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DEPARTMENT FOR AGRICULTURAL ENGINEERING

UNIVESITY OF BASILICATA
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Sarajevo, Bosnia and Herzegovina

BOOK OF ABSTRACTS

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CONTENTS

Section I: Crop, Fruit and Vegetable Production Systems

Section II: Livestock Farming Systems and Equipment

Section III: Power and Machinery; Diagnostics and Maintenance of the Agricultural Machinery

Section IV: Post Harvest Technology, Processing and Logistics; Measuring, Sensing and Data Acquisition in Agriculture

Section V: Information Systems and Precision Farming; Modeling, Predicting and Optimal Control in Agricultural Engineering

Section VI: Soil and Water Use and Environment

Section VII: Energy, biomass and bio recourses in agriculture

Section VIII: Agricultural Policies, Sustainable Agriculture, Ergonomics and Safety in Agricultural Machinery Exploitation

ENERGY EFFICIENCY AND LABOUR PRODUCTIVITY OF NON-CONVENTIONAL SOIL TILLAGE SYSTEMS IN OILSEED RAPE AND WINTER BARLEY PRODUCTION

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Abstract. *Short-term study of non-conventional soil tillage systems was conducted at the experimental field near Štivica (45° 09' N, 17° 31' E) on hypogley-vertic type of soil and semi humid climate conditions. Oilseed rape (Brassica napus L.) and winter barley (Hordeum vulgare L.) were cultivated within four soil tillage systems: CT – mouldboard plough, disc harrow, seed-bed implement, drill, NcT1 – chisel plough, disc harrow, seed-bed implement, drill, NcT2 – chisel plough, rotary harrow integrated with seed drill, NcT3 – mouldboard plough, rotary harrow integrated with seed drill. As the efficiency indicators of different tillage systems the following parameters were observed: energy requirement, work rate and grain yield. Substitution of mouldboard plough with chisel in primary tillage (NcT1 and NcT2) provided substantially lower fuel consumption in those tillage systems than in CT, and in consequence, the specific energy efficiency were improved compared to conventional tillage. Labour requirement comparison also shows that those tillage systems were much more productive than conventional tillage. The average yields in non-conventional systems, with the exception of NcT3 in oilseed rape production, were not impaired by reduction of soil tillage and, therefore, proved that non-conventional tillage systems are not inferior to conventional tillage and could be an important tool to improve energy efficiency and labour productivity in oilseed rape and winter barley production.*

Key words: *soil tillage, specific energy, productivity.*

OPTIMAL PROFILE OF ROTARY TILLER KNIFE FOR CONVENTIONAL ROTOR ROTATION DIRECTION

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Abstract. *Optimal profile of knife, in which all points of the profile enter the soil at the same place during tillage, was determined for the following design parameters of the rotary tiller: radius (R = 0.25 m) and angular velocity ($\omega = 16.038\ s^{-1}$), and for soil tillage parameters: working depth (a = 0.1 m) and working speed ($v_m = 0.77$ m/s). The positions of the knife tip and every point of the knife were determined by parametric equations. First, the time interval in which knife tip reaches the critical point (soil surface) was determined. Also, the time intervals in which all points on the knife defined as X and Y with respect to the knife tip reach their critical point were determined. Equation which can describe optimal shape of knife profile can be obtained by equalizing the travelled distance in the x-axis direction of the knife tip with any other point on the knife profile.*
The curve, which represents the optimal shape of knife profile, was determined for the given parameters. If X is 30 mm, then Y is 7.164 mm, and if X is 60 mm then Y is 18.587 mm. The angle of inclination of the function Y(X) in the coordinate beginning (at the point of the knife tip) is 9.86^0.

Key words: *soil tillage, rotary tiller, knife profile (shape), parametric equation, nonlinear algebraic equation.*

THE IMPACT OF NPK FERTILIZERS ON THE YIELD AND ENERGY EFFICIENCY OF SUGAR BEET AND SOYBEAN PRODUCTION

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Abstract. *Agricultural production is of a great importance for the human population being the major source of food for the population of the planet, whose number is increasing daily. The objectives of this study are the evaluation of the energy embodied in the process of fertilizer application in the sugar beet and soybean production and identification of the energy input – output relation. Data from three production season were collected and analysed. In the case of both cultures results show that the highest share in total energy consumption has the energy input through the application of fertilizers. The nitrogen content in total energy consumption in sugar beet production was 51.89%, 38.44% and 31.83%; phosphorus was 1.77%, 3.66% and 4.18%; potassium was 3.09%, 5.24% and 2.87%. In soybean production the nitrogen content in the energy balance through the seasons was 37.86%, 39.55% and 39.38%; phosphorus was used in first and last season, with content of 4.69% and 3.46%; potassium was used in second agricultural year with the content of 2.30%.*
Based on the data obtained, it was concluded that the use of fertilizers is very important for the sustainability of agricultural production and that it must be balanced concerning the negative impact of excessive amounts on the both production economy and ecology.

Key words: *soybean, sugar beet, fertilizer, energy input, energy output, energy efficiency*

ANALYSIS OF DIFFERENT COMBINE TECHNICAL-EXPLOITATION PARAMETERS

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Abstract. *Wheat is a plant that has the most important place in food production. Success in the wheat production highly depends on successful harvest. This paper aims to draw attention to the exploitation and energy parameters of modern wheat combine harvesters with different concepts in order to see the possibilities of increasing the labour productivity and reducing the fuel energy consumption per unit of product. The results of the exploitation combine testing indicate that combine A, depending on the speed, had a productivity of 1.75 to 2.83 ha / h with the fuel consumption of 15-25 L / ha, and time fuel consumption of about 43 L / h with the engine load of 70 to 80%. Combine B had 13.61 L / ha fuel consumption, ie 38.11 L / h with the productivity of 2.8 ha / h and average speed of 5.5 km / h. Combine C achieved an average performance of 4.34 ha / h with the fuel consumption of 14.40 L / ha, and time fuel consumption of 62.1 L / h with the 71 – 80% engine load. It can be seen that the development of combine harvesters goes in the direction of increasing bandwidth, and that these efforts are simultaneously developed in the combine different concepts and different technical solutions. Efficiency coefficient of the harvester is 0.7, but it can be significantly increased with better harmonization of working regime and working conditions.*

Key words: *wheat, energy, energy efficiency, losses, productivity.*

.

