PART I.

ABSTRACT OF SELECTED PAPERS

POSSIBILITIES OF PRODUCING RENEWABLE ENERGY RESOURCES IN THE AGRICULTURAL ECONOMY

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To summarize foregoings the biomass origin energy source materials in the European FAO member countries can be estimated about 140 million tOE per year that is approximately four times of the fossil energy need of the agricultural industry branches and that is 10 percent of the total energy consumption of the region. With maximum utilization of the potential reserves the biomass origin energy sources could substitute about 44 % of the presently consumed liquid energy sources and 15 % of the total engine fuel consumption.

Based on the mentioned facts one can state that in the far future the agricultural industries can be reformed to become energy self-supplying and net energy producing branches by changing considerably the production targets, profiles and technologies. Producting and using of environment friendly and clean so called green energy sources can contribute in a significant extent to establishing a sustainable agricultural production and rural development and to solving environment pollution problems of micro and macro regions by means of closed CO_2 cycle biomass origin fuel and heating materials.

METHOD FOR PLANNING THE UTILIZATION OF MANURE IN ENVIRONMENTAL FRIENDLY MANNER

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In the scope of the development task such a nutrient supply method is worked out that beside saving of the soil the environmental saving utilization of manure can also be achieved. The programme consists of three parts: determination the composition of the soil, the field oriented manure distribution and modifying of the manure composition to be distributed.

The paper deals with the determination of the area distribution of the soil characteristics. By our elaborated method distribution of organic carbon content of the soil can be determined with not more than 5 % error. Among the macro elements distribution of those can be given from which deficiency can be observed. Obtained results can be documented by rasters so these can be processed by the help of such known photo informatic systems as the ARCINFO.

ELABORATION OF AN ELECTROPHYSICAL PROCEDURE FOR SEED CLEANING

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The aim of our research is working out, establishing a procedure theoretically and practically for separating bulks of components behaving different way in changing polarity, zero mean value, high voltage impulse generated electric field.

In the course of our research the aim was to establish an electrophysical procedure theoretically which can be used to a sorting technology in order to separate mixed seed (grain bulk) components more effectively in comparison to those being used so far. The basis of the technique lays on the characteristics having not been utilized.

SOIL PHYSICAL AND TILLAGE ENERGETIC INTERACTIONS

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In the arable land plant production two main questions are highlighted: increasing yield and making the work more rational. The additional novel topic is the environment. In the environment of arable land economy (above all at the soil) such an extent damages has taken place what queries fundaments of our existence included in the cropland.

The arable land economy need to be rethought and only this can lead to results insuring long term perspective. Complex solutions are inevitable such as interaction examination of the system of physics and mechanics of soil and tillage part, the better and more exact knowledge of soil-material system as well as the changes of them through the cultivation energetic changing. Practical application of multivariable soil-machine interaction in consultant level includes the soil protection, moisture keeping, precipitation utilization and especially the favourable values of tillage cost.

PIG HUSBANDRY ON DEEP LITTER

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In order to test the deep litter housing technology in Hungarian conditions 15-15 pigs were fattened in two 16 square meter boxes on 80 cm thick sawdust litter. In the interest of manure decomposition on the spot the litter was treated with SEF-C and ENVISTIM bioactive litter additive agents.

The litter was regularly rotated by man-power. Automatic feeders combined with nipple drinkers were used for feeding and drinking. As control 8-8 animals were fattened in 8 square meter boxes in traditional liquid manure system.

In the course of the July-August first fattening cycle due to several unfavourable effects the results of both the experimental stock and the control one were worse than expected. In the September-December production cycle the daily weight gain was 652 and 641 g on the average of the experimental groups, while that of the two control group was 621 g.

Thus the weight gain by the deep litter groups was higher by 5 and 3.3 %. The feed conversion efficiencies were 3.52, 3.59 kg/kg and 3.67 kg/kg respectively.

As a result of the deep litter technology compost type material was formed instead of great amount of slurry.

AUTOMATIZATION OF MILKING DEVICE CLEANING PROCESS

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The Hungarian Institute of Agricultural Engineering have been dealing with the robotization and automatization of milking equipments since 1988. Connected this work experiments were carried out for automatizing milking machine

cleaning and periodical rinse. It was a fundamental aim that they could be integrated to both traditional milking devices and milking robots. There were further requirements of saving energy and chemicals in the cleaning process, as well of good quality, low seed number milk produce.

