

PART I.

ABSTRACT OF SELECTED PAPERS

PHYSICAL PROPERTIES OF CORN STOVER PELLETS

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Corn stover is an abundant by-product of agriculture, which as valuable biomass, could have important influence on renewable energy economics. For safe and wasteless storage and transport, as well as efficient industrial firing it is expedient to compact the material. One of the compacting technologies is producing pellets. About physical properties of corn stover pellets exigous information could be found. Therefore in our laboratory research work at the Hungarian Institute of Agricultural Engineering we investigated some physical properties of corn stover pellets. Testing material was produced using a laboratory pellet mill, without additives, applying different moisture content, particle size of material, and different hole diameter of the pelletizing matrix as variables. Abrasion and geometry tests, as well as material and bulk density tests were prosecuted on pellets. Pellet durability index varied from 87 to 97, pellet length between 5 and 22 mm, bulk density were from 500 to 1000kg/m³. It was established, that increasing moisture reduces pellet length. Consequence of decreasing particle size and hole diameter of pellet matrix are provide better resistance to abrasion and increasing density of the pellets. The average heating value of corn stover pellets of 10 % moisture content was found as high as 15,5 MJ/kg. Based on these results can be stated, that pellets made of corn stover without additives provide a heating material of good quality.

BIOETHANOL FROM SWEET SORGHUM

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Two varieties of sweet sorghum (Monori and Cellu) were investigated as raw material for bioethanol production. The juice yields of the two varieties were compared, and the self-life of fresh chopped stem and the juice were investigated during a 12 h storage period. The sugar content decreased rapidly because of the high microbe content of the plant in both cases. During fermentation experiments, the effect of temperature, nutrients and the pH of the juice on the alcohol yield were investigated. Cellulase enzymes were added to the juice before fermentation. In order to experience the remained fibre content that could be converted into alcohol, cellulase enzymes were added to the juice before fermentation. Results showed that the increase of alcohol yield was higher than it was expected from the cellulose content of the juice.

Keywords: bioethanol, sweet sorghum, fermentation

SORGHUM LIKE A BIOGAS INCREASING ADDITIVE

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In the Technical and Agricultural Faculty of Szolnok College, within the frame of Ányos Jedlik programme, we are making experiments for producing biogas with methods like giving Chinese sugar to manure. The aim of experiments carried out under factory conditions is to prove that different additives enlarge the produced gas volume and methane the volume of produced methane and the power of fermentation content differently.

QUANTITATIVE AND QUALITATIVE ANALYSIS OF THE BIOGAS PRODUCTION FROM THE MUNICIPAL SOLID WASTE

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The storage of the refuse takes place in deponia by adequate compression. During the storage gases, mainly methane and carbon dioxide, are developed due to the biological decomposition. We must prevent these gases to get into the atmosphere as they are involved in the global warming of the Earth and so they may cause changes in the environment.

With the regulations getting stricter in the EU where we are going to be members soon it is essential that a refuse dump should have a biogas deflector system in order to protect our environment. A compressor drains gases from the waste material, while another compressor is used for taking the gases to the place where they are used. From utilisation point of view a considerable quantity is developed, which can be diversely utilised.

Keywords: landfillgas, anaerob digestion

ECONOMIC EVALUATION OF SCALING OF AGRICULTURAL BIOGAS PLANTS

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In the different size categories, biogas investment can be facilitated economically even under present macro-economic conditions, though using different technological solutions. In small-sized plants, heat energy utilization is to be considered, with 50-60 Ft/m³ production price (preferably to cover own demands), because of the lesser electric efficacy and extra material costs, and extra investment costs of cogeneration. This can be an alternative to natural gas firing even under present price conditions, especially when the biogas investment is weighed strategically, together with its complex (environmental, employment-assuring) benefits. In middle sized and large plants the own consumption is not realizable because of the greater quantity, therefore, cogeneration production of electricity is advised, under partial or full heat utilization. Under worsening

Hungarian conditions of "green" electricity take-over, the transformation of biogas to another marketable product, bio-methane, is to be considered. This involves no waste-heat generation, the utilization of which is always a critical point of operating cogeneration. Based on waste materials, or, perhaps, also with utilization of the carbon-dioxide from purification, in large plant sizes with 20-30 Ft/m³ biogas prime cost this can mean a profitable way of green energy production.

