

# DETERMINATION OF LACTATION CURVES ON THE BASIS OF DAILY AND MONTHLY MONITORING

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The authors seek for the answer to the question how the lactation curve of dairy and monthly production - monthly milking frequency - dairy and monthly production - influence the lactation curve in the future for the country in milk yield measurement is effected.

According to the above, to predict the individual milk production of the cow, we determined on the basis of monthly lactation curves. Lactation curve, monthly production, lactation curve (LRC) is used with an aim to show how to predict the curve may be over a high as 2% under the conditions.

Based on modeling and measurement the authors arrived at the conclusion that a model to be developed for the accuracy will greatly increase if it will be compared data in question system in the case of low milk yield measurement data.

# COMBINED ENERGY TRANSFER (MICROWAVE-CONNECTIVE) BY DRYING OF AGRICULTURAL MATERIALS

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The microwave heat transfer is a considerably more advanced process in comparison to the traditional method as a result of the possible quantity of the energy source which is transportable in the mass and the material, uniform temperature distribution, developing in the material. With the help of this method, microwave procedure can be carried out faster when applying a continuous technology and a lower energy consumption is also achieved a better product quality. The fundamental problem of the microwave material processing is to assure the uniform distribution of the electromagnetic field. According to the one possible version of the known methods and technical solutions, the uniformity can be increased by introducing the microwave energy into the operating field at two separate fixed places. In the procedure developed for us this technology was improved with a uniform mixing of layers in the inhomogeneous electromagnetic field produced by moving the vibrational layer of the material under treatment. Since the effective relative loss factor ( $\epsilon''_{eff}$ ) of the food powders is generally low, therefore, the degree of the energy absorption was increased by treating the material, in the course of this process the agglomeration of the powder takes place and a capillary porous structure is produced which considerably increases the solubility characteristics. A beneficial effect is also attained as a result of the release of the intrinsic energy in the form of heat.

# INTERPRETATION OF THE DRYING CONSTANT IN MICROWAVE DRYING

Dr. J. Bak  
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Drying experiments were carried out using a special microwave source for various drying kinetics of corn, carrot and potato samples. The process of internal moisture and heat transfer was analyzed in the light of the experimental data obtained. It was found that the modified exponential law describes the water removal process of materials within an isothermic conditions during the specific microwave performance in the drying time for the internal moisture movement. Applying the modified exponential law the drying constant has a key role.

# INVESTIGATION OF WHEAT KERNEL HARDNESS OF DIFFERENT VARIETIES BY MEANS OF MEASURING GRINDING RESISTANCE

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The  $\sigma$  (kWh/t) and  $\epsilon$  (g/kg) specific grinding energy demand shows up right in the beginning of the grinding process. The  $\sigma$  (kWh/t) and  $\epsilon$  (g/kg) specific grinding energy demand values between 1.9-2.2 kWh/t and 0.2-0.3 g/kg, respectively, are typical for the average soft wheat varieties. The variety 'Köszegi Kisbuda' has the average grinding resistance  $\sigma = 1.7$  kWh/t and  $\epsilon = 0.17$  g/kg. At the same time the viscosity of these varieties is the highest, 7.4 and 8.6 g/g. At a similar viscosity the varieties 'Köszegi Kisbuda' and 'Köszegi Kisbuda' are the best, with the lowest values for the  $\sigma$  and  $\epsilon$  parameters. The  $\sigma$  and  $\epsilon$  parameters of the softest varieties are 1.9-2.2 kWh/t and 0.2-0.3 g/kg, respectively.

# THE MYRIAD-MINDED WATER

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Special structure of water and its bio-effect has been discussed in our present paper. Electrostatic effect could modify the geometric arrangement (cluster structure) of water molecules. This influence could be positive or negative for the bio-systems, having large amount water content, depending on the character of interaction. We clarified the strong effect of magnetic (vector-) potential on the properties of water: its evaporation-energy, viscosity and surface tension depends on the treatment. Our strategic aim to use these results in agriculture.