CULTIVATION AND PROCESSING OF MEDICINAL PLANTS IN SLOVAKIA

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Abstract. *Slovak Republic is placed in the Central Europe. It lies in the climatically favorable mild zone of Northern Hemisphere. Nowadays 150 and about 200 medicinal plants are used in the official therapy and in popular doctoring, respectively. A wide range of herbs are now produced in Slovakia and can be divided into three broad categories: those collected from the wild (either individually or on commercial scale),−contracted supplies from small-scale growers, and−large-scale production on agricultural farms. The large-scale cultivation of medicinal plants belongs to the special agricultural production. It is an only way of supply the contracted volume and quality of these crops. The important elements for optimal technology of medicinal plants cultivation are: selection of biological material, soil cultivation, seeding and planting, nutrition and fertilization, control of harmful factors, harvest, processing and conservation.*

Key words: *cultivation fields, herbs, production, raw material, technology*

RESEARCH ON ASSESSING THE PURITY OF PLANT PRODUCT OBTAINED FROM THE MECHANIZED HARVESTING OF CHAMOMILE INFLORESCENCES

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Abstract. *In recent years, worldwide sales of medicinal plants and products based on them had a steady growth. This is due to the side effects of synthetic drugs, but also on the consumers desire to return to traditions, realizing the importance that phytotherapy has on health. For these reasons, the quality of the plant product obtained from harvesting medicinal plants is extremely important. The paper represents a continuation of experimental research conducted within INMA, related to the mechanized harvesting of chamomile inflorescences, using different sizes for the active parts. It presents the assessment of purity, one of the quality indexes for the plant material, by processing the experimental data using multivariable functions. The conclusions issued after interpreting the results constitute an important premise for the optimization of the process of mechanized harvesting on chamomile inflorescences, in order to build efficient equipment and to promote a sustainable agriculture*.

Key words: *quality indexes, experimental data, multivariable functions.*

COST OF TRANSPORTATION IN FOIL COVERED FIELD CUCUMBER PRODUCTION TECHNOLOGY

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Abstract. *In the paper we present the up-to-date mechanized production technology of cucumber production from ridge bed preparation till harvesting including transporting as well. By the presentation of the performance and economic data of machines necessary for production, we are emphasizing the significant volume of transport tasks in the production technology of pickled cucumber. In the present production technology the costs of machine operations and cost of material handling is about 14 Euro Cent/kg concerning the production cost of cucumber. It can be stated on the basis of the results that the total operational cost of the machines amounts 1688 EUR per hectare, which include the cost of transport and material handling in value of 390 EUR/ha. Special attention is to be paid to the machine operations like foil tunnel preparation, picking and planting which the most* ***costly*** *ones are representing about 12, 13 and 17 % of the total machine operation costs. It is worth mentioning that cost of transport and material handling takes the highest value, about 23 % of the total cost of mechanisation.*

Key words: *Foil covered filed, Logistic, Mechanisation, Economic, Machine Cost, Material handling*

TILLAGE FOR PERENNIAL PLANTATIONS BY USING ROTATING MACHINERY

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Abstract. *Intensive fruit production involves large investment in the creation of modern fruit plantations, which require the full-intensity implementation of agro-technical measures, during their exploitation. One of the basic measures is the tillage or maintenance of the inter-row space in the plantation, because that measure has a crucial influence on the growth and productivity of cultivated fruit trees. Good results in fruit production can only be achieved in conditions of proper and timely tillage. Intensive tillage in fruit plantations is a highly energy-demanding agricultural measure.*

This paper explores the operational parameters of the rotational inter-row tiller brand "Termometal", models PTF-125 and PTF-145. In the past years, the tested types of machinery are increasingly used in fruit growing in our country.

The analysis of the results shall acquaint current and potential customers with the exploitation of energetic parameters of those machines. In that way, they are given the chance to select the equipment correctly, in accordance with the production conditions of the plantation.

Key words*: perennial crops, mechanized tillage, movable rotational tiller, tractor unit*.

MECHANIZED PLANTING TREES ROSEHIP (*ROSA CANINA*) AND BLACKBERRY (*EUBATUS FOCKE*)

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Abstract. *Rosehip and blackberry occupy an important place in the diet because of their beneficial effects on the entire human organism. They are very widespread in nature. The growth in range shrubs, in addition to roads, the borders of fields, along forest glades, meadows. Lately crops have been raised for controlled production***.** *This paper presents the results of hand-planting (classical planting) and mechanized planting with hydrobohrer trees rosehip (ROSA,* cultivar *Rosa canina) and blackberry* (*EUBATUS FOCKE* cultivar *Thorn-free). The best results in the receipt of the trees were variants of planting with hydrobohrer* at rosehip 95.0*8 % and blackberry 44.00 %.*

Key words: *Rrosehip, Blackberry, Hand planting, Hydrobohrer.*

USING THE CONTROL CARDS FOR THE STATISTICAL QUALITY CONTROL OF THE PESTICIDE USE

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Abstract. *Use of herbicide, as environmental pollutant, has been maximally reduced in cultivation and maintenance of land in perennial plantations over the recent years. A tendency to reduce pesticide use is mostly motivated by desire to reduce environmental pollution levels, which is seen as major environmental problem. Reduced use of pesticides herbicides means more frequent use of mechanical cultivation which not only removes weeds, but also increases mechanical, as well as other soil characteristics.*
In the article we analyze the exploitation and technical parameters of combined cultivator used for land cultivation in perennial plantations which help achieve high productivity and appropriate quality of cultivated land. We present results of test conducted on foreign-made cultivator used for cultivation of vineyard.
Experience and knowledge on land cultivation technology show that technical solutions applied in basic machine structure should allow for simple adaptation by replacing relevant working elements, which helps achieve universality. Universality of basic machine structure should provide rational procurement and use, since current solutions used on these machines are very expensive for our general.

Key words: *Pesticides, Perennial plantation, Mechanical cultivation, Cultivation effects*

IMAPCT OF TECHNICAL SPRAYING FACTORS ON LEAF AREA COVERAGE IN A VINEYARD WITH HARDI ZATURN AXIAL FAN SPRAYER

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Abstract: *Research is conducted in a vineyard with a Hardi Zaturn axial fan sprayer. The influence of major technical spraying factors (type of nozzle, working speed and spray volume) were observed on coverage of the treated area. The working speed of sprayer was set at 6 and 8 kmh^{-1}, and spray volume on 250, 300 and 350 lha^{-1}. In research, Lechler blue (TR 8003C), yellow (TR 8002C) and green (TR 80015C) nozzles are used. The research was set as three - factorial field experiment with 18 treatments in 4 repetitions. Sixty water sensitive papers (WSP) were used for the treatment, which was processed with digital image analysis (DIA) and ImageJ software. The major technical spraying factors have a high significant statistical impact (**) on the main property of the research. By decreasing the ISO number of nozzles and by increasing the working speed and spray volume, we found the increasement of area coverage. The best adjustment of technical spraying factors (area coverage of 51.45%) was achieved with a green nozzle (TR80015C), working speed of 8 kmh^{-1}, spray volume of 350 lha^{-1}, and working pressure of 19.53 bar. The lowest area coverage was achieved with a blue nozzle (TR 8003), working speed of 6 kmh^{-1}, spray volume of 250 lha^{-1}, and working pressure of 19.53 bar 3.57.*

