which is located in the centre of Zielona Gora. This is the post-cemetery area, with poorly developed plant cover.

Soil samples were taken from the layer up to 0.3 m. Sorption properties were determined by the Kappen method, the pH in H2O and 0.01M CaCl2 using potentiometric method and the TOC using Shimadzu analyser, particle size distribution - using hydrometer method. Nitrogen analysis was determined by Kjeldahl method.

The studies have shown that: 1 - content of organic carbon vary within the park, but not in comparison with soil from other urban parks; 2 - the carbon content of the research area highly significantly dependent on the nitrogen content and significantly from fraction of fine silt and sorption properties; 3 – the content of inorganic carbon was lower with increasing the amount of nitrogen in tested soil; 4 - in areas with high nitrogen content significant content of the organic carbon can be observed.

References

Greinert A., 2000. Zawartość części szkieletowych w powierzchniowych warstwach gleb miejskich jako wskaźnik ich stopnia antropogenicznego przekształcenia na przykładzie miasta Zielona Góra. Zeszyty Naukowe Nr 124, Politechnika Zielonogórska, Zielona Góra

ELECTRICAL CONDUCTIVITY ON THE SIZE OF THE TDR MEASUREMENT ZONE IN TERMS OF DETERMINING THE SALINITY INDEX

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Volumetric moisture distribution and the electrical conductivity of soil samples under natural conditions are most often heterogeneous. Rainfall, water evaporation and gravity contribute to the formation of soil moisture gradient and salt concentration in the soil surface layer. Soil dielectric permittivity (DP) and electrical conductivity (EC) are mainly related to water content, dissolved salts, density and dielectric permittivity of the solid phase. Dielectric properties of water in contact with the solid phase particles affect dielectric loss which depends on the wavelength and determines the penetration depth of electromagnetic waves in a material. Salinity Index (SI) allows the determination of the salt concentration in soil water, selectively in relation to the soil moisture level and requires simultaneous measurement of the EC and the DP. The time domain reflectometry (TDR) method (Dalton et al., 1984) for the simultaneous determination of the EC and the DP from the signal reflection should take into account the previously described gradients, which could occur inside of the measurement zone of the probe.

The aim of this study is to determine the impact of the DP and EC heterogeneity on the TDR measurement zone for further determination of salinity index. Electromagnetic simulations for the TDR probe constructed with three parallel rods were performed. The results can be applied to determine the salinity index during evaporation and moistening processes in the soil.

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References

Dalton F.N, Herkelrath W.N, Rawlins D.S, Rhoades J.D. 1984. Time domain reflectometry: simultaneous measurement of soil water content and electrical conductivity with a single probe. Science 224: 989–990.

EFFECT OF NITROGEN FERTILIZATION ON GRAIN YIELD AND TECHNOLOGICAL VALUE OF SPRING BARLEY

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In the years 2010-2011, pot experiments on spring barley were carried out In greenhouse of Institute of Soil Science and Plant Cultivation – State Research Institute in Puławy. The following cultivars were compared: Afrodite, Bordo, Henrike, KWS Olof and Tocada in terms of their response to 3 levels of nitrogen fertilization (NH_4NO_3): 1,2 and 3 g N/pot. Doses of 1 and 2g N/ pot was divided into two parts: 60% before sowing + 40% at the end of tillering, and the dose of 3g N/pot was divided into three parts: 60% before sowing + at the end of tillering + 15% before heading. Studied spring barley cultivars varied by grain yield, grain yield components and response to nitrogen doses. Cultivars KWS Olof, Afrodite and Tocada had the higher grain yield and greater number of spikes per pot compared to Bordo and Henrike. Cv. Tocada was characterized by higher total dietary fibre and insoluble dietary fibre contents in grains than other cultivars. Cv. Tocada and KWS Olof were characterized by the highest soluble dietary fibre content. Bordo cultivar showed a higher (1-3)(1-4)-β-D- glucan content in the grain than other cultivars. With the increase of nitrogen levels to 3g N/pot, there was obtained significant increase in grain yield and number of spikes per a pot in all spring barley cultivars, but the decrease of 1000 kernel weight. Comparing to other cultivars, the highest yielding cultivars Afrodite and KWS Olof showed greater percentage increases in grain yield and number of spikes per pot under the influence of increasing nitrogen doses to 3g N/ pot. At 2 and 3g/pot doses, the highest dietary fibre and β- glucan contents in barley grains was stated in comparison with a dose of 1g N/pot. With the increase of nitrogen dose to 3g N/pot, there was showed significant increase in protein content in grain of all cultivars. Total dietary fibre and insoluble dietary fibre content in the grain of spring barley cultivars were not dependent on the nitrogen fertilization doses.