## INTERPRETATION OF THE DRYING CONSTANT IN MICROWAVE DRYING

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Drying experiments were carried out using a special microwave surface to examine the drying kinetics of corn, carrot and potato samples. The process of internal moisture and heat transfer was analysed in the light of the experimental data obtained. It was found that the modified exponential law describes the water removal process of materials within an acceptable confidence range when the specific microwave performance is the driving force for the internal moisture movement. Applying the modified exponential law the drying constant has a key roll.

## INVESTIGATION OF WHEAT KERNEL HARDNESS OF DIFFERENT VARIETIES BY MEANS OF MEASURING GRINDING RESISTANCE

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The  $e_s$  ( $\text{kWh}\cdot\text{cm}^{-2}$ ) specific superficial grinding energy demand shows up significant deviations depending on the wheat variety, if  $e_g$  ( $\text{kWh}\cdot\text{t}^{-1}$ ) simple specific grinding energy requirement varies between [ $e_g = 1,9...2,1 \text{ kWh}\cdot\text{t}^{-1}$  e.i. remains roughly constant around  $e_g \cong 2,0 \text{ kWh}\cdot\text{t}^{-1}$ .

The variety Jubilejnaja 50 and GK-Öthalom have the average „grinding resistance”:  $e_s = 0,566...0,541\cdot 10^{-7} \text{ kWh}\cdot\text{cm}^{-2}$ . At the same time the vitreosity of these varieties is the highest: 79,4 and 81,0 %

At a similar vitreosity the varieties GK-Duna and GK-Tavaszi are just on the fourth and fifth places, while the Izabella milling mixture of unknown varieties with its 59,9 % has the third, quite high „grinding resistance”. Probably this was caused by the subjective uncertainty of the diaphanoscope measuring method.

Finally the softest variety became GK-Kata having the smallest specific grinding energy consumption:  $e_s = 0,275\cdot 10^{-7} \text{ kWh}\cdot\text{cm}^{-2}$ .

## THE MYRIAD-MINDED WATER

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Special structure of water and its bio-effects has been discussed in our present paper. Electromagnetic effects could modify the geometric arrangement (cluster structure) of water molecules. This influence could be positive or negative for the bio-systems, having large amount water content, depending on the character of interaction. We clarified the strong effect of magnetic- (vector-) potential on the properties of water: its evaporation- energy, viscosity and surface tension depends on the treatments. Our strategic aim to use these results in agriculture.

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The authors seek for the answer to the question how the controlling milking frequency - daily and monthly monitoring - influences the lactation curve determination as the accuracy of milk quantity measuring is effected.

According to the domestic practice the individual milk production of the cows are determined on the basis of monthly controlling milking. Mechanical milk quantity measuring instrument (TRU-TEST) is used which has an error less than 2 %. In practice the error may be even as high as 5 % under extreme conditions.

Based on modelling and measurements the authors arrived at the consequence that it is enough to use less expensive 3-5 % accuracy milk quantity measuring devices with computerised data acquisition systems in the case of two milk quality measurement daily.

## COMBINED ENERGY TRANSFER (MICROWAVE-CONVECTIVE) BY DRYING OF AGRICULTURAL MATERIALS

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The microwave heat transfer is a considerably more advantageous procedure in contradiction to the traditional methods as a result of the possible quantity of the energy stream which is transportable in the mass unit of the material and the uniform temperature distribution developing in the material. With the help of this method numerous procedures can be carried out faster when applying a continuous technology and a lower energy consumption as well, ensuring a better product quality. The fundamental problem of the microwave material processing is to assure the uniform distribution of the electromagnetic field. According to the one possible version of the known methods and technical solutions, the uniformity can be increased by introducing the microwave energy into the operating field at two perhaps three places. In the procedure developed by us this technology was improved with a uniform mixing of layers in the inhomogeneous electromagnetic field produced by moving the vibroaerofluid layer of the material under treatment. Since the effective relative loss factor ( $\epsilon''_{\text{eff}}$ ) of the food powders is generally low, therefore, the degree of the energy absorption was increased by rewetting the material. In the course of this process the agglomeration of the powder takes place and a capillar porous structure is produced which considerably increases the solubility characteristics. A bactericidal effect is also attained as a result of the release of the intensive energy in the form of heat.