EFFECT OF THE VERTICAL WIND PROFILE UPON THE OPERATION OF WIND-POWER PLANT

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During operation the blades of wind generators work with different wind speed areas in the course of the rotating. It has results in the different dynamic loading of the blades. The vertical wind profile is determined by the Hellmann coefficient. The dynamic equations are given to analyse the power and torque relations for the blades of wind turbines.

COMBINED SOLAR SWIMMING POOL HEATING AND HOT WATER SUPPLY

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This paper presents the results of a monitored solar swimming pool heating system that installed at the campus of Szent István University, Gödöllő, for making preheated water for a swimming pool and preparing domestic hot water for a kindergarten. The recorded data are for the period of 2001-2006. The amounts of solar energy irradiated on collectors' plane, utilized energy directly by the collectors calculated daily. Additionally, directly used up total (supplied by gas and solar sources) and solely solar energy by the consumers have been all calculated daily both in swimming pool operation and in kindergarten operation. On the basis of these data the efficiency of the system has also been determined. The calculations have been carried out by using MATLAB[®] software.

APPLICATION OF MEDIUM-DEEP SUBSOILERS IN THE AGRICULTURE

(Tests on the Working-Quality by Measuring the Electric Conductivity of Soil)

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The present article reports an experiment of the research in the frame of which I search after the relationship between the looseness L of soil characterizing the operating quality of the chisel-type subsoilers of a medium working depth and the change in the electric conductivity in the soil caused by the loosening cultivation. The investigation was carried out with the help of the mobile electric-conductivity measuring device – accounted as a novelty in field-land tests – type *Veris*

3100 with disc electrodes, in field-land operating conditions. As the results of the investigation, the characteristic diagrams of the electric-current conductivity are presented in this article, recorded along arbitrary test lengths, for before- as well as after-loosening soil states. In addition, the shapes of the functions related to the individual soil states are also shown.

BRUISE INVESTIGATION OF THE CULINARY PAPRIKA

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The culinary paprika has an important role in Hungary not only in production, but in the consumption, too. During hand picking and mainly in case of automatic picking and expanding machinery packaging summarily in crop handling the paprika is loaded by many mechanical influences. If the mechanical load remains below a critical level then there is no bruise or the bruise can regenerate. In other case above a critical level an irreversible bruise occurs and so the quality decreases with a considerable degree. The popular V-shaped paprika has a disadvantageous behaviour namely the peak of the paprika is very sensitive to the bruise. As the first step toward analysing it and because of the simple method of approach this article tries to find the limit of the mechanical load which can bruise only the side part of the paprika. The investigation was supported by Hungarian Scientific Research Fund (OTKA T 46917).

A MICRO-CONTROLLER-BASED ALGORITHM FOR SORTING WHITE PAPRIKA

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There is no device available on the market of sorters (pickers) which is suitable especially for sorting the sweet white paprika, and capable of fulfilling the standard requirements. The most of the sorting machines is suitable for selecting roundish, sub-spherical vegetables and fruits (tomato, potato, apple, apricot, cantaloupe etc.) by applying the weight measurement. The function of the system is to qualify the paprika of which most important parameters are its size and shape – measuring them and processing the measured data have to be solved. The record of shape is realized by CCD photoelectric linear array sensors with the help of which the processing with regular accuracy can be provided. An algorithm running in the micro-controller developed by us provides the assorting process; it determines the size fraction from the length and the shoulder-width, the centre-line length, the perimeter and area data.

DISCHARGE COEFFICIENT DETERMINATION OF SWIRL-TYPE NOZZLES BASED ON HYDROLOGICAL ANALOGY

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In a number of early papers presenting a simple mathematical, analytical treatment of swirl atomizers the discharge coefficient, in spite of the weir flow analysis

was determined by the use of the principle of maximum flow. This was by analogy to the principle of maximum flow as applied to swirl atomizers. This paper demonstrates that the principle of maximum flow can indeed be applied, in theory, to the air-core diameter at the outlet region and the discharge coefficient of swirl atomizer.