COMPARATIVE TEST WITH DIFFERENT BIO-DIESEL FUELS IN TRACTOR ENGINE

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As a part of "Alternative fuels for engine" R and D work which was support by OMFB and four Ministry (KHVM, KTM, FM, IKM) we have done a comparative test with diesel fuel, RME (from Austria), RME (Győr) and rape oil mixture (Schur) in tractor engines (MTZ-80 and Zetor 160.45).

Based on the results of the bench engine test with different kind of fuels, Diesel fuel, RME - from Austria and Hungary and rape oil mixture (Schur), we can conclude that:

- The operation of the agricultural tractors (engines) has no any limitation with rape oil fuels,
- Using different rape oil fuels the engine power decreases by a few % compared to Diesel fuel. Otherwise the energy consumption and the efficiency of the combustion becomes a bit better,
- At the test condition was no any significant differences between the results getting from RME's and rape oil mixture (Schur).

DRUM CAGE SUPPORT FORCES AND THE DRIVING FORCE OF DRUM

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The power need of threshing drum was investigated in several countries in the past decades. The concave support forces were however measured hardly. This is now timely because the electronics developed a lot so that the possibility of material transmission monitoring is available. Despite there are already such kind of automates but their control signal measuring place is far from the drum which can be a source of uncertainty.

The drum concave force can be a certain basic signal of the automatic monitoring of transmission. We wish to carry out the measurement on the field in arable land conditions. The declination and torsion of drum shaft will be measured together with the necessary acceleration moment and power. As an introduction to our gap filling measurements in order to get informed the most important professional literature has been collected and are evaluated. Some of them will be shown here.

APPLICATION OF THERMOGRAPHY IN AGRICULTURAL ENGINEERING RESEARCH

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Determination of surface temperature making use of remote sensing and thermovision serve new ways of approach to solve problems of several fields of agricultural research. Surpassing the possibility to examine thermal processes without disturbing the environment the method with the available technical background including video and RGB system and computer processing units ensures such an evaluation possibility to the user which can not be solved with any other technique. The paper shows the possibilities of application through some practical examples.

EXAMINATION OF GRAIN MILL FOR SMALL SCALE FARM

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Investigations were carried out with FV-III-S type crushing mill. Wheat and corn produces were used. The investigation was made with different screen sizes and at a single output rate repeated three times.

According to our measurements with ∅3 screen 1.6 mm groats average particle size, 17.72 Wh/kg specific energy intensity as well as 1.5 groats average particle size and 8.52 Wh/kg specific energy intensity were showed up for wheat and maize, respectively.

With the tested machine the ratio of fractions above 1.6 mm were above 40 % in every case and their values reached 50-70 % when using larger size screens. The specific energy need of the machine can be characterized by regression relationships of E_{fb}=43.56 M^{-1} - 8.72 (Wh/kg) (R=0.983 correlation quotient, S=0.843 standard deviation), E_{fk}=21.69 M^{-1} - 6.53 (Wh/kg) (R=0.969 correlation quotient, S=0.455 standard deviation) for wheat and maize, respectively,. In the expressions M is the groats average particle size (module).

In short it can be stated that the mill is applicable to produce larger size of groats as desirable besides high specific energy consumption.

THERMOVISION METHOD FOR THE MEASURING OF THE KERNEL'S SURFACE TEMPERATURE DURING DRYING

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Research programmes aiming at the drying process of maize hybrids already began at the Pannon Agric. Univ., Faculty of Agricultural Sciences in 1981. Within the project from 1981 to 1984 physical (first of all heat physical), chemical and morphological tests of the hybrid grains of different drying characteristics were carried out. Knowing the drying functions and the surface area of kernels (a new calculation method has been elaborated for this by Neményi and Szodfridt 1985) the diffusion coefficient of the tested hybrids was calculated as a function of temperature and moisture content. On the basis of it, diffusion functions and the mathematical connections among diffusion parameters and the distinctive features of the substance were set up (Neményi 1983, 1988 and 1990; Neményi and Szodfridt 1985; Neményi and Szabó 1987).

