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PREFACE

The Agricultural Engineering Board-of the Hungarian Academy of Sciences which supervises the development of this branch organises annually a conference at Gödöllő, which is the central place of the Hungarian agricultural scientific activity.
During the sessions, research scientist, developing engineers, experts of institutions engaged in agricultural engineering development (for example: Hungarian Institute of Agricultural Engineering at Gödöllő, Faculty of Agricultural Engineering of the University of Agriculture at Gödöllő, Agricultural Machinery Developing Intitute at Budapest, Department of Agricultural Engineering of the Politechnical University at Budapest and foreign guests give account of their results obtained in the research work and development of agricultural machinery.
This yearly English-Language publication the „Hungarian Agricultural Engineerig", started at 1988, contains selected papers presented at the conference of 1991. To the published scientific papers are enclosed reports of the tests performed by the Hungarian Institute of Agricultural Engineerng at 1990. We do hope that this publication will be found interesting to a big part of agricultural engineers.

Prof. Dr. László Tóth
direktor general

Hungarian Institute of Agricultural Engineering
Gödöllő

Part I.

ABSTRACTS OF SELECTED PAPERS

Technical Solutions For Bacterium Fertilization

L. HALÁSZ AND L. MÁTYÁS
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Hungarian Agricultural Engineering, Gödöllő (No 4 1991.) .. 13

Phylazolit, a bacterium fertilizer substituting partly N fertilizers, can be applied in dense cultures and row-crops, resp. It can be distributed in aqueous suspension using special adapters attached to rotary tillers (Ráb-8,4 type) and to corn and sugar-beet planters, resp. (IH-Cyclo-400 and Kühne-Kleine Unicorn 2-12.) According to efficacy-tests 30% of N fertilizers can be saved by this method in case of winter wheat and sunflower. Corresponding figures for sugar-beet and maize are 50% and 70%, resp. Based on long-term experiments bacterium fertilization is to be repeated at two-year intervals. Other advantage of the method is mitigation of the adverse impact of over-dosing N fertilizers, i.e., nitrate accumulation, acidification etc.

The Characteristics Features And Extent Of Losses In Function Of The System Of Sprayer And Of Facts Of Vegetation And Environment

DR. GY. DIMITRIEVITS – J. HUSZÁR – L. PINTÉR
Hungarian Institute of Agricultural Engineering, Gödöllő

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Chemical plant protection processes endanger the biosphere in a great extent. The great amount of chemicals that are spread aren't able to be utilized and charge the environment needlessly. According to the investigations the extent of spraying losses is 15-90 percent of the whole spreaded chemicals.
The essential sources of losses are overdozing, spilling, evaporation, blowing away. The utilization of the spray materials depends on the plants being protected, the meteorological conditions and mostly the structure, adjustment and operation of the sprayer. With a proper application of sprayers the losses can be decreased by 10-40 percent.

Field Test Of The Challenger- 65 Rubber-belt Tracklayer Tractor

DR. J. I. JORI – G. RADVÁNYI – DR. S. SOÓS –
DR. M. SZENTE
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Hungarian Agricultural Engineering, Gödöllő (No 4 1991) ... 17

The most recent developing result of tracklayers is the Challenger--65 tractor equipped with rubber-belt track-drive. On the basis of the testing results it can be stated, that this tractor rises over the traditional tracklayers, due to its outstanding traction features in the speed range which are advantageuus for the soil cultivating machines, as well as its technical solutions making the practical work easier and for this reason it can be a serious rival to the heavy 4-WD, so called soil cultivating tractors.

Variation Of The Germination Capacity, The Yield And Other Plant Characteristics In Case Of Seed Fractions Graded By Seed Separator

DR. P. SOÓS – DR. ZS. SZÜLE – DR. E. U. DUL
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Hungarian Agricultural Engineering, Gödöllő (No 4 1991) ... 19

Different seeds were tested. The seeds graded are: peas, wheat, soya beans and sunflower. After grading the fractions were tested in order to get information about the yield, the germination capacity, the field germintion and other plant features. In the case of the yield and other characteristics among the fractions significant differnces were observed. Numbers of the graded fractions were 4-5. This method gives useful guiding numbers in the seed preparation, but it may arouse the interest of specialists in genetics too, since the seed fractions having good features can be selected from the produced raw seeds for further propagation.

Combined Production Technology Of Silo- Maize And Soya

DR. P. SZENDRŐ – DR. ZS. SZÜLE – DR. J. NAGY –
DR. GY. BASKAY – DR. ZS. SZENTPÉTERY
University of Agriculture, Gödöllő

Hungarian Agricultural Engineering, Gödöllő (No 4 1991.) ... 20

Large-scale experiment was started in Dunavarsány Petőfi Farmers' Cooperative in order to improve the composition of maize silage as well as the protein and carbohydrate ratio. This aim has been achieved by a determined technology, using the combined production of silo maize and soya. The growth of plant population was observed for the purpose of determining the optimum time of harvest, considering the quality requirements and the lowest loss. Different machines and harvesting adapters were tested during the harvest in the interest of the best work quality and the lowest loss. During the silage making model silos were made as well as the soya- and silo- maize was stored separately. In the farmers' cooperative feeding experiment has been carried out, based on the fermented fodder. The paper presents the results of experiments.

Calcualtion Of Motion-fitness Of Vehicles Moving On The Ground

DR. L. LAIB
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Hungarian Agricultural Engineering, Gödöllő (No 4 1991.) ... 23

The calculation of motion–fitness of vehicles moving on the ground played an important role in the researches of the past few years. The mobility model that was introduced among vehicle developers and operators realised some possibilities of research directions. The paper starting form the relationship between ground and chassis, going through vehicular dynamics, discusses different research directions which give opportunities for stepping forward.

Feedrate Monitor And Forward Speed Control System

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Hungarian Agricultural Engineering, Gödöllő (No 4 1991.) ... 25

At our institute tractor engine load control systems and combine harvester feedrate control systems were developed. On the basis of the mentioned systems and the experience with the systems, principle has been established for the monitoring of feedrate and controlling the feedrate of forage harvesters. The forage harvester should be operated at the highest feedrate, or forward speed with which the technological functioning is reliable and the engine does not stall.
The principle established is that the chopping cylinder speed is proportional to the feedrate: when the feedrate increases, the speed decreases. However, when the choppnig cylinder speed is lover then the allowed minimum speed, the working quality of the forage harvester is not the wanted one, or it is not accepted.

Automatic Filling-station Without Operator

DR. J. JANIK – DR. O. SZIJJÁRTÓ,
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Hungarian Agricultural Engineering, Gödöllő (No 4 1991.) .. 27

An additional equipment has been developed which makes possible the operation of filling- stations without operator, the data recording and further perocessing of them by suitable electronics and automatic units. The use of equipment has the following advantages:
– the operators' wages and incidental expenses can be saved.
– the leooses through uncontrollable channels can be practically reduced to zero by recording exact fuel-turnover,
– the computerized data recording and processing and fuel management help to establish the exact accounts and the adequate discipline of labor.

Effect Of Change Of The Farm Structure On The Mechanization

DR. J. HAJDU
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Hungarian Agricultural Engineering, Gödöllő (No 4 1991.) .. 29

In Hungary – simultaneosly with the change of the economic system – a sructural rearrangement can be excepted in the agricultural production. The heavily centralized large-scale production will be replaced by such production that is based on the mixed-type small- and middle- as well as large-scale farms, which will be more suitable for the market economy. This causes significant changes in the background of production. At the market the choice of equipment, which can be used advantageously by the small- and middle – scale farms must be increased and this means new developing works for the Hungarian farm-machine industry and widening possibility for the importers.

Possibilities Of Mechanization Of Agricultural Production, Organization And Economy On The Basis Of Model-studies

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College of Agriculture at Nyíregyháza

Hungarian Agricultural Engineering, Gödöllő (No 4 1991.) .. 31

Despite of a very diverse enterpreneurial segment and area size production is still motivated by extra incomes. The production factors, production structure, equipment scale, production volume, investment as well as expenses-yields etc are all variables affecting the results to be realized. Efforts are therefore to be taken to recognize the new economic relationships of general tendency so as to promote initiation or correction of the enterpreneurial decisions.

The Possibilities Of A Concerted Development Of Custom – Service And Consulting Referring To Structural Changing

DR. I. HUSTI – DR. J. KISS
University of Agriculture, Gödöllő

Hungarian Agricultural Engineering, Gödöllő (No 4 1991.) .. 33

In our opinion within the frame of consulting an important part of the information in the scope of choosing, acquiring, puting into operation, running and secondarily utilitazing the machnines can go to the farmers through an organization that already exist and performs the custom – service of the agricultural equipment. The combination of the custom – service with the consulting activity seems to be the most practial.

Modification Of Suction-pressure Pulsation Ratio

Dr. L. Tóth – Dr. J. Bak
Hungarian Institute of Agricultural Engineering, Gödöllő

Hungarian Agricultural Engineering, Gödöllő (No 4 1991.) . . . 36

According to the tests the parameters of teat cups (diameter, wall thickness, hardness etc.) effect the cup movement and the speed of movement in the course of deformation. Due to this effective suction–pressure pulsation ratio – related to the characteristic curve measured at the pulsator – changes because of these parameters. Knowing the characteristic parameters the change of rate can be calculated with good approximation, but to do this, the main parameters of the characteristic curve – approximating the theorertical one – measured at the pulsator, must be known. In such a way the exceptable change can be prognosticated in advance, in the case of using different teat cups at a given milking machine.

Technical And Energetic Analysis Of Fodder Treatment Technologies

DR. J. CSERMELY – DR. M. HERDOVICS – GY. KOMKA
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Hungarian Agricultural Engineering, Gödöllő (No 4 1991.) . . . 39

Last years the thermic and hydrothermic methods and equipments designed – first of all – for handling of soya and other grain products were also used in Hungary. In 1989-90 in Kisalföld State farm a Hydrothermic fodder processing technology based on extruder was developed.
On the basis of the tests carried out with the earlier dry extruder technologies, as well as with the Bocchi technology we have determined the output and energetic characteristics of the thermic treatment technology.

Atomization And Spraying Characteristics Of Air Atomizing And Cone Nozzles

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Hungarian Agricultural Engineering, Gödöllő (No 4 1991.) . . . 40

The plant protection is getting more and more important role in the production technology of different crops. The improvement of work quality of the chemical plant protection methods is an essential task from economical and environmental points of view. The applied spreading devices, within this the construction of nozzle parts and their technical condition, besides the maintaining of spraying parameters at an optimum level have a basic role. The disintegration of nozzle tips, the drop size and distribution have an important role in most of the protecting methods. The tests covered the Hungarian made nozzles and the all available nozzles of foreign origin. The spraying output of nozzle tips, the spray angle and the drop size distribution have been determined. In the evaluation of the tested parameters the international standards were taken into account.

Automated Forcing Of Vegetables Without Soil

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Faculty of Horticulture, Kecskemét

Hungarian Agricultural Engineering, Gödöllő (No 4 1991.) .. 41

Hydrocultural growing experiments have been conducted at the Department of Vegetable Cultivation of the Kecskemét Faculty of Horticulture for five years.
The Department has developed an automated controlling system for hydrocultural Cultivating. Computer controlling makes possible the optimalization of the major ecological factors, including parameters of the nutriment solution in respect of crop productivity. During experiments considerable improvements have been recorded in quantity and quality of crops.

Air– And Heat– Engineering Tests Of Bábolna-type Driers For Cereals And Determining Development Trends

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Z. BÉKÉSI
Agricultural Company, Bábolna

Hungarian Agridulture Engineering, Gödöllő (No 4 1991.) . . . 42

The study gives information on the research theme of the air-and heat– engineering tests of Bábolna-type driers for cereals determining development trends.
The resistance functions determined by theoretical method and the software for computers give help to define the parameters of operation and modification at available types, further to plan new driers having similar construction.

Recent Results Offered By Three-dimensional Briquetting Of Agricultural By-products

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Hungarian Agricultural Engineering, Gödöllő (No 4 1991.) .. 44

Based on our experiments threee-dimensional briquetting offers advantages not only for briquetting straw materials. Using the same machine we have succeded in briquetting powdered and clumpy materials, as well. This has prompted construcion of an universal pressing machine. The bricks of relatively low density (700 kg/m3) pressed under 40 MPa press show very favourable duraiblity indices, compared to traditional bricks. These recently produced ones are ready to burn in furnaces or ovens of solid fuel, due to their greater weight and homogenous structure. To improve burning, sides of the straw bricks are to be chanelled while pressing.

Energetics Analysis Of Crushing Theories (RITTINGER, KICK, BOND)

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Hungarian Institute of Agricultural Engineering, Gödöllő

Hungarian Agriculture Engineering, Gödöllő (No 4 1991.) . . . 45

We have examined the possibility of using the Rittinger-, Kick- and Bond – models serving to describe the relations of average grain size of grits and specific power demand of crushing. We have pointed out that each theory can be equally used, there is no significant difference in the approximation exactness among the three theories, in the range of examined concrete mass flows and of average grain size at crushing of barley. The significance level was between 90-99% alike.

Testing The Specific Heat Of Pioneer-type Maize Hybrids.

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Hungarian Agriculture Engineering, Gödöllő (No 4 1991.) . . . 46

The knowledge of specific heat has got of vital importance during thermal treatment of cereals. The specific heat of cereals is the funciton of the material composition of seeds. However the chemical composition of seeds is affected by quite a lot of conditions (weather, type, terrain, type of soil, etc), so it is more useful if the specific heat of corns has been traced from the additive feature of moisture content and of the specific heat of dry substance. There is no significant difference among the specific heats of Pioneer-type maize hybrids. The specific heats of Pioneer-type maize hybrids. The specific heat relating the grains of maize can be described with the function

$$C = C_s + A \cdot X^a + B \cdot t^b$$

in the range of temperature 0-80 C and of dry basis moisture content 0–0,5 kg/ha, if – making more precise the additive character of specific heat, – the specific heat of 0 C dry substance (C_s) is corrected in function of material temperature (t) and of moisture content (X).

The Application Of Moisture Measurement At Miorowave Freyuency Of Grain – Dryers

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In Hungary drying plays an outstanding role among the different methods of preservation. Nearly 80 % of the 15 million tons of grain produced annually is stored after drying.
Year by year the agricultural drying requires 10-15 PJ energy which is around 20% of the country's whole consumption. Reducing energy consumption is an improtant task.
Development goes on in the direction of a better use of druing air and insturmentation.
We make proper use of the drying air if it leaves the dryer in a state saturated with steam. It can be achieved through different devices of air conduct.
We can save human labour and energy through the instrumentation of dryers. According to our examinations, around 10% of the energy can be saved by continously measuring the moisture content of the grain during drying. The operator of the drying unit usually overdries the grain because of safety reasons, to 10-11% instead of the necessary 14%. However, if it can keep the 14%, it will, of course, save energy. The system developed by us is suitable for an automatic regulation of crossflow dryers. Regulation is carried out through the operation of the emptying mechanism of the dryer on the basis of the tempereture of the air as well as the mositure content of the grain.
An important part of the system is the microwave mosisture meter, which is our invention.

Applicability Of Infratelevision For Detecting State Of Plants

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Z. PAPP
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Hungarian Agriculture Engineering, Gödöllő (No 4 1991.) . . . 49

Applicability of infratelevision (enabling remote sensing of surface tempereature without touch) for detecting infestant plant diseases and damages by pests has been studied. Based on our results, rises in temperature before manifestation of symptoms cannot be measured. Thus, neither microcolometry nor infratelevising can be applied for previsual detection of diseases. Remarked symptoms are however acompanied with considerable spectral changes, enabling the use of thermovision in plant protection for:
– early diagnosis of infestations,
– exact detection of pathologic foci
– prediction of epidemics
– abrupt protection interventions.
– imperovement of physiological state of plants.

Soil Conservation Tillage

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University Training Farm Gödöllő

Hungarian Agriculture Engineering, Gödöllő (No 4 1991.) . . . 51

In Hungary the renewal of the tillage aspect and practice can be calculated from the middle of 1970's. The balance can be only made in the knowledge of the effects. The mistakes made are: the burning os stubble residues at any price, the „over tillage", the neglected soil conservation, the conservatism against the reversibel plough, the loosener and heavy cultivator, The other side of the balance are the application of the rational management of organic mater, the improving physical-biological ocnditon of the soil, the soil onservation equipment and methods. The paper summarizes the experimental results of one and half decade.

Laboratory Robot With Irrrigation Adapter

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Hungarian Agriculture Engineering, Gödöllő (No 4 1991.) . . . 53

Several studies have been made about the possibility of agricultural application of the robot technique. The studies based on the demands found theat the agriculture requires also special laboratory robots besides the farm robots.
In the paper the authors give account of their robot development work, made for agricultural and biotechnological laboratories. They make known the own designed BR-5 type laboratory irrigation robot which has been carried out at the Faculty of Agricultural Engineering.

Part II.

SELECTED SCIENTIFIC PAPERS

TECHNICAL SOLUTIONS FOR BACTERIUM FERTILIZATOIN

L. HALÁSZ AND L. MÁTYÁS
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Phylazolit, a bacterium fertilizer, has been developed by the phylaxia Vaccine Producing Company for substituting N fertilizers. According to the preliminary studies effective and economical distribution of product may only be performed by special adapters. Attempts have therefore been taken to develope such equipments for suitable distributing the bacteirum fertilizer in one pass with seed-bed preparations and sowing, resp.
During developmental work we have analysed and assessed the experimental data available in technical literatrue. Individual equipments have been designed for the various crops including three kinds of adapters for distributing bacterium fertilizers.
Construction of equipments, laboratory and field tests were carried out between 1988 and 1990. Operation measurements and efficacy-tests of bacterium fertilization were conducted in large-scale farms using parallel control plots.

Universal distributor for dense-crops

In 1989 we constructed and adapter usable for seed-bed preparing machines, distributing the bacterium fertilizer on the soil surface. This adapter was attached to a Ráb 8,4 type rotary tiller, operated by a RÁBA 250 tractor (Fig.1).
The suspension of Phylazolit was applied at a rate of 305 dm^3/ha at an operation pressure of 3,7-3,8 bar. The machine group was moving at a speed of 6 km/h.
It is required that power machine should posses a hydraulic system of 27-30 dm^3/min output and a gear corresponding to a working speed of 6-7 km/h.

Distributor for row crops

At the beginning of 1990 we construced two additional adapter for sugar-beet and corn planting machines, resp.
The adapters for sugar-beet planter was attached to a Kühne-Kleiner Unicorn 2-12 machine operated by an MTZ-80 tractor (Fig. 2) The bacterium fertilizer was distributed with the adapter into the seed-bed behind the seed in a width of 10 cm and at a rate of 15 ml/rm per nozzle. The operation pressure was 0.5 bar, the working speed was 6-7 km/h.
The adapter attached to the IH-Cyclo-400 type cornplanter sprays the bacterium fertilizer suspension in the open sowing furrow at a width of 150-200 mm, at a rate of 9 ml/rm per nozzle, using an operation pressure of 0.5 bar and a working speed of 10 km/h. The planter was operated by JD 4650 power machine (fig. 3.)

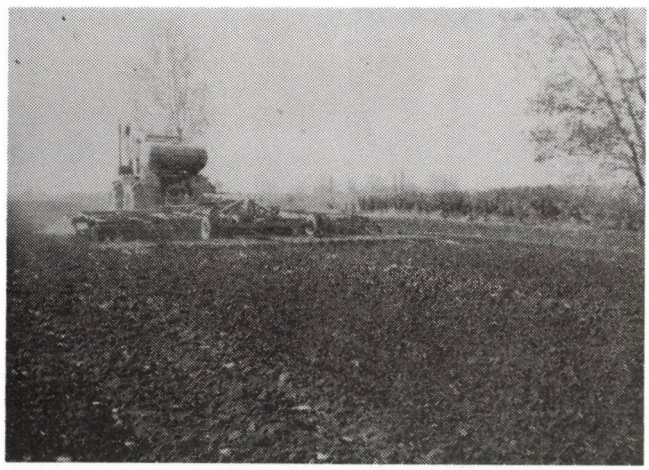

Fig. 1. Distribution of bacterium fertilizer in one pass with prepare of land

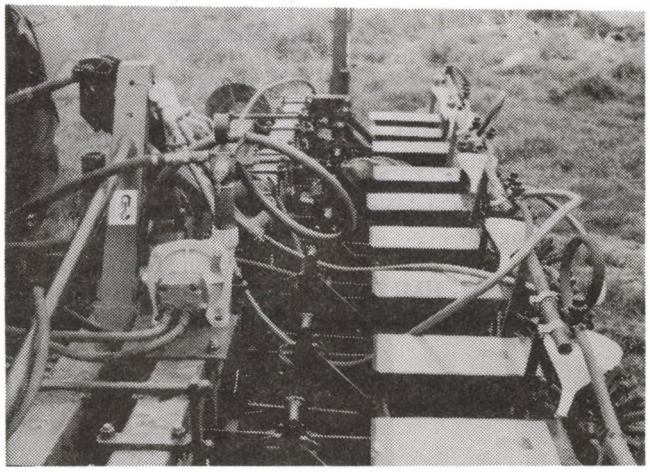

Fig. 2. Distributing adapter for bacterium fertilizer attached to a sugar-beet seeder

Efficacy-atest of the bacterium fertilizer

According to the efficacy-tests no differences were noted between treatments and contorls in respect of number and appearance of crops. but the yield differed already in quantity and quality as well. In case of sugar-beet the yield was higher by 27%, compared to the control. Corresponding yield increases for maize, pees and sunflower were 4, 5 and 14% resp. Considering nutriment conmposition, sugar-beets offered 4% increase in sugar content and the oil obtained from sunflower seeds was higher by 3%. Using bacterium fertilization 30% of N fertilizers could have been saved in case of winter wheat and sunflower. Corresponding savings for sugar-beet as well as for peas and maize were 50 and 70% resp.
Bacterium number was chequed on three occasions during the vegetative period: the Azotobacter quantity per 1 g soil varied between 2,6 and 11,8 million, despite of the unfavourable weather conditons. During overwintering the bacterium number decreased only by ca. 10%.
The adapters can be applied to sereval types of machines and they are funcionally suitable for the task. Application of bacterium fertilizers may save 30-70% of N fertilizers. Other advantage offered by the method is mitigation of nitrate accumulation in the soil and lover contamination of groundwater and runoff waters originated from leaching.
Treated crops show improvement of nutriment contents leading to additional increase in income and improvement of fodder quality, to. According to long-term experiments overwintering and unfavourable weather conditons produced no considerable dacreases in the numbers of bacteria. Bacterium fertilization is recommended to repeat every year in case of row-crops and at two-year intervals in case of total ground spraying.
Based on our results bacterium fertilization can be used as an alternative method of nutriment suppply. It may be important in biofarming technologies and environmental protection as well.

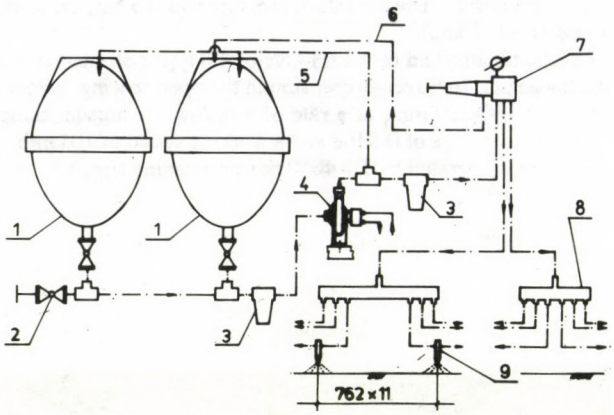

Fig. 3. Operation sketch of a bacterium fertilizer distributor attached to a corn-seeder

1. Suspension containers
2. Charging tap
3. Filter
4. HYPO 9303- HMI hydro-motoric centrifugal-pump
5. Mixing branch
6. Reflux branch
7. Pressure regulator
8. Suspension distributor
9. Nozzles

THE CHARACTERISTIC FEATURES AND EXTENT OF LOSSES IN FUNCTION OF THE SYSTEM OF SPRAYER AND OF FACTS OF VEGETATION AND ENVIRONMENT

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With spreading the sprays we can meet three main sources of losses. A certain part of drops evaporates on the trayectory or they can drift away as well. The extent of this loss depends mostly on the size of drops, length of trayectory and the meteorological conditions (temperature, relative degree of humidity). Those drops that are less than 1 micron can be blown away to some hundred metres at 4-6 m/s windspeed. The loss resulting from the evaporation varies in average conditions between 5-10 percent, comparing with the total amount of liquid that have been sprayed.

The other source of chemical losses is the overspraying. In order to obtain a proper protection of plants we should give a determined numbers of spraying drops on unit area, together with a certain amount of chemical spray. It occurs sometimes in practice that much more chemical spray falls on plants than would be necessary. In extreme cases flowing can come into being on leaves, so the assembled spray can fall on those parts of the plants that are placed lower, or on the ground. These facts decrease the effect of protection, at the same time the unnecessary excess use of chemical means loss. The extent of this type of loss greatly depends on specific atomizing quality, size of drops, measure and situation of foliage, just as the distance between the nozzle and foliage.

The large-sized and less mobile vine-leaves hinder in a great extent the penetration, as a consequence the danger of overspraying is rather great. The extent of loss of overspraying can come up to 10 percent in a vine-plantation.

The third significant loss occurs from drops falling on the ground directly. Whereas we can vary the evaporation of the spray only a little at the moment, and the overspraying can be maintained with proper care at a suitable level, we chose the loss of spray on the ground to be investigated. To determine the losses of sprays we made experiments of spreading. We mounted slides on the ground, in the line or lines that would be sprayed and into both directions in 10 more lines. After this we sprayed the water solution of Na-fluorescence indicator with machines. From the surface of collected leaves and from the slides we dissolved the indicator with a given quantity of water. In order to determine the quantity of material that have settled on the surface, we used sprectrofluor-metre of Spekol type, made by Zeiss. We determined the surface of leaves by VIDIMET II/A type of surface analisator. We calculated the extent of losses in the percent of chemical quantity that had been settled on the ground and foliage. According to previous observations the extent of losses shows rather great difference from the spraying processes of different machine types. We made these investigations in the fields with an ordinary type of NOVOR-105 sprayer. The results can be seen in table 1.

Losses in vegetable plantation

Specific spreading quantity: 6 dm^3/ha **Table 1.**

Culture	Loss (percent)		
	NOVOR 1005	KERTITOX CYCLON	NOBILI blowing-through
Tomatoe	10,4	7,5	8,7
Cabbage	3,3	2,4	3,0
Cauliflower	7,1	5,8	6,9
Brussels sprouts	6,1	5,2	6,0
Savoy	3,9	3,1	3,4

It can be seen from the data that the least loss – in vegetable plantations – was with the KERTITOX Cyclon type of sprayer. The least loss of spray occured with cabbages, while the most was in the tomato plantations. From the respect of the work of machines there wasn't any considerable difference. Its extent depended on the fact what sort of screening effect the plant had on the soil.

In the fruits plantations with different settling methods we investigated the extent of losses with KERTITOX NA-20 type of sprayer, Results can be seen in table 2. We can set down the fact that with protection of 1000 dm^3/ha specific liquid consumption the loss varied between 14-18 percent. Between the observed amount of losses in mid-sized trunk and growing-bough plantations there wasn't any considerable difference, while the value of losses was much less in hedge plantation.

Losses in fruits plantations

Table 2.

Type of plantation	Loss (percent)
Growing-bough	17,8
Mid-sized trunk	16,6
Hedge	14,2

With machines of different types and systems by investigations in mid- sized-trunk orchards the extent of lost (table 3.) varied between 11,8-16,6 percent. With the traditional machines supplied with axial ventilator a much better result can be obtained with the air disperser type KWH and the electrostatically charged KERTITOX NAE-20 type of machines.

