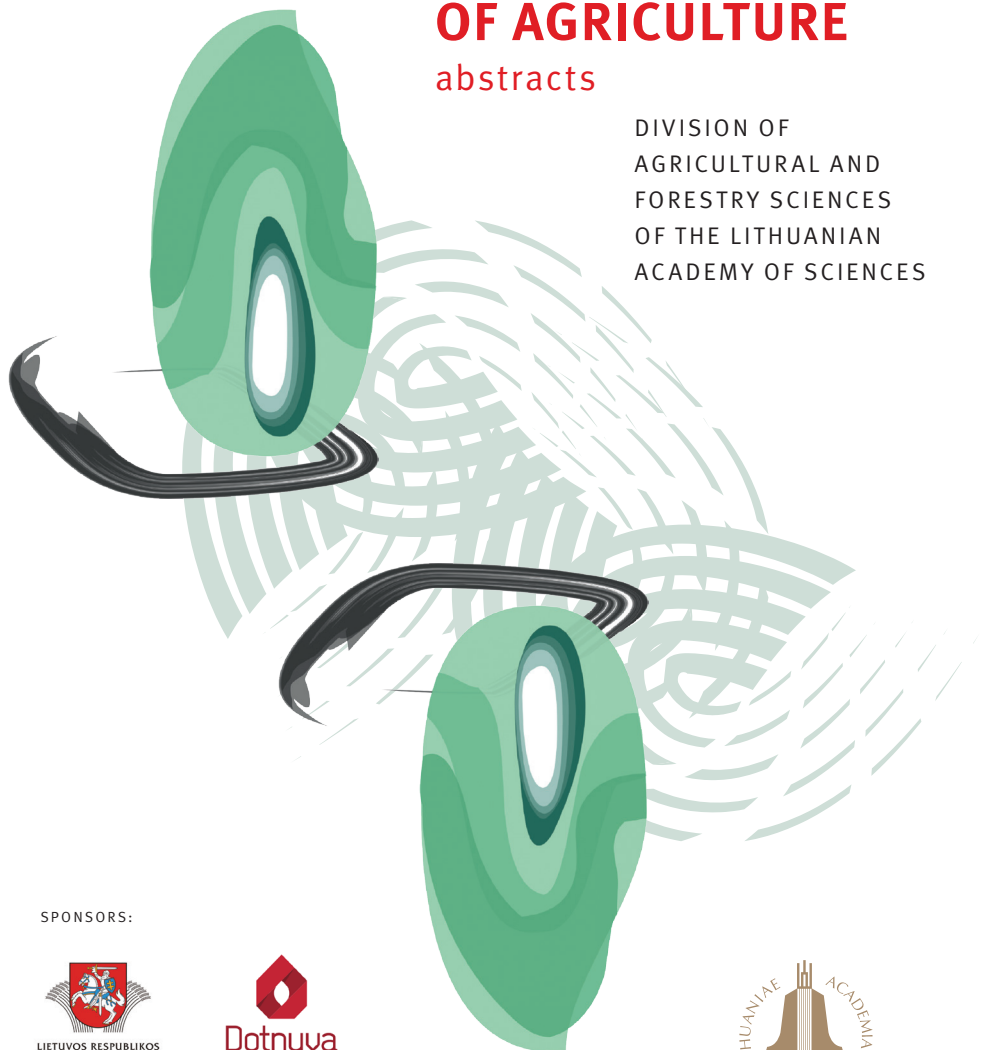


International Conference  
of Young Scientists

# YOUNG SCIENTISTS FOR ADVANCE OF AGRICULTURE

abstracts

DIVISION OF  
AGRICULTURAL AND  
FORESTRY SCIENCES  
OF THE LITHUANIAN  
ACADEMY OF SCIENCES



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AGRICULTURAL AND  
FORESTRY SCIENCES  
OF THE LITHUANIAN  
ACADEMY OF  
SCIENCES

2017

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# FOREWORD

The Division of Agricultural and Forestry Sciences of the Lithuanian Academy of Sciences is organizing the 6th Conference 'Young Scientists for Advance of Agriculture'. The aim of this traditional conference is to rally young researchers working in the fields of agronomy, forestry science, animal science and veterinary medicine, agricultural engineering, food safety and quality, agrarian economics and rural sociology, and to encourage their cooperation and the dispersion of the results of their research. This year it is an international conference the objective of which is to promote international collaboration of young scientists and exchange of up-to-date research results achieved by Lithuanian and foreign scientists.

Participants of the conference are doctoral students, junior research fellows, lecturers, and master's students engaged in scientific investigation at research and educational institutions of Lithuania, Latvia, Estonia, and Poland. This year, there are authors from Belarus, Ukraine, and Syria. This publication contains abstracts of the 34 papers delivered at the conference. They are grouped by the sections of the conference and by the order of their presentation.

We hope that the conference will not only facilitate informing colleagues and the general public on the latest fundamental and applied research but will consolidate relations between research and educational institutions of different countries and spark interest of specialists in agriculture and business entities that have expressed considerable interest in the conference and supported its organization. We hope that the conference will play at least some role in generating more recommendations, of better quality and innovative, for the increase of competitiveness in agricultural production and business, and for the enhancement of environmental protection.