## EFFECT OF TECHNICAL CHARACTERISTICS ON THE QUALITY OF PELLETS

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The quality of pelleted fodder mixture as end-product depends on number of factors. Knowing of the influence of these factors has a basic importance in order to produce pellets of physical characteristics that can preserve their shape and low inclination to shredding during transport storage and other processing before using them up.

Problems of industrial scale pellet producing and influence of technologies have been experienced for many years of testing carried out at our Institute. Taking the above mentioned into consideration investigations were carried out concerning material characteristics as well as some parameters of the machine of pellets in the frame of number T 013144 theme.

## FAILURE AND WEAK POINT ANALYSIS OF COMBINED HARVESTER

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The **failure** is that **state** of a product in which the product can not meet the prescribed functions, except if this state occurs during the preventive maintenance or any other planned activity or it takes place in the lack of external resources. The product reaches the failure state as a result of breaking down by exceeding the failure limit.

The **failure analysis** discovers the failure frequency, cost, type, reason, consequence and other characteristics with the aim of making the appropriate executive measures. So it is focused on the failure. In the failure analysis the mechanism of breaking down (the steps of failure formulation) is followed in reverse order:

**failure phenomenon** → **type of failure** → **reason for failure**

## APPLYING TWO-VARIABLE ENERGETIC FUNCTIONS IN FEED GRINDING (OTKA 016124)

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Three most important theses of the formerly developed energetic equations of feed grinding were managed to verify:

- 1)  $e_g$  ( $\text{kWh}\cdot\text{t}^{-1}$ ) specific grinding energy requirement vs.  $\bar{x}_g$  (cm) grist particle mean size,
- 2)  $e_s$  ( $\text{kWh}\cdot\text{cm}^{-2}$ ) specific superficial grinding energy consumption vs.  $\bar{x}_g$  (cm) grist particle mean size,
- 3)  $e_g$  ( $\text{kWh}\cdot\text{t}^{-1}$ ) specific grinding energy requirement vs.  $\Delta a_g$  ( $\text{cm}^2\cdot\text{g}^{-1}$ ) grist specific surface increase.

## ANALYSING CHOPPED GREEN MAIZE FORAGES BY THE FRACTIONS

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Nutrient intake of cattle and the efficiency of its protein transformation depend on several factors. Most important among

them are the feed value and the physical form structure. Concerning the optimal nutrient composition of forage, accurate data stand at our disposal, while the physical structure (particularly in case of chopped forages) forms subject of debate. Disagreements derive from different requirements on the structure of forage. The guided fermentation process taking place during conservation, demands the least chaff-dimension due to the proper compressibility of silage.

## NEW METHOD AND EQUIPMENT FOR CURING OF FLUE-CURED TOBACCO

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In Hungary many types of curing barns are used for production flue-cured tobacco. In these equipments the air-circulation is the usual (from bottom to up), which is not advantageous in the rack-type barns. In the old equipments there are big fans with too much air-volume and high velocity.

In our institution a curing system has been developed. It means a new curing method and equipment, which in an energy-saving and multi-purpose construction. Briefly, it means a counter air-circulation (from top to down). It favours to the water-loss of the tobacco-leaves, arranged in the racks.

The curing equipment is complex, installed with special heat and sun trap, and can be used out of the curing season, for example as a greenhouse in spring.

The measurement of some components has shown that there is a close relationship between the quality categories and the chemical characteristics of flue-cured tobacco. The amount of reducing sugar and total nitrogen varies considerably, depending on the curing schedule. The nicotine content does not change significantly. This means, that we are not able to influence the nicotine content by using this curing technology. Another result is clear, that the quality alters at different ripening levels.