Losses in mid-sized trunk apple plantation

Table 3.

Specific-spreading quantity: 1000 dm^3/ha

Type of machine	Loss (percent)
KERTITOX NA-20	16,6
KERTITOX SIROCCO	16,1
KERTITOX BÓRA-20	14,3
KERTITOX NAL-20	14,1
KWH Jumbo	13,8
KERTITOX NAE-20	11,8

We examined losses on the soil by operating hydraulic drop-forming sprayers supplied with traditional air-baffle, axial ventilator sprayers, sprayers supplied with electrostatic charger, airdisperser spayers, closed-roomed sprayers, as well as helicopter. (See Table 4.)

We can state the fact that the loss of the traditional machines spraying row by row dont't differ significantly, the chemical loss varied between 12,3-19,1 and 3,3-7,8 percent. We should pay attention to the fact that the application of heavyduty axial-ventilator isn't advantageous if the air current is almost perpendicular to foliage. By adopting KERTITOX NA-10 type of machine the reason of the greater loss value is the fact that the vine leaves are squeezed to each other closely by the effect of air-current, and so the spray cannot reach the inner part of the foliage and a considerable quantity comes to the soil from the leaves wich are on the outside. The same machine can achieve a much better result without ventilator. In consequence of the electorstatical charging the degree

Table 4.

Specific spreading quantity:
with ground machines 600 dm^3/ha
with helicopter 60 dm^3/ha

Type of machine	Spraying system	Loss (per-cent)
KERTITOX N-10	hydraulic spreading arc	5,9
KERTITOX NA-20	spreading construction with axial ventilator	7,8
KERTITOX NAL-20	spreading construction with air baffle	3,3
KERTITOX NAE-20	spreading construction with electrostatical charging	7,2
NOVATOR 1507	spreading construction with cross current	5,0
NYERS RW-36	blow-through construction with axial-ventilator	10,4
Ka-26	spreading construction mounted on helicopter	30,7
ZTP	closed roomed spreading	1,3

of loss could decrease only a little and it must be add to this that this advantageous effect couldn't be proved at every measuring. The application of subsidiary air current proved profitable with KERTITOX NAL-20 type of machine. The drops falling downwards are reached by the air current form below and this prevents them form falling on the ground and can be caried to the foliage. The work of NOVATUR 1507 type of machine supplied by tumbler ventilator didn't differ eseentially from those one supplied by axial ventilator. The HOLDER N-11 type of machine working with cross current gave a favourable result. The NYERS RW 36 type of machine with blow-through system did 4 row spraying at the same time. It should be considered however, that the quantity of spread spray per area was only 57 dm^3/ha.

In the case of closed-roomed sprayer the result indicates the advantage of chemical recovery and decreasing chemical consumption.

On the basis of investigations referring to losses we can state as a whole that the extent of the spray-liquid getting to the ground depends significantly on plant stand system and technical parameters of the sprayer and adjustment. By the application of airtransporting and airdispersing machines the quality of work can essentially be improved, but from the aspect of chemical losses the application of air current can be disadvantageous. This is true in an increased degree for machines with air dispersion: the smaller dorp size can increase the evaporating, and driftway losses.

In supporting the decrease of chemical losses there's a need for developing such a spreading construction that can assure the variability of direction, intensity and character of spraying at a greater extent. Such machines can play an important part – namely the closed-roomed sprayer- which can produce the decrease of losses and at the same time they can preserve the quality of work. The results of investigations can be utilized not only by developing new sprayers, but by operating them expertly also.

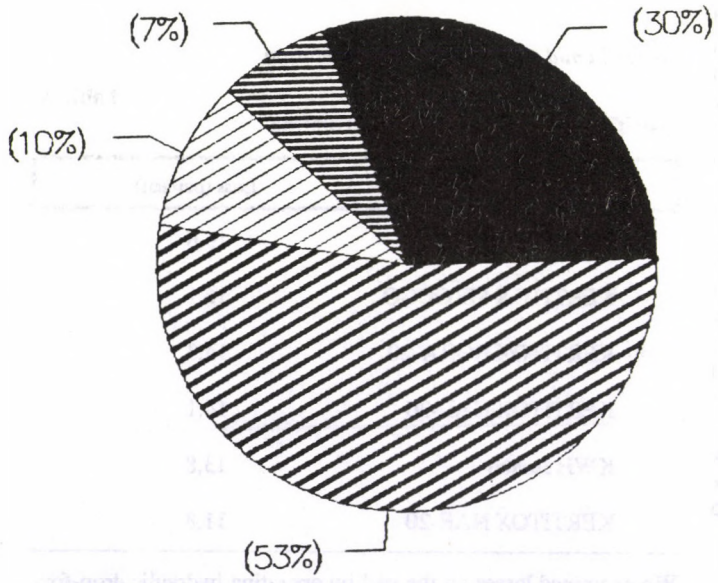

Fig. 1 Formation of losses at spraying vine evaporation (7 percent) loss on the sooil (30 percent) over spraying (10 percent) utilization (53 percent)

FIELD TEST OF THE CHALLENGER-65 RUBBER-BELT TRACKLAYER TRACTOR

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The presence of tracklayers in our agriculture is continuous but their importance is varying. At the beginning of the large scale mechanization of soil cultivation the Sz-100, DT-54 tractors were the only source of power of the operations requiring high traction force. With the appearance of the modern wheeled tractors their importance highly decreased and in the years of 69-89 s we could only occassionally met the practical use of the newer versions (DT-75, T-100, T-130 tractors) of the earlier tracklayers. In spite of the advantages of tracklayers – e.g. high traction force, low soil compaction – the low area output and public road unsuitability represented such disadvantages which could not be solved so far. The main reason of this is, that the design tendency of tracklayers aimed the mechanization of military and earth-moving works instead that of the agriculture.

The developmental conception of tracklayers changed in the middle of 80s. The production of the tipical agricultural tracklayers have been started. Out of these types of tractors the FIAT with gear lever suitable for switching under load and the Caterpillar tractors with variable output seemed to be the most suitable. These tractors were not suitable for public traffic also, due to the destructive effect of tracks. In this field the development of rubber-belt track-drive by the Caterpillar firm meant revolutionary novelty.

Fig. 1. Caterpillar Challenger-65 with rubber-belt track-drive.

Recognizing the importance of the new machine, tractor tests were carried out which covered the brake power test, the traction and field machine testes on stubble.

The purpose of the brake power tests was to determine the main features of the engine and the engine torque flexibility. The pulling power tests aimed at fixing the traction characteristics of the tractor. By the field machine tests we wanted to determine the basically important areas of tractor utilization.

Evaluating the engine brake power test obtained on a AW-400 type test bench it can be stated that the P.T.O. output of the engine is 169.1 kW at nominal revolution (2100 r.p.m). As an engine with constant performance is capable to give an output 5.5 per cent higher (178.5 kW at 1800 r.p.m.) than the power measured at the nominal revolution. The max. engine torque is 1.100 Nm at 1250 r.p.m.

The engine torque flexibility is 1.43 which is quite favoruable. The specific fuel consumption of the engine is 277 g/kWh at the nominal output and the optimum value of the specific consumption is 245 g/kWh.

According to the test results the max. traction performance was between 136-148 kW in the operating speed range (III-IV. gears)

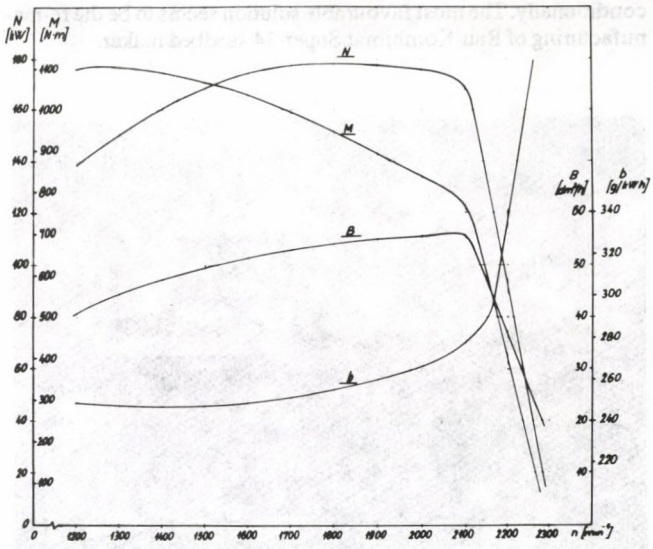

Fig. 2. Engine specifications

therefore it can be reagarded near constant. The gears side by side follow well each other and the optimum tractor speed can be easely chosen.

The measured output utilization factor (taking 201 kW nominal engine output into account) is 0.61 kW/kW, which is very low and the reason is the high power requirement of tractor auxiliary units (stearing mechanism. gear system).

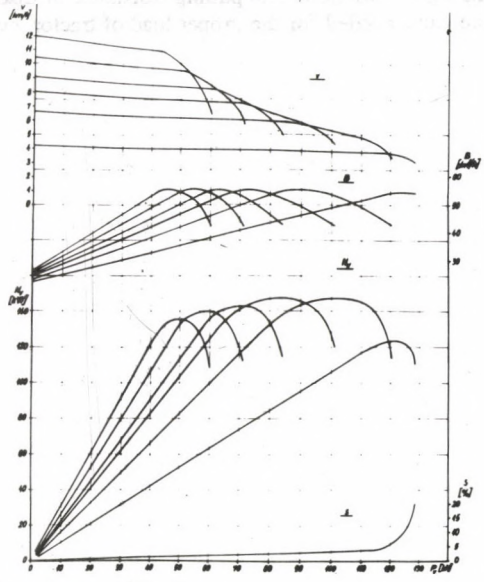

Fig. 3. Traction specification

The field tests were carried out with the following machines:
– Rau-Unimat-8,4 and KRM-8,4 seedbed preparing machines,
– ROME-TACH and NT-3,3 super-heavy discs,
– Rabewerk Marabu trailed plough.

From geometric and hydraulic point of view, both the conventionally mounted and the semi-mounted rotary seedbed preparator can be used suitably. The machine groups, together with the chemical applicators made by the operating farm, can be effectively used in the spring-time soil cultivations. However, the implements tested, are not best suited energetically, due to the slight specific energy requirement of the shallow seedbed preparation. From agrotechnical point of view, the tractor would be able to operate wider (10-16 m) seedbed preparators in the speed range of 8-14 km per hour. Therefore, an effort has to be made for purchasing such machines during this deveopment work. The Soviet and American made, very wide field cultivators, known form literary data and test results obtained earlier, due of work quality and and operational points of view (too wide transport width), can be taken into account only

conditionally. The most favourable solution seems to be the re-manufacturing of Rau-Kombimat Super-14 seedbed maker.

Fig. 4. Challenger-65 tractor with RAU-Unimat 8,4 seedbed preparator

We had a chance to test two super-heavy discs of the field machines which can be used for stubble ploughing and after ploughing cultivation. From the energetic point of view, none of them can be regarded a good solution. The pulling resistance of discs did not reach the value needed for the proper load of tractor, even in the case of basic cultivation (working depth 20-25 cm), substituting ploughing.

To set up a heavy disc harrow can be done by coupling together two 5,2 m wide V-disc harrows (see JD-360, or Wilback). A temporary solution can also be a RÁBA-IH-10-770-7,2 disc harrow, coupled with a trailed cultivator. Purchasing of the wider super-heavy disc can be done if the home-production the IH-780 disc will be carried out.

At ploughing the appropriate utilization of the tractor is not compatible with the serial-manufactured ploughs, marketed in Hungary. Therefore we renovated a 10-furrow Rabewerk-Marabu plough, involed in earlier investigations, for the purpose of field tests. The plough, having four meters working width, was made with jointed main frame in order to be able to follow the soil surface variations accordingly. The plough worked suitably during the tests, and formed an appropriate machine group with the tractor, regarding the points of geometry, hydraulics and energetics.

In the case of furher import of this tractor it would be practical to re-start the manufacturing of Rába-IH-10-800 trailed plough and/or to import the bigger units of Rabewerk Condor plough family. Prospectively must be also dealt with, the development of soil cultivating equipment which is able to plough and cultivate in one pass.

Summarizing the results of the tests we can say, that by use of soil protecting rubber-belt track-drive, with the excellent traction parameters in the speed range employed, and the helpful technical solutions for practical use (e.g. planetary streering, regulating system of suspension), it rises above not only other tracklayer tractors, but it is a great rival of heavy four wheel drive tractors too, when establishing a machinery system. To confirm these results, further field tests are necessary.

VARIATION OF THE GERMINATION CAPACITY, THE YIELD AND OTHER PLANT CHARACTERISTICS IN CASE OF SEED FRACTIONS GRADED BY SEED SEPARATOR

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The sowing of field crops is regarded as a fundamental operation of the production. It can be also added to this fact that the good quality of the basic material is a pivotal question in this process. The further impovement of sowing quality of field crops is of great importance (e.g. cereals, leguminous plants, sunflower) therefore the Ministry of Agriculture entrusted the Faculty of Agricultural Engineering with the improvement of sowing quality of field crops. In the sense of the two year theme the aim was to improve the seed grading and through this to improve the sowing quality and to carry out the laboratory and field tests in order to obtain the necessary parameters for the evaluation. In addition to this, the comparative test of the different types of handling and grading machines, considering the work and adjustability of the pneumatic separators. With starting of the test the improvement of germination, the increasing homogenity of plant population, the increase of plant population, the increase of accuracy of seed-metering of drills and the increase of yield due to the all above-mentioned facts were expected.

The experiments were carried out at the Farm Machinery Institute of the University and in its Training Farm. the data obtained with the laboratory and field machines were evaluated with the same method, but the production test has been carried out only with seeds graded by the field machines.

The following works were done during the test:

– Further grading of plumbed and other seeds with given parameters with separator

– Laboratory test of fractionated seeds in order to indicate the change of physical and valuable features,

– Sowing of fractions and control (plumbed) seeds under the same conditions with the same drill,

– Observation of the phenological phases and determination of differences among the fractions,

– Harvest of the separated fractions and determination of yields,

– Economical evaluation in order to get the expenses and result of the method.

The repeated fractionalization of plumbed seeds used as a basic material was done with Kamas, Heid and Olivieri separators as well as with a Damas-type laboratory separator. In the course of this, at least 4 fractions have been formed from the plumbed groups (without the very light and very heavy fractions) and these seeds were used for field sowing and plot experiments. (The very light and the very heavy fractions were not involved in the experiments.) During the pre-tests and plot experiments for sunflower seeding the SPCV pneumatic precision seeder and for sowing of wheat and peas the IH-620 type drill were used. The different seeds were drilled under the same conditions in all experiments and the experimental fields got uniform handling further on.

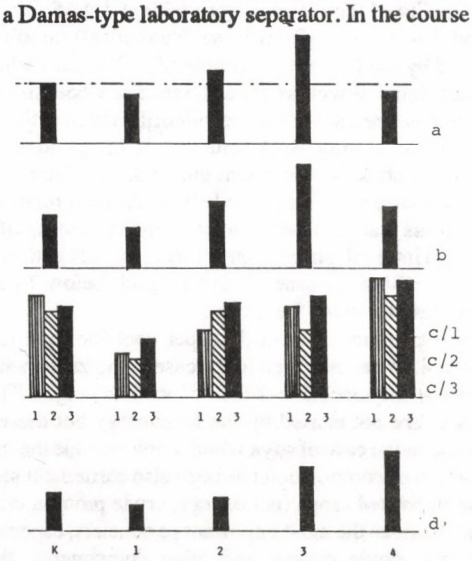

Fig. 1. Fractionalizing test of sunflower sowing seeds, 1988
a- yield (%), b- head diameter(cm), c/1- seed volume(cm^3/100p.), c/2 – 1000 mass of fructification(g), c/3 – germination(%), d – distribution of fractions(%)

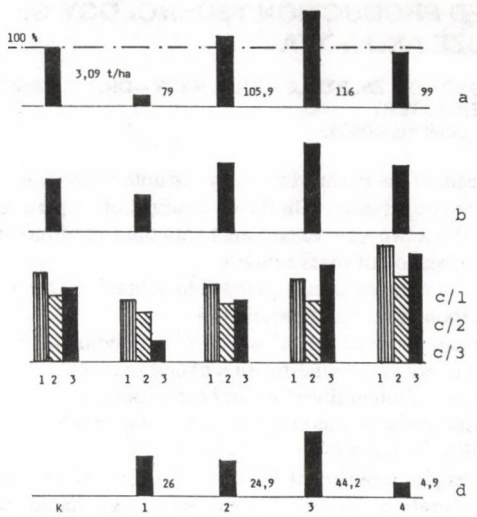

Fig.2. Fractionalizing test of pea sowing seeds, 1989.
a – yield(%), b- mass of plants(g/m^2), c/1 – seed volume(cm^3/100p), c/2 1000 seed mass, c/3 – germination(%), d – mean diameter of seed (mm).

The results of the experiment can be seen in the following figures (Fig. 1. and Fig. 2.)

As the figures show, the physical and valuable features of fractions improve with the increase of the mass of thousand seeds.

For example, the germination capacity improved significantly as compared to the control in the case of fractions II-III and IV. The seed volume shows a significant improvement in case of fractions III and IV.

The harvest shows that fraction III. (which is generally the greatest mass among the fractions) gives the highest yield.

Looking for the reasons it was observed that the phenological phases had postponed at the plants involved in the experiment and the vegetational period becomes longer with the increase of the mass of thousand seeds and in this way – according to the biological regularity – the yield will increase.

The decrease of yield can be traced back to two reasons in the case of fraction IV. On the one hand it would require probably less spacing than the normal population, on the other hand with the lengthening of vegetation the seeds are not able to ripe until the harvesting time of the crops giving an average quality and mass.

The postponement of the phenological phases can be clearly seen in the photos taken in the vegetational period.

Conclusions

1. In the case of fraction III. the yield of sunflower increased by 16 per cent, peas by 14.6 and wheat by 12 per cent, considering the control seed.
2. The costs of separation are recovered approx. 50 times (20-1000) in case of sunflower, approx. 3-4 times (600-2000) in case of peas and 2,5 times (250-800) in case of wheat.
3. Question to be settled is, what should happen with the fraction I. and IV. or what causes the yield decrease in the case of the seeds having the best features.
4. From the economical point of view and for propagating the method the fixing of the seed price according to the number of germs must be urged.

COMBINED PRODUCTION TECHNOLOGY OF SILO- MAIZE AND SOYA

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A research team of the Farm Machinery Institute of the University of Agriculture cooperating with the co-workers of Department of Feeds caried out a two-year experiment with the aim of increasing the inner composition of mass fodders.
The better inner composition is planned to achieve by the improvement of carbohydreate and protein ratio.
The experiments covered all phases of the technology, form the selection of variety to the qualification of end product.
On the basis of technical literature and pre-experiments soya was combined with maize (main crop) in such a way that 2-2 rows of soya was drilled between 4-4 rows of maize.
The farm-sized plot experiment was carried out in the Dunavarsány Farmers' cooperative, The production technology suited for the requirements of the modern mass fodder production. The varieteies of maize and soya sown during the two-year experiment are shown in Table 1.

Sowing parameters of the mixed and control population

Table 1.

Maize variety	Population plant/ha	Soya variety	Population plant/ha	Area sown ha
1989				
PIONER 3838	85000	MIRA	250000	10,3
HS-50/A	85000	MIRA	250000	10,5
PANNONIA 3737	85000	MIRA	250000	9,7
PIONER 3839	100000	-	-	7,7
HS-50/A	100000	-	-	3,2
PANNONIA 3737	100000	-	-	11,5
1990				
HS-50/A	100000	-	-	3,9
PANNONIA 3737	100000	-	–	4,2
HS-50/A+VOLGA	100000	-	-	4,13
HS-50/A	100000	Mc Call	280000	4,36
PANNONIA 3737	100000	Mc Call	280000	4,23
HS-50/A+ VOLGA	100000	Mc Call	280000	4,21

Analysing the experiences of the different variety selections obtained during two years it would say that the Pioner 3839 hybrid used in 1989 had a short breeding season and it was not possible to match the harvesting phase of experimental program to the ecological campaign plan of the Dunavarsány farm. Therefore we used an other hybrid in 1990. (The drought of 1990 proved the truth of our conception.).
Additionally, a quite new attempt was made in the second year experiment in 1990 when the HS-50/A so called sugar maize hybrid was sown side by side per line together with Volga silo maize, which has about the same breeding season. With this, the aim was to pollinate the male-sterile HS-50/A hybrid so as to obtain higher cob yield. In spite of the drought the year of 1990 proved our concept. The cob yield of HS-50/A sown with VOLGA maize was better and this also improved the composition value of the mixed ensilage.
The NODET Gougis Pneumasen II. pneumatic drill machine with individual seed hopper per row was used in both years of the experiment. Using 4 sowing elements for maize drilling and 2 ones for soya made the one pass drilling and the agronomically required row rate possible.
The simultaneous drilling requires individually made sowing discs for suitable spacing (Table 1.) but these can be done with modest fabrication technology.
In both years the germination, the growth and development were observed. The data of germination and growth have been favourable.
In the course of growth the mixed population did not require weeding or plant protection. On the basis of continuous observation of the experimental and control plots it was stated that the plant combination had a very favourable effect on the growth of maize and soya.
During ripening, samples were taken three times (at the beginning of milky ripe, at the end of milky stage, at cheesy stage) and after the laboratory test the most favourable time of harvest was determined, taking the feed quality into consideration.
This series of experiments gave also information to the corrections of variety selection, mentioned earlier.

Besides the determination of yield and the component qualification of silage a great care have been taken of evaluation of crop residues, remaining on the stubble. The specific mass ratio of stubble loss was suitable for the comparative qualification of the harvesting residue, but it also indicated the different interactions in stubble loss caused by the various harvesting adapters and plants having dissimilar morphology.
The harvesting adapter shuld be able to harvest according to the sowing row ratio. This is required becase of the homogenity of silage.

The stubble losses show that the loss of table-type silo maize adapter, monted on the E-281, was very high especially in the case of soya plant. At the same time the stubble heights were 30-38 cm. In the second year of the experiment the table-type adapters were not used.
On the contrary, the HESSTON 7580 forage harvester, equiped with a three-row adapter which has been used in both years during the experiment, was very apprapriate.
A CLAAS Jaguar 690 equipped with a six-row adapter was also used succesfully in the second year experiment.
The latest two adapters developed for maize harvest suit the requirements in the case of both crops, namely the stubble height does not exceed 20 cm which has been planned in the first year. The harvesting quality of the six-row (very wide) CLAAS Jaguar 690 is quite good. The deviation from the set (theoretical) stubble height is only caused by the lateral unevenness of soil surface which can be hardly calculated as well as the difference of wheel sinking.
The cut cross-scections as well as the videofilm taken of the cutting indicate the clear cutting work and this is independent of the differences in the stalk cross-sections and of the plant morphology.
Besides the absolute values of stubble loss, the ratio related to the whole plant mass was also determined by the measuring of longitudinal (at 5 cm intervals) mass distribution. The loss getting in this way was 1 per cent in the case of soya (in pods below 7 per cent) and the loss of maize was 15 per cent.
In 1990 these parameters were 35,8 per cent for soya (in pods number it was 42,5 per cent) and in the case of maize the value was 17,7 per cent at the reachable 20 cm of stubble height. The high specific losses are not caused by the technology but these losses indicate a ratio in the case of soya which grew low due the drought.
Distribution test of composition has been also carried out along the stalk of the cultivated crops (net energy, crude protein, crude fat, crude fibre). Besides the most important parameters, especially the net energy and crude protein and other components, the data indicate that the stalk pieces reaining on the stubble and near the soil are valuable from compositional point of view, in contradiction to the litarary sources (Table 3. and 4.). On the basis of the results the stubble loss should be reduced and further experiments should be carried out in oreder to verify the experiences obtained. The effect of dry weather is also ambiguos in this question.

Stubble loss of variettes taking the effective stubble heights into consideration

Table 2.

	Losses			
Machine type	CLAAS Jaguar		HESSTON 7580	
Average stubble height	17,8 cm		22,6 cm	
	Loss		Loss	
		(%)		(%)
1. HS-50/A				
Stalk mass (t/ha)	3,62	16,41	4,92	20,83
Dry matter (g/stalk)	10,58	7,88	13,21	9,84
Net energy				
(x0,003xMJ/stalk)	333,81	16,89	407,06	20,06
Crude protein (g/stalk)	6.46	18,62	7,84	22,65
2. Pannónia 3737				
Stalk mass (t/ha)	3,41	15,54	4,42	19,11
Dry matter (g/stalk)	7,19	6,58	9,19	8,42
Net energy				
(x0,003 xMJ/stalk)	233,32	15,81	285,15	19,43
Crude protein (g/stalk)	3,86	15,12	4,78	18,72
3. HS-50/A + VOLGA				
Stalk mass (t/ha)	5.12	13,95	6,51	17,12
Dry matter (g/stalk)	7,19	7,92	18,31	9,61
Net energy				
(x0,003xMj/stalk)	233,33	12,15	462,28	16,92
Crude protein (g/stalk)	5,62	12,77	6,81	15,52
4. MC Call soya				
Average stubble height		22,6 cm		24,87 cm
Salk mass (t/ha)	2,84	41,32	3,41	45,72
Dry matter (g/stalk)	4,49	38,87	5,03	43,343
Net energy				
(.0.003 xMJ/stalk)	40.23	40,53	44,89	45,23
Crude protein (g/stalk)	1,45	38,04	1,65	43,41

The yield of mixed-sown plots was fermented and processed differently in the farm. At the same time farm cattle feeding experiment was carried out based on the fermented silage. There was no essential differences between the single crop and soya mixture regarding the possibility of ensilage. The chop size and distribution of both plants were uniform. The experience was the same considering the chopping, the transport and consolidation: the agrophysical features of the chopped material mixed with low stalk stregth of soya were not changed, taking the possibility of ensilage into consideration.

On the experimental field of the Department of Feeds, siloes were made with a capacity of one ton, where the fermentation of differnt silages have been tested and the factors of utilization were determined.

In spite of the increased protein content (Fig. 1.), the fermentation of soya mixtures was as good as in the case of pure maize silage, which is rich in carbohydrate. The high protein content of soya did not influence unfavourably the chemical reaction, the quantity and ratio of the organic acids formed.
The butyric acid content of the mixtures even decreased by a few percent, expressed in the rate of total acids (figs. 2. and 3.).
The feeding experiment s of the farm and model silos indicated that the higher protein content of mixed silages improves fodder utilization and milk production. In both years the digesting parameters of mixed silages were better than the calculated standard factors of soya mixed silage (Tables 5. and 6.)

Conclusions and proposals

Suitable varieties are available for the combined silage maize and soya growing, from these the plant association can be selected and grown successfuly in the given ecological environment.
The mixed growing technology can be done with the machines presently in use in our farms, on a high level.

Distribution of the important compositional values along the plant length in case of Pannónia 3737 maize

Table 3.

Length of plant	Stalk mass	Dry matter	Net energy		Crucde protein	
(cm)	(g/stalk)	(g/st)	(x, MJ/st)	(%)	(g/stalk)	(%)
0-5	11,8	2,19	70,92	4,84	1,02	3,99
5-1	10,6	1,97	70,81	4,81	1,27	4,96
10-15	9,8	1,91	60,66	4,12	0,97	3,79
15-20	9,1	1,99	50,24	3,41	1,08	4,22
20.25	8,9	2,14	52,96	3,62	0,85	3,32
25-30	8,2	2,28	49,86	3,39	0,71	2,78
30 to cob	31,9	10,53	192,99	13,11	2,74	10,71
At cob	31,2	35,93	445,17	30,24	10,08	39,41
Above cob	78,7	50,32	473,77	32,18	6,85	26,78
Total	240	109,25	1472,36	100	25,58	100

The most critical activities are sowing and harvesting. Simultaneous sowing can be done with precision drills, having individual seed hoppers, but the machine should be prepared technically and a great technological discipline should be maintained. Harvesting

Distribution of the important compositional values along the plant in case of Mc Call soya

Table 4.

