Research Institute of Agricultural Engineering, p.r.i.

Proceeding of abstracts
10-th International Scientific Conference of Central and Eastern European Institutes of Agricultural Engineering - CEE AgEng

AGRICULTURAL MACHINERY, BIOENERGETICS AND ECOLOGY FOR SUSTAINABLE AND PROSPEROUS AGRICULTURE

Under the auspices of the Minister of Agriculture of the Czech Republic

Date of event: **13. – 15. 9. 2017**

Venue: Research Institute of Agricultural Engineering, p.r.i.
Drnovská 507, Prague 6 – Ruzyně

ČESKÁ AKADEMIE ZEMĚDĚLSKÝCH VĚD

MINISTERSTVO ZEMĚDĚLSTVÍ ČESKÉ REPUBLIKY

AGRITECH SCIENCE

Programme:

1st day – arrival of participants, accommodation, dinner

2nd day – 9:00 – opening of conference (assembly hall)
13:00 – lunch
14:00 – continuation of conference
19:00 – dinner – rout

3rd day – Excursion – agricultural enterprise, biodiesel plant
Evening – free time

Scope of Conference:

- development of new machine-based technologies and machinery for agricultural productions;
- utilization of robots in agriculture
- development of breakthrough (fundamentally new) technological processes of agricultural production environmentally friendly with significantly lower impact of anthropogenic pollution sources on environment;
- development of new and improvement of existing methods and means of power generation, transfer and application taking into account local power resources, including the farm waste;
- IT-based management and control of farm machinery and processes.

Technology and mechanization of cultivation of Jerusalem artichoke healthier

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Abstract. Jerusalem artichoke (Helianthus tuberosum L.) is a promising bioenergy multi-purpose crop. The Jerusalem artichoke is a valuable culture that is a source of inulin, fructose and pectin. Green mass of the Jerusalem artichoke has a high content of complex carbohydrate (fructose, glucose, sucrose, fructose, etc.) in the dry weight of the plant contain up to 17 % protein with a balanced amino acid composition.

Biotechnological methods are firmly established in plant growing practice and are widely used for rapid multiplication and obtaining healthy planting material of many economically important crops. The technology of micro clonal propagation "*in vitro*" has great importance for the development of seed production of Jerusalem artichoke and obtain sufficient quantity of high quality planting material.

Formed innovative scheme of sequential technological process of seed production of Jerusalem artichoke, including the production of original seed material "*in vitro*" Jerusalem artichoke, mass reproduction by aero hydroponic installations, the rationale based on research of the technology of growing high-quality seed of Jerusalem artichoke.

It is determined that at cultivation of minitubers of micro plants in aero hydroponic installation compared to farming by traditional technology, the cost of one minituber decreased by 9.58 rubles.

Key words: seed of Jerusalem artichoke, an innovative scheme of sequential technological process of seed production of Jerusalem artichoke, source of plants, minitubers

Research of animal manure compost fertilizer granulation and determination of granules quality indicators

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Abstract. It is important to search the new and more rational ways to use biological waste for new forms of energy. Some of these ways – creating fertilizers, building materials and other products. One direction of biodegradable waste management is pelleting as the processing of recyclable materials into organic products. In recent years in the EU countries only 5-7 % of bio-waste is recycled. For comparison, if more bio-waste will be recycled, it could replace up to 30 % of non-organic fertilizers. Currently, the EU imports about 6 million tons of phosphates a year but could replace up to 30 % of this total by extraction from sewage sludge, biodegradable waste, meat or manure. The EU legal requirements specify, that manure is considered to be waste that the livestock owners have to eliminate it by using as crop fertilizer and by trying to reduce the pollution of the environment. By pelleting the manure compost it is possible to increase the bulk density, to improve the material storability, to reduce the transportation costs and to make these materials easier to handle by using the existing handling and storage equipment. For solving of this actual problem there were investigated the granulation process and the factors affecting the organic granular fertilizer physical-mechanical properties. Research was carried out in Aleksandras Stulginskis University with the cattle and pig manure compost fertilizer, which was granulated by the small capacity 7.5 kW granulator with a horizontal granulator matrix, the diameter of produced pellets was 6 mm. Before the production of manure pellets raw material samples were dried naturally till 35-40 % humidity, and before pellet production the manure samples were dried till 25-30 % humidity. There were prepared 6 experimental manure samples and pelletized mixtures of manure waste with some additives. During the researches there were estimated the biometric and physical-mechanical properties of organic fertilizer granules – biometric indicators, raw material and pellet volume and density, material and pellet humidity and their resistance to impact forces. The research results show that produced granules are greatly resistant to compression on a static force and they are convenient for transportation, storage and for mechanical spreading.