In Hungary it is very important to improve the quality of flue-cured tobacco. The author hopes that the new (advanced) applied curing schedule can contribute to it.

## PROBLEMS AND POSSIBILITIES OF HUNGARIAN AGRICULTURAL INNOVATION

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According to the classical opinion, innovation is the **engine of development**. How can one renew its activities, products/services and how can adjust itself to the newest challenges? It is especially important in a competitive environment.

Dealing with innovation just now is **actual**, because Hungarian economy and agriculture have been in a deep crisis for years and it seems that the needed „power concentration” is missing. The present Hungarian recession could be considered, as a period of preparing for the prosperity, but it is to be feared that the lack of innovation results an unbeneficial situation for the participants of the Hungarian economy, which has an intention of integration.

The Hungarian agriculture badly needs innovation processes to improve its competitiveness, which has been impoverished during the last years.

## ORIGIN OF PINK-NOISE IN BIO-SYSTEMS

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The pink- ( $1/f$ -) noise is one of the most common behaviour of the bio-systems. Our present paper is devoted to clarify the origin of this interesting fact.

Recently much attention has been given to the theoretical and experimental studies of the self-organisation processes in various physical, chemical and biological systems. The living system is self-organising, which could be realised by a random stationary stochastic processes.

The self-organising procedure connected by the time-fractal and a special noise, which has a power spectrum definitely reversibly proportional with the frequency, ( $1/f$ -noise or pink-noise, or Flicker-noise).

A new physiology (so-called "Fractal Physiology") has been developed in the last few years. It is well known that there are some new diagnostic methods, which are checking the noise spectrum of the bio-systems to control their proper function.

## AN EXAMINATION OF THE ROLE OF FAMILY FARMS AND FACTORS AFFECTING THEIR STANDARD OF LIVING DURING THE PERIOD OF HUNGARIAN AGRICULTURAL TRANSFORMATION (T-024079 OTKA)

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Concomitant with the economic and social changes in agriculture in central- and eastern-Europe in the 1990's was a change in the nature of the concept of ownership. As a result of this, both forms and means of measurement in farming underwent change. In this period of transformation, in place of the then-existing Production Cooperatives, economically and socially divergent forms of business, reworked cooperatives and family farm units began to appear.

During this time, as a result of the agricultural transformation, more than 1,800,000 households came into control of land. They owned more than 50 % of land. This percentage of ownership does not reflect the level of the farming economy.

The average size of holdings in the EU during this same time of those who pursued a living in agricultural production as their main occupation, thus considered as earning their living in this way, were: in Great Britain, 109.7 hectares; France, 44.8 hectares; Germany, 28.9 hectares; Denmark and Spain, 22 hectares; Italy, 9.3 hectares; Portugal, 8 hectares; and Greece, 6.4 hectares. Within this, on the long term, a tendency toward concentration of holdings and growth in economic size is characteristic of the member states.

In the wake of the economic and social changeover in Hungary, during this period a significant growth was experienced in the change in the percentage of those managing above 20 hectares, as well as in their absolute number.

## INVESTIGATION OF FORESTRY DEEP SUBSOILING BY THE FINITE ELEMENT METHOD

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The finite element method was used to study deep cutting of sandy loam soil by a forestry deep subsoiler. The numerical analysis was performed with a COSMOS/M finite element software. The material of the soil was considered as elastic-perfectly plastic. Therefore, the Drucker-Prager elastic-perfectly plastic material model was adopted with the flow rule of associated plasticity. The material and geometrical non-linearity of soil were taken into account. Soil-tool interaction was simulated adopting the Coulomb's law of dry friction. The draught and vertical forces, vertical and forward soil movement and stress distribution fields were reported. The total vertical force was negative in direction due to the high negative vertical force of the shank, which would have pushed the subsoiler upwards. However, the wing total vertical force was positive in direction.