Length of plant	Stalk mass	Dry matter	Net energy	Crude protein
(cm)	(g/stalk)	(g/st)	(x0.003xMJ/st)	(g/stalk)
0-5	1,24	0,84	7,13	0,1724
5-10	1,7	1,14	9,72	0,3231
10-15	1,44	0,9	8,56	0,3067
15-20	1,6	1,03	9,47	0,4096
20-25	1,72	1,12	10,27	0,4506
25-30	1,7	1,12	10,15	0,2924
above 30	7,3	5,4	43,95	1,8471
Total	16,7	11,55	99,26	3,8017

can be done with modern forage-harvesters equipped with 3 or 6 row adapters, which are widely used in the farms. Mixed mass-fodder for silage can be obtained in excellent quality and homogeneuus composition. At the same time, stubble height and stubble loss are also acceptable. The laboratory tests showed the improvement of silage composition and this will be presumably proved also by the feeding experiments which are in progress.

Summarizing our work, it can be stated, that the composition of fermented mass fodder can be improved successfully with combined growing of silage maize and soya. The operations of production technology have been worked out.

Digestive factors (%), of silages of different maize hybrids and of their mixtures with soya (1989)

Table 5.

Varietes	Digestibility					
	Dry matter	Organic matter	Crude protein	Crude fat	Crude fibre	N-free extract
Pannonia-3737	68,0	75,0	69,0	87,0	70,0	77,0
Pannonia-3737+ Mira 4+2	73,0	75,	71,0	90,0	71,0	76,0
HS-50/A	63,0	64,0	49,0	82,0	70,0	63,0
HS-50/A+ Mira 4+2	61,0	74,0	65,0	70,0	77,0	75,0
P-3839	70,0	83,0	77,0	83,0	79,0	86,0
P-3839+ Mira 4+2	77,0	82,0	78,0	89,0	79,0	84,0

Digestive factors (%), of silages of different maize hybrids and of their mixtures with soya (1990)

Table 6.

Varietes	Digestibility					
	Dry matter	Organic matter	Crude protein	Crude fat	Crude fibre	N-free extract
HS-50/A	55,0	60,0	52,0	80,0	66,0	69,0
HS-50/A+Mc Call	56,0	62,0	63,0	60,0	62,0	62,0
Pannonia 3737	41,0	64,0	37,0	61,0	66,0	68,0
Pannonia3737+ Mc Call	44,0	62,0	53,0	77,0	64,0	70,0
HS-50/A+ Volga	57,0	65,0	60,0	81,0	71,0	74,0
HS-50/A+ Volga + Mc Call	60,0	65,0	66,0	74,0	73,0	75,0

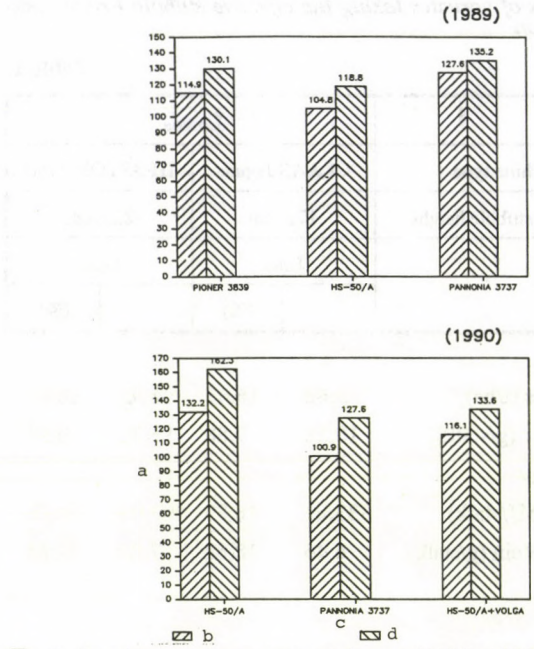

Fig..1. Crude protein content of silages (1989, 1990) a – crude protein, b – pure maize, c – maize vareiety d – maize mixed with soya

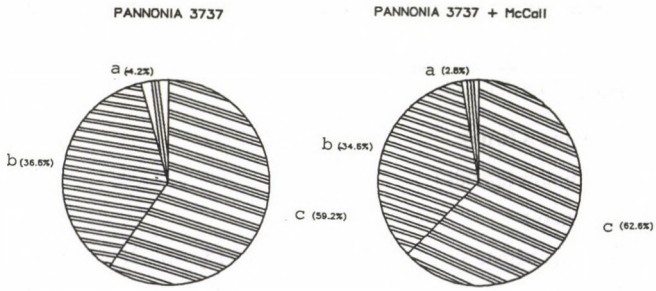

Fig. 2. Lactic acid and volatile fatty acid contents of silages (1989) a – butyric acid, b – acetic acid, c – lactic acid

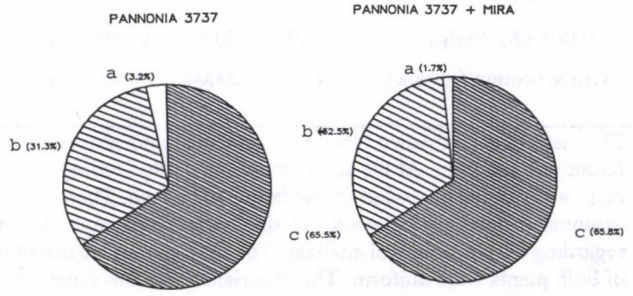

Fig. 3. Lactic and volatile fatty acid contents of silages (1990)

CALCULATION OF MOTION-FITNES OF VEHICLES MOVING ON THE GROUND

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The research work of ground-vehicle mechanics with giving formula referring to carrying capacity and stability of the ground made it possible the dimensioning the chassis with wheels and caterpillar-track and with the help of this developing new, up-to-date vehicle constructions.

The aim of the research — recently — has turned towards analysing of vehicle movements on the ground. Its purpose is to qualify the moving ability of the vehicle and to be able to point out the impermeable terrain sections or predict the advancing speed of the vehicle with account on certain sections. If the vehicle moves on the ground, its moving ability is effected by several factors. One part of it contains well- determined technical parameters, others contain determinical and stochastical functionality as well as their system (See Fig. 1).

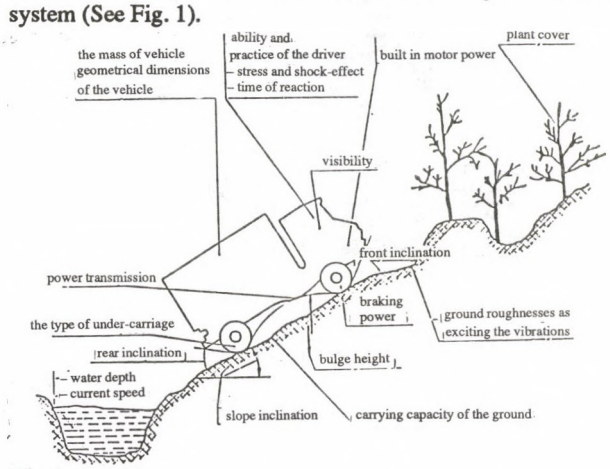


Fig. 1.
Parameter systems which affect vehicle movement and nominating of function relationships

The ability of vehicle moving on the ground is qualified by 2 steps. First on the critical sections, macrobarriers (e.g. river areas) we give qualification: goes — does not go; in case of 'goes' — we give the determination of ground speed of the vehicle as the index-number of the movement ability.

The logical order of the computing methods for qualifying movement ability is the mobility model where the income data refer to ground, vehicle and driver further the determinical and stochatical functions, while the outcome data refer to speed, time of task fulfilment, propellant consuming as well as — for special treating — the mobility map.

On a given ground the task of the model is to imitate the movement of the vehicle with analysing the mechanical and dynamical processes.

The results of the program are predictions which refer to consuming of time, output, energy.

The movement of the machine on terrain resp. on built road means the possible maximum advancing speed and the ability and speed of overcoming natural and artifial obstacles.

The arbitrarily chosen index-number means the achivable average speed between the two points of the ground or, with knowledge of the distance, the necessary time for covering it.

My research works involve three main topics as the followings:

1. The formulazitation of ground-roughness with measuring as inductive-structure of the vehicle, later on its mathematical processing, moreover developing ground-roughness models with parameters.

2. Examination of the connection of the oscillatory acceleration that is generated by ground – roughness and advancing speed and presenting it with function linkage, referring to the type of vehicle.

3. The developing of the computing order of mobility model that can be applied in agriculture and forestry as well as in the army and checking the correctness of computing with field experimentations of the vehicle.

The measuring and mathematical processing of the ground roughness, as forming the inductive system of the vehicle is needed for computing the vertical oscillatory acceleration of the vehicle.

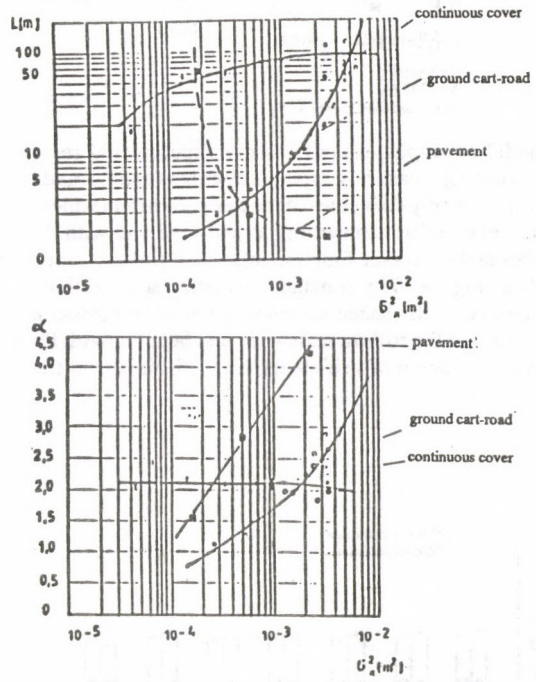
Up till now a lot of scientists have dealt with measuring and mathematically describing the roughness of solid paving. I've made experiments on cart-roads, agricultural grounds (stubblefield, areas covered by residues, ploughed ground) to measure ground roughness.

I used a measuring car as measuring instrument based on acceleration measuring, together with a mechanical ground profilagraph. At the mathematical processing besides the Wiener-Hincsin type analog analyzing I applied digital method for developing stochastical processes with fast Fourier transformation.

During my experimental work I was looking for typical parameters for describing minor grade cart-roads. I continued the method that was developed by Joseph Gedeon and I laid down as a fact that the constant of power functions fitted on correlation and power-density functions which characterise cart-roads. $\alpha = \sigma_x^2 - L$ give a good characterization of average ground-roughness.

For the sake of a later usage I examined the linkage between these parameters. I've made a plenty of measures with cart-roads therfore those functions are west developed which refer to cart-roads. (See Fig. 2.)

Revealing the connection among the three characteristic parameters of the ground-roughness made it possible to determine the advencing speed of the vehicle, in case of constant oscillatiory



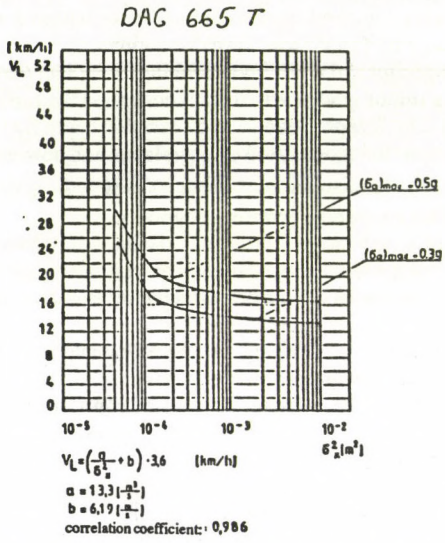
acceleration superstructure, of which is one of the chracteristics of ground roughness – in function of the variance of roughness as an independent variable.

Starting from ground roughess and modelling the oscillating systems of the vehicle it is a rather long computing procedure to determine vibration speed that occurs on superstructure. It became therfore necessary to throw a new light upon this in the mobility model.

In my experiments, by measuring simultaneously thrust coming into being on driven wheel and vertical oscillatiory acceleration, experienced that the greater oscillationy acceleration goes together with less thrust and less acceleration goes together with greater thrust. The two parameters have such a function relationship which graph is similar to hyperbola.

Approaching the topic from an other aspect the oscillationy-acceleration that affects the driver, makes it much more difficult or impossible, over a certain level, to direct the vehicle.

I modelled the vehicle with thre dimensional oscillation models and as a simplication I took the characteristic of spring- and shock absorption elements as linear. I determined the attainable motion speed from the point of oscillation together with a constant oscillatory acceleration of the vehicle as a function of variance σ_x^2 of ground roughness which is characteristical. The determined functions connection for the type of vehicle — at compauting the mobility — makes it possible numerically determine the effect of oscillatory accelleration — generated by ground roughness — on the advancing speed (See Fig. 3.).

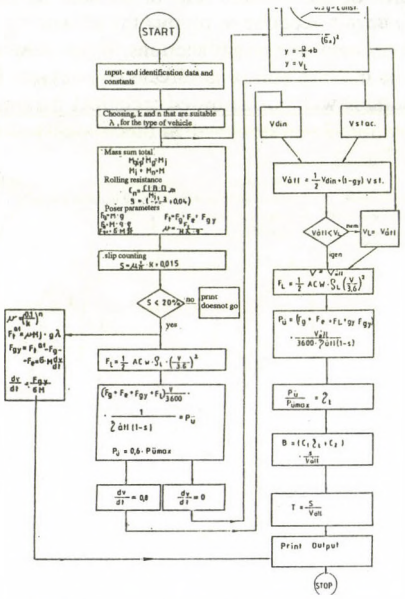


The model as employer contains my experimental results that I obtained during measuring ground roughness and its mathematical processing, namely the values of the tree parameters which describe function relationship concerning to cart-road and with the help of this I obtained a variance function relationship of ground roughness and advancing speed by constant oscillation acceleration.

The mobility model based on conic penetration measuring of the soil determines the rolling resistance and later on, with the help of differential equation of vehicle moving, it estimates if the built-in engine output is enough at different accelerations. With the help of iterational methods it determines the statical and dynamical advancing speed and propellant consumption and in the knowledge of distance the time of task fulfilment.

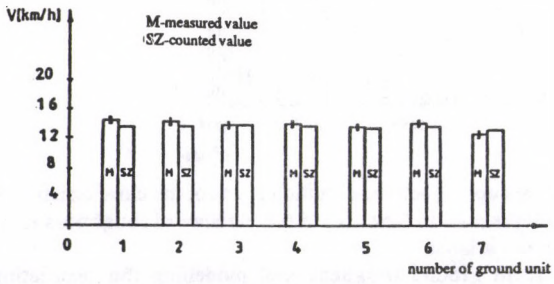
The ground speed limited by oscillatory-acceleration is determined from the function relationship described before. The districts of macro-obstacles are taken into consideration with the so called permeation function, which has been developed for the type of vehicle. This describes the moving of the vehicle with — 'goes' — 'doesn't go' — classification. The computing order is shown in Fig. 4. (See Fig.4.)

I checked the calculation correctness of the model with field measurings and pulling examinations and I found that with data



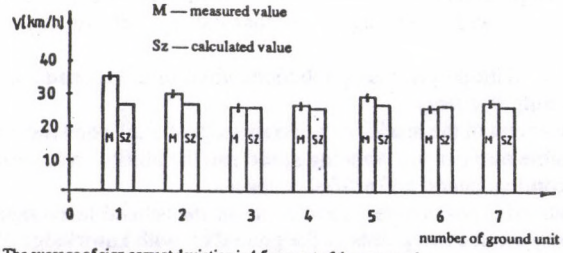
referring to – ground – vehicle – driver as a unit — the calculation accuracy is appropriate. (See Fig. 5.)

The practical utilization of experiences are fairly multiple. The application of the model in one respect makes it possible to increase the efficiency of operation in agriculture, forestry and the areas of the army and in other respect to decrease the costs with the tasks that are being carried on (e.g. testings), respectively it creates opportunities to begin new research works — like judging and defining numerically the driving ability of the driver.



The average of sign correct deviation is 2,0 percent of the measured value

Comparing the measured and calculated ground speed of the DAC 665 T type of vehicle



The average of sign correct deviation is 4,5 percent of the measured value

Comparing the measured and calculated ground speed of the BMP type of vehicle

FEEDRATE MONITOR AND FORWARD SPEED CONTROL SYSTEM

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The efficient operation of the high throughput self-propelled forage harvasters is of great importance, because the fuel consumption and the operational costs of such machines are considerable. Therefore it is beneficial to monitor, or rather to control the feedrate of the forage harvester.

At our institute tractor engine load control system and combine harvester feedrate control systems were developed. On the basis of the mentioned systems and the experience with the systems principle has been established the monitoring of feedrate and controlling the feedrate of forage harvesters.

While operating the agricultural machines the variations in the loading characteristics, or in the throughput should be taken into account. However the machine, the forage harvester should be operated at the highest feedrate, or forward speed with which the technological functioning is reliable and the engine does not stall. The principle established is that the chopping cylinder speed is proportional to the feedrate: when the feedrate increasses, the speed decreases. However, when the chopping cylinder speed is lower than the allowed minimum speed, the working quality of the forage harvester is not one wanted, or it is not accepted.

Feedrate monitor

Feedrate monitor has been developed for forage harvester. The main parts of the monitor are as follows:

– console with controls and display lights and numeric display
– chopping cylinder speed sensor, that is an indirect sensor of the feedrate
– forward speed sensor.

The simplified scheme of the monitor is shown in Fig. 1. The

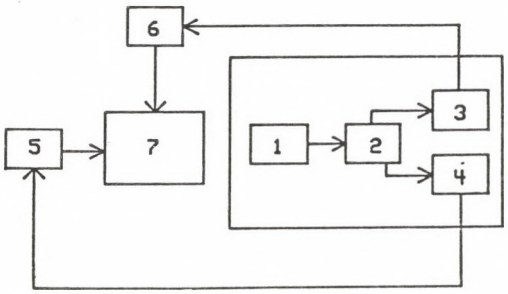

Fig. 1. The simplified scheme of the feedrate monitor (1-engine, 2 – transmission, 3 – wheel, 4 – chopping cylinder, 5 – speed sensor for the cylinder, 6 – speed sensor for the wheel, 7 – console)

numeric display continuosly shows the chopping cylinder speed that is dependent on the feedrate. There are three LED-s: the yellow one is on when the feedrate is lower than the optimum level. The green LED lights when the feedrate is in the optimum range. The red one is on when the feedrate is too high, the machine – the engine – is overloaded.

The operator should watch the lights and accordingly he can increase, or decrease the forward speed of the machine. In this case the driver has got the possibility to determine how often he should change the speed, actually he plays a time delaying and averaging role.

The feedrate monitor was fitted on a self-propelled forage harvester (SPS-050) and experiments were performed with the machine. The monitor was found to be an improtant aid of operating the forage harvester with high workrate and efficiency.

Forward speed control system

Forward speed control system has been developed for forage harvester. The system performs forward speed controlling and overload controlling as well. The system ensures the wanted forward speed when the machine is not overloaded, when the chopping cylinder speed is higher than the allowed minimum speed. However, when the cylinder speed is decreased and it is lower than the allowed minimum value, in this case the system reduces the forward speed temporarily. After overloading when the cylinder speed is higher than the mentioned minimum value, the system maintains the wanted and set forward speed.

The main parts of the control system are as follows:

– console with controls, numeric display and display lights
– chopping cylinder speed sensor, that is an indirect sensor of the feedrate
– forward speed sensor
– actuator to vary the forward speed.

The simplified scheme of the contorl system is shown in Fig. 2. The

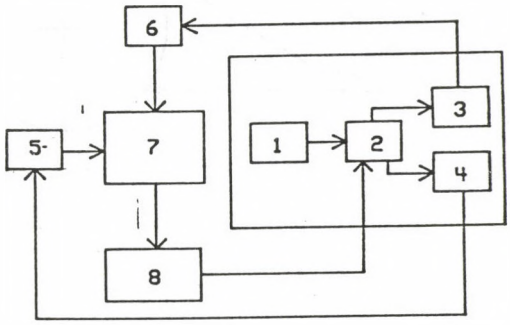

Fig. 2. The simplified scheme of the forward speed control system (1 – engine, 2 – transmission, 3 – wheel, 4 – chopping cylinder, 5 – speed sensor for the cylinder 6 – speed sensor for the wheel, 7 – console, 8 – actuator magnetic valves fitted on the pump)

chopping cylinder speed and the forward speed are measured and shown on the numeric display. The hectares, the working hours, the momentary workrate and the momentary feedrate can be displayed as well. However, the working width of the header should be set on the console by the controls (claviature).

Magnetic valves mounted on the pump of the hydrostatic transmission are used as actuator for the system. Therefore the forward speed is controlled via a potentiometer and its lever, without the conventional bowden.

The wanted level of the feedrate should be adjusted by the, setting of the forward speed control lever. If the adjusted feedrate is relatively high, the frequency of the variations in the speed will be high, however, if the set feedrate is relatively low, the frequency of the variations in the speed will be relatively low. The operator should set the feedrate between the mentioned two extreme values.

The forward speed control system was fitted on different self-propelled forage harvesters (e.g. Mengele SF-6000, SPS-049, Claas Jaguar).

The results of the experiments show that the operator sets a higher forward speed when operating the machine with automatic control, instead of manual one. The automatically controlled machine can be operated at a higher speed, or feedrate level, because the control system prevents overloading, or clogging, or engine stalling. Consequently the use of the forward speed control system increases the throughput and reduces the specific fuel consumption.

The test results show that the forward speed control system is a good aid for the operator. As a result of automatic controlling

– the throughput of the forage harvester is increased by approximately 10%
– the specific fuel consumption of the machine was reduced by approximately 7%
– the cost of the harvesting can be reduced by approximately 5%.

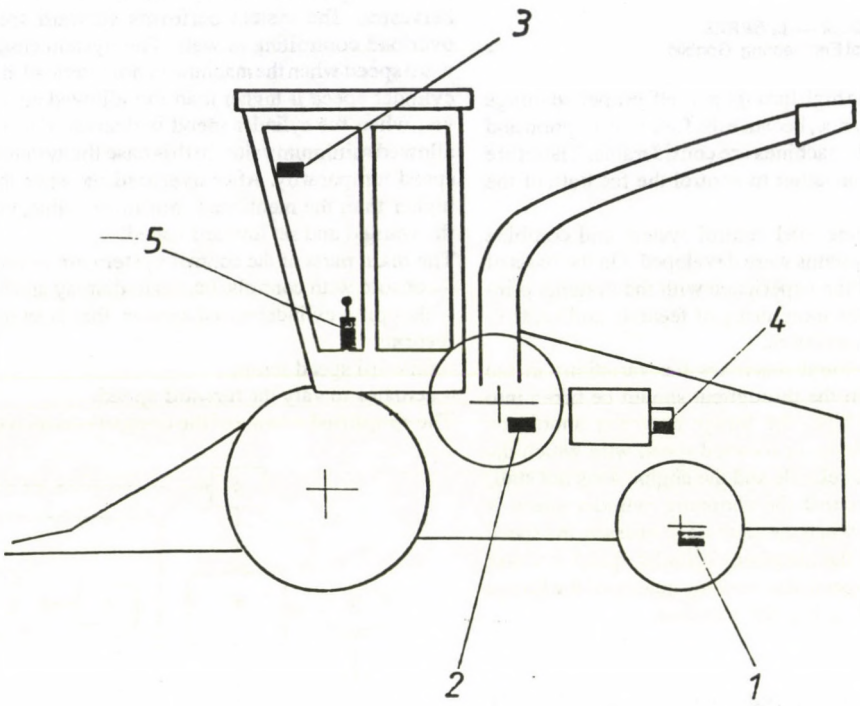

Fig. 3. the forward speed contorl system fitted on the forage harvester (1 – speed sensor for the wheel, 2 – speed sensor fot the cylinder, 3 – console, 4 – actuator, 5 – forward speed control lever with potentiometer.)

AUTOMATIC FILLING-STATION WITHOUT OPERATOR

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The operation costs of machines at farms, cooperatives and state-farms amount a large part of expenditures. The management as well as the regulation of cooperatives and starte-farms must look for those passibilities which are provided by automatization, electronics and computer technique for rationalizing various processes.
The modul-model system used with advantege for developing the computer aided management can be summarized briefly as follows: the cooperative and the state farm running on production as a material process, can be regarded as an input-output system.
(Fig. 1.)

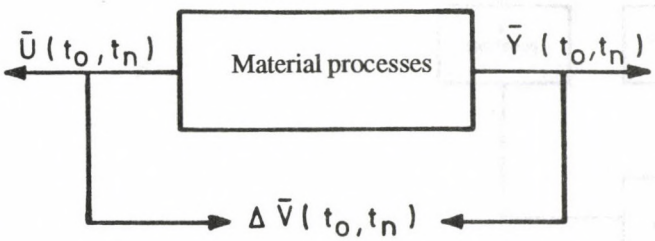

Fig. 1
Input-output system of the process

The processes proceeding in the system can be characterized by an energy-flow (material-flow) and a control balance equation. Namely, the energy-flow balance equation is,

$$\bar{x}\left(t_0,t_n\right)=\bar{x}\,(t_0)\quad U\,(t_0,t_n)-\bar{Y}\,(t_0,t_n)\pm K\,(t_0,t_n)$$

and the control balance equation is the following:

$$\bar{V}\,(t_0,t_n)=\bar{V}_{k_f}\,(t_0,t_n)-\bar{V}_{k_{ny}}\,(t_0,t_n)$$

The control balance equation is at the same time the profit of the system the maximalization of wich, as an object function, the cooperatives and the state-farms are seeking after.
The result is maximum there, where the expenditures are minimal under specified boundary conditions.

Namely

$$K_{\alpha_{min}}=\frac{\bar{V}_{kny}\,(t_0,t_n)}{T}$$

The minimum of the specific expenditure-graph (Fig. 2) shows at the same time the optimal period of operation, too. The use of the modul-model makes it possible for cooperatives and state-farms establishing the production control by computers gradually and so the data processing by hand gets gradually to backgroud.