Key words: organic waste, manure, fertilizer, granulation, pellet properties

Impact of forced air flow upon the precipitation of sprayed droplets when introducing pesticides under conditions of lateral air flow

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Abstract. Pesticide application is accompanied by losses due to the drift of the droplets of the working liquid caused by the wind outside the treatment area, which reduces the efficiency of chemical protection and increases impact on the ecological state of the environment. Influence of the precipitating (i.e. top-down) air flow has been determined upon the reduction of the drift of sprayed liquid droplets under the impact of a lateral air flow (lateral wind), as well as distribution of the sprayed liquid studied by mass and length depending on the pressure of the working fluid in systems of various sprayers. At speed side wind 5.0 m/s and deposition of flow at a speed of 15 m/s the amount of fluid that settled, increased to 30% for spray ST 110-02 and 12% for spray ID 120-02.

Key words: spraying, drift of droplets, lateral air flow

Exploration the working process of the rotary-blade tillage implement

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Abstract. They are provided theoretical and experimental study of the work of the disk-knife working body, and it is substantiated its rational parameters. The basis of the substantiation of the parameters of the cultivating tool is the original analytical model, which reflects the process of interaction of the working body with the soil. To study the performance of the process, on the basis of kinematic equations of motion of the individual points of the working bodies, it is developed the analytical model of the motion of the battery of the working bodies. On the basis of the provided analytical researches, they were determined geometrical parameters and developed experimental samples of the disk-knife working body.

It was carried out a comparative test in the field of tools equipped with disk-knife working bodies and with standard spherical cut-off discs, which confirmed the effectiveness of the use of disk-knife working bodies.

Keywords: modeling, field test, twist angle, burying factor, traction resistance

Determining the influence of the sizes of grain moth eggs on Trichogramma quality indices for biological plant protection

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Abstract. In the article it is established the correlation between the egg size of grain moth and the qualitative characteristics of Trichogramma evanescens Westw. For seven generations it is determined the influence of the egg size of grain moth on the Trichogramma class. Use of large eggs of grain moth in Trichogramma evanescens Westw. production technology allowed maintaining the first grade of quality for seven generations. The Trichogramma, which was made on the eggs of the grain moth, which was cleaned only, had I grade only up to the fourth generation. It was established the economic efficiency of production and introduction of Trichogramma, which is produced on large eggs of grain moth.

Keywords: calibration, parasitic eggs, searching capacity, regeneration of individuals, percentage of females, deformed individuals, fecundity of females

Engine performance and emission characteristics of paraffinic diesel fuel in model diesel engine

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Abstract. The article deals with verification of a diesel fuel and two fuel mixtures with different amount of the bio component using the model single-cylinder engine without the additional equipment for exhaust gases treatment. This combustion diesel engine served for measuring the performance characteristics of the model single-cylinder engine and the individual emissions components in order to assess use of these mixtures of liquid paraffinic diesel fuel in practice and to meet current and forthcoming European legislation and to fulfil the commitments by 2020. A detailed chemical analysis was performed in case of all tested paraffinic diesel fuels.