Tabele 1. The effect of nitrogen rate on grain yield and grain quality of spring barly cultivars

Feature	N dose g/pot	Afrodite	Bordo	Henrike	KWS Olof	Tocada	Average
Protein %d.m	1	9,6c	10,2c	10,0c	9,6c	9,8c	9,8c
	2	11,2b	12,4b	12,3b	11,5b	11,5b	11,7b
	3	12,5a	13,9a	13,7a	13,1a	12,8a	13,2a
	average	11,6	11,8	12,0	11,6	11,9	11,6
Grain yield g/pot	1	50,7c	48,7b	50,1c	53,2c	51,6c	50,9c
	2	64,6b	59,8a	60,2b	65,2b	64,1b	62,7b
	3	71,0a	62,6a	64,5a	71,7a	69,9a	68,0a
	average	62,1	57,1	58,2	63,4	61,8	60,5
TDF %d.m.	1	19,2a	22,2b	20,2b	21,1a	23,4a	21,2b
	2	19,7a	23,1ab	21,5ab	22,0a	24,3a	22,1ab
	3	19,8a	23,7a	21,9a	22,3a	24,6a	22,5a
	average	19,6	23,0	21,2	21,7	24,1	21,9
(1-3)(1-4)-β-D-glucan %d.m.	1	3,6a	3,5b	2,6b	3,8b	3,6b	3,4b
	2	3,8a	4,7a	3,6a	4,1ab	4,4a	4,1a
	3	3,8a	5,0a	4,0a	4,4a	4,8a	4,4a
	average	3,7	4,4	3,4	4,1	4,2	4,0

a,b,c- Differences between values marked with different letters are statistically significant ($p<0.05$)

EFFECT OF WHOLE-WHEAT BARLEY FLOUR ADDITION ON THE QUALITY OF WHEAT BREAD

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Bread is a cereal product enjoying the greatest interest among consumers. Despite a significant decrease in its consumption, still the annual consumption is estimated at about 50 kg/person (GUS, 2014). Polish consumers prefer white bread with lower dietary fiber content. Simultaneous increase in the number of individuals suffering from diet-related diseases, necessitates the introduction of fiber-rich components into bread. Therefore, more and more attention is paid to barley and oats. Barley with exceptional nutritional and functional properties can be used as fiber-rich raw material for the production of functional bread.

The objective of the study was to determine the effect of whole-wheat flour from naked (variety Rastik and line STH 4561) and covered barley (variety Stratus) on the quality of wheat bread. Raw barley was diverse in terms of the content of dietary fiber and (1–3)(1–4)-β-D-glucans. The addition of barley component was estimated at: 2.5, 5.0, 7.5, 10.0 and 12.5%. The assessment of baking was performed; one specified bread efficiency, batch and furnace total loss. In the obtained bread, the volume of 100g of bread, humidity of fresh breadcrumb along with consumer sensory evaluation were determined. The analysis of the total dietary fiber (TDF), water-soluble (WSDF), water-insoluble dietary fiber fraction (WIDF) and (1–3)(1–4)-β-D-glucans content was performed.

The addition of barley component caused an increase in bread efficiency and a significant reduction in bread baking loss. Increase in the proportion of bread-free flour caused a decrease in bread volume. The greatest reduction of volume (14% in relation to the standard) was observed at 10% of Rastik whole-wheat flour. Wheat barley bread was characterized by higher humidity of fresh breadcrumb compared to wheat bread. Increasing proportion of whole-wheat barley flour resulted in a significant increase in the content of dietary fiber fraction. Addition of STH 4561 whole-wheat flour (12.5%) caused a fourfold increase in the content of (1–3)(1–4)-β-D-glucans.

The studies demonstrated the possibility of producing wheat barley bread with high dietary fiber content, simultaneously maintaining the organoleptic properties typical for wheat and white bread.

References

GUS, 2014. Mały Rocznik Statystyczny.

EFFECT OF LIMING AND MINERAL FERTILIZATION ON THE NICKEL CONTENT IN GRAIN OF WINTER WHEAT (*TRITICUM AESTIVUM* L.) AND SPRING BARLEY (*HORDEUM VULGARE* L.) CULTIVATED ON LOESSIAL SOIL