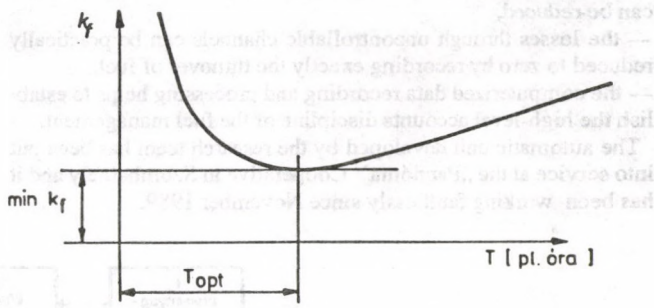

Fig. 2
The specific expenditure-graph

Based on our surveys in the cooperatives and state-farms we can state thet the main shortage of managing the operation is the ureliable recording of basic data, and suitable sorting of data. Further insufficiency is in forming various indices aimed at checking of processes.
As the fuel-costs amount approximately 30-40% of operational expenditures it has arisen, as an important question, to examine the situation of fuel management, (as a modul) and what is the possibility of saving costs.
Filling-station operators are employed for handling the filling-stations at the cooperatives and state-farms. Their tasks are recording the time end amount of purchased fuel and recording the type and number of vehicles having refilled.
Further the recorded data of the filling-station operators are sent to the central registry, where the data are summed up according to different requirements and are sent to the required offices.
Having the data the cooperatives and state-farms have got the possibility to make the balance-sheet of the year, of quarter-years and months as well as to check the amount of fuel in the filling-station in discreet periods, in the interest of giving orders in time. All these tasks require quite a lot of manual activities in present form, and include a lot of possibilities of mistakes and occasional abuses.
More solutions have been elaborated to improve the fuel menagement both on international and on national level. The applicability of these involves various difficulties for cooperatives and state-farms because import equipments are very expensive and the domestic solutions do not satisfy the requirements properly.
The aim of our research work was to establish the computerized fundamental principles of data recording and processing by additional automatization of filling stations. It has been an important standpoint that the automatization has to satisfy the modul-model system of machine operation, and based on this the data information could be connected with the computer-network of cooperatives and state-farms operating already.
The development work included the following part-problems:
a) To determine the necessary basic data in the course of purchasing, transporting and stockpiling fuels.
b) The automatization must ensure the possibility of handing out fuel without filling-station operator.
c) The automatization must ensure the recording of the customer's name, the amount handed out the time of deal as well as the preparation of the filling station's inventory at any time and further processing of data as it needed.
d) To establish cooperation with such an enterprise that is ready to use, the results of research – work elaborated theoretically — as an experiment, with the help of its financial resources.
The result of the research-work can be summarized in that an automatic filling-station without operator has been planned and constructed, the advantages of wich are the following:

— the subjective possibilities of mistakes can be totally eliminated by the computerized data recording and processing,
— the handing out of fuel is based on correct basis by microprocessor controlling,
— the operators' jobs can be discontinued and so the cost of wages can be reduced,
— the losses through uncontrollable channels can be practically reduced to zero by recording exactly the turnover of fuel,
— the computerized data recording and processing helps to establish the high-level accounts discipline of the fuel management.

The automatic unit developed by the research team has been put into service at the „Pannónia'' Cooperative in Szombathely and it has been working faultlessly since November 1989.

The operation of the system, according to Fig. 3, is the following:
— The person purchasing fuel puts the card coded to his own name (3) into the automatic unit (2), then by pressing a button starts, it,
— unhooks the filling pipe (1) of the filling station and takes any amount as he likes,
— takes the magnetic-card out and switches the automatic unit off,
— the data stored in the automatic unit can be copied with the help of a so-called „post-card'' (4) and can be transferred to the central computer (5) where the data are processed (6),
— the identifying cards (3) can be made with the help of identifying card producing disc (7) operagted by the central computer (5).

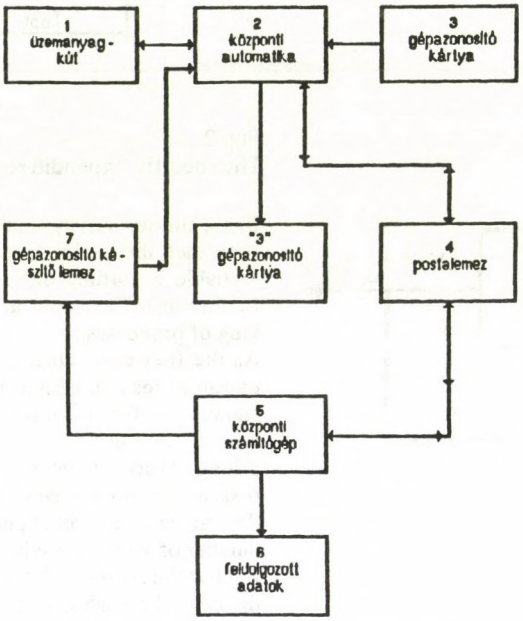

Fig. 3
The structure of the system

EFFECT OF CHANGE OF THE FARM STRUCTURE ON THE MECHANIZATION

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Hungarian Institute of Agricultural Engineering, Gödöllő

The Hungarian agreculture is standing before an essential structural change. The extremely centralized largescale production will be replaced by the multi-coloured productional structure which is more suitable for the market economy regarding the farm size, the ownership as well as the forms of production and interest. The social and exonomical environment will also change fundamentally which determines the scope of movement of the changing agriculture.

The new persons of production will be the owners of the more flexible small and middle -sized farms, family farms who are between the household and large-scale farms at present. Besides the establishement of their legal, organizational and economic frames it is also very important to etablish the conditions of their production. It must be worked out the background of operation, the farm management and farm-type machine systems which were adapted earlier to the circumstances of the specialized large-scale farms.

In order to prognosticate the tendencies of mechanization it has to be outline the problable estate structure. In the new structure the farms can be ranged in according to several parameters which have effect on the mechanization and machine operation:

– On the basis of landownership they can be private, state-owned, collective or tenured farms as well as mixed farms.

– On the basis of means of productionownership they can be private, collective or small and large-scale farms using state-ovned equipment.

– Accordingly, technical means can also be private, collective or state-owned as well as rented.

– According to the manpower the famrs can be based on own or hired manpower as well as on both or them.

– According to the farm size they can be small or large farms, but the farm size can only evaluated by the branch of cultivation.

– The specialization can be typical both for the small and the large scale farms. First of all, the entirely small or the largest farms are specializing for some kinds of productional aim. Probably, the majority of farms will do several kinds of activities (e.g. horticultural and field crop production or animal husbandry). Farms are urged for this, by better utilization of the working time, rational utilization fo the main and by-products and the expected permament income and circualtion of money.

The small-scale farms can come into being form 0,6 to 100 hectares in size and they can have many productional profiles. First of all, the work-intensive areas can be taken into consideration where the owner's mentality and the human care are quality improving and efficacy increasing factors.

The large-scale farms will predominate in the area-demanding production activities between 100 and 15,000 hectares where the advantages of the concentrated production and the complex mechanization can be well utilized. In this category the formation of the new large-scale sturcture can be expected with the transformation of large farms and colouring of ownership forms. As new persons the appearance of contractors and service undertakers can be expeected and the collective forms of machine use can be also taken into account.

In the large-scale mechanization fundamental changes cannot be expected. On the basis of scientific and technical development and the clear view of machine system it is required to speed up the modernization – which slowed down last years – and to reform the means of prduction constantly. However, it must be considered that the production activity will be based on internal undertakings in te majority of large-scale farms which shifts the demads towards the modern machines with medium output.

The mass production in the large-scale farms will depend on the price fluctuation of farm products in the future therefore the low-input production technologies come more and more into the limelight to which new machine systems, energy-, and equipment saving methods will join.

In the technical development the biggest work is the mechanization of small farms coming into being during the privatization and transformations.

The machine need of the starting small farms can be already selected from home made machines. Namely, the home industry produces more than 300 types of machines for the small farms. At the same time the industry has good fundamentals to widen the small-farm machinery production.

Satisfying the machine demand of small-scale farms a temporary and fast solution can be the purchase of machines becoming superfluous in the large-scale farms, due to their liquidation or transformation.

The revival of the home tractor production, on the suitable technical level of our age in the category of 9-14 kN (30-50 kW) – which can be a basic tractor of smaller farms – can be only imagined with a suitable collaborative background and assistance.

At the same time the home agricultural machine industry can increase it s market positions significantly in the fields of fabrication of equipment for small-scale farms namely:

– soil cultivating machines (basic, additional, active and passive, combined soil cultivating equipment),
– soving and planting machines,
– maure and fertilizer applicators, row and deep fertilizer, spreader equipment,
– plant protection machines and mounted adapters,
– irrigation equipment,
– fodder harvesting machines,
– vegetable harvesting and manipulating equipment,
– vine processing equipment,
– barn and farmstead machinery (mills, choppers, steamers, feed mixers etc.)
– equipment of pig and cattle keeping,
– equipment of small animal keeping,
– food processing equipment.

It is needed to modernize the production and products as well as the increasing of the technical level in the field of home agricultural industry. The international cooperation starting on a new base can help the modernization in small machine produciton. It would be important that a singificant deveopment should have been taken place in the branches of basic material production and background industry.

Besides the home production a significant machine import will be needed in order to satisfy the machine demand of the small farms. The production becoming multi-coloured in its size, ratio and production structure requires a multi-coloured machine offering in choice, scale and quality. The import machines appearing at the home market can originate from the developed west-european countries or form east-european former socialist countries alike. The market activity, the price contest and the level of services can determine the ratios.

It the neighbouring east- and middle-european countries where the agricultural machine industry is based on the large-scale techique it can be expected that the agricultural machine industry will probably transform its structure and appear with a wider machine selection at the market. Naturally, at the Hungarian market too. The greater import selection will probably urge the home producers too, and the purchasers and users will enjoy its advantage. Considering the machine demand of small farms it can be expected a high ratio of import machines in the following categories:

– tractors (small, medium-sized and heavy universal as well as special tractors),
– special soil cultivating machines (rotary, combined),
– precision drills,
– grain combines,
– fodder harvesters (choppers, balers),
– fibre crop harvesters,
– potato and sugar-beet harvesters,
– vegetable harvesters,
– vine processing equipment,

– milking and milk handling equipment,
– lorries,
– self-propelled loading equipment.

We are working out the recommended machine systems of small-scale farms at the Hungarian Insitute of Agricultural Engineering.

So far 15 different machine systems have been worked out for small farms with 8 various production profiles. We are looking for those rational solutions which are the most favourable for the small-scale farms.

POSSIBILITIES OF MECHANIZATION OF AGRICULTURAL PRODUCTION, ORGANIZATION AND ECONOMY ON THE BASIS OF MODEL-STUDIES

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The recent economic life is rather rich and varied. It is a common attitude that all people (experts and dilettantes) urge on venture and more and more of them embark on business since this means future orientation. The enterpreneurial temper has been increased. What is the reason for this? More than half of the recent ventures originate from those families in which forebears had as well been involved in ventures. It is important that the society also starts to tolerate the successful businessmen, primarily the innovators, undertaking risks. Nowadays these people are not suspicious and may fail without any shame.

In this light it is moral obligation of the consulting organisms to warn the candidate-venturesomes that from five only one-two of them can stand a long-time test. To improve this ratio it is important to give various technical supports in the frame of agricultural projects, such as:

— establishment of training bases acting as sources of agricultural consulting system,

— creation of banks of information on the main topics of the condition system of production,

— model-surveys, studies answering the actual operational and developmental alternatives of the venturesome (construction of such a model is presented here).

Ventures are always prompted by a given, concrete IDEA. According to Maslow's motivation theory individual aims and needs are in the background of motives. The needs are arranged in hierarchic order of five stages: physiological-security-social-appreciative-self-accomplishing ones. Having satisfied one the next need will appear. Individual and societal motivations of venturesomes may therefore be varied. Idea together with motivation leads to decision. A model illustrating a supposed activity of a dairy-farmer has been worked out. The model is designed to promote direct utilization of the field yields using one final product to facilitate understanding. Supposed, the venturing farmer and his family are aware of the problems of milk production in details and posses outlet for sale, despite of limited possibilities.

The initial data are as follows:

— The model farmer family has four members, but one is still in his nonage. Thus, only three persons can be considered as manpower in the farm as in the family.

— The family lives at an acceptable living standard, according to the present price and cost conditions supposed a minimal monthly income of 7000 Ft, surpassing somewhat the domestic average income. We can therefore reckon upon a minimum program of the venture, since beyond this level the labour has no sense.

— The dairy farmer possesses his own arable field and pasture. He can produce the forages necessary. He maintains and repairs the machines. Taking the farmer as an excellent husbandman producing the highest yields in his farm he is supposed to provide the fodder for 1 cow per ha area.

— The expenses are based on the data of a successful dairy farm. However: the high general expenses attributable to the big undertakings here are lacking or limited considerably which also increase the farmer's income. Thus, under the individual farmstead conditions a cow producing 6.000 litres milk per year enables obtaining a gross income of 30 thousand Ft. In case of calves the production costs and sales receipts are approximately equal. Among production costs land value (30 thousand Ft/ha) is also to be reckoned on. Based on the initial data, model calculations are to be performed for the types of costs of the farmsteads keeping cows in various number, to determine the value of capital to start with (Table 1).

It can be seen that dairy farmsteads require quite a great capital to start with. It is true that investment per cow decreases with the increase of the capital investable. Source of investment may be own capital or credit. Even if the farmer family posseses a money supply necessary, it is worth considering to invest or long-term outlay of its money. A recent alternative for interest return is lizing. It is difficult to make a decision, therefore the three-forms of investment should be discussed in a separate paper. Taking real incomde requirements and real curtailments, lizing together with deposits seem the most favourable for the investor.

Unfortunately, this means at the same time criticism of the present regulation since investment-oriented utilization suffer from the highest tax burden, leading probably to a further decline of investment interest.

Value of capital to start with

Table 1.

Fixed and current assets th. Ft	Cow stock (No.)					
	5	10	20	30	40	50
Animals (80 th.Ft/sps.)	400	800	1600	2400	3200	4000
Cow-shed (65-50 th.Ft/space)	325	620	1080	1680	2120	2500
Machines, facilities:						
milkers (30 th.Ft/5 sps.)	30	60	120	180	240	300
handling and storing of milk (15 th.Ft/5 sps.)	15	30	60	90	120	150
machines of fodder production	500	1100	2000	2500	3000	3400
accessory machines, tools	50	110	200	250	300	340
cropland (30 th.Ft/ha)	150	300	600	900	1200	1500
Total fixed assets	1470	3020	5660	8000	10180	12190
Current assets required (0.1 F.a.)	147	302	566	800	1018	1219
Total investment required (th.Ft/sps)	323	332	311	293	280	268

It is quite a different situation when no capital is available at start and credits appropriate to sums given in Table 1 are to be applied for. In credit plus interest besides supplementing the family incomes. (Comparing separately lizing to investment of credit, the latter used to be more lavourable.) For additional analysis it is important to determine gross and net incomes so that to consider a credit-tolerance beyond upright living of the family (Table 2).

In Table 2 gross and net income, rsp., are performed by distracting production costs from sales receipts. As an initial condition upright living of a four-member family has been aimed: 4x7000x12 = 336.000 Ft is separated and the remaining gross income is presented by row 15. According to this it is not worth dealing 5-10 cows with and an extra income will results only from 20 cows in the farm.

The situation is quite different when equipping of the farm requires credit. At dairy farms with 5-10 cows the actual incomes cannot cover repayment of credit at any rate of interest. The 20-cow farms posses only theoretical guaranty for repayment since an investment from, e.g. a credit of 6,2 million Ft may only be repaid during 30,2 years at 20% rate of interest, without purchase tax obligation! It is true that expansion of venture is accompanied by shortening of the repayment period, but there is no real chance that a farmer can satisfy a medium-term bank credit construction. Naturally, ventu-

somes possessing some conditions for establishing a farmstead noney, building, land, technical facilities etc) are in a more lvantageous position, compared to those starting from zero.

Finally, the venturing farmer can recognize that money can be obtained from money, more exactly, from own money, only. If he has his own money he will invest it in a given farm after comparison with other possibilities!

Analysis of profitableness and creditability

Table 2.

Item	Cow stock (No.)					
	5	10	20	30	40	50
1. Milk production (6000 l/sp.)	300	600	1200	1800	2400	3000
2. Sales receipts (14 Ft/l) (th.Ft)	420	840	1680	2520	3360	4200
3. Fodder expenses (based on restricted costs for maize: 43.200 Ft/ha)	216	432	864	1296	1728	2160
4. Other material + energy	21	43	85	126	165	196
5. Service used	17	34	68	100	132	153
6. Land tax (1.600 Ft/ha)	8	16	32	48	64	80
7. Other direct expenses	20	32	48	64	89	122
8. Profit tax of venture	-	-	-	136	218	340
9. Expenses without wages	282	557	1097	1770	2396	3051
10.Wages required (7000 Ft/month)						
1 person	84	84				
2 person			168	168		
3 person					252	252
11. General taxation of wages (43%)						
1 person	36	36				
2 persons			72	72		
3 persons					108	108
12. Total production costs	402	677	1337	2010	2756	3411
13. Gross income	138	283	583	750	964	1149
14. Net income	18	163	343	510	604	789
15. Gross income of family over 336 th.Ft	-	-	247	414	628	813
16. Repayment of credit (year)						
without interest	-	-	25,2	21,2	17,8	16,5
20% rate of interest	-	-	30,2	25,5	21,4	19,8
25% rate of interest	-	-	-	26,6	22,3	20,6
30% rate of interest	-	-	-	27,6	23,2	21,4

THE POSSIBILITIES OF A CONCERTED DEVELOPMENT OF CUSTOM-SERVICE AND CONSULTING REFERRING TO STRUCTURAL CHANGING

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Out of the 'background actions' of the Hungarian agriculture where a lot have been changing nowadays, people speak a lot about the consulting activity and its hows and whys. We can observe laudable efforts: a great deal of ideas, plans have been born to form a system than can provide the Hungarian farmers with advisement in their operation.

This paper applys the principle of approaching from the 'part' to the 'whole' as a complex system in the future (as a consulting service can be imagined). We present a smaller part as a potential sub-system. Probably, for farmers there won't be of main importance from what service (organization), they ar able to obtain those necessary information to their work, but the fact that they should have the necessary quantity and quality of information *at any time*. Surely out of these there'll be such pieces of information that will come not from the consulting organization but from other way to the users. This is the reason why– before developing new organizations– it is worth thinking of the idea how to change our existing and 'well-run' activity of the organizations. They must meet the latest demands.

As you can see it is worth examining the possibility for a coordinate development of *custom service* and *consulting* that have relations with the agricultural machines.

With the agricultural machines *custom service* means the sum total of those supplementary services which are provided by the producers (or the organization with their assignment) to support the user with the equipment in:

— choosing,
— acquiring,
— putting into operation
— runing safely and constatly,
— making use of it secondarily.

This activity-system involves such sum-total co-ordinative (technical-economic trade and juristic) activities that each of them (directly or indirectly) trends that the given equipment is due to fulfil its expected functions at an optimum level during the period of usage.

Every element of the complex custom service should serve the customer so that the equipment mentioned above stands in focus of the activity-structure. Fig. 1. shows the relationship of custom service with the chracteric life periods of the examined quipment in this concept.

Fig. 1.

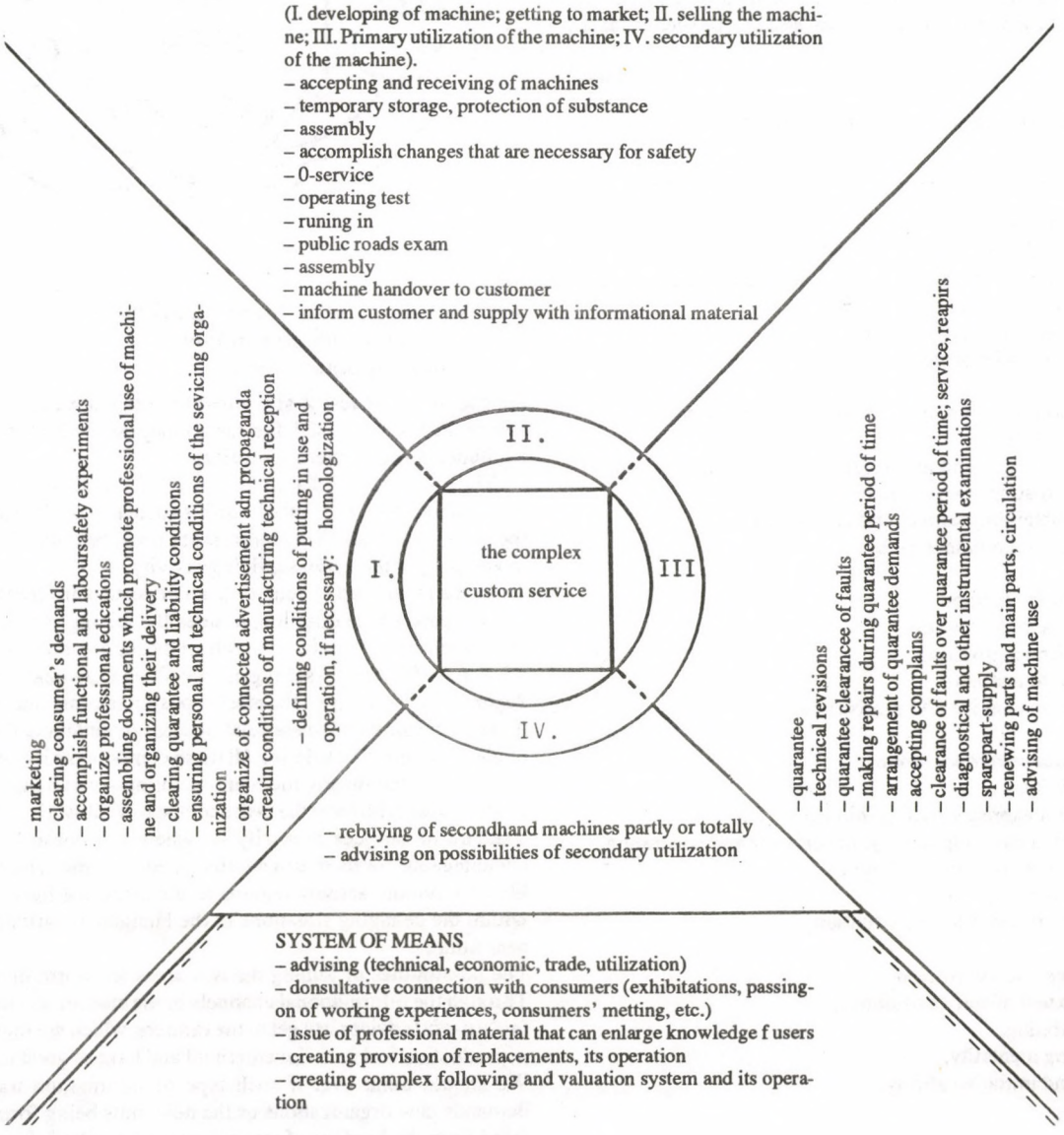

Fig. 1.
Main tasks and means of the complex, machine centre shopping service

It wouldn't be useful to set up some order of importance among the custom service activities. It's obvious that other aspects dominate in the period of choosing a machine or of those that are already worn-out and should be made use of them again. (Secondarily usage).

We must state that in the relation of activities the 'minimum-law' succeeds in a special way, namely the standard of the whole service is determined by that value judgement of user, which is the most forceless relatively. Inspite of content differences in among activities what we're talking about, we can make a statement general within the frame of complex custom-service such pieces of information are circling which cannot be found anywhere, in connection with the given machine.

On the basis of this the custom service organization involves the possibility for contributing a bridge-role, by accepting and processing these informations between the producer and user. We have to underline that this bridge is based on the given equipment and the servicing activities form the connecting chains. Generally advising is such an intellectual service that is based on a contract which is provided to employers by specially trained experts.

The basic condition of successful advising is an adviser who is professional and independent in every respect. He should be responsible for his own activity, for the sound foundations, accuracy and fidelity of his advice during the work. They must work without any influence; they carry on the necessary measures and analyases, make recommendations for praticable solving methods and if the employer needs they participate in realising their proposals.

The necessary characteristics of the advisers can be seen in table 1.

Table 1.

Essential characteristics required from advisers

Intellectual abilities
— ability for quick and easy learning,
— abilities of observation, selection, collection of data, estimation,
— inductive/deductive reaction,
— ability of syntetisation/generalization,
— creativity and originality.

Comprehension of others and a joint work with them
— respecting others,
— ability of foresight and ability of valuing human reaction,
— ability of creating contacts in an easy way,
— ability of obtaining respect and confidence,
— politeness and good manners.

Ability of communication
— ability of paying attention,
— sense of phrasing/writing,
— inclination to instruct,
— inclination to convice and motivation

Intellectual and emotional mature
— stable activity,
— independent expression of opinions,
— inclination to enduring tensity, uncertanity and frustration,
— balaced, quiet, objective behavior,
— self-control in any case.
— flexible compliance to any situation.

Personal drive and motivation
— suitable extent of self-confidence,
— proper ambition,
— undertaking mentality,
— courage and initiative ability.

Ethics
— helping others frankly,
— exeptional honesty,
— ability of recognition of competence possiblities,
— ability of learning by mistakes.

Physical and mental condition
— ability of working among different conditions.

Taking advantage of consulting is reasonlable only in such a case when it is connected to a certain problem. A sensible user can ask for advice only if he has a real problem; advising can become on effective method of the venture-managing work. With a simplification we say that advising is a kind of *bridge* between the employer's practice and theory that is always based on a given problem and the joining chains are formed by advising activities which take the user's views into consideration.

In establishing and effective operating of the given bridges (shematic presentation is in Fig 2.) both parts — who gives service and that of the user — are interested in.

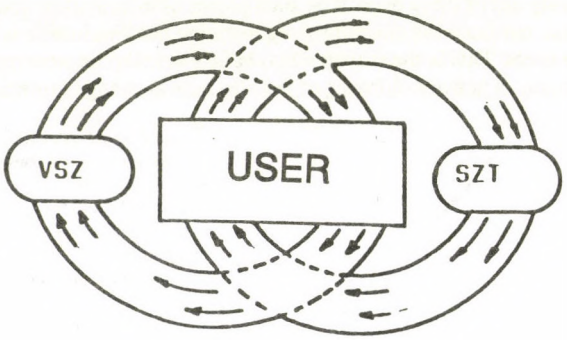

Fig. 2.
Schematic model of the information bridge
(VSZ: custom service organization
SZT: consulting organization)

For the *user* it is essential interest to obtain a reliable and useful advice in his work and for his money as well as the suitable equipments and connected services.

— The organization that gives the *service* will get real pieces of information through its relationships about the user's criterions and the changes of them. These information can be utilized properly in developing of the given servicing activity.

There's a great need to point onto an important difference between the two parts of the question, besides the joining at some points: *a servicing enterprise* intends to sell all the time — no matter whether it is a manufacturing – selling or consulting organization. Its future depends on the fact how the market positions come into being, how it can stabilize its business relationships, maintain and extend the circle of clients. Considering all these components it doestn't seem astonishing that mostly the manufacturing – servicing organizations are those who have the task and responsibility giving rise to the standard of services primarily — whereas it doesn't seem to be advantageous for them in a shorter period of time. The responsibility of servicing activity regards to the tasks that have to be done within the changing situations in the Hungarian agriculture in the near future.

The possibilities of joining the two areas are worth investigating. Through the informational channels of the custom servicing bridge fairly useful advices can get to the farmers, which are indispensable in production and in its development and have of great importance. We should think over if such type of information transmission demands new organizations or the new units being formed can be freed from the burdens of transmission of similar information and what extent. We should also take care the fact that „too many cooks spoil the broth".

The change of *producers'* structure in agriculture must be followed by the *servicing* structure, namely the development of the producing and servicing units cannot be taken apart from each other. We can count on 'big', 'medium', 'small' units which go by in the field of services.

— The relatively *big* servicing units develop where capital makes it possible. It seems that only those units can be profitable within our country which are able to coordinate the possibilities in universities, research institutes, manufacturing, production–organizing and trading bodies. Otherwise our handicap compared to the highly industrialuized consulting units and manufacturing-organizing ones remains.

— The creation of *medium* units have the most favourable conditions in our country. Our machine producers, dealers, the institutes in agrarian research field and higher education all have those advantages, abilities and possibilities which make them able to earn their living from a servicing type of activity in the future. To this they have to be renewed basicly; first of all they should develop the modern organizational-technical conditions to establish and maintain the business relations with an increasing number of clients.