Key words: combustion engine, paraffinic diesel fuel, harmful emissions, engine performance, hydrotreated vegetable oil

Possibilities to increase the efficiency of the use of substitutes with a high proportion of cellulose in the biogas process

Jaroslav Kára, Irena Hanzlíková

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Abstract. There are many substrates that can be used for anaerobic digestion. When selecting a substrate, however, it is necessary to take into account the economy of the whole process. It is important here how raw material costs are, how much biogas and especially methane is produced per unit mass of the input substrate. In this respect, a large number of cellulosic materials are available in the agricultural and manufacturing industries. Due to the large number of combinations of materials and treatment options, we focused on cellulosic materials and biochemical preparation.

The trial was 5 weeks (35 days) according to the VDI methodology. The smallest production of biogas was measured in the anaerobic digestion of sawdust, which was 50-60% lower compared to other substrates, treated sawdust but increased the production of biogas by 33%. The biologically active additive in straw increased biogas production by 28% and on paper by up to 30%. Generally speaking, biogas production increased by 30% on average. Straw and cardboard have also shown significant increases in methane production by 5 to 9%.

Keywords: biogas production, substitute substrates, cellulose, additives

Different methods of ammonia and greenhouse gasses emissions measurement after organic fertilizer application

Miroslav Češpiva, Petra Zabloudilová

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Abstract. Many different methods are used for measurements of greenhouse gasses emission after application of fertilization on a field. It is very difficult to compare results from these measurements, because each method has some advantages and disadvantages dependence on the measurement conditions. This article describes results of ammonia, carbon dioxide and methane emission measurements after manure applications on a field by two different methods. These methods were used simultaneously and the results were compared.

A closed chamber above the surface with continual concentration measurement was one of the methods. The speed of gasses diffusion from a soil to an air was from the speed of gasses concentration increasing inside the chamber calculated.

Chamber with constant airspeed above the surface was the second method of measurements. The mission was from airspeed and difference between input and output concentrations calculated. There were significant differences between results by different measurement methods.

Key words: ammonia emission, methane emission, manure application, gas emission measurement

Impact of different transportation system on the mechanical damage of transported material

Jiří Bradna, David Hájek, Daniel Vejchar

Research Institute of Agricultural Engineering, p.r.i., Drnovská 507, 161 01 Prague 6, Czech Republic

Abstract. The increasing demands of modern society on the quality of grain lead to the need for the development of sufficiently sensitive, accurate and user-appropriate tools for detection and subsequent analysis of external quality indicators of food grains during post-harvest treatment and storage facilities. One of the basic requirements for storage of grain crops is mainly the sustainability of required quality of stored grain in storage space. The quality of grain is a sum of indicators, which expresses qualitatively the utility parameters of a given species and variety for the purpose of subsequent application. There is a difference between internal and external quality of grain. The external quality of grains is in practice negatively affected by using unsuitable conveyors during the post-harvest treatment of grain. The majority of these negative effects can be minimized by suitable storage and logistics strategy or it is possible to avoid them completely.

This article describes procedures and results of operational tests of screw and belt conveyors. During the transportation of grain (bread wheat variety Bohemia) in postharvest lines, grains were sampled on transportation routes at selected points with the aim of investigating damage to grains during transportation process and removal from storage facilities by screw and belt conveyors. Sampling for detecting damage to grain during transportation was carried out in accordance with the EU standards. Each sample was thoroughly mixed and two portions each weighing 100g were taken out as test samples. Each test sample was further processed separately.

During removal of grain from storage tower using a circulating screw conveyor, the amount of fragmented grains was in the range of 0.09 to 0.60% and the total mechanical damage ranged from 0.19 to 0.63%. The results of operational tests indicate that belt conveyors are very friendly to transported grains and the total mechanical damage was also significantly lowered in an auger conveyor when using a circulating auger with an active push into conveyed material.

