



ENGLISH LANGUAGE ABSTRACTS OF PHD DISSERTATIONS DEFENDED
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Development of measurement techniques for precision plant production

MÁTYÁS CSIBA

Dissertation Adviser:

Miklós Neményi, academician, professor and Attila József Kovács, PhD, associate professor

During my research work I was focusing on correction of measurement techniques in precision agriculture and developing new methods, which means a forward step and correction for the field work. Inside this, my aim was: To develop a technique for continuous soil strength measurement, what could be an easy, universal and a useful tool for farmers during site-specific tillage; to find a solution for an autonomous quasi continuous soil water measurement system using TDR (Time Domain Reflectometry) method; to develop a measurement technique for continuous on-line weed detection; to investigate the precision techniques, which can be used in pest control based on helicopter assignment in Hungary and to determine the precision of grain moisture sensors during harvest and map the spatial diversity of protein and oil content of the crop, using AccuHarvest On-Combine Grain Analyzer (Zeltex Inc.).

As a result:

1. I have remodeled the earlier development for continuous tillage force measurement and have expanded it with an ultrasonic working depth sensor.
2. During my investigations I have confirmed the statement that cone index data are not comparable with soil strength data, measured on-line, therefore do not give useful information for practical farm use.
3. I have worked out a measuring method for quasi-continuous soil moisture measurement based on TDR method to fasten the work of hand sampling.
4. I have developed an on-line weed diversity monitoring method for spatial locating of weed occurrence. Using the technology the weed coverage on the field could be determined in a percentage.
5. I have proved that the capacitance grain moisture sensors (if the measured volume changes continuously) are holding a great error.
6. I have examined the opportunities for use of precision techniques in helicopter assignment considering autonomous guidance. We have proved that it could be a useful tool also during helicopter application.
7. I have prepared calibration functions for corn and winter wheat for post correction of grain moisture data, which have been measured by a capacitance sensor using saturation data, what can be determined from continuous sensing of grain tank saturation.



Farm business relations of precision plant production

SÁNDOR KALMÁR

*Dissertation Adviser:
Lajos Salamon, candidate, professor*

Precision plant production is a major agricultural innovation of the past decades. Technology development is faster than the spread of the innovation, mainly because the advantages of practical application are hard to define (due to the differences of the technological elements, or the specific features of different crops and production locations). The spread of precision plant production is influenced by several factors; the dissertation puts the investigation and evaluation of these factors into the focus.

During the research primer and secondary investigations have been carried out. The research has been conducted at the Lajta-Hanság Public Limited Company (successor: Mezort PLC.) and at the University of West Hungary, Faculty of Agricultural and Food Sciences Institute of Farm Business and Management Sciences (and predecessors).

The background of research – and practically the topic selection – has been given at the Lajta-Hanság PLC., where the practical work of the author – as a plant production engineer between 1998 and 2000 – induced further investigations.

New and novel scientific results are as followed:

1. Based on the results of a questionnaire survey it can be stated that significant relation (significance level 80%) can be proved between the age and the intention to introduce new precision plant production technology. Older farmers (above 50 years of age) apply precision technologies with less likelihood, as they think in shorter time horizon (plan for shorter term) and they do not intent to invest human and financial capital that is needed to precision plant production. Precision plant production – certain elements and the whole system – requires IT skills, primarily from the operator of the technology.
2. Educational background and the intention to apply precision plant production technologies also show significant relation. In this case the educational background of the decision-maker at the farm and the operator of the precision technology should be divided. They both play a central role in the application of the technology. The decision-making person realizes and understands the possibilities of precision plant production; the operator of the technology has the necessary basic knowledge that is needed to operate precision tools.
3. Theoretical and practical economic evaluations of precision technologies are supported with the elaborated "Precision plant production investment calculator" model. The "Precision plant production investment calculator" model applies a novel approach: the return of investment of the given precision tool is calculated from the input material savings, while calculations methods are usually based on income data. It should be noted that the model calculates the return of investment of supplementary precision tools that are used to apply input materials (e.g. fertilizer, chemical).



Epidemiological situation of nasal botfly infestation in the Hungarian roe deer population and the biological characteristics of the parasite

ISTVÁN KIRÁLY

Supervisor:

Sándor Faragó, DSc, professor

The fly species that causes the nasal botfly infestation of roe deer has a palearctic distribution, and is widely present in Europe. Our current knowledge regarding the distribution of the named fly in Hungary, the level of infestation of the Hungarian roe deer population in this country as well as aspects concerning the biology of the involved botfly species and its larvae is scant.