COMPARISON OF INERTIA TYPE SHAKERS IN A SOUR CHERRY ORCHARD

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A slider crank type inertia shaker produced in series and an experimental shaker with rotating eccentric masses with similar output parameters were tested in the same sour cherry orchard. Acceleration of the tree and power consumption of the machine was recorded at different PTO speeds. In "Érdi bőtermő" sour cherry variety the performance of the two machines was different. At the same specific power consumption (kW/ms^{-2}) the shaker with rotating eccentric weights produced higher acceleration amplitudes and consequently higher fruit detachment ratio. Test results are analysed and conclusions are drawn to help shaker machine design.

REDUCTION OF FRICTION AND CUTTING LOSSES IN FORAGE HARVESTERS

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Self-propelled forage harvesters are currently the preferred means for chopping green forage such as grass or maize. A major part of the energy is required for the chopping and transportation of chopped material in the harvester. This energy can be reduced by minimisation of the friction coefficients between the housing and the chopped material or by reduction of the friction processes as the result of design optimisation. The friction process between the chopped material and different surfaces is investigated by means of practical tests and analysed based upon theoretical analyses. First results from theoretical analysis are initially shown. The investigations have the purpose of showing those potentials that allow minimisation of friction processes. Results from cutting tests on a test bed with knives with a slotted geometry (uneven cutting edge) are then presented.

PARTICLE-SIZE DISTRIBUTION OF GRINDS

Theoretical and empirical discussion
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In the comminution, the fineness of grinds (grits) is the most important quality character. However, it can be interpreted and determined only in an indirect way. Using the data base gathered during the several-year research in laboratory conditions, we derived such simple and definitive relationships between the different accepted fineness parameters – empirical and theoretically created nominal particle sizes as well as the specific surface area of the grinds – and we proved their validity in a wide

operating and material-property range from the experimental results as well. These are the characteristic curves of the materials to be ground and the comminution procedure as well.

EFFECT OF HAMMER SPEED ON PARTICLE SIZE DISTRIBUTION IN HAMMER MILLS

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In the frame of the research project carried out for several years on comminution of different agricultural materials, and comminuters, we improved the earlier conservative measuring system. The new electronic 8-channel, computer-aided testing system and the well instrumented laboratory-size hammer mill equipped with a frequency converter makes possible to carry out multi-parameter measurements and to gain multi-variable plotted and calculated theoretical functions. In the present article I show the effect of the rotor speed of the mill upon the size distribution and the fineness of the produced grits, and some other selected geometric and energetic parameters when grinding maize.

AUTOMATIC STEERING OF POWER MACHINES WITH GPS NAVIGATION AID IN AGRICULTURE

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The objective of the research work performed was to determine the characteristics of steering with GPS navigation aid. The purpose was to determine the accuracy when following the edge of the working width with different tractor and implement combinations. The best results were obtained when steering with a GPS based automatic steering system both when following a straight leading line and when following the edge of the working width made during the previous test run.
Keywords: Error, Global positioning systems, Navigation, Precision, Tracking

CREATION OF DEVELOPMENT SYSTEM FOCUSING ON PRODUCT-RANGE

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The macro-economic location, evaluation, operation of subsidy systems, CAP-reform and necessity of agricultural production are sources of debates all over the world. Besides certain balance explanations they are the traditions and mainly political reasons that are behind the agricultural "regulations" formed in separate regions. The European subsidy system is most probably due to change that results definitely in production support decrease. The current system is not only deforming the real economic situations deteriorating the healthy development of entrepreneurs but also eliminates the need and importance of development and innovation. The change in the agrarian-regulatory system is increasing the competition and makes innovation more important in the economic production.

Agricultural production can be successful via its products consequently creation of development system focusing on product-range is the main target. The method of „market-conscious technology development” is suitable for this task.

QUALITY MANAGEMENT SYSTEMS FOR SUSTAINABLE DEVELOPMENT

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To lead and operate an organization successfully, its necessary to direct and control it in a systematic and transparent manner. Success can result from implementing and maintaining a management system that is designated to continually improve performance while addressing the needs of all interested parties. Managing an organization encompasses quality management amongst other management disciplines. A quality management system is a sustainable system to direct and control an organization with regard to quality.