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The present study aimed at evaluating the impact of liming and mineral fertilization on nickel content at grain of winter wheat and spring barley cultivated in four rotations on loessial soil situated in Rzeszów Foothills (south-eastern Poland). Before establishment the experience (1986), bulk density of soil amounted 1.405 Mg m^{-3}, porosity 45.33 m^3 (100 m^3)$^{-1}$ and water content at $pF_{2.0}$: 24.17 kg (100 kg)$^{-1}$. The experiment set up by means of randomized sub-blocks, growing plants in 4 four-year rotation cycles including potato, spring barley, fodder sunflower, and winter wheat. Mineral NPK nutrition was applied on a background of a constant Mg as well as Mg and Ca fertilization (liming). General fertilization level ($N_1P_1K_1$) for spring barley was: 80 kg N ha^{-1}, 100 kg P_2O_5 ha^{-1} and 120 kg K_2O ha^{-1}, while for winter wheat: 90 kg N ha^{-1}, 80 kg P_2O_5 ha^{-1} and 100 kg K_2O ha^{-1}. Liming at a dose of 4 t CaO ha^{-1} was applied before experiment setup and each year that completed a subsequent crop rotation. Nickel content in crops was determined by means of FAAS technique (Hitachi, Z 2000) after sample digestion in mixture of HNO_3:$HClO_4$:H_2SO_4, at 20:5:1 ratio. There was significant decrease in nickel concentration in grain of winter wheat and spring barley due to liming applied. The liming procedure applied to the soil with very acidic reaction (in Serbia) significantly decreased the nickel uptake by winter wheat and winter barley grain (Milivojevič et al. 2008). Studies performed by Hamner et al. (2013) showed a negative correlation of Ni content in winter wheat and spring barley grain with pH value. Mineral nutrition had no impact on the element amounts variation in grain of test cereals. However, some tendency to lowering the metal content in winter wheat grain resulting from increasing NPK rates applied at constant N:P:K ratio, was recorded.

References

Milivojevič J., Nikolič O., Dekič V., Jelič M. 2008. Nickel and lead in the kernel and above – ground portions of small grain plants. In Proceedings. 43rd Croatian and 3rd International Symposium on Agriculture. Opatija. Field Crop Production,: 604-608.

Hamner K., Eriksson J., Kirchmann H. 2013. Nickel in Swedish soils and cereal grain in relation to soil properties, fertilization and seed quality. Acta Agriculturae Scandinavica, Section B - Soil and Plant Science, 63(8): 712-722.

SOIL DEHYDROGENASE ACTIVITY (DHA) IN HEAVY METAL-CONTAMINATED MINERAL SOIL WITH DIFFERENT MOISTURE CONTENTS.

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Soil enzymes play a major role in biochemical processes acting in this ecosystem. Soil dehydrogenases are one of the most important enzymes, which are used as an indicator of microbial activity. This is caused by the presence of the enzymes in all living soil microorganisms. Soil dehydrogenase activity (DHA) depends on many environmental factors, such as soil moisture, pH, temperature, heavy metal contamination, or temperature. DHA is probably the most frequent test used for determining the influence of a wide range of soil contaminants on soil microbiota.

The aim of the study was to investigate DHA after methane oxidation in mineral soil contaminated with a heavy metal (Pb) in two doses at different soil moisture (pF: 0; 2,2; 3,2). The assay was performed according to the Casida method, using triphenyltetrazolium chloride (TTC), which is converted to triphenylformazan (TPF).

The highest DHA activity was obtained in soil with pF=0. In terms of the addition of the heavy metal, the investigation showed that the single dose of the heavy metal stimulated the DHA and the higher dose degraded it.

In conclusion, it can be stated that the lower the moisture of the soil, the lower the activity of the DHA and the higher concentration of the heavy metal, the lower the DHA activity.

References:

Brzezińska, M., Gliński, J., 2004. Effect of methane on soil dehydrogenase activity. International Agrophysics Agrophysics 213–216.

Casida, L.E., 1977. Microbial metabolic activity in soil as measured by dehydrogenase determinations. Applied and Environmental Microbiology 34, 630–636.

Walkiewicz, A. et al., 2016. Methane oxidation in heavy metal contaminated Mollic Gleysol under oxic and hypoxic conditions. Environmental Pollution 213, 403–411.

Wolińska, A., Stępniewska, Z., 2012. Dehydrogenase activity in the soil environment. Dehydrogenases 183–210.

SELECTED PROPERTIES AND NUTRITIONAL CHARACTERISTICS OF FUNCTIONAL SNACKS ENRICHED WITH POWDERED TOMATOES

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Tomatoes are important vegetables in a healthy daily diet. A regular consumption of those vegetables could possibly lead to a decreased risk of various forms of cancer, in particular prostate cancer and heart diseases, according to health-related food components as carotenoids (in particular, lycopene), ascorbic acid, vitamin E, folate, vitamin E, flavonoids and potassium, behave as nutrients and diverse disease-preventing molecules. Corn snacks are popular products as gluten-free carbohydrates source, because of its texture and convenience, especially for the consumers with celiac disease diet.

The objective of this study was the effect of powdered tomatoes addition on functional characteristics of ready-to-eat corn snacks. Nutritional value, antioxidant activity and selected properties were assessed for quality of tomato enriched corn snacks. These products seemed to be nutritionally valuable gluten-free snacks.

Freeze-dried tomatoes were added in amount from 5 to 30%. Total lycopene and phenolics content, scavenging ability on DPPH radicals and ferric reducing antioxidant power (FRAP) were determined for nutritional value, as well as neochlorogenic, chlorogenic, p-coumaric acids and rutin level. Selected physical properties as expansion ratio, density, hardness, and water absorption and water solubility indexes were assessed for quality of tomato enriched corn snacks.