— The creation and extension of *small* units depends mostly on the fact how big territory the enterpreneurial view nowadays can occupy from this sphere.

The structural changes — whether they're advantageous — don't mean any guarantee by themselves in order to reach the aimed at developing goals. There's a great need for the services to be filled up with new contents. It'd be desirable if the competition of servicing organizations in agricultural production would establish a more and more precise, qualified and correct activity.

It is of highly important to explore the linkage possibilities of the two areas without overlapping. According to up-to-date opinions out of the elements of custom-servicing activity-system the consulting-system can be charged with the followings:

— the marketing work of the procducing equipment; clearing tasks connected with the users' demands;

— professional trainings together with assuring documents that help professional machine use;

— tasks related to a given equipment, as; puting in use, operating conditions and systematization;

— providing consumers with correct information about their possibilities, rights, responsibilities;

— advising about the possibilities of the secondary utilization.

This list is an example illustraiton; in a concret case the connection can be wider and deeper or perhaps tighter and more superficial.

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MODIFICATION OF SUCTION-PRESSURE PULSATION RATIO

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Researches carried out 20-30 years ago indicated that the well-constructed, excellently operated milking machines in themselves, used under optimum conditions do not make the animals sick. But the badly operating and contaminated milking equipment can cause mastitis, therefore the present role of milkers in the spreading of infection has to be moderated, especially in the case of cows in great numbers.

The teat cups are in direct tuch with the living organism, that is with teats, therefore their harmful effect can be the most essential. The parts of a given milking machine together form an operating unit. Presumable, the change of certain elements effect the operating characteristics of the total unit too. The movement of teat cup will modify if other pulsator with different parameters is used. This is true also if the same pulsator is fitted with teat cups having different features (teat wall thickness, form, flexiblity etc.). Therefore different teat cups have been tested in order to determine the change of movement and with this the change of effective pulsation ratio, related to the theoretical characteristic curves of pulsator.

The theoretical sketch of measurement and signal processing are shown in Fig. 1.

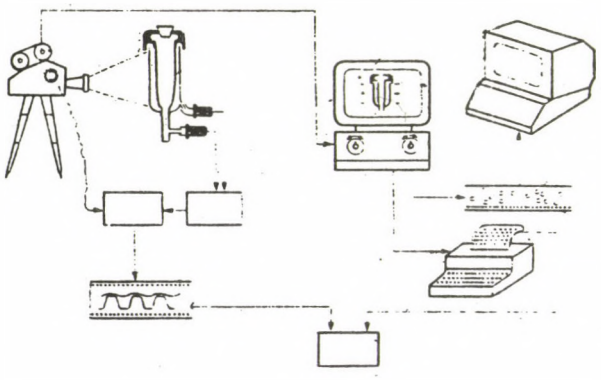

Fig. 1. Theoretical sketch of measurings and the primary signal processing

Observations during the test:

— The peak vacuum of pusator was 50 kPa andf it has not changed in the course of measurings.

— There was no change in the pulsation frequency and pulsation ratio.

— The vacuum changed at the tip of teat.

Setting the teat-end vacuum to 32-34 and 50, 62 kPa the moving mechanism could be well studied at extreme values. These situations occur in the practice in the case of traditional and double-vacuum milking machines.

About the teat cup movement films were taken at a speed of 150 and 300 pictures per second. The film can be evaluated picture by picture in the evaluating equipment. The theoretical accuracy of the evaluation — besides 0.006 mm of picture resolution — can be assured up to three decimal accuracy (measured in mm). The accuracy of timing (0.03-0.07 s) is characterized by the picture speed.

The cross-sectional drawings of the tested teat cups are shown in Fig. 2. The more important parameters can be seen in Table 1. Several more kinds of teat cups are known but their basic paramters do not differ from each other significantly, regarding the moving parts. The Fig. 2/a. shows the measuring planes. In fig. 2/b and 2/c the Bou-Matic milker's teat cup can be seen. A ruber ring was

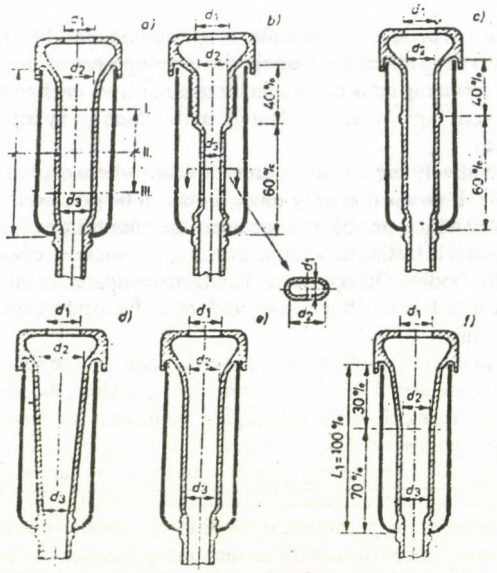

Fig. 2. Cross-sectional drawings of the tested teat cups

Table 1.

The main technical parameters of the tested teat cups

Specific-	Sym-	d_1	d2	d_3	D	1	F	Characteristics of materials		
								Hardness (Sb°A)	Breaking str (%)	Tensile strength (N/cm^2)
Bou Matic oval	b	21	21	7	56	146	28	42	550	8.8
Bon-Matic cylindrical	c	21	21	21	56	146	28	41	550	14.8
Conical	d	25	30	22	59	147	50	53	500	14.8
Cylindrical	e	23	25	24	59	133	42	55	555	11.0
Conical-cylindrical	f	22	27	22	60	95	28	45	470	8.6
Silicon+		24	26	23	60	140	53	40	590	7.3

+Note: the teat cup marked with „d" is similar to the conical form.
Standards applied: MSZ 494-67; MSZ 490-74; MSZ 11071-73; MSZ 135-1-71.

placed on the upper part of the teat cups in order to prevent the bulging, thus the teat cups are less able to climb up the teats. At the modified versions the climbing was moderated by oval form of the lower part.

Fig. 2/d shows a teat cup being conical at full length. At this types the diameter d_2 is greater than diameter d_1 of mouth opening. The Fig. 2/e shows the widwly-used cylindrical teat cup. The Fig. 2/f shows a specially formed teat cup of which the upper part is conical and lower part is cylindrical.

Diagrams were made about the changes of teat cup diameters. (Such diagram can be seen in Fig.5.). It can be read from the diagram that how the suction-pressure pulsation ratio changes related to the theoretical one due to the change of milking vacuum and the effect of other facts. The following symbols were used to denote the change of suction period (Fig. 3.).

t_c = the total pulsation cycle (ms)

t_o = period of time of pulsator peak vacuum and than the teat cup is in undeformed state if the milking vacuum corresponding to the former one (it can be named as a theoretical suction period) (ms)

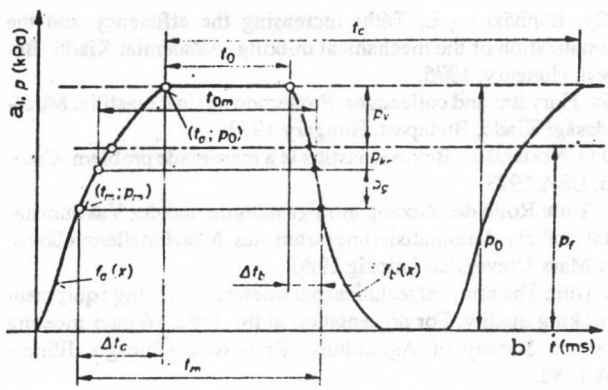

Fig. 3. Symbols used in the calculations to denote the suitable sections of the pusator characteristic curve
a — vacuum, b — time

t_m = the teat cup finished its movement, when the teat channel closes and there is no milk flowing (it can be named as a practical suction period) (ms)
(t_a; p_0) and (t_m; p_m) are coordinates on curve $f_n(x)$
Δt_a and Δt_b are increments of the suction period starting from t_0 (ms)
p_0 = the peak vacuum of pusator but it is also the milking vacuum if there is no vacuum decrease (kPa)
p_f = the vacuum forming under the teats during milking (milking vacuum, kPa)
p_v = milking vacuum decrease due to the flowing losses (p_0 — p_f = p_v (kPa)
p_{kr} = pressure difference required for starting of the teat deformation (by calculation or measuring) (kPa)
p_g = value needed to close the teat channel calculated from the value of p_{kr} (10 mm) (kPa)

In general, the value of d_g is approx. 10 mm in the case of normal teat cups.
On the basis of these data the variation of pressure pulsation can be calculated in the function of milking vacuum decrease and cup teat characteristics.
According to dynamic measuring:

$$\frac{t_o}{t_c} < \frac{t_m}{t_c}$$

or the rate of suction period increases during milking.
For computing it is necessary to know the intensity of vacuum change (pulsation) between the wall space of pusator. The interim sections — practical calculation — can be well used with approaching straight lines but more precisely it can be characterized by higher degree functions.
If the transition to suction is characterized by

$$p = A_1 + B_1 \cdot \ln t;$$

and the transition to pressure is expressed by

$$p = A_2 \rho^{-B_1 t}$$

then the increments of suction elements can be written down.
At the transition to suction the increment of suction period is (we disregard the long demonstration based on Fig. 3.):

$$\Delta t_a = e^{\frac{1}{B_1}(A_1+p_0)} - e^{\frac{1}{B_1}\left(A_1+p_0-p_r-p_{kr}-\frac{d_0-d_g}{m_g}\right)} \quad [ms]$$

At transition to the pressure the increment is:

$$\Delta t_h = \frac{1}{B_2} \ln A_2^{-1}\left(p_0 - p_r - p_{kr} - \frac{d_0-d_g}{m_g}\right) \quad [ms]$$

m_g = the radial spring constant of teat cup which is computed from the deformation diagram of teat cup (mm/kPa)
As an example the calculations have been done for teat cups of 24 and 27 mm of diameters:
— value of p_v: 15 kPa
— at Ø 24: $p_{kr} + p_g$ = 10.1 kPa
— at Ø 27: $p_{kr} + p_g$ = 5,5 kPa
t_0 = 570 ms; t_c = 1250 ms
So:
at Ø 24: $\Delta t_a + \Delta t_b + t_0$ = 155.7 + 101.4 + 570 = 827.1 (ms).

at Ø 27: $\Delta t_a + \Delta t_b + t_0$ =146.14 + 89.3 + 570 = 805.4 (ms)

The starting suction rate is:

$$\frac{t_0}{t_c} = \frac{570}{1250} = 0{,}45$$

The changed suction rates based on the calculation are:
at Ø 24: 0.66,
at Ø 27: 0.64.

Values obtained during the dynamic tests are:
at Ø 24 (5 measurements: 0.66)
at Ø 27 (4 measurements: 0.63)

Namely, the length of suction pulsation can be well approximated by calculations based on the relations. Since at the pulsators the measurable suction and pressure rate does not give a reliable information on the milking machines, the results of the measured parameters of pulsator characteristics can be only informative. The vacuum conditions can also change significantly at the end of teat cup due to the formal and material change of teat cups.
The modifying effect of formal change proves that while the suction period does not change significantly, due to the higher or lower vacuums in case of the cylindrical teat cup, at the same time 20-30 per cent change can be experienced at the conical teat cups. According to this, if a different teat cup is used in a given milking equipment instead of the original one, then the technical and milking parameters of the equipment will also change significantly.

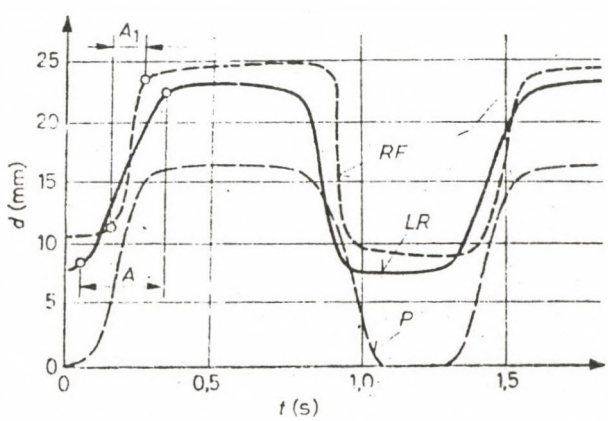

Fig. 4. Movement of the new and used teat cups
p — pulsator characteristic curve
A and A_1 — increasing times of diameter

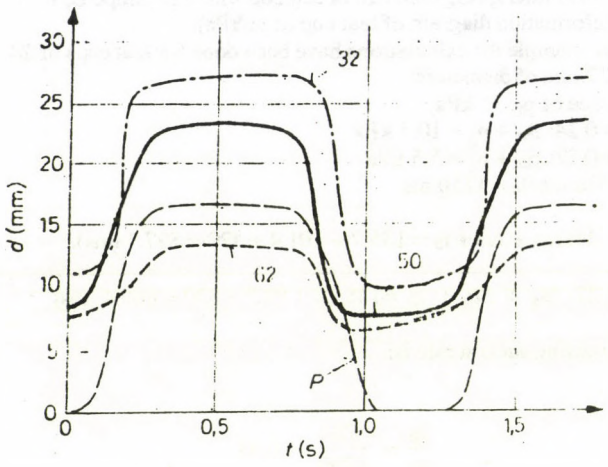

Fig. 5. Movement diagram of teat cup conical at full length on the three tested vacuum levels in the second measuring plane.

The Fig. 4. shows the moving characteristic of the new(RF) and the used (LR) teat cups.
In the case of used teat cup the moving conditions change due to the loss of flexibility, such the suction period increases and the opening speed of the teat cup is getting higher.

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TECHNICAL AND ENERGETIC ANALYSIS OF FODDER TREATMENT TECHNOLOGIES

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In Hungary the introduction of heat treating technologies was started by the demand for direct feeding of soya of full oil content around 1987-88. Among these technologies the thermic and hydrothermic methods can be equally found. Regarding the technologies about 10-20 extruder methods are in the farms, of which the basic machines are the home-made MONEX 75/700 (Monor State Farm) and the EX-75 (ÉLGÉP).

As it is known, the handling of soya is necessary to remove the typsin inhibitors. From this point of view the hydrothermic treatments show more favourable results, according to literary data.

Knowing these facts, in 1989 in the Kisalföld State Farm a hydrothermic fodder processing technology, based on extruder, was introduced, of which the flow chart is shown in Fig. 1.

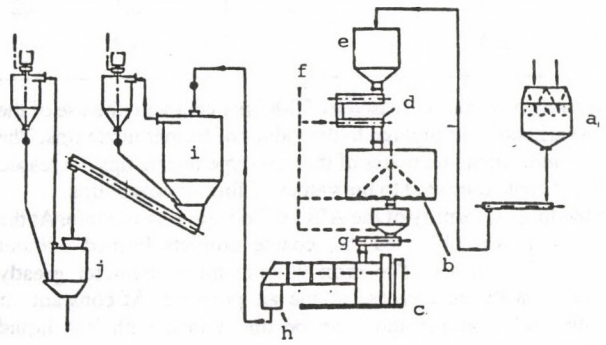

Fig. 1. Outline of the technological machine arrangement based on PIKO-180-IV extruder
a — cylinder mill, b — steamer, c — extruder, e — pre-hopper, f — steam, g — feeding auger, h — mobile cutter, i — cooler, j — grinder

From the pre-storaging cells the material to be processed goes to the cylinder mill through the material moving lines. There is also a possibility for cutting up of two types of materials simultaneously in a determined rate. The crackled grain gets into the pre-hopper of the WALTER type steamer, then through the whirl mixer — where the steam condensation takes place — into the steaming boiler. Here, the crackled grains are staying for a determinecd time and temperature, depending on the material to be treated.

The prepared material is moved into the pre-bin of the extruder by an auger and from here the steplessly adjustable auger transports it into the extruder.

The one-axled PIKO-180-IV type extruder can be fitted with suitable augers and pressure plates according to the grains.

The BOCCHI-type flaker also does hydrothermic heat treatment and these equipment have been put into operation in more than 10 farms from western lease.

The output and energetic parameters of soya heat treatment are summarized in Table 1.

About 300-340 MJt^{-1} specific total energy belongs to the O 6-0.9 th^{-1} of mass output of dry extruders. The mass output of the wet extruder(WALTER) is 1.15 t/h and its specific energy consumption is 15-25 per cent higher. The specific total energy consumption of BOCCHI method — having the greatest output — is very high.

The rate of decrease of antinutritive effect in soya, heat treating technologies can be checked by laboratory (MSZ: 16897/88) and fast testing method (TI-test) applicable in farm practices. In the tested technologies the qualification of heat treatment can be put among the „well-treated" categories.

With the technologies designed for soya heat treatment, other grains can be also treated. In case of these grains the aim of heat treating is the increase of starch revelation. The output and specific energy values obtained by thermic and hydrotermic treatment, in case of the most important grains used for mixed animal feeds, are shown in Table 2.

Table 1.
Output and energetic parameters of hydrothermal treated soya

Technology	Mass output th^{-1}	Gas consumption $m3t^{-1}$	Heating oil consumption kgt^{-1}	Specific electric energy consumption MJt^{-1}	Total spec. energy consumption MJt-1
BOCCHI LE 25/50 E flaker	1.68	27.8	—	17.0	973.0
MONEX 75/700 extruder (dry)	0.91	—	—	81.7	294.1
EX-75 extruder (dry)	0,56	—	—	94.7	340.9
WALTER PIKO-180-IV extruder (wet)	1.42	—	5.65	48.7	411.5

The BOCCHI technology gave the highest output (2.3-2.6 t/h), while at the other three technologies using extruders this value can be put between 0.6 and 1.0 t/h.

The sequence among the technologies, considering the specific energy consumption, is similar to the data mentioned in case of soya.

To give a comprehensive evaluation about the technologies it has to be considered the value of investment, the production expenses, the detailed analysis of utilization of differently heat treated grains which finally determine the spreading of the – regarding the technical-energetic points of view – suitable methods.

Table 2.
Output and energetic parameters of thermal treating technologies of different grains

Technology	Grain	Mass output th^{-1}	Gas consumption $m3t^{-1}$	Heating oil consumption kgt^{-1}	Specific electric energy consumption MJt^{-1}	Total spec. energy consumption MJt-1
BOCCHI LE 25/50E	horse-beans	2.57	12.6	—	13.2	460.8
	peas	2.30	19.8	—	18.5	716.0
	wheat	2.29	18.9	—	21.5	697.3
	maize	2.30	16.6	—	20.4	617.9
MONEX 75/700	maize	0.69	—	—	114.0	410.4
	maize germs	0.90	—	—	83.3	299.9
EX-75	wheat	0.59	—	—	103.0	370.8
	maize	0.63	—	—	96.3	346.5
WALTER PIKO-180-IV	wheat	1.11	—	4.24	61.8	401.8
	barley	0.85	—	4.92	76.4	480.7
	maize	0.96	—	4.60	60.6	410.4

ATOMIZATION AND SPRYING CHARACTERISTICS OF AIR ATOMIZING AND CONE NOZZLES

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The plant protection is getting more and more important role in the different crop production technologies. The improvement of work quality of the chemical plant protection methods is an important task from economical and environmental points of view. Within the applied spreading devices the construction of nozzle parts and their technical condition have a basic role, besides the maintaining of the paramteters at an optimum level.

The aim of the test was to determine the atomization of the new high pressure swirl type nozzle tips and swirl bodies as well as the AIRTEC air atomizing spraying equipment.

The spray output, the uniform feeding and spray distribution of different tips were determined. The international standards have been taken into account in the evaluation of parameters.

The new high pressure cone nozzle tips differ in their material from the old type and the swirl bodies are also modified. The new swirl bodies produce solid and hollow spray patterns.

The new high pressure cone nozzle tips are made of aluminium oxide ceramics and their orifices were 1.0, 1.6 and 2.0 mm. The tested swirl bodies were in two colours. The black swirl bodies can be used for nozzles having 0.8, 1.0, 1.2, 1.6 and 2.0 mm of bores and the blue ones can be applied for spray nozzles with 2,5, 3.0, 3.5 and 4.0 mm in diameter of bore. In the AIRTEC nozzles the air is mixed with the spray material and the spray emerging out from the nozzle orifice goes through an impact nozzle before reaching the plants.

The nozzle test was carried out with water. Determination of the nozzle output was done with TURBOQUANT flow meter and the deviations from the average was also calculated.

The measuring and evaluation of drop mass produced by the nozzles were made by MALVERN 2600 C laser drop analyser and computer.

The comparative tests of cone nozzles were done in three variations. In the first variation the old type nozzle tips fitted with former swirl body were tested serving as a base of comparison. In the second phase the former nozle tips fitted with new swirl bodies were tested. The third variation involved the measurings of the new nozzle tips with newly developed swirl bodies.

In the AIRTEC nozzles the air pressure has a significant role besides the liquid pressure and the tests of this type of nozzle were carried out at 0-0.20 MPa air pressure and 0.2-0.4 MPa liquid pressure.

The output values of the tested cone nozzles due to the new swirl bodies increased by 31-113 per cent with the former nozzle tips. The output values of the new nozzle tips increased by 5-25 per cent compared with the former ones. The feeding uniformity of the former and the new high pressure cone nozzle tips satisfy the agrotechnical requirements.

The test results of the cone nozzles fitted with new tips and swirl bodies can be seen in Table 1.

During the drop tests it was stated that the drop volume mean diameter of the old type nozzle tip in the case of solid and hollow

Table 1.

Test results of spray nozzles

Nozzle tip	Pressure	Colour of swirl body	Spray pattern	Average spray output	Deviation from the average	
					+	-
(O mm)	(MPa)			(dm^3/min)	%	
1.0	2.0		solid	2.4	6.4	4.1
1.6	2.0	black		4.3	5.7	4.0
2.0	2.0		cone	6.0	6.0	4.3
1.0	2.0		hollow	2.1	5.0	6.1
1.6	2.0		cone	4.1	6.1	4.2
2.0	2.0			5.4	4.2	4.0

cone spray patterns decreased by 50-80 per cent with the use of the new swirl bodies compared to the values of former nozle tips. The drop volume mean diameter of the new-type nozzle tips decreased 5-10 per cent compared to the values of former nozzle tips.

The feeding uniformity of the AIRTEC nozzle was suitable. At the drop test it was observed that coarse droplets formed without suitable air pressure. The drop volume mean diameter greatly decreased with the increase of the air pressure. At constant air pressure better atomization can be maintained with less liquid pressure.

The reason of this that the increase of difference between the liquid and air speeds ensures better conditions for atomization. Another reason is, that the atomization of the same quantity of water can be done with a higher volume of air.

In the drop mass produced by the AIRTEC nozzles at a suitable liquid-air ratio the greater part of droplets are in the range of 50-250 micron instead of 150-600 micron range which is tipical for the high volume spray application.

With the use of the new swirl bodies — both the old type and the new high pressure cone nozzle tips — finer atomization and decreased volume of spray material can be obtained. The new and improved swirl bodies increased the outputs and nozzle tips having smaller orifices can be used.

One version of the new swirl bodies can produce a solid cone spray pattern, hereby the coverage will be more uniform on the crops. The finer droplets increase the danger of drift which can be reduced by a suitable spray bar.

Under favourable liquid and air-pressure conditions the AIRTEC spraying unit with its fine atomization is suitable for drop spraying below the specific spray of 100 dm^3 per hectare.

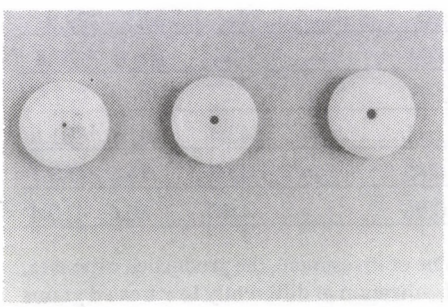

Fig. 1. New high pressure cone nozzle tips

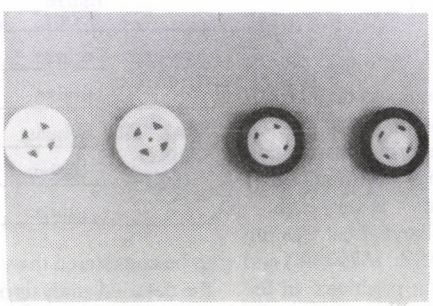

Fig. 2. Blue and black swirl bodies

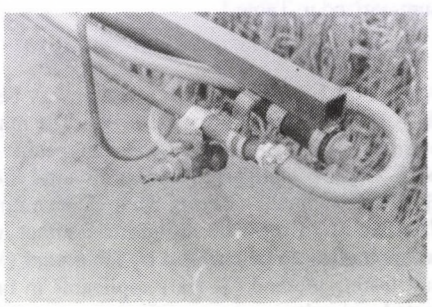

Fig. 3. AIRTEC nozzles

AUTOMATED FORCING OF VEGETABLES WITHOUT SOIL

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Growing plants in forcing houses can practically be accepted as monoculturing. This means several problems, two of these are emphasized here: excessive one-sieded utilization of the soil nutirments and accumulation of the same group of soil pathogens and pests. Naturally, these problems can be solved but they are getting more and more difficult, due to environmental protection and economic aspects. The soil-free growing method offers a new approach for the growers.

Air-conditioning and hydrocultural growing both suggest possibility of automatization. In countries with advanced forcing culture automated regulation of climate (air and soil temperature, ventillation, occasionally humidity and CO_2, photoperiod) is a natural part of the modern growing systems.

We have been conducted our hydrocultural studies for 5 years at the Department of Vegetable Cultivation of the Kecskemét Faculty of Horticulture.

Principle of hydrocultural growing is artificial ensuring for all what giveh by soil, i.e. nutriements are provided in the from of solution, and using for root-fixing a chemically indifferent material. The hydrocultural growing may be divided into two main groups according to distribution of the nutriment solution: of open and closed system. We have used the latter alternative (Fig. 1.)

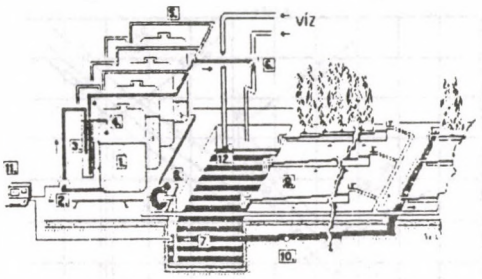

Fig. 1. Schematic diagram of the nutriment and water supplying system

1. Container of nutriment solution
2. pump
3. charging cylinder
4. spillway
5. delivery conduit
6. water jet-pump
7. basin
8. pump
9. canals
10. collecting canal
11. computer
12. floating-valve

Advantages offered by the method can be summarized as follows:
– higher average yield and a product of better quality, compared to the traditional method,
– it is friently to environment, especially the latter,
– energy saving (instead of soil heating, only the temperature of the container, surrounding the soil is regulated),
– soil cultivation and related activiteies are absent,
– infestation by pathogens and pests via roots is minimal

These advantages can only be realized by keeping two parameters namely, pH and electronic conductivity (EC) within narrow ranges. This regulation can be done manually or by electronic control Realization of contolling requires harmonic and simultaneous operations of several funcitonal units. Detecting sensors transforming the basic parameters (temperature, humidity, EC, pH, intensity of radiation etc) into electronic signals, are of importance.

From the mentioned sensors those characters which are specific for growing in nutriment solution are discussed here.

The pH value should be chequed continuously, or at least at regular intervals. It is recommended to use commercially available so called combination glass – electrodes.

Selection and formation of the sampling sites of the sensors requires a special attention to get always the momentary values of the solution in the system. Since the signals induced by the electrode vary between 100 μV and max. 1-2 μV, the electrode is rather sensitive for electric noise and, a galvanic sepearation is needed. The electrode is therefore be placed in specific sampling dish, providing noise-protection and data equivalent with the solution of the system. The desired value for most vegetable and ornamental plant cultures to be ensured varies between pH 5 and 6. Special attention is to be paid on regular care of the glass-electrode and its calibration at approximately two-week intervals.