The quality and its continual improvement is one of the most important area for the organizations of competitive economy. These organizations depend on their customers and therefore should understand current and future customer needs and strive to exceed customer expectations. That is why the sustainability of the customer focused organizations depends on the level of satisfaction of their customers. The producing and servicing companies – apart from their activities – therefore turn higher attention to implementing and sustainable developing of their quality management systems.

LOW COST MECHANISATION SOLUTIONS FOR EFFECTIVE FARMING ON SMALL AND MIDDLE-SIZED ARABLE FARMS

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It is essential to develop a cost effective fleet of machinery for the present day various standard sizes of plants. In the case of the small units it is essential to develop equipment and cost saving mechanical solutions, but there is also demand for the building up of systems of machinery with modern, cutting edge technology and profit improving attributes for the middle-sized farms, which more favourable specific cost level.

The changing and modernising of the Hungarian fleets of machinery, the majority of which is obsolete is unavoidable. Farmers working from different amounts of capital on farms, which provide different levels of mechanical development potential, have to develop mechanisation solutions using the wide range of types and price range of the power and work machinery.

Taking into consideration the current partitioned structure of the farms the goal was established to determine that in the case of the different branches of plant production on small and middle-sized farms which combination of fleet of machinery can be used effectively.

BASIC TASKS OF THE AGRICULTURAL INVESTMENT PROCESS

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The elaboration of the **methodology** and the **computer program** have been performed in order to support the complex decision preparation processes, serve the **efficient utilization of the development resources** and be a well-applicable tool for the management of the enterprises having even average professional skills, minimal computer facilities and knowledge, diverse production structure and plant size.

I set up a model for seeking answer for the **six basic questions** emerging in the phase of **preparation** of complex **decisions** of agricultural investments. It helps to evaluate or rather tender the different investment possibilities and versions. Certain elements of the model **can be altered in a flexible way** considering the current circumstances, and they can be utilized in different sequences or even separately.

I prepared the computer-aided version of the model for MS Excel, which supports the most rapid completion of the **versions, calculations** or even **sensibility analysis** related to the decision preparation. Based on the results of model-calculations, the program is suitable for not only the preparation of agricultural investments but also for the decision preparation of **other tasks of technical development**.

ABRASIVE WEAR TESTING OF ENGINEERING POLYMERS

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To improve the abrasive wear behaviour of a certain tribo system - modifying the system -, there are more keys e.g. replacing the metal surface with a plastic one. If in a given tribo system the engineering plastic part can be acceptable from other engineering points (e.g. strength, life period and fatigue) than the proper plastic selection may improve the abrasive wear performance of the system. The proper plastic material selection is considered as a keyword, because each tribological system is different. Taking these into account, first, we have carried out some simply laboratory test have already been published. Following that we designed a real machine element test systems applying different plastic/metal gear pairs running in abrasive media. The conclusion of the systems and the comparison of the systems were published in different journals and a PhD thesis work was written.

But to clarify the real plastic material behaviour in case of abrasive particles we had to design a further test system, where the sliding plastic surface always act on a pure abrasive contact surface, which is not covered with transfer layer or third body particles. So, the sliding path to run is always clear. Some mechanical properties of the tested materials were measured at the Hungarian Institute of Agricultural Engineering and tribotesting was carried out at SZIU and UNBM. (OTKA T42511, NI 62729, INNOCSEKK, GVOP 3.3.)

Keywords: engineering polymers, abrasive wear

THE IMPACT PATHWAY METHOD FOR ESTIMATING EXTERNAL COSTS OF ELECTRICITY GENERATION

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External costs of electricity refer to the costs of damage imposed on society and the environment by an electricity generation chain, but not accounted for in the market

price of electricity. Electricity generation impacts include effects of air pollution on health, buildings, crops, forests and global warming; occupational disease and accidents; and reduced amenity from visual intrusion or emissions of noise. Effects of air pollution on human health are the most significant among them. The equivalent monetary value of health damage, i.e. external cost, is calculated here for two types of fossil fired power plants, located in Croatia, with the analysis covering Croatian- and European-wide scope of effects.