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## Prediction of skip-jack beetles (Agriotes spp.) and wireworms by precision methods

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During the elaboration of my PhD thesis I investigated the numbers of swarming imagos of *Agriotes* spp. *(A. lineatus, A.ustulatus, A. obscurus, A. sputator, A. rufipalpis)* in the fields outside the village Himod near Kapuvár during a period of three years (2005, 2006, 2007) with the use of YATLOR funnel" (Yf), CSALOMON VARb3 type sex-pheromone traps. The habitat of skip-jack beetle larvae is the soil, where they feed on grown crops and on the roots of the weeds as they are polyphagous. Their damage depends on their numbers calculated per $m^2$. Therefore it is necessary to know their numbers in the soil and if their numbers reach or exceed the risk threshold (2–3 pcs/$m^2$). To estimate the numbers of larvae I used the mechanised quadrate volumetric method (forest drill hole and shovel bucket dipping). Wireworms occur in most of the cases in clusters. They can be found in areas chosen by the females that are suitable for egg-laying in groups and offer favourable ecological conditions for the embryonic development. I marked the sample taking sites according to the checkerboard pattern and stored them with precision methods. Besides the samples I measured the featuring parameters of the habitat among them the soil water capacity and soil resistance together with the liquid limit fixed by Arany. Further on I estimated the weed covering particularly the occurrence of field thistle *(Cirsium arvense).* Using the method of comparison, statistical evaluation of the range of data acquired during the 3 years of survey I managed to estimate the connection between the numbers of wireworms and the measured parameters of the habitat. The economic benefit of the method is that we can mark the parts of the fields, where it is advisable to carry out soil disinfection for the sake of preventing damages.

New scientific findings are as follows:

1. I was the first to use species specific sex-pheromone traps to catch swarming skip-jack beetles in the fields outside the village Himod. Based on the data of catches I could estimate the determining role of the species *A. lineatus, A. ustulatus* and *A. sputator.* The published data showed that *A. obscurus* was the dominant species in the years of 1960–70.

2. I could observe that swarming peaks of the species *Agriotes lineatus, A. ustulatus* and *A. sputator* happened in the last decade of May, although there were some little differencies. *A. ustulatus* did not show any swarming peaks.
3. Among the larvae of *Agriotes* species *Agriotes lineatus* dominated in all three years, but the dominancy of *A. obscurus* larvae was very low similarly to the imagos.
4. The ditcher is most suitable for sample taking under natural conditions, because we can estimate the numbers of wireworms that live in the soil more precisely and it does not damage the wireworms lifted together with the soil.
5. The low constancy of the wireworms and their variable abundance on the sampling sites prove their cluster-like spreading in the soil.
6. In all three years I could confirm a close positive correlation between the numbers of wireworms and the weed covering *(Cirsium arvense).*
7. There is a strong positive correlation between the numbers of soil living larvae and the soil water capacity. Soils of a water content of higher than 60 V/V% are more optimal for the living conditions of wireworms than those lower than 40 V/V%.
8. Based on the liquid limit fixed by Arany and the values of soil resistance there is a negative correlation between the soil resistance and the density of the wireworms.
9. Based on the research results and with the use of statistical methods we can estimate the localisation of the numbers of wireworms in the soil, which can greatly influence the needs for soil disinfection.
10. If we apply precision crop growing we should take into account the localisation of wireworms and as a result we can save significant costs of operation.

# Improvement of economic efficiency of slaughter pig production with utilizing by-products from arable crops processing for energetic purposes

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Concerning the use of by-products (rapeseed cake, DDGS) obtained from the biofuel (bioethanol and biodiesel) industry, numerous feeding trials with animals have been conducted up to now worldwide. Doing our own research work, there were 120 Hungarian Large x Hungarian Landrace x Seghers pigs examined in feeding trials. Feeds used in these trials (fattening I. and II. phases) contained 6.8% and 8.5% of rapeseed cake, as well as 8.4% and 10.5% of DDGS. Through utilizing rapeseed cake and/or DDGS, the soybean meal – as a basic component of fodder mixture – was highly substituted by these by-products. Furthermore, feed supplements (e.g. L-lysine HCL) – in order to ensure the same nutrient content of the experimental mixtures – have been used, as well. The overall conclusion that can be drawn is that the use of these by-products – under the conditions required – is an effective tool of improving competitiveness of slaughter pig production. New scientific findings are as follows:

1. The partial substitution of extr. soy with rapeseed cake and DDGS has no unfavourable effect on the performance of fattening. Treatments had no significant impact on carcass quantity, while seasonal effects ($P < 0.01$) influenced it sharply.
2. Relying upon the cost to income calculations of our own experimental findings, the rapeseed cake does not improve the economic efficiency of slaughter pig production, but DDGS improves it considerably.
3. The application is only recommended optionally, as the development of cost-revenue relations is significantly influenced by the extent of substitution and/or the change in (resource) prices. The use of our own model indicates how the gross profit margin ratio can be improved according to the increasing DDGS/rapeseed cake levels in mixtures, as a result of the more favorable economic (cost to income) circumstances.
4. The results of the actual research and the simulation model highlighted that further research should be carried out to investigate the application possibilities of ”DDGS” separately, or examinations on the application possibilities of ”DDGS” combined with oilseed cake are reasonable.

## Development of a biological preservative of good efficacy for the preservation of medium and hard fermentable forages

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Roughages play an important role in the feeding of ruminants both in terms of nutrition physiology and economics. However the majority of feeds at harvest are not in air-dry state, so it is necessary to preserve them until use. One possible way of preservation is the fermentation. However, for this the natural fermenting ability of some forage shall be improved by using additives (e.g. biological preservative). The use of biological preservatives is spreading nowadays, to improve the natural fermentation capability of forages.
The objective of the dissertation was to develop an efficient carbohydrate-based biological preservative, which is suitable for the production of good quality and stable silages from moderate and hard fermentable green forages, with a high security, low losses and a good lactic acid:acetic acid ratio.
Because feedstuffs, rich in fermentable carbohydrates are not available in sufficient quantities in our country, we designed to provide the necessary carbohydrates by the enzymatic breakdown of corn starch. We planned to do it not "in situ" in the silo, but under controlled conditions (temperature, pH). Later on the hydrolyzed and dried corn meal product shall be added to the green alfalfa or grass before ensiling. The energy demand of enzymatic hydrolysis is greatly affected by the amount of energy, used for heating up the water to 90 $^{o}$C, added prior to the corn meal for setting the DM content of the medium. Most of this energy can be saved if we use e.g. hot whey (80–85 $^{o}$C), a by-product of the ricotta cheese manufacturing, instead of water for adjusting the DM of the medium. In addition to energy efficiencies, this also has the advantage that the fermentable sugar content of the hydrolysate can be further increased. When determining the whey proportion of the mixture we assumed that the lactose content of the ricotta whey should increase substantially the reducing sugar content of the preservative, but the DM content of the mixture should not exceed 30%. A proportion of 1 kg corn meal and 2.5 kg whey proved to be favourable. Next to the carbohydrate components (hydrolyzed corn meal and ricotta whey) another essential component of the preservative designed is the freeze-dried bacteria culture, which is responsible by changing the racial composition of the epiphyte microflora for the control of the fermentation process.
The fermentation dynamic experiments were performed with green alfalfa and grass wilted of varying degrees. In these experiments we examined the effect of bacterial inoculation combined with hydrolyzed corn meal supplement and with hydrolyzed corn meal and ricotta whey supplement on the fermentation parameters in the function of fermentation time.
Based on the results of the investigations the following new scientific results can be stated:

1. Developed a combined enzymatic hydrolysis procedure by which 90% of the corn starch can be broken down into reducing sugars within 20 hours.
2. Developed a procedure for the use of the ricotta whey, a by product of cheese making, as a silage aid.
3. Based on hydrolyzed corn and ricotta whey developed an efficient biological preservative for the preservation by ensiling of the medium and hard fermentable green forages.
4. In fermentation dynamic experiments determined the dry-matter dependent dose of preservative, by which from green alfalfa or grass a stable silage of low losses and of favourable lactic acid:acetic acid ratio can be produced.

# A survey of employment trends in cattle raising farms

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Cattle breeding is a significant and decisive branch of agriculture with strategic importance both in Hungary and in the world.

Large scale cattle raising takes place in farms with modern conditions and of technologically – technically high standards. Due to sector- and plant management and planning tasks attention is concentrated on the efficiency of human resource management.

In Hungary a significant quantity of milk is produced in specialized agricultural farms which were established 30–40 years ago with a technical and architectural structure and management typical for the time. They have been only restructured sometimes instinctively in response to the force of quickly changing conditions and circumstances.

Considering the present trends problems in connection with employment in cattle raising farms may arise in the long run (within 10–15 years) but even in the short run (within 3–5 years) as well which may make the development of milk production, in extreme cases its maintenance untenable.