Other important character of the nutriement solution is EC, i.e., electronic conductivity. This value shows changes in total salt concentration of the solution. Briefly, concentration of the solution is to be regulated between 1 and 4 mSc^{-1} values, depending upon plant specieds and phenological stage. For EC measurements bell or ringed electrodes or their combination can be recommended. It is again important that the measuring cell should contain the same solution as the entire system. This electrode is less sensitive to the electritic noise, but is disturbs the pH measurement considerably, which needs special attention.

The signals released by the sensors enable evaluation with the aid od the traditional electronic system as well intervention in case of bias. More modern data processing can be achieved by digiting then computerizing the analogous signals which makes possible several comparisons, depending upon software, then releasing signals for intervention. Naturally, data recording, display, error signaling, alarming and other services can be obtained from the computer too. (Fig. 2).

Those functonal units operating electronically which provide acid and base at appropriate doses for pH regulation are very important

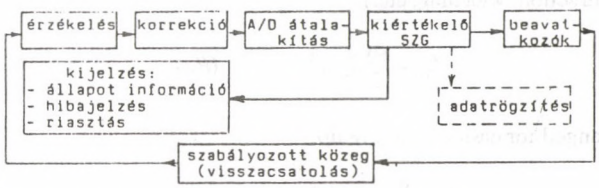

Fig. 2. Operation of the controlling system (Block scheme) sensing correction A/D transformation evaulating interveners display.

– state information
– error signaling
– alarming
– data reording
–regulated medium (feed-back)

chain links in the system (intervening organs). In case of EC regulation these correct the bias by adding stock solution of appropriate dilution.

Inertness of the system is rather high, due to the high mass of nutriment solution. The speed at which the processes undergo is slow. Therefore no continuous intervention is necessary, evaluations may sufficiently be done at 20-60 min. intervals.

Future aim is realization of such controlling, which may consider the impact of the most important ecological factors on plants and can optimalize them in respect of crop productiity. Naturally, for this we have to recognize the interaction between environmental factors and plants and to prepare mathematical models. We are collecting data at the present also to get knowledge of the effects of air temperature, himudity, EC, pH and carbon dioxide content on growing and development of plants, in relation to the minimal radiation, as independent variable, occurring in Hungary during the major part of the forcing season. Optimalization and regulation of relationships of so many factors can effectively be realized by computer controlled automatics only. We belive it is important the fast propagation of this growing method, since it may enable increases of yield even by 30-70 %, with quality improvements.

AIR - AND HEAT - ENGINEERING TESTS OF BÁBOLNA-TYPE DRIERS FOR CEREALS AND DETERMINIG DEVELOPMENT TRENDS

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The Technical Department of the Faculty of Agricultural Sciences in Mosonmagyaróvár of the PANNON University of Agriculture — based on the order of Agricultural Company, Bábolna — carried out the air– and heat engineering tests of Bábona–type driers for cereals and determined the development trends.
Within the research the B2-15; B2-15M; B2-15/M810 and B3-21, Bábolna-type driers were inspected. This inspection beside the construction included first of all the air– and heat engineering analyses.
During the research work our aims were the following:
— to suggest modification for the existing, operating driers,
— to make a proposal for the construction of the type under production from 1990, as well as for fans and furnaces to be used,
— to prepare a software for computers to clear first of all the problems of air– and heat engineering that helps to plan, modify and to operate the given type of driers.
We started from inspecting the air– engineering because existing driers were in question.
The exact measuring of pressure– loss and volumetric– flow values are impossible at certain air resistance places practically. So, during the inspection of air– engineering based on data from bibliography (FEKETE, 1975) we carried out step by step the determination by calculation of the resistance — of the pressure loss — of some forms (diffuser, confuser, bend, sudden sudden cross section resp. contraction, widening, etc.):

$$\Delta_{p_x} = \frac{\rho_x}{2} \xi v_x^2 \qquad (Pa)$$

Changed for easier summing up:

$$\Delta p_x = \frac{\rho_x}{2} \xi \left(\frac{Q_x}{A_x}\right)^2 = \rho_x \frac{\xi}{2A_x^2} Q_x^2 = \rho_x B Q_x^2 \qquad (Pa)$$

where:
Δp_x — pressure loss at x-place (Pa)
ρ_x — air density at x-place (kg/m^3)
ξ — coefficient of resistance of certain form
v_x — air flow velocity at x-place
Q_x — volumetric flow of air at defined x-place (m^3/s)
A_x — effective cross section of form (m^2)

$$B = \frac{\xi}{2A_x^2}$$

We determined the resistance of the material layer to be dried based on data from bibliography also.
(SITKEI, 1986).

The pressure demand of fans could be defined by summarizing the pressure loss values.
We chose the B2-15 type as a prototype for two reasons. There were some partial data from previous tests, as well as there was a possibility to carry out air– engineering tests at a drier having similar construction and filled up with maize, too. We carried out the measuring of the volumetric flow of air stream and of the simultaneous pressure loss of larger tracts here.
The tests made it possible to check the theoretical approximation and to do the necessary corrections.
As an example, at the B3-21-type drier we show the results of air–engineering inspection of operating driers. The functional scheme of the drier can be seen at Figure 1, and the resistance graphs plotted on the basis of theoretical connections, as well as the characteristic curves of fans at Figure 2.

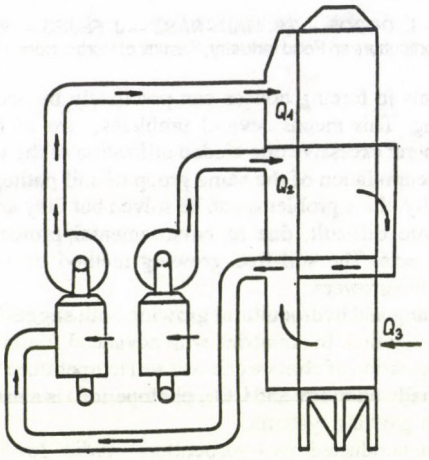

Figure 1.: Operational scheme of B3-21-type drier

The 1 — index refers to the first drying zone, the 2 — index refers to the second drying zone and the 3—index to the cooling zone. There is a need for considerable changes of operational parameters at this drier in order to achieve a suitable working stage.
The proposed modification would result better cooling, more favourable factors and less electric power consumption.

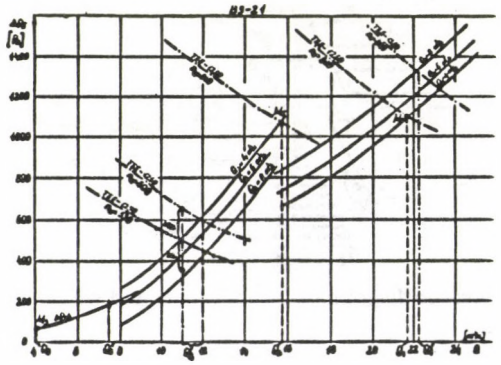

Figure 2.: Resistance curves of B3-21-type drier and characteristic curves of fan
— Q_1; Q_2; Q_3 — existing operational values
— Q'_1; Q'_2; Q'_3 — suggested operational values

The block-diagram of the software developed for Bábolna-type driers belonging to the same construction, can be seen at Figure 6. The measurement of air flow parameters on different places of the drier has been carried out in greater part by computerized solution formula of the i-x diagram (WILHELM, 1976) partly by empirical connections.

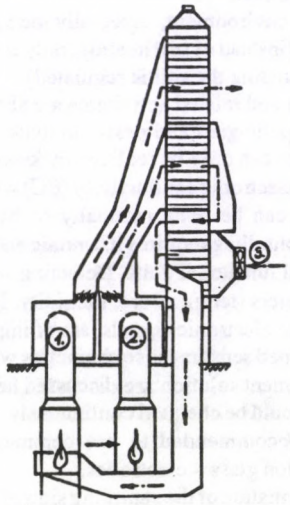

Figure 3.: Operational scheme of the suggested drier

Forming the empirical connections we leaned on our previous test data as well as on flow diagrams making probably these in the i-x diagram.

By the software according the block diagram five driers could be analysed having the same construction but different tructures and sizes. The variations of No. 1 and No. 2 show types that can be found in practice.

At the varation of No. 1 — as could be seen. At the variation of No. 1 – as could be seen before — the aim was determining the optimal parameters of operation among various working conditions. At the variation of No. 2 as a recommendation for modification we modelled the installing of the third fan to improve cooling. To the variations of No. 3, No. 4 and No. 5 the construction and basic structure of Figure 3, are characteristic, there are differences in the sizes of certain structures and in the shape of air duct. Here we ensured the possibility of choosing fan, too. (Figure 4.)

The software for computers writes out as well as prints the defined results beside the initial basic data, among them appear all characteristic values of operation.

Further the pressure data of inlet and outlet sides of fans are also printed relating to given parameters of operation.

For example we show a pressure diagram made by computer, See. Figure 5

The driers having the construction and structure based on the parameters of software were made in 1990. See Figure 3. The experiences of run–in have proved the applicability of the construction, the available accuracy meets the real requirements extensively.

The developed software for computers can be also adapted to driers having other construction and structure. However it is necessary preliminary determine and give the variabiliti principles of the air parameters and resistance functions concerning the ranges of fans.

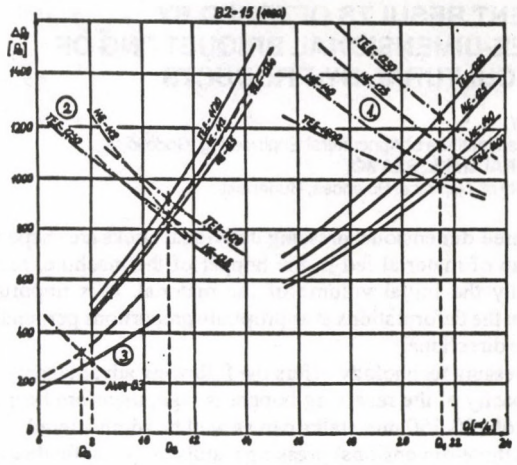

Figure 4.: Resistance curves of the suggested drier and characteristic curves of fans

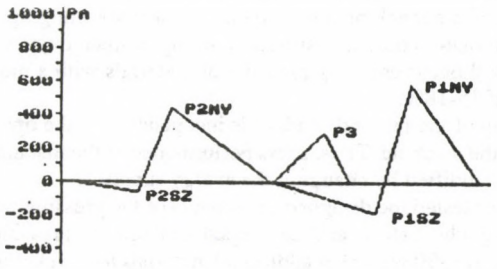

Figure 5.: Pressures on operational temperature:
P 2 SZ — inlet static pressure of the No. 2 fan,
P 2 NSZ — total static pressure of the No. 2 fan relating to outlet side,
P 3 — total pressure of the No. 3 fan,
P 1 SZ — inlet static pressure of the No. 1 fan,
P 1 NY — outlet total static pressure of the No. 1 fan

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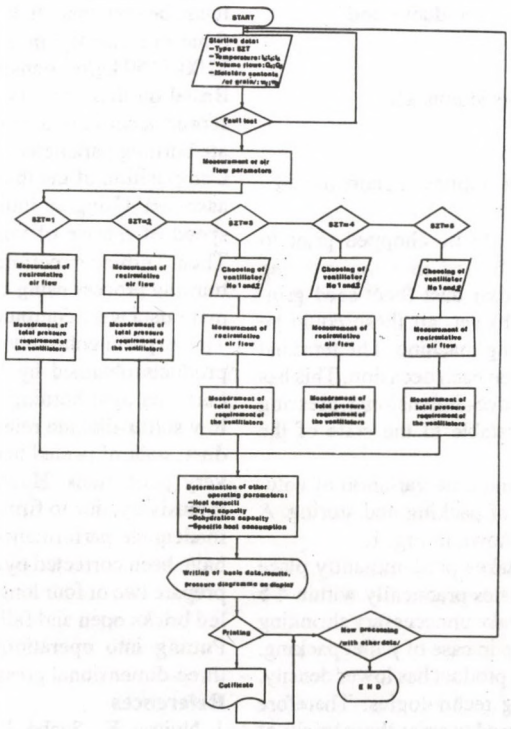

Figure 6.: Block diagram of computer processing
(Types: SZT = 3-B2-15/1990; SZT = 4-B2-15/M810U; SZT = 5-B2-15/M810R)

RECENT RESULTS OFFERED BY THREE-DIMENSIONAL BRIQUETTING OF AGRICULTURAL BY-PRODUCTS

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With three-dimensional pressing individual bricks are shaped from the heap of material fed in the hopper of the machine, reducing gradually the initial volume of the material. It is important to perform the deformations at appropriate proportions perpendicular in three directions.

This pressing technology offers the following advantages:

— Capacity of the receiving hopper is high, therefore heaps consisting of 100-150 mm stalks can as well be administered.

— The three-dimensional pressing results in spatial feathering out thus, the pressing product is isotropic in respect of strength.

— The new technique makes possible a considerable reduction of the terminal pressure of pressing, due to the favourable structure of the pressed product, compared to one-dimensional pressing.

— The lower pressing force exerts less load on the structural elements of the machine and also cause lower warming up in the braking tunnel. Thus, nor surface burning neither inner vapour tension will occur enabling pressing of materials with a moisture content of 15-18%.

— Quality of the pressed product is independent of the operation speed of the machine. Thus, press performance of the machine can easily be modified by changing the energy supply.

In 1989 we tested the designed parameters of the pressing technology using wheat straw and developed a laboratory pressing machine (1). In 1990 we tested additional materials for bricketing. By now we have tested 12, not only agricultural but wood and textile-industrial byproducts and waste, also.

These are as follows:

wheat straw	sunflower seed-husk
barley straw	stalk of peeled hemp
rape straw	beet-seed grindings
corn-stalk	wood-chips (from deciduous and coniferous wood)
sunflower-stalk	sawdust (from deciduous and coniferous wood)
corn-cob	textile-industrial cuttings of short-thread.

Of these only the first five items have to be chopped prior to pressing, the other ones can directly be fed into the pressing machine. The materials listed varied from dust (beet-seed grindings) to large clumpy items (corn-cob) yet, all these could be pressed with the same laboratory pressing machine. The terminal pressure of pressing was below 40 MPa on each occasion. This has enabled development of a universal three-dimensional pressing machine with a receiving hopper adjustable to the state of the material to be processed.

It is important to know the magnitude and time variation of volume-expansion of the prisms in respect of packing and storing. A characteristic size– growing pattern is shown in Fig. 1.

It can be seen that volume-expansion takes predominantly place during the first half an hour and terminates practically within 4-5 hours. This volume-gain of 4-7% may make unnecessary shrinking of the foil-bag but it is to be reckoned up in case of pallet packing. With the three-dimensional pressing the product has lower density, compared to the traditional briquetting technologies. Therefore comparative tumbling tests were performed to asses these bricks of lower density for wearing-resistance, using the American standard No. S. 293.3. The products were rotated in a prism-like tumble

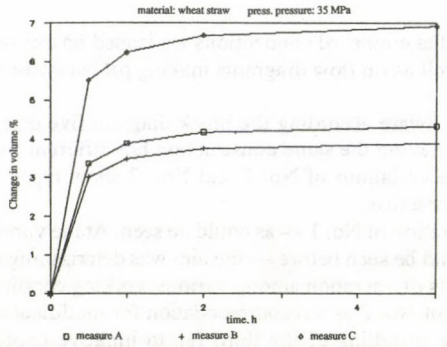

Fig. 1. Horizontal and vertical volume-expansion of wheat-straw brick immideately after pressing (water content: 8%)

covered with wire-meash at an r.p,m. of 13/min for 3 minutes and the material detached was weighed. The qualifying score was performed according to the standard.

The maximum value for the durability and particle distribution index, resp., can be 100% and 400. The experimental results obtained for some sorts of brick are given in Table 1.

Table 1.

Results of tumbling test

Basic material	Moisture content %	Density kg/m^3	Durability index %	Size-distribution index %
Wheat-straw (of 80-120 mm stalks)	8,0	690	99,3	397,1
Wheat-staw (of max. 50 mm stalks)	15,5	700	99,0	395,9
Rape-straw	8,6	710	98,7	398,8
Stalk of peeled hemp	10,8	720	98,3	398,3
Wheat-straw (one-dimensional pressing)	12,2	1150	98,9	396,0
Wheat-straw (one-dimensional pressing)	12,0	1100	98,4	353,0

It can be seen that bricks of ca. 700 kg/m^3 density, produced by the three-dimensional pressing, offer better durability than those of 1100-1150 kg/m^3 density obtained by one-dimensional pressing. Based on these results it can be stated that bio-bricks cannot be scored according to density only. Tumbling data and the appropriate burning parameters are also important classifying factors.

Composition of the materials and calor value of bricks were also assessed. Using an individual burning device we determined the speed of release of volatile materials resp. of the volume–loss. Then, burning experiments were conducted to study the complete burning process using commercial burning devices. The measurement data were computerized.

The experimentes revealed that the majority of the prism-like products obtained by three-dimensional pressing were ready to burn and their burning polluted less the environment, due to their low sulfur-dioxide release, compared to coals. Wood-chips, sawdust, stalk of peeled hemp and sunflower-stalk have proved to be very good fuels. However, strawbricks could not have burned intensively, due to firm adherence of the stalks. Which resulted in inadequate performance of the furnace. This disadvantage could have been corrected by mounting knives in the braking channel to prepare two or four longitudinal grooves on the bricks. The chanelled bricks open and fall to pieces in the fire and burn intensively.

Putting into operationt large-scale pressing machine applying three-dimensional pressing is our future task.

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ENERGETICS ANALYSIS OF CRUSHING THEORIES (RITTINGER, KICK, BOND)

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In this year we set as an aim the practical checking of the models:

— RITTINGER: $e_R = \frac{C_R}{\bar{x}} - e_0$ ... (1)

— KICK: $e_K = e_0 - C_K \ln x$ ... (2)

— BOND: $e_B = \frac{C_B}{\bar{x}} - e_0$ ... (3)

being used as the three most important theories for making connections between the specific power demand of crushing, (e_d : kWh/t), and the average grain size of grits ($\bar{x}$: mm) at the crushing with hammer crusher of barley.

We wanted to determine the constant parameters of the above equations based on more measuring with a sieve each and without sieve, and which model gives the more exact approximation writing down the connection, compared with experimental data.

By this we meant the quadrate sum of differences regarding specific power-consumptions, e_d, needed to given averge grain size, x, having got by measuring, calculated with the a above regression functions respectively.

The experiments have been carried out by *LÁSZLÓ-MEDIKÁGÓ N-16* type 16-hammer crusher with gravitation grits-outlet, driven by 11 KW electromotor with V-belt transmission.

We have done regression and variation analyses for checking the connection between the specific power demand, e_d, and average grain size, $\bar{x}$ for every theory and sieve. We have illustrated the regression functions of all three theories for every sieve concerning the $\bar{x}$ 2... 4... 7 mm interpretation range, aimed to demonstrate the approximation character of different models. We illustrate the measuring results with 2 mm-sieve and without sieve in the Figures 1. and 2.

We have marked the really examined ranges on the figures everywhere. Finally the most important conclusion of the experiments is that the regression functions of all three models — almost indistinguishably — run together in the examined ranges on all four sieves. Differences can be found only at the third — fourth digits of the specific power consumptions calculated according to three various theories. So the approximation exactness is practically the same at all three modells. Based on tests we can state very likely that the e_d, (x) energetics connection at barley can be approached roughly with the same exactness in the examined ranges at the same sieves with all three equations. Moreover it may be supposed that other similar regression function (for examle: e^{-x}) could be probably used in the same way, too.

After all the three models — although physical sense may chiefly be interpreted of the RITTINGER-theory — can be considered equivalent writing down the e_d (x) connection mathematically.

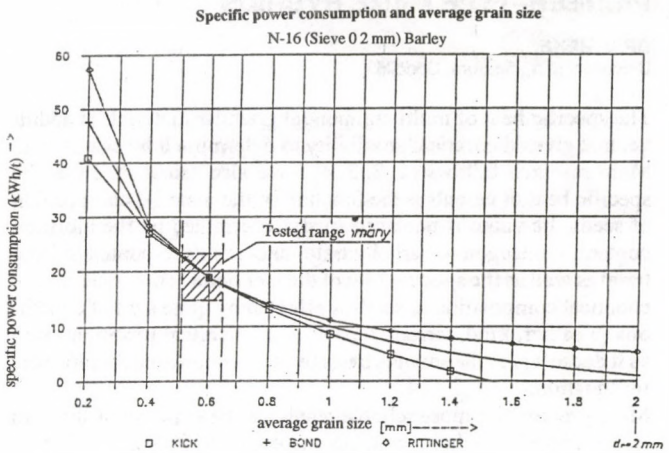
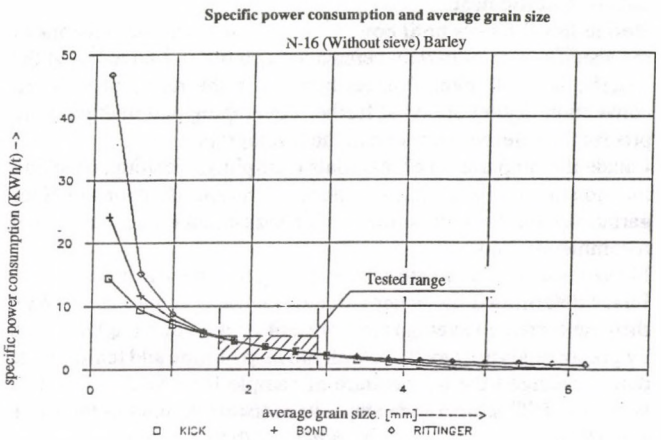


Figure 2



The results of variation analyses still give further indication done for every sieve and for every theory. Based on these

— at the 0 2 mm sieve 1 — = 99,9%
— at the 0 4 mm sieve 1 — = 95%
— at the 0 8 mm sieve 1 — = 90% as
— without sieve 1 — = 99%

it can be proved in the above significance level that the correlation coefficient is different from zero. So the regression connection assumed between x and e_d can be made between given limits probable.

TESTING THE SPECIFIC HEAT OF PIONEER–TYPE MAIZE HYBRIDS

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The specific heat of multi-component granular materials is additive, that gives theoretical possibility to determine it by calculation. More research fellows (1, 2, 3, 4) have also established that the specific heat of cereals is the function of the material composition of seeds. Its value is unambiguously determined by the moisture content, – nitrogen –, carbohydrate- and cellulose-content of material as well as the specific heat of the mentioned components. The chemical composition of seeds is affected by quite a lot of conditions (weather, kind, terrain, type of soil, chemical treatment, etc.) so it doesn't provide suitable basis for determining the specific heat by equation.

More precise and more reliable result can be expected if the corn is considered as a homogeneous material and its specific heat is tested as a function of its moisture content and its temperature.

So far the published studies in the international technical literature (1, 4, 5) give the solution with the

$$C = a + b \,.\, X$$

function. However these equations give acceptable exact result only in a limited temperature range. Based on the disclosed equations (4) 30-40% differences can be found among the calculated data of specific heat.

Beside this the tests until now have not discussed the relations of the specific heat of certain cereals to each other. I have tested the specific heat of seven Pioneer-hybrids in the range of standard convection drying aimed at further developing and making more precise the references, found in the bibliography.

I made the preparation of materials (sampling, cleaning, checking the moisture content, etc.) according to the specifications of Hungarian Standards on the subject, which are equal with international recommendations.

I have used adiabatic calorimeter testing the specific heat.

First I determined the water value of Dewar-Vacuum flask (W_k), then the corrected average difference of temperature (t_k) recorded by graphoanalytical method, with the help of time and temperature data. I changed the temperature of sample from O°C — to 80°C with t = 5 °C temperature steps, its moisture content in the range x = 0,05–0,5 Kg/kg 0,03–0,06 Kg/kg with value steps.

I have estimated the test data by fixed parametric method. After determining test conditions I calculated the spedific heat of material with the help of the following equation

$$C = \left| \frac{c_w m_w \Delta t_k - 2w_k\left(T_{ki} - t_{vb}\right)}{m_a\left(t_0 - t_{ki}\right)} \right| \qquad (KJ/kgK)$$

Where:
— m_w: mass of water (kg)
— m_a: mass of sample (kg)
— c_w: specific heat of water (KJ/kgK)
— t_{ki}: equalization temperature (°C)
— t_{vb}: initial rtemperature of water (°C)
— t_o: initial temperature of maize sample (°C)

I have repeated every test five times. I used regression analysis for determinig functionality.

The specific heat of cerals having moisture content can be defined as a weighted average of specific heat of water and of dry substance of material at isothermal condition

$$c = c_s \frac{1}{1+x} + \frac{x}{1+x} c_w \qquad (KJ/kgK)$$

My tests, corresponding to numerous other research fellows' experiences, have also demonstrated that the specific heat of cereals (at non — isothermal condition) can be interpreted as a function of two variables. Beside the moisture content the temperature of cereals has also an effect on its value.

The function analyses, $c = f(t_{ax})$ and $c = f(x)$ carried out separately of the Pioneer hybrids being tested show the results in the Figure 1. The equations writing down the fuctionality of specific heat of various hybrids can be found in the Table 1.

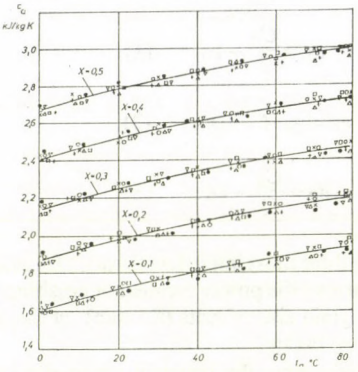

Figure 1: The variation of specific heat relating grains of maize in function of the moisture content (X) and of temperature (ta) of crops
X — Pi 3737; 0 — Pi 0047; Δ — Pi 3732;
n— Pi 3901; + — Pi 3925; Δ — Pi 3906;
• — Pi 3709; Number of all measurings: 3913

Based on the analysis extended to $0,05 < x < 0,5$ and $10 < t_a < 80$ °C interval it can be determined that the

$c = (X, t_a)$ function can be solved with the

$$c = c_s + A \,.\, X^a + B \,.\, t_a^b \qquad (1)$$

equation.

The specific heat of the grains of maize — at Pioneer hybrids — can be calculated with the following equation:

$$c = 1{,}33 + 2{,}65 \,.\, X^{0,98} + 0{,}01 \,.\, t_a^{0,80} \ (KJ/kg, K) \qquad (2)$$

in the range of moisture content $0,0 < X < 0,5$ and of temperature $0 < t_a < 80$ °C at p = 1% significance level.

The moisture content relating the dry basis of crop must be substituted into the equation in decimal figure and the temperature of material in centigrade.

Based on the tests and test data the following main conclusion can be stated:

— There is no significance difference among the specific heat of Pioneer-type hybrid maizes. The No. 2 equiation gives appropriate exact result of the $c = f(X, t_a)$ function. The No. 1 equation is suitable for determining the specific heat of all cereals with great probability.