We are grateful to the conference participants, partners, and sponsors, and to everybody who has contributed to the organization of the conference and preparation of this publication.

CONFERENCE ORGANIZING COMMITTEE



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# PLENARY SESSION

## DEVELOPMENT AND INNOVATION EFFICIENCY OF THE MUNICIPALITIES IN THE KURZEME REGION

Linda Sunina, Baiba Rivza, Peteris Rivza  
*Latvia University of Agriculture*

Innovations are considered a significant source of competitiveness and development in all countries. Innovation is one of the most widely used concepts in the current literature of economic geography highlighting the importance of regions in innovative development. Regions themselves are targets of numerous policies enhancing a complex interaction between different processes such as education, labour market, and the economy.

Latvia is divided into four historical regions and 110 municipalities and currently, when innovations guide welfare and economy of a certain territory, the municipalities should think of innovation development and efficiency for a smarter economy of the municipality, the region, and the whole country.

There exists some research into the role of innovations in the development of Latvian municipalities. With the help of factor and cluster analysis, the present paper addresses the role of innovations in municipalities of the Kurzeme region. The authors used ten initial factors, such as total density of the road network, the number of registered long-term unemployed, the territorial development index, the number of economically active self-employed people per 1000 residents, the E-index, higher education, number of enterprises in knowledge-based economy (KBE) sector, net turnover of enterprises in KBE sector, employed in KBE sector, and the number of NGOs per 1000 residents. The use of factor analysis can be biased with Kaiser-Meyer-Olkin and Bartlett test values and afterwards initial factors were combined in complex factors and clusters assessing the development and innovation efficiency of municipalities in the Kurzeme region.



# **EFFICIENCY OF OESTRUS SYNCHRONIZATION AND OPPORTUNITIES OF INCREASING THE PREGNANCY RATE IN BEEF HEIFERS**

Audronė Rekešiūtė, Artūras Šiukščius,  
Aloyzas Januškauskas, Henrikas Žilinskas  
*Veterinary Academy, Lithuanian University of Health Sciences*

This report presents data from an experiment the aim of which was to evaluate oestrus synchronization protocols and to compare changes in ovarian structures, oestrus expression, ovulation, the pregnancy rate, and embryo size following fixed-time artificial insemination (FTAI) in beef heifers of different breeds.

The experimental protocol was based on oestrus synchronisation protocols using progesterone-releasing devices, GnRH and FTAI. Angus (n = 8) and Limousines (n = 8) beef heifers of similar age, weight and reared in identical conditions were selected. Starting on Day 0 of the irrespective oestrus cycle stage, all heifers received an intravaginal progesterone-releasing device (PRID DELTA, 1.55g); prostaglandin (DINOLYTIC, 5 mg/ml) was injected intramuscularly 24 h before removing PRID DELTA. The intravaginal device was removed on D7 and simultaneously all heifers were injected GnRH (FOLLIGON, 1000TV) and inseminated 56 h later. The pregnancy rate was detected on D34–38 following the FTAI using rectal ultrasound scanner.

Following the synchronisation protocol, oestrus expression was by 25% higher for Angus heifers compared to Limousines. There were no significant differences between Angus and Limousine heifers in ovulatory follicle size –  $12.6 \pm 0.18$  mm vs.  $12.0 \pm 0.2$  mm. The pregnancy rate was higher in the group of Angus heifers compared to Limousines by 12.5% (62.5% vs. 50%). Angus heifers were assessed for pregnancy on D38 following the FTAI, their average embryo size was  $103.4 \pm 7.7$  mm<sup>2</sup>. Limousine heifers were assessed for pregnancy on D34 and the size of the embryos was  $59 \pm 4.5$  mm<sup>2</sup>.

FTAI protocols increase breeding efficiency in tested breeds of beef cattle.

# TARGETING INDUCED LOCAL LESIONS IN GENOMES (TILLING) NONTRANSGENIC APPROACH TO THE IMPROVEMENT OF WINTER WHEAT

Radvilė Nagrockaitė-Lelešienė, Rita Armonienė, Gintaras Brazauskas  
*Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry*

Wheat has been the main crop grown around the world due to its wide use in food and fodder industries. Many traits important for wheat production and quality would profit from the ability to modify the function of specific genes. ‘Forward genetics’ (from phenotype to gene) and ‘reverse genetics’ (from gene to phenotype) could be used for wheat breeding. Forward genetics requires the cloning of sequences underlying a particular mutant phenotype, while the strategies of reverse genetics seek identification and selection of mutations in a known sequence. TILLING is a new reverse genetic approach for mutation generation and a method that does not rely on transgenic technology. This method is suitable to all organisms but is particularly efficient in polyploidy plants such as wheat. McCallum and co-authors have shown that the TILLING method has an advantage for both functional genomics and crop. With TILLING, a library of DNA samples from thousands of individuals can be screened in a high-throughput manner for induced or naturally occurring single-nucleotide polymorphisms (SNPs).