Increasing tomatoes addition increased nutritional value of snacks, especially total phenolics content. Snacks enriched with tomatoes characterized lower expansion ratio, water absorption and solubility indexes, but higher density and hardness than corn snacks. A powdered tomato seems to be a functional additive with high nutritional value and enriched snacks characterized good physical properties if additive level not exceeds 15-20%. Higher additive amount significantly lowered expansion and increased hardness of snacks, but products with 25 and 30% of powdered tomatoes addition are more valuable containing much higher level of functional components compares to the corn snacks.

GREENHOUSE GAS EMISSIONS FROM AGRICULTURE IN THE PODLASKIE VOIVODSHIP IN YEARS 1999 – 2015

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The increase of global greenhouse gas (GHG) emissions is an undisputable fact and cause of climate warming with its environmental, economic and social consequences. Although the global acts and state policy are very important measures in mitigation of GHG emissions, the regional differences and trends mainly in agriculture development should be also considered. Therefore the aim of this paper is the assessment of GHG emissions from agriculture in the Podlaskie Voivodship in years 1999-2015 as an example of the region where agriculture is still in quite deep transition.

The Podlaskie Voivodship is located in north-eastern part of Poland. More than 60% of the voivodship is under agricultural use and almost 31% is covered by forest. GHG emissions for years 1999-2015 for the Podlaskie Voivodship were calculated according to the methodology used by the National Centre for Emissions Management for national inventory for United Nations Framework Convention on Climate Change and Kyoto Protocol (KOBiZE, 2014).

Despite the climatic change mitigation policy total GHG emissions from agriculture in the Podlaskie Voivodship rose from 2615 Gg CO2-eq. in 1999 to 3594 Gg CO2-eq. in year 2015. Methane emission in year 1999 was equal to 58 Gg and in 2015 it grew to 77 Gg. This increase is mainly due to the growth of livestock population in last decades. The emission of nitrous oxide originated from agriculture in year 1999 was equal to 4.5 Gg N2O and rose to 6.3 Gg in year 2015 as a result of higher N fertilizer dosage. The results indicate that in regions where agriculture is basic economic factor GHG emissions from this sector do not follow the trend typical for the whole country. This is especially important in regions such as the Podlaskie Voivodship where changes in agricultural sector are still an ongoing process.

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References

KOBiZE, 2014. Krajowy raport inwentaryzacyjny 2014. Inwentaryzacja gazów cieplarnianych w Polsce dla lat 1988-2012. Warszawa.

INFLUENCE OF COPPER CONTAMINATION ON SELECTED SOIL PROPERTIES

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Our aim has been to determine the effect of increasingly severe copper contamination of soil on the soil content of selected elements and the C:N ratio. Compost, bentonite and zeolite were added to soil in order to alleviate the impact of copper. Observations were based on a pot experiment completed in a greenhouse of the University of Warmia and Mazury in Olsztyn (north-eastern Poland). Soil was contaminated with copper in the form of copper chloride, added in the doses of 0, 50, 100, 150 and 200 mg Cu · kg^{-1} of soil. The experiment was conducted in four series: without neutralizing substances and with compost (3%), bentonite (2%) and zeolite (2% of the soil mass). In addition, each pot was enriched with fertilizing components in amounts that covered the plants' nutritional demand. Copper chloride, compost, bentonite, zeolite and fertilizing components were carefully mixed with soil, transferred to polyethylene pots and sown with maize (*Zea mays* L.). Throughout the whole experiment, the soil moisture content was maintained at 60% of capillary water capacity. Soil samples for laboratory analyses were collected during maize harvest after tassel formation.

Soil contamination with copper and the application of soil neutralizing substances had significant effects on the analyzed soil properties. In the series without any substance expected to mollify the pollution, copper caused a significant increase in the content of total nitrogen and available forms of phosphorus, potassium and, most distinctly, magnesium. It also resulted in a broader C:N ratio in soil. All the neutralizing substances affected most strongly the content of total nitrogen and the widening of the C:N ratio in soil, causing a decrease in total nitrogen and widening the C:N ratio. They also raised the content of available magnesium in soil. The impact of the tested neutralizing substances on the other elements was evidently weaker, as the range of changes observed did not exceed 12%.