The survey regarding the botfly infestation of the roe deer (*Capreolus capreolus*) population in Hungary was performed between 2002 and 2005. During this period, 645 males (roe bucks), 211 females (roe does) and 100 roe kids, thus a total of 958 individuals were examined. The investigations revealed only the presence of *Cephenemyia stimulator* botfly larvae. The prevalence of infestation was 34.6% in case of males, 33.60% in case of females, and 61.00% in case of fawns. The average larval intensity was 8.87 in case of roe bucks, 5.94 in roe does, and 24.50 in case of roe kids. The medium intensity in case of males and females was 5.0, while in case of kids it turned out to be 20.5. Larval infestation was present in all of the ten counties where the survey took place.

There was no significant difference in the infestation indices of the different age groups of bucks, but roe kids were significantly more infested than both males and females, in case of all analyzed infestation indices. The average larval intensity in males was significantly higher than in females, but this tendency could not be observed in case of the other infestation indices.

During the three years of the investigations the infestation indices have not changed significantly. Of the three larval stages L₁ larvae could be found between October and April, while L₂ and L₃ larvae, between April and August. As of April, the infestation indices presented an increasing tendency. The number of L₂ larvae had a constantly decreasing tendency, while the L₃ larvae presented a constantly increasing trend.

The infestation level of roe deer populations living on territories with a higher population density (on better habitats) was significantly higher than of populations living on territories with a lower population density (on worse habitats), in case of more infestation indices. Still, these results of the investigations led to the conclusion that the level of infestation of roe bucks did not influence either the body weight, or the antlers weight.

According to the investigations carried out, the following new scientific result can be stated:

1. In the roe deer population in Hungary the *Cephenemyia stimulator* (Clark 1815) could be general.
2. Roe kids turned out to be significantly more infested than adult roe deer.
3. No significant difference could be observed in the main prevalence, average intensity and median intensity of botfly infestation of successive years.
4. There is no significant difference between field and forest roe deer's larva density.
5. The level of botfly infestation did not influence either the body weight or the antlers weight of roe bucks.



Optimization of heat treatment parameters for duck liver products

ZSÓFIA SIPOS-KOZMA

Dissertation Adviser:

Jenő Szigeti, candidate, professor and Balázs Ásványi, PhD, assistant professor

In this research, heat resistance of *Clostridium* (*C.*) *perfringens* and *C. sordellii* spores and that of *Enterococcus* (*E.*) *faecalis* vegetative cells were tested at different temperatures. Occurring in raw waterfowl livers, *C. perfringens* and *C. sordellii* have a major effect on the shelf life of canned liver products, whereas *E. faecalis* is an indicator organism limiting the shelf life of semi-preserved foods. Based on the results obtained, a technology of manufacture for a specially flavored semi-preserved duck liver product has been developed.

The *C. perfringens* strains tested (i.e., NCAIM B.01417 and NCTC 1265) produced significantly higher ($P < 0.05$) spore counts in the broth proposed by Duncan and Strong (1968) than in the sporulation media developed by Ellner (1956) and Kim et al. (1967). For promotion of sporulation by *C. sordellii* ATCC 9714, the sporulation broth developed by Schaeffer et al. (1963) produced the best results. For lack of literature data, thermal treatments below 100 °C resulting in destruction of *C. sordellii* ATCC 9714 in waterfowl products were established. It was determined that 76.0 min and 22.2 min were required at 90 °C and 95 °C, respectively, to reduce the spore counts of this strain by 2 log₁₀ cycles, which was necessary for the manufacture of safe liver products. According to the literature, a similar degree of reduction in spore counts of *C. botulinum* E is attainable with such a heat treatment. The Z value for *C. sordellii* ATCC 9714 was calculated to be as high as 12.6 °C. The decimal reduction times for *C. perfringens* NCTC 1265 in semi-preserved duck liver ranged from 50.5 min (D₈₀) to 2.2 min (D₉₅). These D values are somewhat lower than those published in the literature. The Z value of *C. perfringens* NCTC 1265 was calculated to be 11.1 °C. Other authors reported Z values ranging between 8.3 °C and 16.8 °C. The media (i.e., culture broth and semi-preserved duck liver) spiked with the tested strains of *C. perfringens*, *C. sordellii*, or *E. faecalis* had no significant influence ($P > 0.05$) on the effectiveness of thermal inactivation processes.