Key words: *axial sprayer, working speed, nozzle, spraying norm, area coverage, water sensitive paper*

EFFECT OF THE MICROCLIMATE FACTORS ON EVAPOTRANSPIRATION RATE IN NURSERY PRODUCTION

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Abstract. *A lysimeter study was conducted to determine evapotranspiration (ET) rate of Red Maple (Acer Rubrum) under field conditions. The average daily measured ET for the plant was 998.75 g. Simple linear regression analysis showed that a solar radiation or a VPD based stochastic ET model could be successfully used to predict ET in terms of R^2 values of 0.875 and 0.684 respectively. Multivariable, first and second order regression models with an R^2 of 0.883 and 0.899 respectively showed that the first order multiple linear regression model was adequate to demonstrate effects of climate factors on measured ET. Statistical analysis showed that using a first order linear regression model was more practical than using a second order model since the more complex second order model did not significantly improve the R^2 of the ET model. Even though Stanghellini and Fynn ET models were developed under greenhouse conditions, they predicted ET under field conditions better than Penman.*

Key words: *Evapotranspiration, Deterministic ET models, Stochastic ET models.*

BERRY HARVESTING BY PULSATING AIR FLOW

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Abstract. *This paper presents a unique technical solution of berry fruit harvesting by accurately controlled pulsations of air flow. A special harvester, which induces strong turbulent fluctuations of atmospheric air from both sides of the plants, has been designed and tested in the past fifteen years. It is towed behind a tractor, but also equipped by own diesel engine that drive all hydraulic components and, indirectly, the fan, pulsating air flow control units, machine leveling system and fruit conveyer. The study is focused to operational parameters of the harvester, technical specification and design.*

Key words*:* Berry fruit, air harvester, turbulent pulsations, fan, hydraulics.

FUEL CONSUMPTION AND PRODUCTIVE EFFECTIVNESS OF THE ALFALFA MOWING BY THE OSCILLATORY AND ROTARY MOWERS

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Abstract. *This study summarizes results of three-year study performed on an oscillatory mower IMT 627.667 and a rotary mower with two drums PÖTTINGER CAT 185, with the special attention on fuel consumption and production effectiveness. The aim of the research was to obtain optimal values of parameters for the tested mowers by conducting comparative analyses of various technical characteristics of the mowers from the aspect of the exploitation parameters, working quality, fuel consumption, etc. Over three-year study period, at the average working speed of 5.97 km h^{-1}, the average fuel consumption of the oscillatory mower IMT 627.667 was 2.22 l h^{-1}. Average specific fuel consumption was 2.59 l h^{-1}, with average pure effectiveness of 0.88 ha h^{-1}. The average fuel consumption over three-year study period of the rotary mower PÖTTINGER CAT 185 was 3.37 l h^{-1}, at the average working speed of 9.67 km h^{-1}. Average specific fuel consumption was 2.77 l h^{-1}, with average pure effectiveness of 1.47 ha h^{-1}. During the test of the oscillatory mower IMT 627.667, the average three-year study production effectiveness was 0.77 ha h^{-1}, at the average working speed of 5.97 km h^{-1}, while mowing by the rotary mower PÖTTINGER CAT 185, the average production effectiveness was 1.43 ha h^{-1}, at the average working speed of 9.67 km h^{-1}.*

Key words: *fuel consumption, productive effectiveness, plant mowing*

TURKISH LIVESTOCK HOUSINGS – GENERAL CONDITIONS, PROBLEMS AND POSSIBLE SOLUTIONS

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Abstract. *Housings in livestock facilities of Turkey are most of the time not designed and constructed based on scientific parameters and principles and housing systems thus are far away from meeting the environmental and health conditions of animals. Improper housing systems are among the most significant problems of livestock industry of the country and the number of facilities with modern buildings and housing systems are highly limited. Housings are constructed without taking local climate conditions into consideration and mostly the similar ones of the neighboring buildings are constructed. Although economic and strength parameters are considered in design, environmental control and internal installations are not sufficiently considered. Livestock industry is a significant industry in Turkey with regard to both capital use and supports provided to country economy. However, yield levels per animal are highly lower than the levels of developed countries. Housing systems are the critical components of the industry and they should be improved and developed to increase the current yield levels. Increasing yield levels will only be possible by providing proper environmental conditions to high-yield* races. *In the present study, current constructional and environmental conditions of the livestock housings of Turkey were assessed, existing problems were identified and possible solutions for these problems were discussed*

Key words: *Livestock housing, Environmental conditions, Structural members, Turkey.*

VARIATIONS IN EXPLOITATION CHARACTERISTICS OF TRACTORS DEPENDING ON PRE-IGNITION ANGLE OF THE ENGINE

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Abstract. *Maintenance of tractors on small private farms in Bosnia and Herzegovina is not given sufficient and adequate attention. Consequences of such a trend reflect on exploitation characteristics of tractors, significantly increases fuel consumption and environmental pollution. The goals of the research focused on the part of the issue related to the influences of different pre-ignition angle of the engine on the available power at the PTO shaft and increase of the specific fuel consumption. The research was conducted in the laboratory and experimental facilities of the agricultural machinery testing station in 2015 at the Butmir range, Sarajevo. The obtained results indicate that the tractor power at PTO shaft varied from 21kW do 45kW, that is in a range from 46.6 - 100 %. Variation of the engine power caused changes in fuel consumption which in the plough mode varied from 4.01- 6.86kg/h of fuel (D-2). Cost-wise, this influenced variations from 2.25 to 4.72 €/h in the idle mode (stand gas) and from 5.57 to 8.81€/h in the plough mode. The obtained results confirmed the hypothesis that regular maintenance in accordance with manufacture's standards needs to be implemented; otherwise the costs of consequences will exceed the maintenance costs several times.*

Key words: *tractor, maintenance, engine power, fuel consumption.*

CONSIDERATIONS REGARDING THE CONDITIONS OF USING TRACTOR-TRAILER COUPLING DEVICES

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Abstract. *Coupling devices can be one of the main causes of accidents on public roads due to the use of inadequate systems (both on tractors and also on trailers or agricultural machinery), this mainly due to the fact that the systems in question were built most of the times without taking into account the national, European and international regulations that are in force. The paper presents a few aspects regarding the coupling (traction) devices, the conditions of use and the tests that are necessary to be performed for approval before being used on public roads*.