BEHAVIOR OF ETHYLENE AND INHIBITION ON ATMOSPHERIC METHANE CONSUMPTION IN FOREST SOILS

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Excess water (for example, after heavy rainfall) and abundance of nutrients such as C, N and P stimulating microbial growth can promote the formation of anoxic conditions in forest soils, with accumulation of C_2H_4. Indeed, under oxic conditions ethylene can be consumed by a range of soil microorganisms. Methanotrophic and nitrifying bacteria are able to co-oxidize C_2H_4 due to their unspecific methane and ammonia monoxygenases, respectively, and thus they may be responsible for C_2H_4 degradation in soil. Consumption of C_2H_4 in forest topsoils has been shown to induce a maximal CH_4 consumption in subsurface soils under temperate forests. Forest soils have been recognized as a major contributor to the consumption of atmospheric CH_4 and C_2H_4 in terrestrial ecosystems, but the behavior of C_2H_4 in forest soils and its relationships with the soil atmospheric CH_4 consumption are poorly understood. The results can improve our understanding of C_2H_4 cycling in forest soils and how this process interacts with atmospheric CH_4 consumption by soil.

References

Xu X., Inubushi K. 2009a. Ethylene oxidation, atmospheric methane consumption, and ammonium oxidation in temperate volcanic forest soils. Biology and Fertility of Soils, 45: 265-271.

Xu X., Inubushi K. 2009b. Temperature effects on ethylene and methane production from temperate forest soils. Chinese Science Bulletin, 54: 1426-1433.

Xu X., Inubushi K. 2009c. Responses of ethylene and methane consumption to temperature and pH in temperate volcanic forest soils. European Journal of Soil Science, 60: 489-498

Xu X., Inubushi K. 2009d. Soil acidification stimulates the emission of ethylene from temperate forest soils. Advance in Atmospheric Sciences, 26: 1253-1261.

Xu X., Yuan B., Wei J. 2008. Vertical distribution and interaction of ethylene and methane in temperate volcanic forest soils. Geoderma, 145: 231-237.

Xu X., Inubushi K. 2008. Measurement of ethylene and methane production in a temperate forest soil using inhibition of acetylene and carbon monoxide. Chinese Science Bulletin, 53(7): 1087-1093.

Xu X., Inubushi K. 2007a. Production and consumption of ethylene in temperate volcanic forest surface soils. European Journal of Soil Science, 58: 668-679.

Xu X., Inubushi K. 2007b. Effects of N sources and glucose on the consumption of ethylene and methane by temperate volcanic forest surface soils. Chinese Science Bulletin, 52: 3281-3291.

Xu X., Inubushi K. 2004. Effects of N sources and methane concentrations on methane uptake potential of a typical coniferous forest and its adjacent orchard soil. Biology and Fertility of Soils, 40: 215-221.

NEAR NULL GEOMAGNETIC FIELD CONTAINER FOR LONGER APPLES STORAGE

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The geomagnetic field is a natural component of the environment for the living organisms on Earth. In the earliest studies the role of the geomagnetic field was examined in relation to directional orientation of birds and other migratory animals. A number of hypotheses have been suggested to account for this phenomenon. In particular, research has focused on optical orientation and navigation based on “maps’ of the terrestrial surface and starry sky. Other studies have investigated navigation along the lines of force of the geomagnetic field, which are known to be rigidly bound with the geophysical coordinates of the earth. There are experimental indications supporting the latter hypothesis in the numerous observations of the ability of some biological species among microorganisms, insects, fish, birds and mammals.

The present study is an attempt to carry out a comparative analysis of selected varieties of apples, in storage deprived of the local geomagnetic field, i.e. stored in conditions with induction close to zero. The influence of external geomagnetic field will be eliminated by placing the selected fruits in a prototype device based on Helmholtz coil. The mechanism of action is based here on cancelling out the resultant vector of the Earth's magnetic field inside the coil by the vector induced in the opposite direction. This type of approach to the process of fruit storage, and to replacing traditional methods of extending the shelf life of fruit (e.g. fruit storage of controlled atmosphere) is a new, innovative and forward-looking approach to extending the life of plant material. The prerequisites for the possible success of the proposed method result from the extremely interesting observations reported by Balyavskaya in 2004. The alleged impact of reduced natural, Earth's magnetic field, with which we are dealing for example in the outer space, as well as in spacecraft, which act as a kind of shell screens for magnetic fields.

This solution makes it possible to store fruit for a longer time in a place where fruit respiration is reduced and also what is most important degradation of starch into mono sugars occurs more slowly.

References

Belyavskaya N.A. 2004. Biological effects due to weak magnetic field on plants. Adv Space Res., 34(7), 1566-1574.

EFFECT OF STORAGE TEMPERATURE ON CHANGES IN DIETARY FIBRE COMPOSITION AND RHEOLOGICAL PROPERTIES OF OAT FLOURS

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Oat products e.g. flour, due to high content of dietary fibre, are commonly classified in the group of food products with highly beneficial physiological properties (Sangwan et al., 2014). During storage oat flour undergoes physical, chemical and biological processes which can lead to changes in its chemical composition and technological properties (Lampi et al., 2015).