Key words: mechanical damage, screw conveyor, belt conveyor, internal and external quality of grain, postharvest line, transportation

Effect of Fertilization on Optical Properties of Crop Stand

Jiří Souček

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Abstract. Into the agricultural research and practice penetrate new technologies, which enable the use of new measurement methods. In comparison with traditional methods based on sampling and subsequent analysis they have the disadvantage in less accuracy and reproducibility. Their advantage is topicability and the possibility to obtain a large volume of data in a short time. A simple and inexpensive method for obtaining information on cultivated crops is to scan and evaluate them with use of appropriate tools of image analysis. In combination with the possibility to take the snapshots of crop stands from a bird´s eye view, this method of determining the stand properties seems promising. The paper presents differences in the visible spectrum at different levels of winter wheat fertilization. The results of image analysis of the snapshots of experimental plots were compared with actual known level of fertilization. The analogy of obtained results was demonstrated particularly in case of nitrogen fertilization, but also it was demonstrated the dependence of analyse on the content of other nutrients and organic matter.

Key words: optical analysis, agricultural technology, plant nutrition, distance measurement methods, UAV

Functional properties of working tools of blade tiller

Radek Pražan, Josef Hůla, Pavel Kovaříček, Jakub Čedík, Ilona Gerndtová, Marcela Vlášková, Martin Stehlík

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Abstract. After the harvest of winter wheat, the tensile force, cross section of loosened soil and specific resistance of soil were measured on a plot with loamy soil. During the comparative measurement there were used 3 blades with chisel width of 20 mm, 40 mm and 75 mm. In case of all blades the measurement was carried out at the depth of 100 mm, 200 mm and 300 mm. In the course of measurement, the standards of blades were attached in a measuring frame on six-component hinge with connected tensometric sensor. The selected blades were developed for a new type of tiller destined for primary cultivation of soil. Moreover, in case of blade equipped by chisel there were used side wings of a width 110 mm, 150 mm and 200 mm for tillage into a depth of 100 mm. It was found, that the width of blade chisels didn´t have statistically significant effect on the values of specific resistance of soil during the soil tillage. At all widths of blade chisels there was recorded a trend of increase in specific resistance of soil at growing recess into the soil.

Keywords: primary tillage of soil, depth of tillage, specific resistance of tillage

Magnetic-Pulse processing of berry crops seeds

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Federal Scientific Agricultural Engineering Center VIM, 1-st Institutskiy proezd, 5, Moscow, 109428, Russian Federation

Abstract: To increase the productivity of berry crops in order to increase the sustainable yield, there are a number of methods, including the use of low-frequency pulsed electromagnetic fields. The article gives a classification of methods for preparing seeds of fruit crops for sowing and presents the results of a laboratory experiment on irradiation of strawberry seed. The effect of a pulsed low-frequency magnetic field on the seed germination and the growth of seedlings of strawberry garden under different conditions of processing and functioning of the apparatus magnetic-pulse processing of plants (MPP) developed by us has been established experimentally. It is shown that the value of the germination energy of seeds treated with a pulsed magnetic field varied from 29 to 47 percent, of germination from 34 to 48 percent. The highest value of their germination corresponds to an irradiation frequency of 16 Hz and an exposure time of 360 seconds with an induction value in the treatment zone of 5 mT. The maximum increment in the germination of irradiated seeds was 14 percent compared to the control sample. It was determined that further increase in exposure time and irradiation frequency led to a decrease in germination energy by 5 percent. It was noted that the average root length in the experimental version of 16 Hz, 360 seconds, compared with the control was more by 24 percent; height of sprouts is more by 28.2 percent. The positive effect of pulsed electromagnetic fields on linear dimensions of germs has been revealed. The increase in the biometric parameters of strawberry shoots affected their weight, compared to the control it increased by 33.3 percent. The possibility of using pulsed electromagnetic field of low frequency for increasing seed quality of seeds of fruit crops was shown and the effectiveness of application of the technology of presowing seed treatment with an electromagnetic field was demonstrated.