Key words: *coupling device, resistance, deformation, mobility, tractor*

INFLUENCE OF LOAD, VELOCITY AND TRAJECTORY CURVATURE ON THE COMBINE'S STABILITY

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Abstract. *The paper is focused to analytical estimation of the combine ZMAJ 142 stability range under various working conditions, which include different speeds (0, 5, 10 and 15 km/h), radiuses of trajectory curvature (10 m, 15m, 20 m ,∞) and longitudinal and lateral slope of terrain in the range of up to 60 deg. Stability range is evaluated analytically for combine with empty bunker and bunker fulfilled with wheat grain. Applied simulation algorithm comprehends the mechanical stability criterion, supported with 3D analytical geometry tools and total-search optimization method.*

Key words: *Combine, slope, turning radius, speed, dynamics, stable movement.*

INSTRUMENTAL AND SENSORY METHODS FOR EVALUATION OF DRIED FRUITS QUALITY

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Abstract. *Results of instrumental and sensory analysis of qualitative characteristics of dried quince are presented in the paper. Combined drying which applied in experiment, consisted of osmotic and convective. The osmotic drying was performed in a sucrose and water solution. The temperatures of osmotic solution were 40°C and 60°C, and the initial concentrations were 50°Bx and 65°Bx. Higher values of ΔE*ab were recorded following the treatment of quince samples with the osmotic solution concentration of 65°Bx. Lower values of the total colour change were recorded in the same samples after convective drying. Minor differences in colour after convective drying are caused by a greater amount of solute retained on the surface of the fruit and make barriers between fruit tissue and surrounding air. Temperature of osmotic solution 60°C caused softening of quince tissue. Thermal softening has a positive influence on naturally hard quince tissue. The results of experiment point at positively affects of osmotic drying on physical properties and quality of dried quinces.*

Key words: *quince, drying, instrumental, physical properties, sensory analysis.*

SOME PHYSICAL PROPERTIES OF JUNIPER SEEDS (*Juniperus Communis* L.)

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Abstract. *The physical properties of seeds and grain are significant tools to be used in farming, harvest, processing, packaging and storage of these seeds and grains. Knowledge on these parameters plays important roles in machinery design and process chain from grain to food. Accurate design of machines and processes in the food chain from harvest to table requires an understanding of physical properties of row materials. This study was carried out to determine the effects of moisture content on physical properties (basic dimensions, porosity, bulk and true densities, angle of repose and sphericity) of juniper seeds. As the moisture content increased from 10.79 to 24.79% dry basis (d.b); mean height, diameter and geometric mean diameter increased respectively from 8.16 to 8.51 mm, from 9.37 to 9.90 mm and from 8.95 to 9.41 mm. In the same moisture range, surface area, 1000-seed weight, true density, bulk density and porosity increased respectively from 251.70 to 278.39 mm^2, from 201.77 to 260.79 g, from 638.82 to 712.52 kgm^{-3}, from 325.59 to 354.64 kgm^{-3} and from 49.03 to 50.23 %. As the moisture content increased from 10.79 to 24.79% d.b., sphericity decreased from 95.48 to 95.05 %, whereas angle of repose increased from 22.80 to 29.61°.*

Key words: *Juniper seed (Juniperus communis L.), Physical properties, angle of repose, porosity.*

ANTIMICROBIAL PROPERTIES OF MARRUBIUM VULGARE ESSENTIAL OIL AND ETHANOLIC EXTRACT

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Abstract. *The interest in medicinal and aromatic plants with antibacterial properties has been renewed due to the current issues associated with microbial resistance to antibiotics. Essential oils and plant extracts, naturally occurring antimicrobial agents, are attractive alternative to synthetic preservatives used in food industry. Antimicrobial properties of the aerial parts of medicinal plant Marrubium vulgare, collected in Serbia, were investigated against some common food-born pathogens. The minimum inhibitory concentration (MIC), as well as minimum lethal concentration (MLC) of the plant essential oil (EO) and ethanolic extract (EE) were determined by broth microdilution assay against seven G (+) bacteria, eight G (-) bacteria strains and one yeast. The EO exhibited antimicrobial activity against Gram (+) bacteria with MIC and MLC values ranged from < 0.47 mg/mL to 7.50 mg/mL, whereas inhibitory and lethal concentration for Gram (-) bacteria ranged from 1.85 mg/mL to 7.50 mg/mL and from 3.75 mg/mL to 7.50 mg/mL, respectively. Ethanolic extract was active against Gram (+) and Gram (-) bacteria with MIC and MLC values in the range <0.12 - 3.75 mg/mL and 1.87 - 7.50 mg/mL respectively.*

Both M. vulgare EO and EE exhibited the most potent antibacterial effect against strains belonging to G (+) bacteria, such as Bacillus cereus, Staphylococcus aureus, Staphylococcus epidermis and Rhodococcus equi, with microbicidal effect of all the tested concentrations. None of the concentration tested had inhibitory effect on G (-) bacteria strain, Esherichia coli O157:H7. Moderate activity of M. vulgare EO (MIC= 3.75 mg/mL and MLC = 7.50 mg/mL) and EE (MIC= 1.85 mg/mL and MLC = 3.75 mg/mL) was observed against the yeast Candida albicans. The EO and EE obtained from aerial parts of medicinal plant Marrubium vulgare from Serbia could be considered as a potential source of novel antimicrobial agents in the food industry.

Key words*: Natural antimicrobials, Medicinal plants, Food preservation.*

MODELING DRYING KINETICS OF VALERIAN *(VALERIANA OFFICINALIS)* ROOTS IN A CONVECTIVE AIR DRYER

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Abstract. *An experimental investigation of low-temperature convective drying of valerian (Valeriana officinalis) roots in laboratory scale dryer was conducted. Valerian roots separated into rootlets (the long roots cut from the crown) and crown (the main root and rhizomes), without pre-treatment, were used. The crowns were dried whole or cut at halves and quarters. The parameters of air stream over the tray with samples were fully controlled and adjusted in several sets of experiments. Drying air temperature was 30, 40 and 50°C and velocity 1 m/s. The drying air relative humidity was in range 4-10%. Data were analyzed to obtain diffusivity values from the period of falling drying rate. The effective moisture diffusivity was used to describe drying process efficiency. The results of the study are very useful for commercial scale drying of valerian roots to optimize drying process and to achieve superior quality dried product.*

Key words: *Convective drying; Experimental results; Drying time; Effective moisture diffusivity, Shrinkage.*