## SOME QUESTIONS OF MANUFACTURING OPTIMAL SPECIFIC WEIGHT MACHINES

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The Department of Machine Manufacturing and Repairation Technology has been dealing with the questions of material and energy saving manufacturing of agricultural machines for one and a half decade. At present the actuality of the topic needs no evidence, but the situation was not always the same in during the development of the industry. Now the effect of the machine fabrication is surveyed in the areas of material and energy saving as well as the environment protection.

The level of the industry of the country can be characterised by the figures of material used up for the gross national production. According to the reports 185 kg steel was used to produce \$1000 national income in Hungary while the same figure was 80 kg in Germany and 60 kg in Japan. The investigations of the Department proved that the specific weight of the agricultural machines exceeded the average of foreign ones by 20-50 %.

As for saving energy two factors are considered. On the one hand to produce basic material is an extremely energy consuming process, so that reducing basic material and premanufactured product application results in significant energy saving. On the other hand the operation of the lower mass machines needs less energy.

The machine manufacturing has many direct and indirect connections to the environment from the metal mining to the waste material reutilization when the wear out machine is processed. The protection of the fertile soil is exposed in this area what is covered by more scientific fields. In our case it means that the lower specific weight machines compact the soil in less extent. The too high soil compacting is a significant damaging factor of the mechanised agriculture.

In the past nearly one decade delivered considerable changes in the ownership conditions and structure of our industry. As a consequence the differences mentioned have reduced between

the domestic and international machine manufacturing, however there are still problems to improve. Considering that the efforts of development for material saving will provide result rather for the user or the national economy than for the manufacturer, it is important to demonstrate those effects.

## THE USE OF WIND ENERGY IN HUNGARY

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The main task of this research is to measure and calculate the local wind circumstances and to design an optimised blade. The first evaluated wind measurements were made in North-Western part of Hungary. The wind energy is the most preferable in this part of the country. The results and the feasibility study indicates that the wind power plant installation is feasible in case of making some parts in Hungary. There is a way for analysing blade production for local circumstances. We have to take into account the local wind speed and design the optimised blade with inverse design methods.

Nowadays, the use of renewable energy is becoming an important question. Wind energy is currently viewed as one of the most promising energy source. The use of wind energy has no toxic emissions so this matter will be important concerning EU energy norms. Wind energy is an unlimited source of energy. It is not an easy task to choose a site for a wind generator because we have to take into account many factors. The most important factors are wind speed, the energy of the wind, generator type and the feasibility study.

Windmills have been working since the earliest antiquity. The first modern wind turbines driving electric generators appeared at the dawn of the 20<sup>th</sup> century, then spread all over the world. Nowadays the use of wind energy is concentrated on producing electricity.

The moving air has energy, so on site measurements are used for determining the data for installation and technical properties. The first evaluated wind measurements were made in North-Western part of Hungary in Kis-Alföld region in Osztfyasszonyfa. The local wind measurements were made in order to determine the wind speed, the main wind directions and the energy. We have to perform statistical study of local winds, in order to state accurately the wind turbine model to be used and the rated wind velocity to be considered for determining the geometrical characteristics of the wind rotor.

## MACHINERY-DEVELOPMENT OF AFFORESTATION

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Our socio-economic situation has been rapidly changing nowadays and as a result forest management should meet the requirements of the high demands of this new challenge. Forestry mechanisation and forest machinery is also expected to meet the constantly changing demands. Machines and machinery-systems should satisfy the following requirements:

- should be adjusted to the structural changes (in our future forest management machinery should not be the aim of development but only a tool);

- flexibility should be maintained to implement new technologies;
- cost-effective technologies should be supported;
- new technologies should be suitable both for the quality and the environmental requirements.

## YIELD MAPPING

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There are efforts on the development and practical use of different methods and means for precision farming, or rather site specific farming. Site specific farming means a technology according to which the fertilizers, herbicides, seeds are controlled according to the local conditions within the field and tillage operations are performed accordingly, as well.