Key words: physical impact, presowing seed irradiation, electromagnetic field, horticulture.

Leakage flow rate of liquid cattle manure into subsoil during storage

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Abstract: Under laboratory conditions seepage of liquid cattle manure with dry matter content of 3 - 8 % through subsoil was studied in relation to its dry matter content and period of storage. Statistical dependence of the total amount of eluate on the dry matter has been found (p=0.0013). A hypothesis was also confirmed that liquid cattle manure shows sealing effect during storage. It was found, that the average value of coefficient of permeability decreases as soon as 48 hours after start of storage under the value 5.56171 x 10^{-6} $cm.s^{-1}$, which, according to peer reviewed literature, is not hazardous to the environment. The results will help in designing projects of liquid cattle manure reservoirs and assessment of their effect on the environment**.**

Keywords: Cattle liquid manure, manure storage, sealing effect, coefficient of permeability

The full text of the articles will be published in a special issue of the journal *Research in Agricultural Engineering (RAE)*.

http://www.agriculturejournals.cz/web/rae/

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Mezinárodní konference výzkumných ústavů zemědělské techniky

V Praze ve dnech 12.–14. 9. 2017 proběhla 10. mezinárodní vědecká konference výzkumných ústavů zemědělské techniky zemí střední a východní Evropy. Konference měla název Zemědělská technika, bioenergetika a ekologie pro udržitelné a prosperující zemědělství a byla organizována Výzkumným ústavem zemědělské techniky, v. v. i., pod záštitou ministra zemědělství Mariana Jurečky.

Akce byla zaměřena na prohloubení mezinárodní spolupráce v oblasti zemědělské techniky, technologií a energetiky, sdílení nejnovějších poznatků v oblasti výzkumu a možností jejich implementace v zemědělské praxi.

Konference se zúčastnily delegace ze sedmi zemí – České republiky, Litvy, Lotyšska, Maďarska, Polska, Ruska a Ukrajiny. Vedle účastníků zahraničních delegací byli přítomni i zástupci Ministerstva zemědělství, České akademie zemědělských věd, Ministerstva průmyslu a obchodu, univerzit, výzkumných ústavů a českých výrobců zemědělských strojů a technologií. Konference je pořádána pravidelně ve dvouletém cyklu s tím, že se pořadatelské země střídají na základě návrhu společného komitétu.

V úvodu byli účastníci přivítáni ředitelem VÚZT Praha Ing. Antonínem Machálkem, CSc., a Mgr. Vítem Doležálkem, ředitelem Odboru kanceláře ministra zemědělství. Následně zástupci jednotlivých delegací představili aktuální situaci v oblasti výzkumného oboru zemědělská technika a energetika ve svých zemích a institucích. Následný program byl věnován prezentaci nejnovějších výsledků výzkumu formou krátkých odborných referátů. Na závěr konference proběhlo plenární zasedání, kterého se zúčastnili hlavní zástupci delegací.

V rámci plenárního zasedání bylo sepsáno memorandum o spolupráci na mezinárodní úrovni v oblasti výzkumu, vývoje a inovací. Člen maďarské delegace oficiálně převzal pověření komitétu organizovat 11. mezinárodní konferenci výzkumných ústavů zemědělské techniky zemí střední a východní Evropy v roce 2019 v Gödöllö. Zájemci z řad účastníků se zúčastnili rovněž doprovodného programu, v rámci něhož proběhla exkurze v zemědělském podniku ZD Krásná hora nad Vltavou, a. s., a ve společnosti Primagra, a. s., v Milíně. Celá akce byla ze strany komitétu a zahraničních i tuzemských účastníků hodnocena velmi dobře. Největším přínosem byla výměna kontaktů a memorandum o mezinárodní spolupráci na základě vícestranné dohody i bilaterálních smluv mezi jednotlivými institucemi.

Jedním z témat konference byla bioenergetika

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