Table 1

Regression equations of specific heat relating grains of maize in function of temperature (t_a) and moisture content (X) of material

Serial No.	Symbol of hybrid	$c = f(X, t_a)$	Determinant coefficient, r^2
1.	Pi 3737	$1{,}336+2{,}65.X^{0,97} + 0{,}079.t_a^{0,85}$	0,9222
2.	Pi 0047	$1{,}332+2{,}64.X^{0,009} + 0{,}009.t_a^{0,82}$	0,9606
3.	Pi 3732	$1{,}326+2{,}57.X^{0,96} + 0{,}011.t_a^{0,75}$	0,9444
4.	Pi 3901	$1{,}321+2{,}66.X+0{,}013.t_a^{0,77}$	0,9292
6.	Pi 3906	$1{,}340+2{,}63.X^{0,98} + 0{,}01.t_a^{0,82}$	0,9282

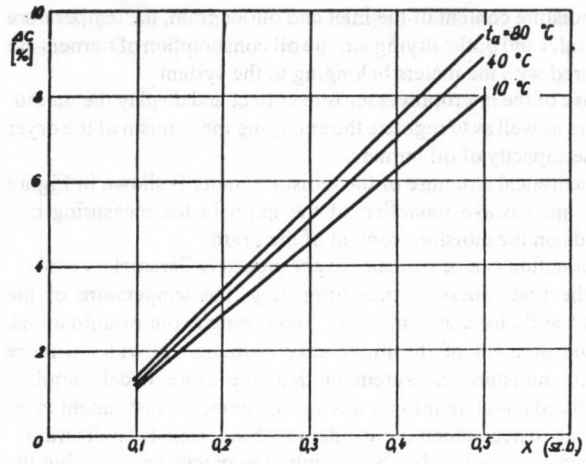

Figure 2: The difference of the values of average specific heat claculated and measured by axdditive (Δc) in function of the moisture content (X) and of temperature (ta) of material

— The value of specific heat is affected not only by the moisture content of crop but by the crop temperature too.
— The additive character of the specific heat can be be proved in the range tested, however there is significant difference between the measured and calculated values of specific heat in the intervals of higher temperature and higher moisture content. (Figure 2)

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THE APPLICATION OF MOISTURE MEASUREMENT AT MICROWAVE FREQUENCY ON GRAIN — DRYERS

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In Hungary maize and fresh-fodder require the largest drying energy. It is a very important task to reduce the energy demand of both drying technologies to a level as low as possible.
In the case of crossflow dryers widely used for drying maize there will be a possibility for this with the use of different air conduct methods and the automatically controlled operation of the dryer.
The most widely applied multi-stage crossflow dryers consist of prestorage, two drying and one cooling zones (Figure 1). The air coming out of the cooling zone can be recirculated into the second drying zone. In the second drying zone the direction of the air flow is reversed, and the air coming out here can be recirculated to the first drying zone.
During drying the next regulatory tasks appear:
— ensuring the required outlet moisture of the grain (13-14%)
— the reduction of the energy used by external heaters through properly proportioned recirculation.
In practice this purpose can be achieved through the regulation of mass flow rate of the material to be dried, the capacity of the heaters and the mass flow rate drying air. In this latter case there may be some problems with the adjustment of big fans.
The simpliest technical solution to the regulation is the microprocessor based data acquisition/control unit.
The theoretical structure of microprocessor control is shown in Figure 2.

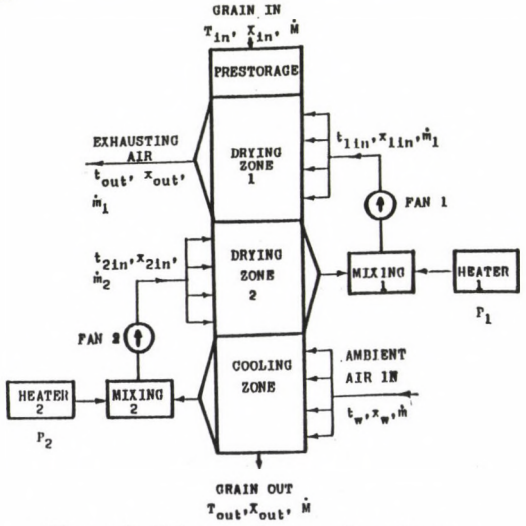

Figure 1.: Scheme of a crossflow dryer

The moisture content of the inlet and outlet grain, the temperature of the inlet and outlet drying air, the oil consumption of burners are measured with the meters belonging to the system.
The task of the microprocessor is to collect and display the measured data as well as to regulate the emptying mechanism of the dryer and the capacity of oil burners.
The theoretical structure of the moisture meter is shown in Figure 3. The microwave reduction of the grain in the measuring cell depends on the moisture content of the grain.
The reduction can be measured very precisely Parameters concerning the preciseness of measuring (e.g. the temperature of the grain), hardly have any influence. According to our examinations, the measurement of the microwave reduction provides a more accurate moisture measurement than the more widely applied dielectrical moisture measurement. However, the instrument is far more expensive, which is considerably hindering its application.
The displayed system has been applied in practice as well, but the automatic unit has problems. In case the moisture content of the grain to be dried varies immensely (e.g. 25-35%), the automatic regulator cannot follow this fluctuation. In such a case manual intervention may be needed. However, practice proves that a continuous measurement of the moisture content of the grain is necessary by all means and it will promote the operator's job to a large extent.

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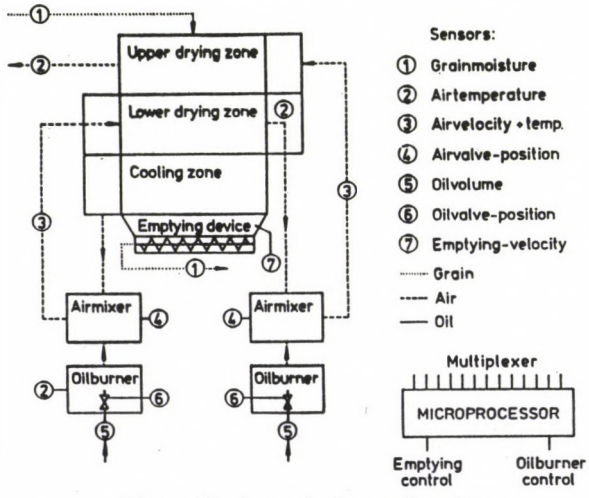

Figure 2.: Control of crossflowdryer

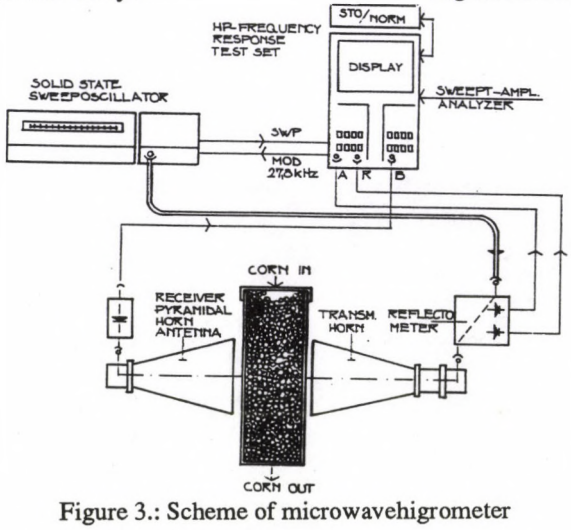

Figure 3.: Scheme of microwavehigrometer

APPLICABILITY OF INFRATELEVISION FOR DETECTING STATE OF PLANTS

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Infratelevision or thermovision(R) is suitable for remote sensing of surface temperature and to determine the distribution of temperature without touch. Its applicability for detecting the state of plants is due to the fact that temperature of the living plant differs from that of the environment. This difference results from the energetical processes taken place in plants as well as from water exchange with the environment and evapo-transpiration.

Thermal balance of plants

Thermal or radiation balance of plants can be characterized with the following formula, considering the signs given in Fig. 1:

$$(1-R)(I+H)+\varepsilon G-\varepsilon\sigma T^4=\frac{1}{r_v}(\Delta e)+\frac{1}{r_L}(\Delta T_L)+S+B,$$

where
R = short-wave remission ability of leaf (from 3.6 um)
I = direct insolation
H = diffuse radiation
G = atmospheric antiradiation
σ = Stephan-Boltzmann constant
T = surface temperature of plant
ε = emission coefficient ($\varepsilon \approx 1$)
r_v = conduction or diffusion resistance of water transport
r_L = turbulent diffuse resistance between leaf surface and atmosphere
Δ e, ΔT_L = steam pressure or temperature gradient between leaf surface and atmosphere
S = heat stored
B = soul warm-current } negligible
As it can be seen parameters S and B have negligible effects on thermal balance in plants:
— Isolation parameters: I; H; G;
— Atmospheric parameters: Δe; T_L;
— Aerodynamic parameter: r_L;
— Plant parameters: R; E; r_v;
Insolation and atmospheric parameters are weather-related and do not characterize directly the state of plants.
The aerodynamic parameter may already indirectly be characteristic of the state of leaf, in case of changes in the angular position of the leaf, or whirling and due to decrease in leaf surface caused by demage.
The ability of reflecting (R) and that of emission (ε) are affected by external deposits (dust, powdery mildew etc), morphological changes of leaf, quantitative and qualitative changes in pigmentation.
In respect of thermal balance conduction resistance of water transport, „r_v", plays the most important role. It determines transpiration temperature of the affected plant may be higher than that of the healthy plant under the same weather conditions.

Material and method

Our experiments were carried out on infested plants under greenhouse and field conditions. The greenhouse plants were provocatively infested with pure cultures of pathogens and the plants were closely observed from latency to appearance of marked symptoms. Some examples of the infestations produced:
Viral infestation: soyabean — (MV/cucumber mosaic virus)
Bacterial infestation: bean — bacterial blight of beans
Fungal infestations: wheat — leaf-rust, stem-rust
During field trials thermal phenomena of the following host-parasite relationships were studied:
sunflower — sunflower mosaic virus
sunflower — stem and head sclerotinia rot, mocrofomic stem disease
soya — peronospora
Jurusalem artichoke — powdery mildew
wheat — damage by barley-beetles
soya — damage by spider mites

Besides thermovision tests were conducted for assessing the effects of Tomplast and Proetomplast under green-hosue and field conditions.
The measurements were performed with an AGA 782 SW camera so as the longitudinal axis of the objective formed a right angle to the leaf surface to be detected. The thermal images were recorded on a measuring tape recorder and the digitized data were computerized.

Results

1. In case of both provocative greenhouse infestations and natural field infestations the temperature difference between pathological and health leaf surface can be measured as „febrility". With viral, bacterial and fungal diseases the temperature on the plant surface is higher by 0,3-8 °C, compared to healthy plants.
2. The rise in temperature is directly proportional to the severity of symptoms.
3. Latent symptoms produce minimal or negligible differences in temperature.
4. The differences in temperature between pathological and healthy plants are considerably affected by the measurement conditions. The maximal difference can be detected at the highest position of the sun, under direct and intense radiation.
5. Damages by barley-beetles and spider mites produce 1-3 °C higher temperature in the infested plants, compared to the healthy ones.
6. Treatment with hydrogel adjuvants produced decreases in temperature of plants, compared to controls. Hydrogels can absorb dew on plant surfaces, their mass may be multipled by 50-600. The treated plants return slowly and permanently the wetnes, keeping thereby the plants fresh and healthy even in droughty periods. In case of rust-infestation they can „palliate" this febrility (1).

Conclusions, utilization of the results

1. The infratelevision technique recently applied at plants may offer an easy-realizable method for detecting physiological state of plants.
2. Application of the method requires standard climatic conditions, or, in lack of these, symultaneous detections of control and treated plants.
3. Field application of the infratelevision testing offers perspectives in practice of plant protection. It enables
— early diagnosis of infestations,
— exact detection of pathologic foci,
— recognition of water transport deficiencies,
— assessing physiological state of plants.

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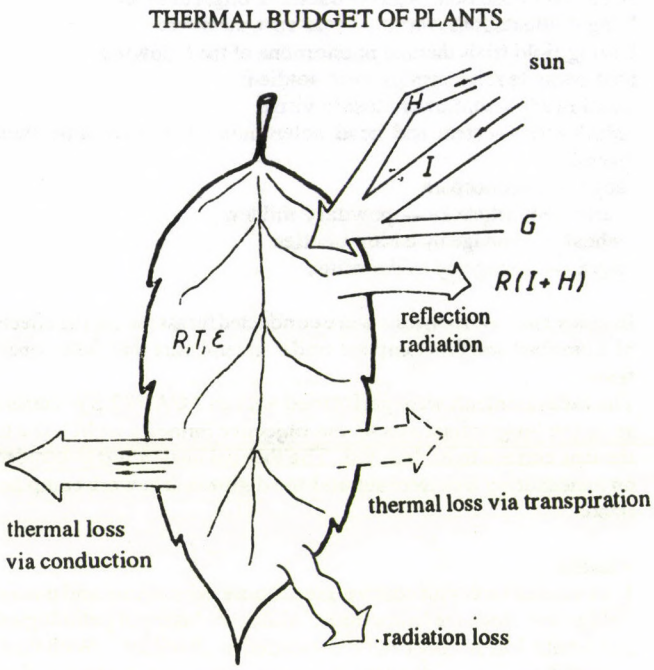

Fig. 1. Radiation balance of plants

SOIL CONSERVATION TILLAGE

BALANCE OF 1975 — 1990

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The aim of the tillage basides the establishment of the effectiveness of crop production is conservation of the soil.
The theoretical formulation of the soil conservation methods already got an important place in the life work of the classics, such as J. Nagyváthy, F. Pethe, S. Cserháti, J. Gyárfás, Sr. A. G. Manninger, E. Kemenesy and S. Sipos. Their teachings are summarized in the followings:
— Giving up the „multiploughing" method, the rational placing of ploughing in the tillage systems.
— Embracing and spreading of not-clodding ploughless methods (discing, tillage by grubber) in the case of dry soil condition.
— Spreading of methods suitable for conservation of the biological life of the soil.
— Alternation of shallow and reasonably deep cultivation determined according to the condition of the arable land.
With such strong and realizable theoretical bases we ought to farm today on soils that are in good structural condition, are in respect of biology active and so in a certain extent independent of their physical variety, as well as of the weather conditions. In spite of that in the big part of the arable land the structure and load-carrying ability of the soils, the organic matter content decreased and the rate of soil compaction increased.

Compaction of the soil and the loosening
As early as the beginning of the years of 1960's scientists of the soil tillage proved the production reducing effect of the compact soil condition and the importance of the loosening. Only one explanation can be for that, why the loosener is only a tolerated equipment today. The cost of the deep loosening around 60 cm can be the decisive reason. However, the cost of 30-45 cm loosening cannot be more than the cost of 30-32 cm deep ploughing. The experiments carried out in the different arable lands of the country proved that any tilling method being done on copact soils gives more cloddy soil and the clod breaking demand is higher by 3-5 passes, as in the case of soils having good physical-biological condition.
The cloding of loosening being done on strippingless, dried up stubble urge many farmers to disregard the loosener. The clodding indicates only the soil condition. It shows that the upper layer is dry and compacted and the deeper layers are also compact. In this case it is a great mistake to waite for the soaking of soil, because the ripper effect of the loosener does not occur on wet soil. The farmer, taking care of the soil, has the loosening done on stripped, matured stubble and with this, according to our measurings, he reduces the average clod size by 26-50% and the number of clod breaking passess at least by two.
There are several farms where the loosener is operated on ploughed land. In this way, the depth of loosening does not attain the planned one. It is a self deceit to waite a 4-5 year effect from — at most — 35 cm deep loosening on the ploughed land (the ploughed layer included).

Utilization of the technical development
By the end of the years of 1960's the farm machinery production gave the indispensible equipment for the farmers. However, with West-European measures these tillage machines were not really suitable for the developing agriculture (e.g. due to construction problems, great mass, bad material quality, the impossibility of machine couplings etc.). In the beginning of 1970's the farmers in the USA and Western-Europe used the second generation of the equipment, which were suitable for energy saving cultivation. In Hungary the first combined primary cultivator the LATAR (loosener+disc combination) did not arouse the farmers' interest. A great breaking through was the organization of the „production systems" and the new demand of their experts for the fast adaptation of the scientific and technical results. At the shows the Hungarian farmer could become aquainted with modern ploughs and several equipment wich are suitable for primary tillage without soil turning. The purchases of licence and beginning of production fell on this period of time. However, the change of general tillage view was late and only the increase of energy prices and the effect of droughty years — unfortunately not finally — made it perceptible in the practice.

The appearance of the modern tillage technique brought also a lot of bad things, regarding the soil. Firstly the neglecting of stubble stripping and missing its favourable affect the biological life of soil. It can be obtained the suitable biological condition of the soil with effective technical means for the plant, but the biological ripening is far away from this.
Secondly, the use of heavy tractors and machines which increase the soil compaction. Namely, the technical development — neglecting the biological life of the soil — does not go with the reduction of tillage passes and tillage rationalization, in many places. The clodding concomitant of the tillage of compact soils can be only abolished by many passes. Meanwhile the soil suffers more and more losses, the erosion and the risk of deflation and the inclination to crusting increases. Breaking- up the crusting causes clodding again. The soil being poor in organic matter has rapid settling and a newer work-pass is required to loosening it.

Subjective judgement of tillage machines
In the years of 19230's Sr. A. G. Manninger proved the advantages of primary tillage of the heavy cultivator in the conservation of soil structure and moisture, the moderation of the costs and clodding. The neglecting of the heavy cultivator, in spite of the relatively succesful licences (AGRIKON RAU Multitiller, RÁBA Conser Till) is a model-machine of the incomprehension. Indisputable factor is the high price, but the moderately clody tillage — which can be done by the machine also under dry conditions — and the less demand for clod breaking should be taken in consideration too.

In the same way only the view explaines the strength of reservation against the reversible ploughs. It is true, the good construction and quality of material (Rabewerk, Kverneland) also appear in the price, additionally, at least two tillage seasons are needed for the evaluation of the economical use of the reversible ploughs. Besides the furrow and ridge-free, even surface ploughing, must not forget the idle-traffic reduction and the moderation of head-land compaction.
An opposite direction indicates the share of shallow discing. Certainly, that the field capacity, the good utilization speak for the disc. Shallow discing of the compacted soils, however is a risk factor. The discpan compaction caused by the frequent discing is not less harmful than the ploughpan compaction formed in the deeper layer. Ploughing through the discpan, the stronger clodding indicates the tillage mistake made earlier.
It is true, the tillage exaggerations and damages should be not generalized. A mitigationg circumstance is that the stubble and straw burning is already strongly limited, so thus the shallow stubble stripping and the cultivation of stripped stubble may to be done. The gradually mixing of stubble residues into the soil, decreases the moisture loss and clodding and increases the quality of primary tillage.
The modest farm machinery selection is a high limit. At the same time we saw that under better technical conditions not the machine, rather the view and the special knowledge of its user determines the direction of practice development, which can serve the soil conservation or cause soil degradation.
Simple and old advices can be given to the turning of soil degradation back. From these the most important ones are: the selection of tillage methods considering the soil moisture content, the short peroid loosening, the alteration of shallow and deep tillages regarding the soil condition. To these the minimum basic machine selection consist of the plough, the loosener and the disc. The

reduction of tillage pass numbers can be done by to the primary tillers connected, or tractor mounted clod breakers.
The present impossibility of investment forcibly gives free-way to the home-made equipment. The developing work of the farmer and the machinist, their daily struggle can be put into the soil conservation service.

LABORATORY ROBOT WITH IRRIGATION ADAPTER

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In the article the authors give account of their robot development work made for agricultural and biotechnological laboratories. They make known the own designed BR-5 type laboratory irrigation robot which hes been carried out at the Faculty of Agricultural Engineering.

Several studies have been made about the possibility of agricultural application of the robot technique. The studies based on the demands stated theat the agriculture also requires special laboratory robots besides the farm robots.

The quality and ergonomic reasons related to the laboratory work offer grounds for the workers there in order to be freed of monotone and unhealthy activities. In this way the work of robots — first of all — can be limited to automatable activities, which do not require special knowledge. The frequent and disturbing mistakes caused by human errors and fatigue can be also eliminated.

At the Faculty of Agricultural Engineering, with the utilization of design and manufacturing experiences of industrial and teaching robots, we started to design and manufacture the low producing cost robots, with the required accuracy only, to meet the demand of the agriculture and biotechnology.

We set as an aim that the presently described BR-! type experimental machine should be suitable for:

— Intensive test of the irrigation or nutritional solutions, in case of uniform seedlings and soil,

— Test of different soils, in case of uniform irrigation intensity and seedlings,

— Comparative test of seedlings, in case of uniform irrigation intensity and soil.

Regarding the technical objects we emphasize the followings:

— For the sake of usable mathematical-statistical methods in the comparative tests the equipment should handle minimum 80-100 seedlings,

— The equipment should be controlled or programmed by computer,

— The machine should operate automatically according to the programme in any optional variation, time and cycle,

— Its positioning or repeating tolerance should be maximum ±1 mm.

The robot consists of the following main parts:

The robot head and irrigation pipe, the moving mechanism, the handling table, the feeding unit, the drive-electronics and the control computer.

The robot head can be changed according to the prevailing task. At the present experimental machine such an adjustable mechanism is mounted into which the irrigation pipe can be fitted.In other case, for example, the robot head can be fitted with automatic pipette or mixer.

The so-called ball-spindle developed for this purpose at the moving mechanism can be regarded as a novelty. The robot head is operated by two such ball-spindles at right angles to each other, in Descartes coordinate system, driven by step-motors.

In general, the complicated and expensive ball-spindles are used in the robot technique by which micron-sized positioning can be obtained. The present task does not require such accuracy, but it is important to avoid the slide friction and only roller friction should occur. This task has been solved with the ball-spindle which has a conical-barrel profiled roller moving in its slot and rotation of the roller in the sleeve that corresponds to the nut is insured by ballbearings. The reducing gear was eliminated by this construction, because the 20 mm thread-pitched spindle gave 1.2 m/min robot head speed, which was suitable for the purpose.

On the present handling table two rusters containing 7x7 cells can be placed. The usual 2 dl plastic cups with plants can be placed into the ruster, which are automatically manipulated by the robot from the programme. At present it irrigates. The ruster can be changed, for example, it can also consist of cells containing 1000 test-tubes and in this case the ruster spacing is 20 mm only.

The feeding unit is piston type and the minimum quantity of liquid conveyed is 0.1 ml and the maximum volume per stroke is 1 dl. Between the values the quantity of liquid can be multiplied to taste above any plastic cup.

The drive-electronics also contains a microprocessor control unit besides the normal interface and high voltage joining circuits. This unit also does the dynamic control of the stepmotors according to the programme made by the faculty. The great advantage of this arrangement is that the revolution of motors can be altered from the programme. By this, the effect of dynamic forces resulting from acceleration and decelaration can be reducecd, in this manner more precise positioning can be obtained besides the optimum working speed.

XT/AT computer was used for the control. The interactive control programme has such structure that for making user programmes and running of programmes operator's knowledge are needed only.

The control programme consists of the following main points:

— active programmes
— new programmes
— simulation
— starting the programmes
— control by step and the
— completion

The equipment activate the active programmes according to menu, or the already written programmes in accordance with date, hour and minute, as well as starts the programme self if the computer is switched-on.

The new programmes serve the making of menu and user programmes. Graphic monitor helps the programme preparing. By quiting the menu the programme is saved automatically.

With the aid of simulation menu a written programme can be run on graphic monitor without operation of the robot.

Starting the programmes in menu the prepared user's programmes can be generated once or run cyclically.

Out of the by step control menu the robot can be controlled manually. Here the work is also helped by graphic monitor.

The finishing menu makes the control programme quitting sure.

Our aim is to increase the dimensions of equipment during the development work and hereby we make the described system suitable for carrying out productive work.

Part III.

ABBREVIATED TEST REPORTS

RENAULT 155-54 TZ tractor

Manufacturer: Renault Agriculture, France

The RENAULT 155-54 TZ tractor is a heavy, universal power machine with a semi-self-carrying chassis fitted with a auxiliary front-drive.
The tractor is operated by a six-cylinder, diredt injection, turbo-load Diesel engine with max. 100.2 kW P.T.O. output. According to the traction results carried aout on asphalt road 0.80-0.82 output utilization efficiency can be obtained in 4 gears. Hitching and field tests were made with 4 different implements.
Summarizing the results it can be stated that the RENAULT 155-54 TZ tractor can be groupped into the category of widely used heavy, universal tractors and it improves the narrow choice of smaller tractors of this class.

Main technical data:

Engine output	100.2 kW
No. of gears	16 forward 16 reverse
Speed range	2,15-31,42 km/h
Hydraulic system pressure	192 bar
lifting capacity	42 kN
Linkage mechanism	ISO III

CSEPEL D-566 lorry

Manufacturer: Csepel Autógyár – MH, Hungary

The modified 7 ton load capacity, all-wheel drive Csepel D-566 lorry with a 3 -way tip box is suitable for transportation of various bulk materials. The engine and power transmission system make the operation possible under unfavourable conditons too, when a six ton nominal load capacity trailer is coupled to the lorry. Its good cross-country capacity and the mounted additional sped-proportional drive possibilities also make the lorry suitable for operation of special farm devices.

Main technical data:

Load capacity	7.0 t
Own mass	9,4 t
Load volume	4,45 m^3
Engine output	147 kW
Max. speed	80 km/h
Wheel size	14.00-20

KBP-11,5 trailer

Manufacturer: Agrinnov Ltd. Nyíregyháza, Hungary

The KBP-11,5 two-axled trailer was designed for IFA-L60 lorry. First of all, it is suitable for transport of bulk materials. The operational safety of the machine is acceptable.
Under average operative conditions the transport capacity in river gravel transportation during the basic time was 5,7 t/h, in the case of 93 km transport distance.

Main technical data:

Load capacity	11,5 t
Own weight	4,25 t
Load platform	12,87 m^2
Wheel size	12.00-20ST
Brake system	pneumatic
Load capacity	14.35 m^3

FARMER-06 trailer

Manufacturer: Gépipari Vállalat, Szentes, Hungary

The Farmer-06 two-axled trailer can be operated wiht tractors. First of all, it is suitable for transport of bulk materials. The operational safety of the machine is acceptable. Under operative conditions the transport capacity in maize silage during the basic time was 5,6 t/h.

Main technical data:

Load capacity	6 t
Own weight	2,3 t
Load platform	9,68 m^2
Load volume	9,68 m^3
Wheel size	12,5-18 (10PR)
Brake system	pneumatic

SZE rotary ploughing tiller

Manufacturer: AGRIKON RT, Kecskemét, Hungary

During the tests it was stated, that the soil-driven star-wheels form an even soil surface and iprove the breaking-losening work of the plough by 35-80%, depending on the working speed. The energy demand of the tiller consisting of six rotors was only slightly higher as of the sole plough and did not essentially affect the energetic harmony of the tractor – plough. Its operational safety is good (K_4=0.97). The tiller mounted on the RIH-10-720-6/18-KMT plough, pulled by RÁBA-Steiger tractor can perform 1,2 ha/h. The equipment can be well-utilized with a plough for one pass tilling on different types of soils.

Main technical data:

Working width	2,75m
Working depth	max.12 cm
No. of star wheels	6
Diameter of star-wheels	600 mm
Mass	300 kg

WEIGHLOG weight indicator

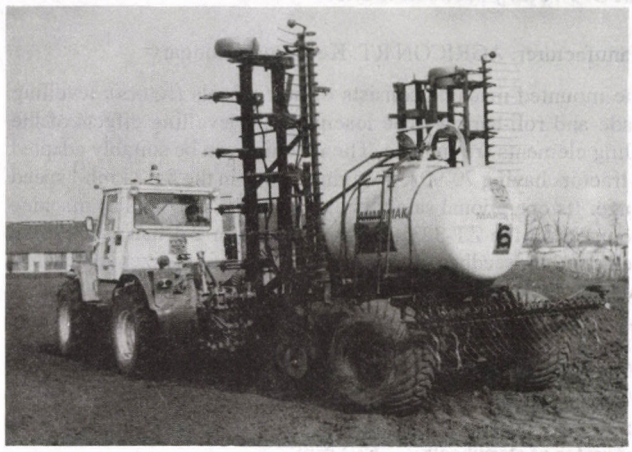
Manufacturer: RDS-H Kft., Gödöllő, Hungary

The Weighlog weight indicator is suitable for measuring of maas lifted by machines equipped with hydraulic lifting device. The five channels of the instrument can be calibrated for five crops, or machines. The sixth channel can be used for the adding of the values measured by the six five channels. The device – with keeping the operative recommendations – is able of mass measuring within 2% limit of error.