In the next step (1985-1986) the so called endosperm mutants, firstly the Opaque 2 hybrids were tested. Ripening of the endosperm mutants is slower than that of the normal hybrids; but at the same time under artificial circumstances the Opaques dry more intensively. We tested that how much Opaque 2 gen ingestion speeds up the drying under artificial cirsumstances, in that way that ripening still does not slow down (Neményi 1988).

From 1986 different hybrids (56) were tested resp. ranked in the interest of the practical application of the research results.

ENGINEERING AND ENVIRONMENT PROTECTION QUESTIONS OF VEGETABLE ENGINE FUELS

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In several countries of Europe including Hungary attention is focused on the questions of vegetable oils fuel application in diesel engines.

The properties of plant oils - treated in different ways, mainly esterificated - have approximately the same properties as fossile diesel oils have. In our study engine tuning, operational specialities and environmental load are dealt with and compared.

MATHEMATICAL MODEL OF MASS REDUCING OF TILLAGE MACHINES

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The author describes theoretical considerations supported by soil box measurements with plough, harrow and disk. The useful mass calculation expression has been elaborated for each examined cultivation ways. The influence of machine mass reducing on such important parameters of implement - power machine - soil system as hauling force, pressure on soil and energy consumption. Furtherly those formulas were also elaborated which can be used to estimate the extent of mass reducing of a machine part if the cross section or material or both of that is modified practicably.

OPERATION EXPERIENCES OF DAIRY COW PLANTS SUPPLIED WITH COMPUTER PRODUCTION MANAGEMENT SYSTEM

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In our dairy farms computerized plant management systems were installed partly as home development and partly adapted from different western European countries. In the research operationally important questions as accuracy of animal identification with different technical solution units, relations of the number of feeder and the number of animals, milk meter operation with milking devices are covered. The investigations seek for answers to the economy of creation of systems taking into account the operation aspects.

ANALYSIS MEASURING ERRORS OF MEASURING CIRCUIT BUILT WITH THERMOCOUPLE

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Temperature sensors built with thermocouple are widely used in practice. In the course of our research work a measuring arrangement and evaluation method without fixed reference point was elaborated. In our paper systematic errors of the assembly are analyzed by means of non-equilibrium thermodynamic. The dependence on electrochemical potential temperature gradient and static magnetic fields is touched.

Based on literature data the concrete calculations are carried out for copper-constantan thermocouple, as well.

ROUTE PLANNING ON TRANSPORT NETWORK

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Today no one argues that transport is most costly and important operation of logistic activities. Traffic manager who manipulates vehicles faces to simple everyday problems of route planning, vehicle distribution, path and connection determination etc. Amongst them route determination is the most frequent problem, which means nothing else but the seeking for optimal path of a vehicle on a given traffic network.

A SYNTHESIS OF THE INTER-RELATIONS ANIMAL HOUSE, ENVIRONMENT, RENTABILITY, HUMAN AND ANIMAL WELFARE

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The environmental elements of husbandry processes are important factors, nevertheless they are not exclusive standpoints of the economical production. The effective factors should be considered in the wider system of relations. In the case of cow, pig, and poultry plants one can evaluate the advantages and disadvantages of housing with or without litter only taking into account all the factors such as investment cost, labour need, emissions, comfort feeling, etc.

It can be stated, that in the case of housing a compromise should be found. Such an equilibrium should be formed where the roles of single factors can not be overplayed.

HEAT- AND MATERIAL TRANSPORT PROCESS IN DRYING OF SEED PEAS

Dr. J. CSERMELY - Dr. Z. BELLUS - Dr. M. HERDOVICS - GY. KOMKA
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Drying process of seed peas in tower with vertical vent pipe was examined in different heights along the radius of the tower.

16.3-17.7 tons units of peas with 16.3-17.0 % starting moisture were ventilated with pre-heated air which has a temperature of 37.3-40.8 °C and a relative humidity of 26.2-28.2 %.

Drying in radial direction at the 2/3 height of the tower lasted for about 15 hours, while near the casing, except the upper measuring points, for about 22 hours. Drying process can be characterized by exponential equations of an r = 0.93-0.99 regression coefficient.

NON-DESTRUCTIVE METHOD OF FRUIT ELASTICITY DETERMINATION

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A simple and rapid non-destructive method was developed to determine the elasticity characteristic of fruits. The latter was defined by the coefficient of elasticity of the fruit that is dependent on the compressive stress and on the deformation.