The present study aimed at the determination of changes in dietary fibre composition of wholemeal oat flours and apparent viscosity of gruels from oat flours during storage of oat flour at different temperatures. Flours obtained through laboratory milling of 3 cultivars of naked oat were kept in storage for adopted periods of time (1, 2 and 3 months) in tightly closed containers at temperatures of 20^{o}C, 4^{o}C and -20^{o}C. The content of TDF, SDF and IDF in the oat flours was determined acc. to methods AOAC and AACC. Changes in viscosity (initial, max, final, breakdown, setback), taking place during the heating and then cooling of oat suspensions were also determined. Measurements of apparent viscosity of 5% (w/w) gruels were made using a rotary viscometer with a coaxial cylinders attachment. Additionally, the coefficients of linear correlation (Pearson) between apparent viscosity of gruels of oat flours and the changes in dietary fibre fraction were determined.

An effect of storage temperature of oat flours on the direction of changes in the dietary fraction and rheological properties was shown; regardless of the storage temperature an increase was observed in insoluble dietary fibre and a decrease in soluble dietary fibre. Measurements of viscosity revealed, e.g. an decrease of initial and increase of final viscosity of gruels from oat flours after the 3-months period of storage, as compared to the viscosity of gruels measured immediately after grinding. Also, changes in other rheological parameters dependent on the temperature and time of storage were observed, however, the range of changes was too narrow to have significant effect on the technological value of the flours. No unequivocal relationship between changes of dietary fibre fraction and rheological properties during storage has been demonstrated.

References

Sangwan S., Singh R., Tomar S., K. 2014. Nutritional and functional properties of oats: An update. Journal of Innovative Biology, 1(1), 3-14.

Lampi A. M., Damerau A., Li J., Moisio T., Partanen R., Forssell P., Piironen V. 2015. Changes in lipids and volatile compounds of oat flours and extrudates during processing and storage. Journal of Cereal Science, 62, 102-109.

AN INFLUENCE OF WHEAT SPROUTS BIOFORTIFICATION ON ITS NUTRITIONAL QUALITY

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Dietary deficiency of essential micronutrients in human is very common. Biofortification of wheat, which is the second most produced cereal crop, could greatly reduce micronutrient malnutrition. Wheat sprouts could be a natural alternative for diet supplements - sprouting of grains causes increased activities of hydrolytic enzymes, improvement in the contents of certain essential amino acids, total sugars, and B-group vitamins, and a decrease in an antinutrients (Koehler et al., 2007). The aim of the experiment was to investigate the effect of dissolved organic components on nutritional quality of sprouted wheat.

The research material comprised wheat cultivar originating from the Research Farm in Czesławice (Poland). Hydroponic cultivation consisted of the direct placement of the seeds at the surface of the prepared test solutions of Zn, Cr, Mn, Cu, Fe, Mg, Ca or deionized water in an attempt to be controlled. For each element three solutions were prepared at concentrations of 50, 100 and 200 ppm. The plants were grown in appropriate medium at a day/night cycles of 16/8 h under 20/15°C, relative humidity 50% and natural light. Fresh plant materials were washed, dried, mineralized and analyzed using high-resolution flame atomic absorption spectrometry. The fraction composition of dietary fibre was determined with the enzymatic method, using Megazyme enzymes and methodological procedures.

During wheat seeds germination in microelements solutions, their content were multiplied in comparison with control (non-biofortified) - it was observed for all test solutions. The insoluble dietary fiber content in the sprouted grain exceeded the control in samples fortified with 50ppm and 100ppm of Zn and 100ppm and 200ppm of Mn. Except fortification with 50ppm of Zn, in all wheat sprouted samples content of soluble dietary fiber were below to the control. The Cr and Cu cannot be recommended to fortify sprouted wheat because these elements gave the lowest content of insoluble dietary fiber – their negative influence were stronger with higher concentration.

These results can be treated as general recommendations what concentrations of metals in solutions should be applied to provide good enrichment. Germinated wheat has not been widely utilised in food processing, but biofortified sprouted wheat can be potential dietary supplement rich in one or several particular microelements to reduce micronutrient malnutrition.

References

Koehler P., Hartmann G., Wieser H., Rychlik M. 2007. Changes of folates, dietary fiber, and proteins in wheat as affected by germination, Journal of Agricultural and Food Chemistry, 55, 4678–4683.

NON-INVASIVE DETECTION OF TOBACCO PLANT RESPONSE TO THE INFECTION WITH TOBACCO MOSAIC VIRUS

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Thermography and hyperspectral imaging are widely used techniques to monitor physiological status of plants upon biotic and abiotic stress (Baranowski et al., 2015; Chaerle et al., 2004; Sirault et al., 2009). We applied this methods to detect tobacco mosaic virus (TMV) infection on tobacco cultivars (*Nicotiana tabacum* L.), which differ with resistance to the virus. In contrast to a tobacco cultivar resistant to TMV, which is characterized by hypersensitive reaction (HR) resulting in the death of infected cells and limiting virus spread, a tobacco plant susceptible to TMV shows less visible symptoms of infection. The aim of the study was to detect response of cultivars susceptible to the pathogen, describe rate of infection development and indicate parameters valuable for early detection of biotic stress. The experiment was performed on plants (grown in the growth chamber with controlled photoperiod, temperature and humidity) at the same stage of development. Plants inoculated with a suspension of TMV and untreated (control) were imaged for ten days using the MWIR (8-13µm) camera and hyperspectral system equipped with VNIR (400-1000 nm) and SWIR (1000-2500nm) cameras with spectrometers. Obtained results revealed good applicability of hyperspectral imaging for studying the biotic stress in plants. Additionally, results suggest that thermography imaging is more useful tool to reveal differences between treated and untreated plants of studied tobacco cultivar at further stage of TMV infection development.