Main technical data:

Feed voltage	10-16 V/DC)
Current consumption	100 mA
No. of displays	6
Numerical display	4-digit
Dimensions	143x101x82 mm

ABG ammonia injector and embedder



Manufacturer: AGRIKON RT, Kecskemét, Hungary

The ABG ammonia embeddig machine is suitable for the application of water-free ammonia in a depth of 8-12 cm. However, if the machine is equipped with twin-wheels and operated by RÁBA-250 tractor carrying Huniper-2000 sprayer it can be also used – together with ammonia injection – for application of suspension. The arae treated by the machine can be expected between W_{01}= 6,4 – 6,8 ha/h and W_{03} =4,4 -4,7 ha/h.
Its quality of work meets the agrotechnical requirements. the loss (evaporation) of ammonia put into the soil is insignificant. The operational safety of the machine is acceptable yet (K_4=0,91).

Main technical data:

Volume of ammonia container	1,5 m^3
Application rate	100-250 kg/ha
Working width	8,4 m
Depth of work	8-12 cm
Tractor required	180 kW

HCS-9 clod crusher roll

Manufacturer: AGRICON RT. Kecskemét, Hungary

The test of the clod crusher roll according the crushing-loosening and levelling effects of its elements are suitable, but better compaction can be only maintained by increasing the line-load. The pulling resistance of the rolling elements is insignificant therefore the machine can be well-adapted energetically to the tractors having 80-100kW engine output in the 6-10 kmh^{-1} speed range. Its operational safety is suitable (K_4=0.96). In general, the crusher roll operated by the FIAT-1880 DT tractor can cultivate 5,0 hah^{-1}. It can be used for clod crushing and sealing of soil surface satisfactorily.

Main tecnical data:

Working width	9,7 m
No. of roll members	5
Widht of roll members	1920 mm
No. of rolls/diameter	
Flat roll	5/520 mm
Ring roll	122/400 mm
Clod crusher	126/420 mm

MARSK STIG ammonia injector

Manufacturer: MARSK STIG A/S, Denmark

The Marsk Stig ammonia injector is suitable for early spring top dressing of autumn-sown plants, for N-supply of maize after seedbed preparation and for application of N-fertilizer, required after the autumn soil preparation, before sowing. The amount applied can be regulated steplessly between 80 and 200 kg/h. The area treated during the productive time is 5,9-6,32 ha/h. The quality of application is suitable. The loss (evaporation) of ammonia after the application into the soil is insignificant. The operational safety of the machine is suitable (K_4=0,96).

Main technical data:

Volume of ammonia container	2,03 m^3
Working width	7,5 m
Depth of work	8-15 cm
Tractor required	min. 150 kW

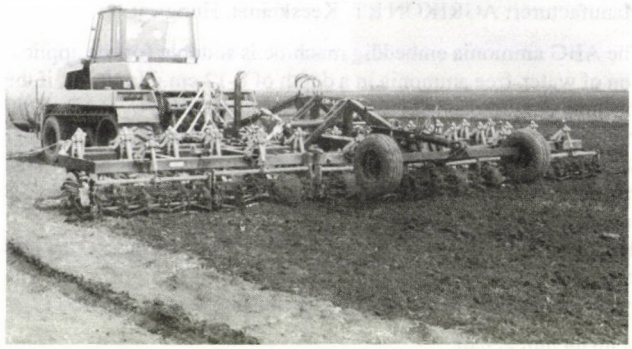
FMG-4 rotary seedbed maker

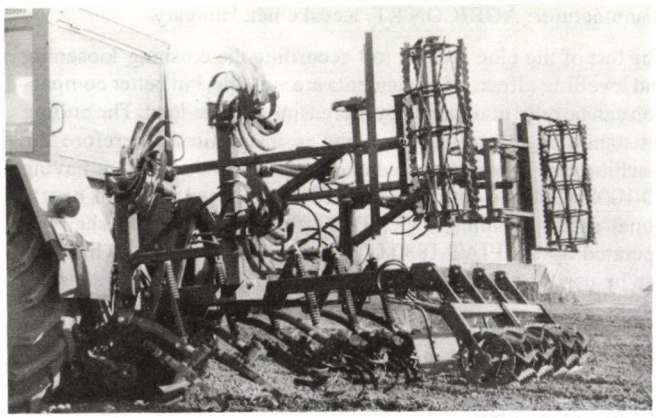
Manufacturer: AGRICON RT. Keckemét, Hungary

The mounted machine consists of star wheels (rotors), levelling blade and roll-harrow. The losening and levelling effects of the tilling elements are suitable. The machine can be suitably adapted to tractors having 70-90 kW engine power in the 8-12 kmh^{-1} speed range. Its operational safety is excellent (K_4=0,99). The machine mounted on the ZT-323 tractor can perfom 2,4 hah^{-1}. It can be well-used for seedbed preparation, mixing of fertilizer and chemicals into the soil as well as for soil cultivation on different soils.

Main technical data:

Working width	4,0 m
Working depth	max.12 cm
no. of starwheels	12
Diameter of starwheels	630 mm
No. of roll-harrows	40





WN 12 seed dresser

Manufacturer: W. Niklas GmbH, Germany

The seed dresser have been made for wet dressing of grains, maize, peas and beans. The throughput of the machine is 3,42-11,66 t/h in wheat and 4,34-7,27 t/h in case of peas. During the work quality tests, the quantity of dressing material got onto the units of seeds varied between 3,06-4,21%, which is quite good. It operational safety is very good (K_4=1,0). The seed dresser can be well fitted ire the machine-lines of the different seed-plants. The machine met the requirements excellently.

Main technical data:

Nominal output in wheat	2-12 t/h
Dressing material feeding	0,5-20,0 cm^3/kg
Post-mixer	brush type
Total electric power needed	2,01 kW

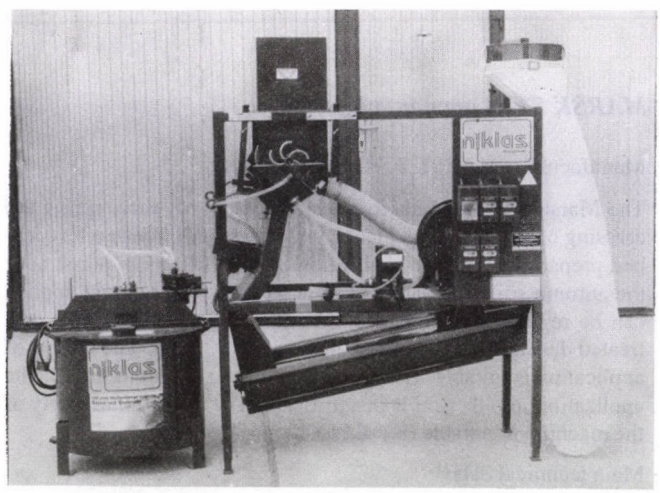
KRM-8,4M rotary seedbed maker

Manufacturer: AGRIKON RT, Kecskemét, Hungary

The machine, consisting of soil-driven star-wheels(rotors), levelling blade and roll-harrow, worked satisfactorily during the test. Even taking into consideration the havier soil conditions the machine can be well-matched energetically to the 180-190 kW tractor in the 8-14 kmh^{-1} speed range. Its operational safety is suitable (K_4=0,96). The machine operated by a RÁBA-Steiger tractor can perform 6,5 hah^{-1} in average. It can be well-used for ploughed land planing, cultivatoring and seedbed making, on soils of various resistance..

Main technical data:

Working width	8,4 m
Working depth	12 cm
No. of tilling units	3
No. of starwheels	14+13
Diameter of starwheels	630 mm
No. of roll-harrow members	6



FLEXI-COIL-800/1110 drill-cultivator

Manufacturer: Flexi Coil Ltd., Canada

The machine – consisting of a field cultivator and a pneumatic drill – operated after different preceding crops and in various field preparation. During the test the cultivator has worked satisfactorily and favourable results were obtained in the application of fertilizer and seeds in the range of 8-12 km.h^{-1}. The machine can be well adapted to the tractors having 180-190 kW engine power. Its operational safety is good (K_4=0,98). The average area output with Rába-Steiger tractor is 5,4 ha.h^{-1}. On different soils the machine can be used for soil preparation and drilling operations of plougless technology.

Main technical data:

Working width	8,2 m
No. of cultivator hoes	27
No. of coulters	27
Container volume	2,28+1,59 m^3
No. of spring harrow gangs	5

K-42 0 and K-430 balers

Manufacturer: Fortschritt Erntemaschinen GmbH, Germany

The balers with sliding piston can be used for baling of both hay and straw. Considering the whole working time the output of the machines were between 4,5 and 5,5 t/h. In the case of hay the bale density was between 171,9 and 162,2 kg/m^3. The operational safety of the machines is suitable. The fuel consumption changed between 4,21 and 6,19 kg/h.

Main technical data:

	K-420	K430
Width of pick-up	1,6 m	1,8 m
Bale dimensions	360x400x1200 mm	
No. of tying heads	2	2
Tractor required	30 kW	40 kW

E-303 B self-propelled windrower

Manufacturer: Fortschritt Erntemaschinen GmbH, Germany

Widths of the cutting tables delivered together with the machine are: 5,6-4,2-3,6 m. The output of the windrower, equipped with conditioner, can be varied between 2,0-2,5 ha/h, related to the total working time. Utilization of the working width of the machine is 92-94% in the speed range of 8-13 km/h and the stubble height was between 83-93 mm. In the case of 6,5-6,9 kg windrow mass per metre the utilizetion of engine output varied betwen 50-70% The operational safety of the machine is suitable.

Main technical data:

Engine output	44 kW
Working width	3,6-4,2-5,1-5,6 m
Cutting height	4,5-7,0-9,5-13 cm
Widht of conditoner drum	1800 mm

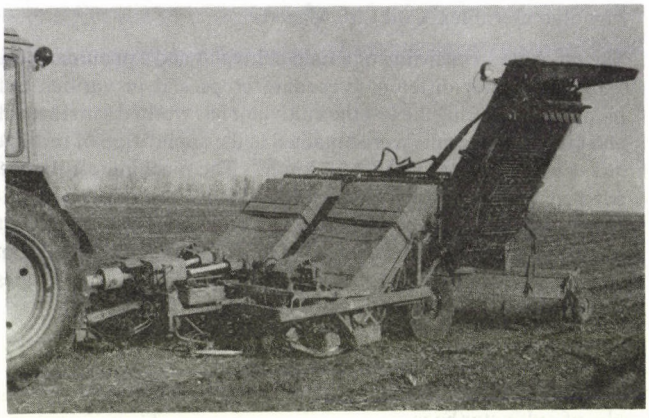
K-440 baler

Manufacturer: Fortschritt Erntemaschinen GmbH, Germany

The K-440 baler operated by a tractor having 37-44 kW engine output can be used safery for baling of grasses, lucerne and straw. During the total working time the obtainable output of the machine is 4-5t/h. Under Hungarian conditions the machine – first of all – can be taken into consideration in large-scale farms for supplying fodder or straw.

Main technical data:

Width of pick-up	1,78 m
Bale size	360x460x1200 mm
No. of tying heads	2
Tractor required	45 kW



KSZV-6V sugar beet lifter-loader

Manufacturer: Combine Factory, Ternopol, USSR

The 6-row harvester with 45 cm row distance has a working width of 2,7 m. The self-propelled machine lifts the sugar beet roots – topped previously and after cleaning loads into the transport vehicle in one pass. Its work can be characterized by 3,5% loss of harvest and the active root cleaning effect. The shift output is 6-7 ha while the season output is 120-150 ha. The self-propelled machine is operated by a 125 kW engine.

Main technical data.

Working width	2,7 m
No. of rows	6
Row distance	45 cm
Engine output	125 kW

BM-6B sugar beet topper-loader

Manufacturer: Combine Factory, Ternopol, USSR

The pull-type machine with 45 cm row distance and 2,7 m working width tops 6 rows of sugar beet in the soil and loads the leafy tops into the transport vehicle. The standard topping ratio is between 60-70% with 0,5% soil contamination is. The machine is able to top 6-7 ha/shift i.e. the tops of this area can be harvested. It requries min. 59 kW tractor power with a P.T.O. shaft with 540 r.p.m.

Main technical data.

Working width	2,7 m
No. of topable rows	6
Row distance	45 cm
Tractor required	min. 59 kW

Matrot M-31 Electronic sugar beet harvester

Manufacturer: Matrot S.A., France

The working width of the 6-row harvester is 2,7 m. In one pass the machine performs the following operations: topping, lifting, cleaning and loading. 60-70% standard topping and 2-3% harvesting loss characterize its work. The area harvested is 9-11 ha/shift, while the season output is over 300 ha. The self-propelled machine with hydrostatic power transmission is operated by a 175 kW engine.

Main technical data:

Working width	2,7 m
No. of rows	6
Row distance	45 cm
Engine output	175 kW

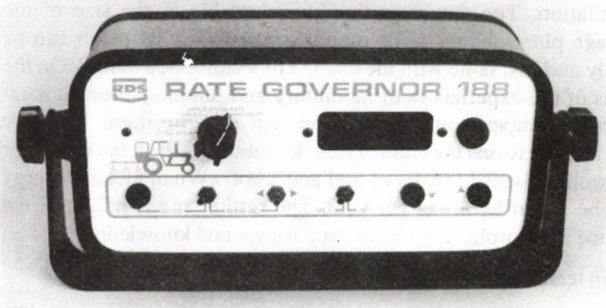
RG-188 spayer regualtor

Manufacturer: RDS Technology Ltd., England

The RG-188 type sprayer regulator measures the working pressure and on the basis of this, it regulates. The regulator can be mounted additionally, on most sprayer machines. Before operation the instrument must be programmed and henceforth the regulator shows the most improtant parameters during the spraying operation. The measured and displayed values are: the working pressure, the momentary liquid output, the speed of travel, the daily and total area sprayed. On the basis of the tests it cen be stated tha the connecting the units of the regulator and the programming of the central electronic unit should be done by specialist at the first mounting, while every further modification can be performed – with care – by non-qualified persones too. The measuring and controlling precision of the regulator as well as its operational safety are suitable.

Main technical dat.

Feed voltage	12 $V^{+42\%}_{-17\%}$ DC
Current rate	3A
No. of programmble parameters	9
No. of displayed values	5
Dimensions	320x155x93 mm



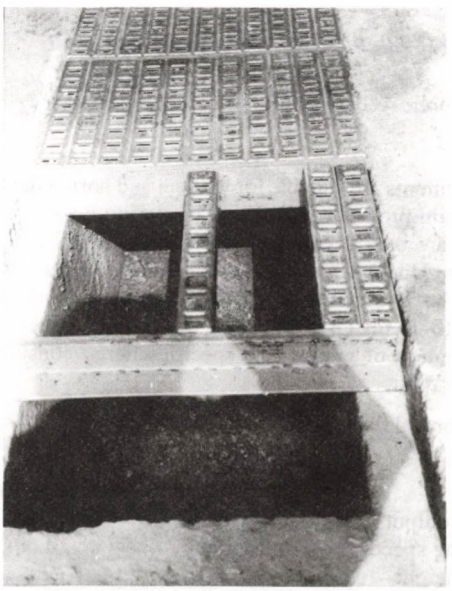
SZP ventilating floor

Manufacturer: AGRIKON, Kecskemét, Hungary

The SZP ventilating floor was made for airing of horizontal stores and flat-bottomed low tower stores. The equipment can be assembled from panels which are galvanized. With the SZP-1 and SZP-5 equipment, suitable to tower stores, 10 m^3/h, t air change can be maintained if they cover 20% floor space. In the case of horizontal stores 25m^3/h.t air-change can be performed with 20% built-in-area. The specific energy comsumption is 0.01-0.02 kWh/t.

Main technical data:

Panel size	386x50x44 mm
Sheet thickeness	from 1 mm to 2,5 mm
Gap surface ratio	6-8%
Panel mass	from 0,4 to 1,0 kg/pc



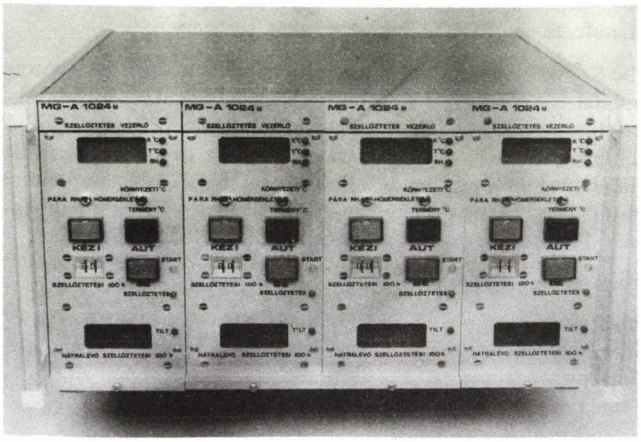
MG–A 1024 M ventilation controller

Manufacturer: FM, Műszaki Intézet, Gödöllő, Hungary

The MG-A 1024 M modul-type ventilation controller is suitable for ventilation control of the grain tower driers used for preservative ventilation. The device is flexibly adaptable to the size of the storage plant, thanks to its modul construction. Its repair can be easily and fast done with the change of a calibrated modul. On the basis of the experiences of laboratory and functional tests it measures the temperature of the environment and crop, the air humidity and also performs the control functios suitably. With the use of the controller about 4,000 kg of fuel and 3,000 kWh of electric energy can be saved by tower per year. The setting and handling of the device are simple, there is no need for special knowledge.

Main technical data:

Feed voltage	220 V 50 $Hz^{+10\%}_{-15\%}$
Power input	70 VA
No. of parameters measured	5
Protection	IP 42
Dimensions	430x220x460 mm



BCS unloading planetary augers

Manufacturer: AGRIKON RT, Kecskemét, Hungary

The BCS planetary augers are suitable for unloading of grain storage towers having a diameter of 11-27 m and flat bottom. The measured unloading capacity of the augers are 67 t/h in case of BCS-50/11 and 85 t/h in the case of BCS-80/24 auger. The specific electric energy consumption was 0,06-0.11 kWh/t at the former one and 0,12-0,16 kWh/t was at the latter. Their quality of work and operational safety are acceptable and thay meeet the labour safety regulations.

Main technical data:

	BCS-50/11	BCS-80/24
Nominal output	50 t/h	80 t/h
Length	5,193 mm	11,600 mm
Diameter	178 mm	130-150 mm
Revolution	348 r.p.m.	292 r.p.m.
Built-in electric power	4 kW	11 kW

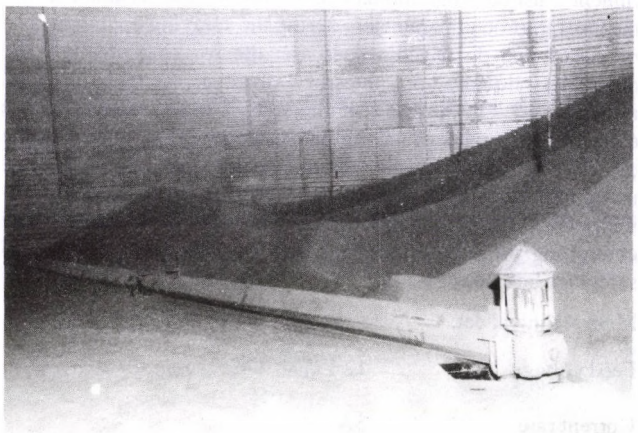
F-20 and R-20 material conveying quipment

Manufacturer: AGRIKON RT, Kecskemét, Hungary

The equipments are suitable for vertical and horizontal transportation of grain products (e.g. filling of storing tower). The vertical elements are bucket elevators and the horizontal ones are chain conveyers. Under laboratory conditions the output of the equipment can be 36 t/h, but in operating circumstances the output was between 10-14 t/h. Grain crushing was not experienced during the transsportation of grains. The specific energy consumption was 0.06-0.1 kWh/t.

Main technical data:

	F-20 M bucket elevator	R-20 chain conveyer
Nominal output	25 t/h	20 t/h
Conveying speed	1,85 m/s	0,4 m/s
Built-in height	31 m	-
length	-	40 m
Electric power	4.0 kW	3,0 kW



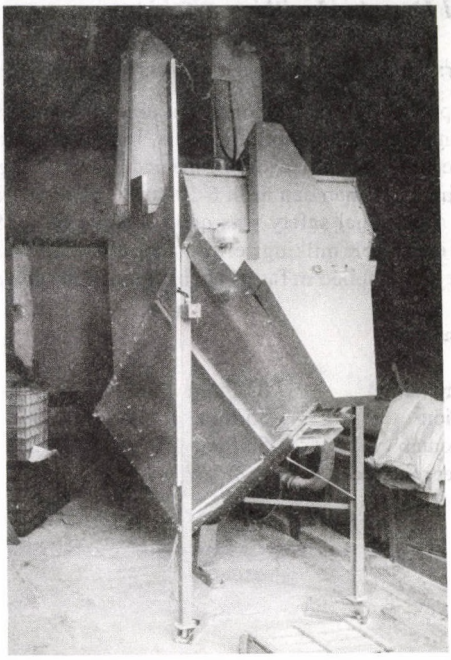
Piko-180 IV extruder

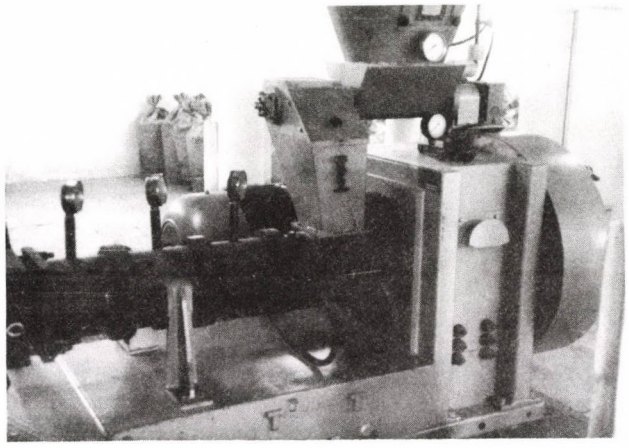
Manufacturer: Walter Maschinenban GmbH, Germany

The Piko-180 IV extruder is suitable for mechanical and hydro-thermal processing of grain products. On the basis of the tests the Piko-180 IV machine showed higher output (1.0-1.2 t/h) than the nominal one, in the case of processing of pulses and other grain products. The specific energy consumptions – regarding the most important procucts – were 43,3 kWh/t for soya, 60.6 kWh/t for maize and 61,8 kWh/t for wheat. Besides this, the values (physical, toxicological) of quality of the processed materials also proved suitable on the basis of the tests. Concerning the output the energetic and quality work as well as the operational safety the Piko-180 IV extruder belongs to the well-suited category.

Main technical data:

Nominal output	0.8 t/h
Parametes of augers can be built-in:	
Lngth	75-218 mm
Thread pitch	62-86 mm
Revolution	960 r.p.m.
Built-in electric power	80 kW





SKIOLD COMPACT-500 feed mill and mixer

Manufacturer: SKIOLD Maskinfabrikken, Denmark

The SKIOLD COMPACT-500 milling and mixing equipment is suitable for mixed animal feeds production according to specified composition, using 4 different basic materials as well as concentrate or premix.
The precise feeding of the basic material sucked automatically is done by metering elements.
In the case of well-homogeneous feed production the output of the equipment is 260-400 kg/h, depending on the premix or concentrate. The specific energy consumption was between 6,88 and 9,92 kWh/t, according to the feeds.

Main technical data:

Nominal capacity	500 kg/h
No. of suction heads	3
Electric power requirement of the mill	4 kW
Volume of mixing container	1200 litres
Electric power requirement of the mixer	2,2 kW

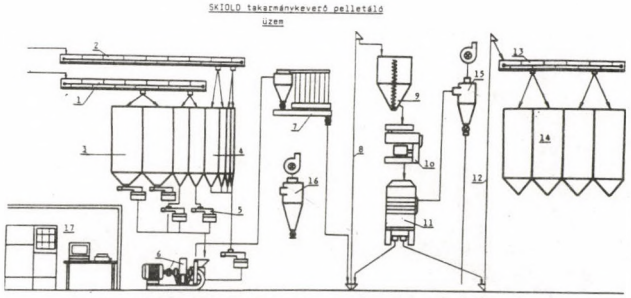
SKIOLD FEEDTRONIC fodder mixing and pelleting plant

Manufacturer: SKIOLD Maskinfabrikken, Denmark

The SKIOLD fodder mixing plant is designed to produce pelleted mixed animal feeds, using different grain basic materials and concentrate, according to a prescribed composition, as well as to store the fodder temporary.
The technology based on the FEEDTRONIC system is a continous, miling, pre-mixing and pelleting system with mass-oriented feed ing.
The plant can maintain 5-5,5 t/h output in continuous operation. The utilization of the operational time is 90-100%. The energy consumption of the plant is 21.5-24,2 kWh/t.

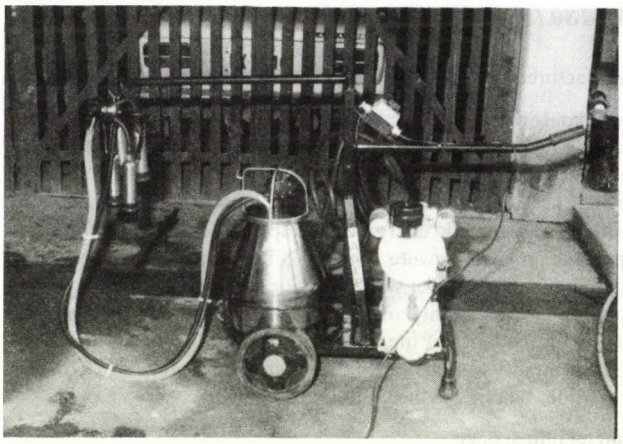
Main technical data:

The nominal output of the plant	5 t/h
Volume of pre-stores	136 m^3
Volume of after-stores	136 m^3
Overall dimensions	15x6x13 m
Built-in electric power	206 kW



1. láncos szállító 2. Láncos szállító 3. Tárolótartály (szemes) 4. Tárolótartály (koncentrátum) 5. SKIOLD-TOMIX adagoló 6. Kalapácsos darálo 7. Porleválasztó ciklon 8. Serleges felhordó 9. LAMIX keverő 10. MATADOR pelletálógép 11. Hűtő 12. Serleges felhordó 13. Láncos szállító 14. Készteméktároló 15. hűtőventillátor + ciklon 16. Porelszívó ventillátor + ciklon 17. Üzemirányitás (FEEDTRONIC)

FARMER-1 household milking machine



Manufacturer: VAGÉP Nyíregyháza, Hungary

The vacuum pump of the milking device is able to deliver 85 litres of air per minute after 200 working hours, but reserve air is not available. The milking cup size joining the udder is large, regarding the tested animals. A man can milk 6-10 cows per hour with this machine. Its operational safety was quite suitabla (K_4=0.98). In operation the expectable milking performance is 0.4-2,5 l/min. The milker can be well-applied in farms having one or two cows.

Main technical data:

Vacuum pump output	83 l/min
No. of pulsation	55/min
Operating vacuum	5 kPa
Electric power required	0.75 kW

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