A penetrometer was developed to perform experiments. Compressive stress and strain characteristics were measured with different varieties of fruits to determine the coefficient of elasticity and to compare it with conventional parameters of fruit strength.

WARMING UP OF BARLEY GRITS IN HAMMER-MILL (OTKA)

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The warming up has very important role in the comminution process and at the determination of the hammer-mill's technical efficiency (%). Regression analysis carried out on barley grits (water content = 13,5 % w.b.) proved, that the Δt warming up of grinds is influenced by the fineness of the grits (particle mean size or specific surface area) just in 18-19 %, while by the specific grinding energy requirement (kWh/t) only by 5 %.

It is surprising, that the warming up of the grits varies at about the same level, when screen is not applied at all.

APPLICATION POSSIBILITIES OF SOLAR AND WIND ENERGIES IN THE ENTEREPRENEURIAL ANIMAL FARMING

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The object of our work was to develop and test the water and electricity supplies generated and served by wind machines and solar cells of a sheep farm having 100-150 ewes. The daily water demand of the farm is 1500-2000 litre. Because of the expected 3-5 days of calmness period we planned the water tank of 10 m^3 capacity. SZV-2 multi blade wind-machine with diaphragm pump is used for lifting the drinking water from a dug well having the water level in 2-5 m deep. We built in altogether 8 compact fluorescent tubing of 9 and 11 W power capacity to light the sheep fold, about 45 m^3 and a part of social building consisting of 3 rooms. The electricity supply and storage were given by four SIEMENS made M40 type solar cells, LR-4 charging regulator and two 100 Ah batteries. The efficiency of 12 V D.C. system is about 12 % and the planned least average daily energy utilization is 12 hours. Parallel with the lighting system of sheep farm for small farms we have developed a very simple solar-water collector, which is combined with a hot water boiler of 200 storage capacity. The boiler beside the solar energy can be heated by agricultural wastes and residues.

INTENSIVE MIXING THE CEREAL BULKS BY PNEUMATIC METHOD DURING STORAGE

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The main point of the patented method is to place elastic, inflatable hoses into the store and by the inflation and deflation of these hoses grain layers can be moved. With this method, on one hand, the forming of rotting part can be prevented, existing centres can be eliminated; on the other hand, the method combined with ventilation can increase the safety on the storing.

The other advantage of the method is that it does not cause mechanical damages to expensive seeds.

With these experiments our aim was to increase the intensity of the mixing wet and dry parts of the stored grain.

QUALITY CONTROL OF BIOBRIQUETTES AND EXPERIENCES WITH THEIR COMBUSTION

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Good solid fuel can be made of the different combustible agricultural residues and of by-products. While testing these fuels we did not recognize exact relation between the stability and burning characteristics. The good solidity is important because of storing and delivery, and can be achieved by different pressing methods.

Given the same stability, the quality is first of all determined by the burning characteristics. The well-known agricultural and wood industrial residues and by-products can be considered as environmentally clean fuels.

The testing methods and the system we have worked out are suitable for the objective qualification of biobriquettes. With its help we can avoid getting briquettes made of environmentally dangerous materials and having bad burning quality on the market. It is in the interest both of the users and the producers and the distributors.

APPLICATION POSSIBILITIES OF FINITE AND BOUNDARY ELEMENT METHODS IN CLIMATE CONTROL DESIGN OF GREENHOUSES

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Finite Element Method (FEM) is applicable to solve heat conduction, heat flow, heat radiation and diffusion type problems. In the case of glasshouses the inner desired and uniform climate are determined by the physical phenomena of heat flow and conduction as well as vapour diffusion. They are the most important to be followed by climate control. The greenhouse climate are also influenced by outside condition such as outdoor temperature, solar radiation and air vapour content.

Two most important characteristics of the glasshouse climate are temperature and vapour content. The change of them can be described field differential equations, which can be effectively solved by FEM or Boundary Element Method (BEM). To solve the coupled or simultaneous differential equation one should know the boundary and initial conditions. They are given by outer heat transfer, heat radiation, moisture content, evaporation, ventilation, shading, etc.

The final aim of this long term research to respond the technical solution issues of the necessary heating, cooling, evaporating and ventilating in glasshouses.