SAFETY OF HERBICIDE USE IN CHAMOMILE

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Abstract. *The common practice in chamomile production involves weed control using herbicides. Since, there are no authorized plant protections products for use in medicinal crops, there are no recommendations on doses required for efficient weed control and crop safety. Linuron is selective herbicide used for control of broad-leaved weeds. It is foliar herbicide with some residual activity, so it enters the plants both via leaves and roots (from soil). This study investigated the residue level of linuron in chamomile flower, stalk and flower with 4 cm long stalk attached. Linuron was applied in spring in two doses. After harvest, samples of chamomile plants were air dried, and herbicide residues were determined by LC-MS/MS using the QuEChERS method. Linuron residues in chamomile flower were below official maximum residue level (MRL) of 0.1 mg/kg, but significantly higher in chamomile stalk and flower with 4 cm stalk (average over doses: 1.7685 mg/kg and 1.409 mg/kg, respectively).*

Key words: *chamomile, weed control, crop safety, linuron, herbicide residues*

POSTHARVEST CHANGES OF THE APPLE VARIETY IDARED

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Abstract. *Postharvest losses of fresh fruits and vegetables are very high, especially in undeveloped countries. Therefore, modern postharvest treatments such as modified and controlled atmosphere storages are increasingly used to prolong shelf life. In this work we analyzed postharvest changes of cold stored apples under air and in controlled atmosphere. Other conditions were the same in both cold chambers, ie. temperature was 1°C and relative humidity was maintained in the interval 85 to 90 %. Changes in gas composition of cold chamber atmosphere as well as chemical composition of fruits have been monitored during four months of storage. The obtained results have shown significantly less changes in contents of relevant quality parameters of apples stored in controlled atmosphere compared with air stored apple variety Idared. After four months of storage in refrigerated chamber under air, apples had significantly lower firmness than apples stored in controlled atmosphere. Furthermore, total mass loss was higher in apples stored under air, that is in natural atmosphere conditions.*

Key words: *apples, postharvest technology, storage, low temperature, controlled atmosphere, quality.*

ULO STORAGE OF APPLES

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Abstract. *"Ultra Low Oxygen" (ULO) storage system is applied throughout the world, especially for storing apples. ULO is the most contemporary system of preserving fresh apples up to 300 days. The main advantage of the ULO atmosphere storage is the slowing down of the ripening and aging processes of the stored fruits. In this paper were presented technical details of ULO storage system, and a respectable example of ULO storage. As example of the newest and most advanced ULO cold storage for apples in Serbia can be found in Celarevo. The new (second) ULO storage was increased the total storing capacity at "Podunavlje" estate to 13,000 tons and that is the biggest in Southeast Europe.*

Key words: *cold storage, ULO, capacity, apples, long-time storage*

THE RISE OF SMARTPHONES ANDROID APPLICATIONS FOR AGRICULTURE MACHINES, NEW REVOLUTION OF FARM MACHINERY - FIELD COMMUNICATION?

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Abstract. *This paper explains the increase of smartphone Android applications use in agricultural machinery and equipment. According to a report published by the American Life Project Pew Internet 83 percent of adults in the United States have a mobile phone of some sort. Research shows that 35 percent of all American adults has a smart phone. In fact, one out of every two adults aged between 18 and 50 years old used one mobilphone. This is a huge potential for increasing use of these devices and the Android software in different areas and agriculture. Smart phone technology and free or very small price software application, creates new opportunities for the implementation and management of activities in agriculture, especially for small farms.*
Increasing scarcity of water in semi-arid areas, due to population growth and drought, increase the need for more efficient use of resources in agricultural production. Make use of the smart phone provides emergency mode when the user can access and use information on land, water resources and rainfall. Some application also has the ability to reduce the use of fault records of irrigation water usage and duration of irrigation crops that consume a lot of water in the season.
This modern technology can be applicable in the near future in progressive cultural practice in Republic of Serbia, Republic of Srpska, and Montenegro.

Key words: *Smart phone, Android software, Agricultural equipment and machines.*

ANDROID SMART PHONE APPLICATION FOR CONTROL PROCESS IN PROGRESSIVE AGRICULTURE PRODUCTION

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Abstract. *This paper explains the development and implementation of a mobile application to make fieldwork easier. The application uses a number of devices in a Smartphone such as a GPS or a camera to collect information and broadcast it to an office in real time. Smart phone technology and Android software application creates new opportunities for farm management applications in agriculture, especially for small farms in EU and USA and the other country of World.*
Farmers working in agriculture now are able with a low cost smart phone and the specialized different Android application to obtain facilities that could not have before.
The use of the Android software application in a smart phone can overleap the high difficulties of Agriculture management requirements which were stand as obstacle for many years so far.
The downloading mobile application is staggering, and there appears to be no slowdown in the future. In fact, iOS application download could exceed 100 million per day by 2017. The otherwise this download has also had a huge impact on agriculture in USA and EU, with mobile applications. However for every useful application, there are likely several that will be abandoned after one use. Consider 53% of vendors say they are using less than 20% of the total number of agriculture-related applications they have ever downloaded on their tablets on -at least a weekly basis, according to a recent Crop Life Media Group study for year 2015. In this paper only some top Android smart phone application for 2014. and 2015 are presented (applicable in the near future in modern and progressive agriculture of R. Serbia, Montenegro and R. Macedonia).

Key words: *Android software, Smart phone, Application, Progressive agricultural*

FUNCTION OF INFORMATION AND COMMUNICATIONS TECHNOLOGIES IN AGRICULTURAL EDUCATION

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A**bstract.** *The objectives of agricultural education are achieved at all levels through comprehensive updating of the instruction approach, which includes both conventional teaching and the use of information-and-communications technologies (ICT). In Serbia, agricultural education is offered at secondary (secondary agricultural schools) and tertiary levels (academic and professional studies at junior colleges and universities). In order to identify the role of ICT in secondary and tertiary education, as well as to get the opinions of the staff and students, a survey was conducted among secondary school teachers and professors at the University of Belgrade, Faculty of Agriculture (UBFA). The respondents included 18 secondary agricultural school teachers, and 57 UBFA professors and teaching assistants and 441 students. There are many opportunities for ICT use for instruction at secondary agricultural schools and in academic studies at all levels. The secondary schools and the UBFA have considerable ICT resources at their disposal, and there is a favorable mindset of both the educators and students. However, electronic sources are still rare in Serbia's electronic cataloguing system, which uses COBISS bibliographic management software, but their number is increasing from year to year. The use of various forms of ICT is widespread in agricultural education. A high percentage of SAS and UBFA educators use computers often or regularly, to design courses (94.5% and 85.9%, resp.), teach (55.6% and 64.9%, resp.), and evaluate knowledge (44.4% and 54.4%, resp.).The educators largely rely on ICT (e.g. PowerPoint presentations) as a teaching aid and to communicate with students via email. The majority of SAS teachers (61.1%) have received some form of ICT training in the field of education, since the obligation to continually upgrade their level of professional competence systemically motivates educators to undergo training. In contrast, UBFA professors have generally acquired their ICT skills independently (54.4%), with only a limited number benefiting from international projects (e.g. TEMPUS, WUS, FP6). However, e-learning is rather underdeveloped at this time; its expansion at both secondary and tertiary levels in the field of agriculture still lies ahead. Educational projects play a significant role in the application of ICT in instruction.*