References

Baranowski, P., Jedryczka, M., Mazurek, W., Babula-Skowronska, D., Siedliska, A., Kaczmarek, J. 2015. Hyperspectral and thermal imaging of oilseed rape (*Brassica napus*) response to fungal species of the genus *Alternaria*. PloS One, 10(3), e0122913.

Chaerle, L., Hagenbeek, D., De Bruyne, E., Valcke, R., Van Der Straeten, D. 2004. Thermal and chlorophyll-fluorescence imaging distinguish plant-pathogen interactions at an early stage. Plant and Cell Physiology, 45(7), 887-896.

Sirault, X. R., James, R. A., Furbank, R. T. 2009. A new screening method for osmotic component of salinity tolerance in cereals using infrared thermography. Functional Plant Biology, 36(11), 970-977.

MAIZE RESPONSE TO DIFFERENT TYPES OF FERTILIZERS IN A DROUGHTY YEAR

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Traditionally, maize grown for silage in Lithuania received organic fertilizer, but a new focus on grain needs research efforts in order to re-evaluate the use of organic fertilizers for this crop. The aim of the study was to investigate the effect of different organic fertilizers on yield formation of maize grown under droughty conditions.

A field experiment was carried out in 2015 at the Lithuanian Research Centre for Agriculture and Forestry. Pelleted poultry, cattle manure and municipal green waste compost was applied at a rate equivalent to 170 kg ha^{-1} of N or 80 kg ha^{-1} with addition of 90 kg ha^{-1} of N as ammonium nitrate (AN).

Maize growing season in 2015 was relatively long - 158 days, but with significant water deficit at critical growth stages. In our experiments grain yield in the plots without fertilizers was relatively high - 7.11 t ha^{-1}, however, the effect of fertilizers was rather low presumably due to limitation of yield potential by water shortage. Calculations with model "Cropwat" suggest that yield reduction in relation to water shortage can as high as 40 %. Effect of poultry manure on grain yield (+0.69 t ha^{-1}) was higher than that of cattle manure, but lower than that of commercial NPK fertilizers. The highest grain yield (8.83 t ha^{-1}) was obtained in the plots applied with pelleted poultry manure in combination with AN. The effect of municipal green waste compost was very low, but increased substantially when combined with AN.

Analyses of soil samples taken after maize harvesting showed relatively high amounts of nitrates (above 60 kg ha^{-1} in a layer of 0-60 cm) in the treatments that had received 170 kg ha^{-1} of N as AN or AN in combination with pelleted poultry manure.

CROP PERFORMANCE UNDER DIFFERENT MANAGEMENT AND CHANGING CLIMATE CONDITIONS

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The study on the performance of arable crops under different management and weather conditions was conducted during 2008-2011 in the Valinava long-term experiment (55.22° N, 23.51° E), established in 1991 on a 4.4 ha area of sandy loam soil at the Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry. Spring barley, red clover, winter wheat and spring oilseed rape were grown in a 4-course crop rotation under three levels of management: a) conventional, b) integrated and c) organic.

The growing period of crops during the experimental years was warmer than the climate normal, with contrasting rainfall. Drainage water runoff measurements show that substantial part of precipitation was lost during the non-growth period resulting in lower levels of ground water table and temporary moisture deficiency in crops. Although soil moisture measurements and simulation indicated water stress in late spring or early summer in all experimental years, significant yield losses occurred only in a few cases. On average, the yield of winter wheat grown without fertilizers and pesticides was 67%, spring barley 70%, spring rape 47% and red clover 124% of that under conventional management.

The DSSAT v4.0.2.0 model was used to simulate the likely productivity changes of the cereal crops under different temperature and rainfall regimes in relation to climate change. The simulation suggested that spring barley might be more sensitive to changes in climatic conditions than winter wheat, if no adjustment measures are applied. Cereals grown under organic management are likely to be less affected than those grown under conventional management. In our simulations, no extreme events were anticipated and the conventional crop growing technologies were used, thus the results of the simulations can be treated as very preliminary estimations.