Powerful influences of social processes can be felt in the cattle raising plants analyzing the indicators of age and qualification of the employees. These trends are intensified by those rooting from the character of the jobs and their circumstances. At sectoral and plant level tremendous human resource reserve is to be exploited with purposeful management of work, plant management and training in order to maintain the competitiveness of the sector.

The scientific results of the research are the follows.

1. The methodology of the survey what is the complex order of analysis of employment it contains the analysis of demographic data, the survey referring to training, the survey and analysis of work done and research on personal references, attitude, motivation and expectations with the help of questionnaires.
2. Cattle raising farms total up to a major part of milk production, their employees compared to national demographic average show significant ageing. This situation within 3–5 years may threaten to maintain production unless this trend changes.
3. Employees' motivation and system of expectations show though they belong to a socially sensitive and utterly vulnerable layer it is not the material disbursement what matters first for them. It is rather the content of work and working with animals their closeness what counts. This being recognized is of significant importance in motivation and recruiting new employees.
4. Four job groups can be separated in cattle raising farms which contain those jobs which are considered to be homogeneous regarding their content, conditions, economic goals impact on production and the scope of knowledge necessary to perform tasks these are jobs in connection with milking (animal products) farm or farm management. Practical utility of job groups (activities) in labour force planning and human resource development strategy is significant.

5. The research defined the frequency and significance of work activities, the number of workers carrying out the activities that is the degree of specialization in cattle raising farms in Hungary. Accordingly it is necessary to separate almost each general or special activity done by each employee or group of employees the scopes of activities.
6. The comprehensive analysis of vocational training shows that trainings providing qualifications for employees at cattle raising farms pose only as possibilities but their realization in time and content is unbalanced and does not serve labour force supply.

## Improving N-3 fatty acid content of bovine milk by feeding

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Some important nutrient contents and the fatty acid profile of bulk milk samples delivered to a cheese factory located in western part of Hungary were evaluated in a 2-year-long study. Results confirmed that milks from Hungarian cattle farms appear to be lower in nutritionally beneficial n-3 fatty acids (e.g. linolenic acid-C18:3; docosapentaenoic acid C22:5) and c9,t11-C18:2 (conjugated linoleic acid, CLA) compared to international scientific literature. In situ and rumen fermentation model studies were carried out using two fish oil based omega-3 products produced by different coating technology. The efficiency of rumen protected supplements with special fatty acid compositions was evaluated using different preserved fodder based diets (maize silage-alfalfa haylage; grass haylage-alfalfa haylage) in dairy cows feeding. It was stated, that the experimental diets significantly ($P < 0.05$) improved the rate of the most important n-3 fatty acids (e.g. C18:3, C20:5, C22:5) and the tested CLA isomers (e.g. c9,t11-C18:2; t10,c12-C18:2) in milk fat. The high concentration of trans-fatty acids (TFA) measured after feeding experimental diets showed a gradually decreasing trend. This draws attention to the experiments of which aim is to modify the fatty acid composition of milk it is advisable to use longer experimental period.
New scientific findings are as follows:

1. For each of the seasons statistically proved differences were found in the fatty acid compositions of bovine bulk milk samples examined during different periods of years (spring, summer, autumn, winter) regarding all the saturated fatty acids (SFA) analyzed – except for heptadecanoic acid (C17:0) – and in respect of linoleic acid (C18:2) and eicosatrienoic acid (C20:3) levels of the polyunsaturated fatty acids (PUFA).
2. According to the results of in situ experiments the omega-3 fat product II developed by a special coating technology showed 70.5% effective fat stability. No unfavourable effect was detected on some parameters of ruminal fermentation (pH, $NH_3$, short-chain fatty acids, SCFA concentration) when the amount of 2.2% in daily DM intake of omega-3 fat product II was applied.
3. Besides feeding of grass haylage-alfalfa haylage-corn meal based diet the 0.5 kg/day unit of the fish oil based omega-3 product II significantly ($P \leq 0.05$) improved the rate of the n-3 fatty acids and the tested CLA isomers in the milk fat. The experimental diet had no negative effect on the organoleptic properties (smell, taste, colour) of the pasteurized milk samples.
4. In experiments aiming to modify the fatty acid composition of milk longer experimental periods (10 weeks or longer) are suggested to set up, because in the early phase of the trials trans vaccenic acid (t11-C18:1) and elaidic acid (t9-C18:1) appearing in an extremely high concentration showed a gradually decreasing tendency during the experimental period lasting for 10 weeks.