Key words: *education, electronic sources, multimedia, ICT, e-learning*

EVALUATION OF VARIOUS TURBULENCE MODELS PERFORMANCE FOR GREENHOUSE SIMULATION

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Abstract. *The objective of this paper is to evaluate the performance of various turbulence models on solution of computational fluid dynamics (CFD) greenhouse simulation. For this purpose, temperature and velocity distributions inside the greenhouse are calculated using three different turbulence models (the standard k-ε model. the renormalization group (RNG) model and the realizable k-ε model). The simulations are then compared against each other. The results of simulations show that temperature and velocity distributions inside the greenhouse are quite different and confirm the importance of the appropriate turbulence model choice. Standard k-ε model was recommended as the most suitable turbulence model.*
Key words: *greenhouse, nano-roughness, mathematical model, simulation, cell wall.*

CONTRIBUTION OF GREEN WALLS TO BUILDING MICROCLIMATE CONTROL

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Abstract. *The Urban Heat Island (UHI) effect induces an excessive use of buildings cooling systems, increasing the energy consumption, airborne pollution concentration and greenhouse gas emissions into the atmosphere. The Green Walls can be used as passive energy savings systems for controlling the solar heat gain for the buildings in summer and for increasing their thermal insulation in winter, contributing to the UHI effect mitigation. Experimental tests were carried out at the University of Bari (Italy), starting from summer 2014, aimed to analyze the contribution of green walls with two different plant species (Pandorea jasminoides variegated and Rhyncospermum jasminoides) to the building thermal performance. Three prototypes of building vertical wall were built; two walls were covered with plants and the third was kept uncovered for control. The collected data analysis pointed out that in warm days the maximum daylight temperatures observed on the external surface of the walls covered with plants were lower up to 4 °C than the respective temperatures measured on the control wall and during the nighttime of cold days the minimum temperatures measured on the external surface of the walls covered with plants were higher up to 2°C than the ones of the control wall.*

Key words: *Energy savings, Passive systems, Urban heat island, Surface temperature, Solar radiation, Green technology*

MODELLING OF SOIL TEMPERATURE USING TIME SERIES ANALYSIS IN THE MIDDLE BLACK SEA REGION OF TURKEY

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Abstract. *The study was conducted to develop the model for monthly soil temperature measured at a depth of 5 cm in the Central Black Sea Region and to establish regional models. Average monthly data for the years 1969-2013 were analyzed with the Box Jenkins (BJ) technique. Seasonal AutoRegressive Model (ARIMA(1,1,0) $(1,1,0)_{12}$) for Samsun, Moving Seasonality Model (ARIMA(0,1,1) $(0,1,1)_{12}$) for Tokat, Moving Seasonality Model (ARIMA(0,1,1) $(0,2,1)_{12}$) for Corum, Seasonal AutoRegressive Model (ARIMA(1,1,0) $(1,2,0)_{12}$) for Amasya and Seasonal AutoRegressive Model (ARIMA(1,1,0) $(1,2,0)_{12}$) for Ordu, were determined as appropriate models. Using these models, soil temperatures were estimated for the next years, i.e. 2014-2024. Also, soil temperature map created as kriging method for the year 2013 was compare with the year 2014 map.*

Keywords: *Box Jenkins technique, ARIMA models, soil temperature, Black Sea Region*

THE CHAOTIC GROWTH MODEL OF ELECTRICITY CONSUMPTION IN AGRICULTURE: EU

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Abstract. *Energy has essential role for the production of food. Final electricity consumption covers electricity supplied to the final consumers. It is calculated as the sum of final electricity consumption from all sectors. Over the period 1990-2009 final electricity consumption increased by 26.4% in the EU-27 countries. In the EU-27, the strongest growth was observed in the services sector (including agriculture) (66.8%). However, due to the financial crises , between 2008 and 2009 , final electricity consumption decreased by 5.0% in the EU-27 .*
The basic aim of this paper is to provide a relatively simple chaotic growth model of electricity consumption in agriculture that is capable of generating stable equilibria, cycles, or chaos. This paper confirms stable growth of electricity consumption in agriculture in the EU countries in the period 1970-2011.

Key words: *electricity consumption, agriculture, chaotic model, stable equilibria.*

ON A CLASS OF PARTIAL DIFFERENTIAL EQUATIONS OF PARABOLIC TYPE

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Abstract. *The great advances of technology and computers during the last sixty years have spread to agricultural equipment. The key objective in the maintenance of the agricultural machinery is to minimize the defects and disorders. In this paper results are presented of a tractor engine durability examination on Serbian farms. The experimental results had been used and the engine durability of the popular heavy-tractor model, Massey-Ferguson 8160, was examined. A partial differential equation, which describes the tractor engine lifespan, was used and solved, thus providing the new method for describing the tractor engine durability.*

Key words: *agricultural machinery, engine, defects, partial differential equations*

MATHEMATICAL PHYSICS FOR THE DURABILITY OF A TRACTOR'S ENGINE ON SERBIAN FARMS

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Abstract. *Equipment, repair and maintenance costs are important issues for agricultural concerns. Motivated by the investigation of the engine durability of the popular heavy-tractor model, Massey-Ferguson 8160, a partial differential equation had been derived by engineers. In this publication, a whole new method of solving this equation is presented. Since it is difficult to solve partial differential equations analytically, but because almost all technical processes are described with them, a quite new way of solving such a equation is presented in this paper.*

Key words: *Tractor engine durability, differential equation, solution*

PARTIAL DIFFERENTIAL EQUATIONS FOR DESCRIBING THE WATERBORN SOLID IMPURITIES SIZE DISTRIBUTION

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Abstract: *This paper presents a partial differential equation, which describes the waterborn solid contaminants size distribution which was previously experimentally verified. The solution of a diffusion equation which describes a density function is derived. The solution includes a exponential function.*

Key words: *Partial differential equation, waterborn contaminants*

ASPECTS REGARDING THE CONSERVATION SOIL TILLAGE SYSTEMS USING ON THE WORLD– A REVIEW

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Abstract. *The maintenance and conservation of the properties of soil can be also achieved by performing adequate agricultural works, conducted in the optimal period, complying with the technology related to the respective crop. The paper presents the most important conservative works used in Romania and worldwide, which can lead, on a medium and long term, to maintaining and restoring the physical-chemical properties of soil*.