The yield map of a field, that includes the yield variations within the field, can be a useful source of information and a considerable contribution to the application of site specific farming. At first the efforts were concentrated on yield measurement with combine harvesters (Macy, 1994; Reitz and Kutzbach, 1994), and forage harvesters (Auernhammer et al, 1995). Lately the yield was measured with other machines, such as potato, sugar beet, pea and bean harvesters, as well.

Different Global Positioning Systems (short: GPS) can be used to determine the location of the machines, the combine harvesters, within the field during the operation. This can be performed by the NAVSTAR (Navigation Satellite Timing and Ranging) time and distance measurement navigation system. This is based on minimum four satellites of the 24 NAVSTAR satellites by using the signals of the satellites for the momentary location by a GPS. Such a way the position is determined by three geographic coordinates (longitude, latitude and altitude), therefore three dimensional location can be performed and used for the speed and time measurement at any place along the Earth.

The original high precision signals of the satellites are not available for civil purposes. The maximum error of location can be up to 100 m by the signal available. Therefore some kind of improvement of the accuracy of the signal is needed. For this purpose a GPS is fitted to the combine harvester and a second GPS is located at a point the coordinates of which are known. Assuming that there is an appropriate radio connection between the two GPS a so called differential operation is used to reduce the error to 2 to 5 m. In several developed countries such a differential signal is available via a special radio channel to perform the correction needed. Such a situation exists in some parts of Hungary now and will be soon all over the country, as well.

## ANALYSIS OF FUNCTIONAL MICROPROCESS OF DIESEL ENGINES FOR DIAGNOSTIC PURPOSE

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The effectiveness and economy of the agricultural operations depends on some conditions and parameters of the tractor engine such as: loading factor, technical condition, optimum settings.

During the operation the load and some diagnostic parameters of the engine can be changed. Because of the mentioned parameters are functions of e.g. the fuel consumption, their continuous observation during the operation should be desirable. It means that it would be desirable to find a physical parameter which indicates serviceable informations about the engine operation for diagnostic and energetic purpose. The angle velocity of the crankshaft seems to be a good parameter for this purpose.

## LOGISTIC CONCEPTS FOR ENERGY CROPS

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The availability of adequate logistic systems, which include harvesting, recovery, compaction, transport and storage represents a basic requirement for the utilisation of energy crops as feedstocks for industrial and energy purposes. Each conversion technology has specific requirements concerning dry matter content, shape, size and particle consistency of the raw material. The logistics of the raw materials is the tool to establishing an effective link between agricultural production systems and industrial activities.

Harvesting of agricultural products is always associated with the need of handling, transportation and processing of large volumes. This refers particularly to the harvest of biofuels from annually yielding herbaceous field crops, such as energy cereals, miscanthus, straw and hay. As for these crops, because the total dry matter contributes to the energetic yield, the annual turnover can be extremely high. Moreover, cost-effective combustion units have to exceed a certain size; thus the area for biofuel production and supply has to be relatively large and increases the demand for long-distance transportation in order to meet the

demand of biofuel. Here, the dilemma with biofuels shows quite clearly: while the mass- related energetic density of solid biomass varies only little, the required volume for a single unit of fuel equivalent can easily vary by the factor ten, depending on the method of harvesting or processing.

## AUTOMATIC STEERING CONTROL OF PLANTATION TRACTOR BASED ON IMAGE PROCESSING

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The driving by man in straight line and turning at the end of the row of the plantation demands high concentration which may limit the possible speed of the vehicle. With automatic steering control working speed can be increased and there is no health hazard when working with chemicals.

**The necessary input information for the automatic steering can be taken from the natural surrounding. In the plantations the stems of the plants are the most characteristic objects, the bottom of the stems appear in a straight line. The equation of such a line is not influenced by the distance between the stems.**

In the project described below a CCD camera mounted on the front of a model tractor takes pictures from one side of the plantation row. Evaluating the images in real time the necessary intervention for keeping the vehicle in straight line can be calculated. The basic equations for steering control and the first image processing experiences are presented.

**Keywords:** Automatic steering, image processing, plantation, self-propelled machine, tractor.