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26. Dyjakon, A., Den Boer, J., Bukowski P., Gebresenbet G., Techane B., Adamczyk F.: TECHNO-ECONOMIC ANALYSIS OF THE PRUNED BIOMASS HARVESTING IN APPLE FRUIT ORCHARD FOR ENERGETIC PURPOSES – A CASE STUDY
27. Dziki D., Polak R., Rudy S., Krzykowski A., Gawlik-Dziki U., Różyło R.: INFLUENCE OF PULPING AND FREEZE-DRYING TEMPERATURE ON THE PROCESS KINETICS AND SELECTED PHYSICOCHEMICAL PROPERTIES OF KALE
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61. Cieśla, J., Koczańska, M., Bieganowski, A.: AN INFLUENCE OF K+ CONTENT ON THE PHYSICOCHEMICAL PROPERTIES OF THE FERTILIZER STABILIZED BY BIOSURFACTANT
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74. Banach, A., Wolińska, A., Kuźniar A., Błaszczyk M.2 Stępniewska Z.: THE INFLUENCE OF SOIL TYPE AND WAY OF ITS CULTIVATION ON BIODIVERSITY OF MICROORGANISM IN SOILS FROM LUBLIN PROVINCE

75. Lemanowicz, J., Siwik-Ziomek, A., Koper, J.: ACTIVITY OF PHOSPHATASE AND THE CONTENT PHOSPHORUS IN SOIL AFFECTED BY LONG-TERM EXPOSURE TO THE EFFECTS OF THE SODA PLANT
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ERRATUM

POSTER PRESENTATIONS

SEEDER SOWING QUALITY UNDER CONDITIONS OF HIGHER SOIL MOISTURE

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Sowing quality is the basic precondition for maximum utilization of corn, sunflower and soy variety or hybrid potential. With appropriate conditions, seeder sown seed on exactly defined distance which has potential for high yield. Precision sowing at the recommended distance in the row allows plant enough volume space for growth and balanced development. If outdoor conditions are met, adequate, a crucial role assumes sowing quality.

Large number of factors affects to seeding. Some of them are preparation plots, micro and macro relief, seeding depth, the seedbed quality, seed size, speed, speed of seed plate, the value of vacuum or negative pressure in pneumatic seeder, ratio, planting mechanism ... Especially at sowing soybean, where the seeds very close one to another, sowing quality plays a significant role in yield forming. Soybean seed is approximately rounded, whereas this is not the case with sunflower and corn. For agroecological conditions in Serbia, sowing sunflower and corn should be done at a depth of 0.05 m to 0.07 m and soybeans at about 0.02 m - 0.04 m. These factors explain why the uniform seeding is important for optimum yield formation.

The paper presents the results of the regular 6-row seeder Özdöken, Turkish producer whose planting apparatus identical as Gaspardo seeder. Due to the frequent rainfall in late April, sowing is carried out in conditions of increased humidity in the spring of 2016. Characteristically for this is the emergence of seeding grouped sowing seeds. This is due to a sticking seed to furrow opener. Sowing quality was medium quality in maize and sunflower. Coefficient of variation in maize ranged from 20.58% to 23.07% and sunflower from 20.13% to 23.56%. Soya is sown very bad because the coefficient of variation exceeds 46%. It has been observed grouping of seeds as a result of sticking to the walls of furrow opener.

Keywords: seeding, coefficient of variation, moist soil, corn, soybean, sunflower, seeder.

NOZZLES TRANSVERSE DISTRIBUTION MODEL DEVELOPMENT: EFFECT OF PRESSURE AND BOOM HEIGHT

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Timely and high-quality application of pesticides contributes to environmental protection, economical production and production of healthy food. The efficacy of pesticide application depends not only on the quality of pesticides but also the quality of the application. One of the factor that most influences on the applications quality, from the standpoint of mechanization, are nozzles. They applied liquid on the surface of the plant which resulting that same volume of pesticide is applied to the entire surface of the plants. To achieve this goal, nozzles must performed uniform application of liquid per unit area, or working width. The variable factor in the application of pesticides may be nozzle and operating pressure. With increasing working pressure it was obtained smaller droplets.

The paper presents test of three different nozzles. Each nozzle is characterized by a flat jet with an angle of 110o and a flow rate of 1.6 l / min at a pressure of 3 bar. Differences between each other is the number of jets. Exactly this characteristic causes that with boom height change coming to changes in the uniformity of nozzles transverse distribution. The best distribution has nozzle with a flat jet. The coefficient of variation is between roughly from 4 to 6% at the pressure application of 2 to 4 bar. Very bad distribution have nozzle with triple flat fan jet at higher boom heights and higher pressures, CV becomes closer to 10%. This is very important because of boom moving during pesticide application at open field.

Obtained mathematical model that describes changes in the coefficient of variation depending on boom height can be a good basis for easy harmonization parameters in the pesticide application.

Keywords: nozzle, coefficient of variation, uniformity of distribution, pressure, sprayer, model, boom height.

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