Key words: *sustainable development, conventional, organic agriculture, system, sustainable*

EVALUATION OF THE SECONDARY TILLAGE EFFECTS

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Abstract. *The paper is focused to quality evaluation of mechanized secondary soil tillage, using the comprehensive own experimental results of dry sieving of soil test samples. Proposed approach is based on detailed analysis of the mean weight diameter distributions of soil aggregates. Test samples were taken at two standard-depth layers (0-5 cm and 5-10 cm) of the test plot, previously exposed to the secondary autumn tillage specified for wheat seeding. In this study are evidenced large discrepancies between distributions of soil aggregates dimensions, taken at various locations (denoted here as "test-points") and within the two depth layers over the experimental plot square area of 100 m in length and 70 m in width. It is shown that tillage effects may strongly differ over the parcel area and depth and therefore can be accurately evaluated only after thorough analysis of large number of samples tightly acquired over the whole parcel area and depth layers of interest.*

Key words: *Tillage, wheat, quality evaluation, multi-tiller, disc-harrow.*

INFLUENCE OF SOIL COMPACTION ON SOIL CHANGES AND YIELD OF BARLEY AND RYE AT THE HEADLANDS AND INNER PART OF PLOT

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Abstract. *The moving of tractors and mobile systems leads to intensive soil compaction, poor conditions for the root system development, and poor microbiological activities, which results in a reduction of yields. The paper presents the results of few years of research of the impact of compaction on changes in soil and the yield of crops of barley and rye on headlands and inner part of parcel. Tests were carried out in agro ecological conditions of central Serbia in the period 2011/14, on the soil type vertisol (smonitza). Based on these results it was concluded that soil compaction compared to the interior of the plot during the germination was on average 43.32 – 44.51% higher, while before harvest, increase soil compaction compared to interior grounds was on average 51.76 – 53.28%. The yield of barley in the inner part of the plot was 36.16 % higher compared to headlands, while the yield of rye in the internal part of the plot compared to yields that are measured on the headland was 35.48% higher .*

Key words: *soil compaction, headland, barley, rye, yield.*

LAND FUND AS AN INSTRUMENT FOR AGRICULTURAL AND RURAL DEVELOPMENT

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Abstract. *Land is a limited resource needed for agricultural production. Due to the expansion of urban areas, infrastructure development, the effects of climate changes and many other factors, the area of land that cannot be used for agricultural production is increasing. Therefore, it is necessary to use the land in a way that will allow maximum production, meet social needs and have a minimal impact on the environment.*

In most European countries land funds are very important instrument in land management. As support to: land consolidation, land market control, infrastructure development, restitution, reduction of the abandoned land etc., land funds are necessary for efficient managing of land and sustainable rural development. European countries analyzed along the article are: Denmark, Spanish province of Galizia and the Czech Republic, whose similarities with Serbia were highlighted as well. Denmark is a country with very efficient land management, high price of land and agricultural production. Also, Denmark is a state that has successfully made the transformation of state-owned land. Galizia and Czech Republic in past had a similar political system and land policy as Serbia had. Through land fund these province and country solved a lot of problems related to the management of land. This article presents the role of land funds in agricultural and rural development in these countries, and possible role in land management in the Republic of Serbia.

Keywords: *land, land fund, land management, rural development*

DRAINAGE OF FARMLAND ALONG THE IRON GATE 1 HPNS RESERVOIR ON THE LOWER DANUBE

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Abstract. *Before the Iron Gate 1 Hydroelectric Power and Navigation System was built, farmland along the river was partly protected from high stages of the Danube by means of levees and a low-density channel network with pumping stations whose purpose was to evacuate meteoric water and groundwater that rose to the surface. During dry periods, the river drained groundwater. Following construction of the Iron Gate 1 dam, the water levels of the resulting reservoir had a permanent adverse effect on the nearby farmland. In the Lower Danube hydraulic reclamation district, which is the subject matter of this paper, there are a large number of drainage systems which effectively drain riparian farmland along the right bank of the Danube. The scheme is comprised of an open drainage network (channels), subsurface drainage network (drain line, drain collectors, culverts, and concrete collectors), self-flowing wells, drainage wells, pumping stations, levees, and revetments. A case study of one such protected area, Godomin Field near the City of Smederevo, shows that the water table is under the dominant effect of the Danube's stages and that owing to the drainage scheme the farmland along the right bank of the Danube is effectively protected from excess water.*

Key words: *Danube, drainage systems, farmlands, pumping station, drainage network.*

LOW-COST ALTERNATIVE WASTEWATER TREATMENT SYSTEMS: CONSTRUCTED WETLANDS

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Abstract. *Parallel to rapid increase in world population and nourishment needs, water demands are rapidly increasing. Agricultural, domestic and industrial water users are in continuous competition for limited water resources. Continuously polluted waters, decreasing water resources due to global warming and climate chance, increasing labor and energy costs all brought the water and treatment technologies into the first place of the world's agenda. To overcome the water-related problems, water losses in agricultural, domestic and industrial uses should be prevented, effective and efficient water use should be provided and possible use of wastewater and treated water should be investigated. Constructed wetlands are natural treatment systems employed as an alternative to conventional treatment systems because of their low construction, operation and maintenance costs, low energy demands, simple operation and low sludge generation. These systems are specially designed systems imitating the natural wetlands and include soil, plant and microorganisms to remove the pollutants from wastewaters. These natural treatment systems are mostly used for sewage treatment of villages in Turkey. Natural treatment systems are defined as the "primary treatment alternative" in rural development strategy document of State Planning Organization of Turkey. The present paper discusses the possible use of constructed wetlands for waste water treatment in rural parts of Turkey, especially in villages and possible use of treated water in irrigation. Current drawbacks observed in construction, operation and maintenance of these systems were also put forward in this study.*

Key words: *Wastewater, Treatment, Natural treatment, Constructed wetland.*

THE MANAGEMENT OF THE AGRICULTURAL WASTE COME FROM PLANT PRODUCTION: AN ANALYSIS INTO TWO DIFFERENT EUROPEAN AREAS

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Abstract. *Many different categories of waste are produced by the agricultural sector. Agricultural waste includes both natural residues (i.e. animal manure, biomass from plants, dirty water, silage effluent) and non-natural ones (plastics, oil, tires and batteries, pesticides, veterinary drugs, building material). Intensive waste flows are produced also by the agro-industries (mainly wine, olive oil, milk, meat and cheese industries).*
Farmers use several recovery and disposal methods, depending on national legislations and traditional uses, such as the reuse on farm, the recovery by suppliers, the inclusion with household waste, the stockpiling etc. However, in many European areas, the most common practices of the waste disposal - forbidden by the Law - are: abandonment in illegal landfill; burying in open and uncontrolled sites. In case of fluid waste, they are introduced into water courses without any pre-treatment.
The present work aims to estimate the agricultural waste amounts coming from plant production (crop, vegetable and fruti) in two different areas in Europe, Italy and Serbia. The final aim is to find the best practices used in order to plan a common approach about new innovative ways for the disposal of this typology of agricultural waste, through the definition of new local and regulatory solutions and proposals for their optimized management.

Keywords: *Agricultural waste, plant production, environmental pollution, disposal scheme.*

A REVIEW OF PASSIVE SYSTEMS IN AGRICULTURE STRUCTURES TOWARDS ENERGY CONSERVATION

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Abstract. *Agriculture is a continuously technologically developed sector. The increase of food and of any agricultural product demand results to an increase of the energy requirements, which, many times, has simultaneous odd effects on the environment. Moreover, several targets concerning environmental issues have been set by the EU and other organizations in order to prevent climatic change. For the above reasons, several methods and techniques have been investigated to rationalize the energy consumed in agriculture, among which some are based on passive energy systems. Passive systems have been used extensively in urban applications with significant results leading to great amounts of energy savings. In the present study a brief review of innovative agriculture structures towards this direction are presented. The theoretical background of these passive techniques will be analyzed (i.e heat transfer mechanisms) for the better evaluation of the system's energy efficiency. Some considerations on environmental and economical benefits will also be cited to estimate the contribution of those systems towards these directions, as well. Finally, the adaptability of those techniques on the European region and conditions are investigated taking into account climatic, economical and policy factors.*

Key words: *energy, agriculture, passive energy systems, innovative structures*.

THE USE OF TELEHEATING FOR AGRICULTURAL PRODUCTION: A CASE STUDY IN PTOLEMAIDA, GREECE

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Abstract. *The use of teleheating in agriculture requires the existence of a heat and power production (CHP) plant, such one of those operating in the area of Ptolemaida and is already used for urban heating. The reason to undertake this case study was the will of the local authorities to exploit an abandoned industrial area for fertilizer production in agriculture. This area was 15.8 ha and the project should be used as a prototype for the exploitation of another 300 ha of available agricultural land in Ptolemaida and 45 ha in the nearby area of Kozani. Greenhouse heating was the main application of teleheating, but also its use for grain drying and livestock house heating was also considered. The expected conventional energy saving in greenhouses was calculated at 12000 GJ/ha per year, while the respective saving for maize drying was 657 GJ/10^3t per year and for cotton drying 488 GJ/10^3t. The cost cut of heating was about 65%, in all cases. Also, the final investment on this project is expected to create 184 new vacancies (employment). Finally, from environmental point of view, teleheating as a clear alternative energy source will not surcharge the already heavily polluted environment of Ptolemaida area.*

Key words: *Teleheating, Waste heat, Greenhouse, Energy saving*

PRODUCTION TECHNOLOGY AND OPPORTUNITIES OF USING BIOGAS OBTAINED FROM ORGANIC AGRICULTURAL WASTE

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Abstract: *The world is increasingly focused on the development and application of biofuels produced from renewable primary and secondary agricultural raw materials.*
Today, the production of biofuels is mainly based on the production of methanol, biomethanol, ethanol, biodiesel, natural gas, hydrogen, that are obtained from primary agricultural production such as: sugar cane and sugar beet, sorghum corn, maize, wheat, rapeseed, sunflowers, potatoes, barley, olive, palm. One part of the biofuels, has its base in forest mass, wood, pulp, paper, black liquor etc.
However, today increasing attention is paid to the development and procedures for the collection and production of biogas from various forms of waste, such as municipal waste and secondary, wastes from livestock production, cereal production and food and other forms of waste.
The paper gives a short overview of the possibilities of biogas production from organic waste as an alternative fuel powertrains and industrial plants, and at the same time as a solution for reducing the waste disposal.

Key words*: biogas, agriculture, waste, biomass, production, potential*

NEW EU TYPE-APPROVAL LEGISLATION FOR AGRICULTURAL AND FORESTRY VEHICLES

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Abstract. *In the Official Journal No. 167 from 2013 the new Regulation (EU) No 167/2013 of the European Parliament and of the Council of 5 February 2013 on the approval and market surveillance of agricultural and forestry vehicles has been published and the framework for the new legislation structure for agricultural and forestry vehicles has been set. Following the recommendations from the Competitive Automotive Regulatory System for the 21st century (CARS 21) report the European Commission prepared and in year 2015 published in the Official Journal all relevant legislation acts and with this prepared the complete new EU type-approval regulation for agriculture and forestry vehicles. This new system will start on 1 January 2016 when the existing framework Directive 2003/37/EC and their 23 separate Directives on will be repealed. This paper describes the content of all legislations acts followed by Regulation (EU) No 167/2013.*

Key words: *EU legislation, agricultural vehicles, forestry vehicles, approval.*

VALORIZATION OF TRADITIONAL BUILDING MATERIAL FOR THE SUSTAINABLE DEVELOPMENT OF RURAL AREAS

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Abstract. *The recent increase in the sensitivity about the concept of sustainable development is stimulating the valorization of the locally available material for agricultural construction, both for housing purpose and for some single components. This traditional building technique has indeed interesting consequences on the rural landscape perception - since the color is similar to the countryside surroundings – as well as on the agricultural environment – this material being, at the end of its useful life, recyclable in the same context. Traditional material could be employed in other agricultural components, e.g. for food ageing, a technique used since Roman times, involving the use of earthenware amphorae, buried in the soil and used for storing wine and oil. In the present paper, the most diffused traditional building materials currently rediscovered are analyzed, focusing on their utilization opportunities. One of the most interesting traditional construction material is the sun-dried earth brick, made of raw clay soil (so-called, "adobe"), often improved by the addition of fibers to control cracking while drying in the sun. After a general overview about the diffusion of earthen construction within agriculture, the results of experimental tests on adobe bricks reinforced with a natural fibre – Spanish Broom (Spartium junceum L.) – are reported.*

Key words: *Rural areas, sustainable development, farm building, traditional material, Adobe brick, Spanish Broom*

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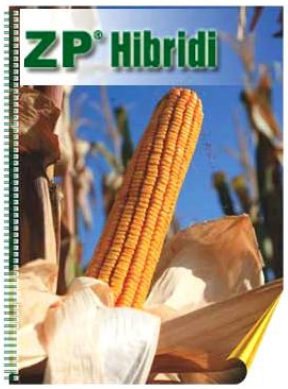

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