In this study, we created TILLING population of two winter wheat cultivars ‘Kena DS’ and ‘Gaja DS’ developed at the Institute of Agriculture of the Lithuanian Research Centre for Agriculture and Forestry. With our study we aimed to improve winter wheat freezing tolerance by using the TILLING method. M<sub>3</sub> generation seeds of the mutant population were sown and sprouted to the 3rd leave stage. Then the plants were acclimated for two weeks in a climate chamber at +2°C. After acclimation, the plants were transferred to the freezing chamber where the freezing test was performed. After artificial freezing test, the plants were evaluated. We selected four mutant plants from ‘Kena DS’ cultivar and one mutant plant from ‘Gaja DS’ cultivar, whose survival temperature was lower compared to the wild-type genotypes. Survived mutants were multiplied and an artificial freezing test was repeated to determine the LT<sub>50</sub> value of the mutant plants. We found that LT<sub>50</sub> values of all four ‘Kena DS’ mutants were significantly higher compared with the wild-type plants; however, the LT<sub>50</sub> value of ‘Gaja DS’ mutant plant was lower compared with wild-type genotype. We multiplied this mutant for further genetic analysis to find out what kind of mutations are behind the improved freezing tolerance in wheat.



# CHANGES IN SOIL WATER STABLE AGGREGATE STABILITY DURING SOIL FORMATION PROCESS

Mihkel Are, Karin Kauer, Are Selge, Tanel Kaart, Endla Reintam  
*Estonian University of Life Sciences*

Soil is a valuable resource on which all agricultural production is based. Therefore, to ensure sustainable production it is needed to conserve or even improve the soil conditions with appropriate land management, which otherwise would cause degradation. Once soil is degraded, in the most severe cases, like on former construction sites, closed open-pit mining areas, and eroded slopes, the fertile soil layer is completely missing. In such cases, soil restoration especially for agricultural use, is an extremely time-consuming process. Although soil formation is a natural process, it can be accelerated with appropriate land management. The quality of the restored soil can be measured with its water stable aggregate (WSA) stability, because it directly influences other physical, chemical and biological properties of soil. At same time, WSA is one of the most complex soil properties. To understand this process better, especially in the Baltic region, this study was carried out on a long-term pedogenesis experiment in Estonia near Tartu (established 1964), where initial soil up to 100 cm deep was replaced with organic matter-free moraine. In this study, 0.25–1.00 mm soil fractions from 1966, 2000, 2007, and 2014 were used to determine the WSA by the Eijkelkamp Wet Sieving Apparatus. The study included the following treatments: ( $o_t$ ) – control; ( $B_t$ ) – barley with  $P_{40}K_{75}$ ; ( $B+M_t$ ) – barley with  $P_{40}K_{75}$  and manure; ( $G_t$ ) – perennial grasses with  $N_{150}P_{40}K_{75}$ ; ( $G_t$ ) – perennial grasses with  $N_{40}P_{40}K_{75}$ ; ( $G+N_t$ ) – perennial grasses with  $N_{150}P_{40}K_{75}$ ; ( $WG_t$ ) – white clover and grass mixture with  $N_{40}P_{40}K_{75}$  and ( $HA_t$ ) – hybrid alfalfa with  $N_{40}P_{40}K_{75}$ . The study found that: (1) WSA was highly correlated ( $r = +0.66$ ) with soil organic carbon (SOC) content; (2) WSA and SOC relation was non-linear, by peaking if SOC was 1.44% and decreased thereafter; (3) WSA had a high variability within years, and (4) fertilization, especially nitrogen, increased WSA during the study. In conclusion, NPK-fertilized grass mixtures ( $G+N_t$ ) and/or PK-fertilized legumes ( $WG_t$  and  $HA_t$ ) should be grown to restore eroded soils.

# EXPRESSION OF PARTNERSHIP ORGANIZATIONAL MECHANISM IN LITHUANIA'S LOCAL ACTION GROUPS

Eglė Štareikė

*Aleksandras Stulginskis University*

Process of rural area development becoming more open, complex, depending on the various stakeholders. In many countries stakeholders' action in partnership while managing rural areas resources is a recognized element being important both in policy formulation and in the planning and implementation of activities.

Local action group (LAG), as a tool for the rural areas, acting in partnership with local authorities, business representatives and rural communities, purifies the needs for the local population, shapes the priorities of the locality, provides stakeholders with the opportunity to participate in the creating and executing process of the rural areas development strategies. LAG has an organizational non-hierarchical structure, the involvement of relevant stakeholders, their participation, and their interlinkages are the key part of the LAG's partnership process.

The purpose of the presentation – to define partnership organizational mechanism and determine it's expression in the Lithuania's local action groups.

During the first stage of the research, the concept of partnership organizational mechanism was analyzed, that created preconditions for determine expression of partnership organizational mechanism in Lithuania's LAG. The missions analysis of Lithuania's 51 LAG development strategies (2007–2013 year) allowed to identify basic characteristics of partnership organizational mechanism. The second stage of the investigation involved the creation of a questionnaire, which helped to identify the characteristics of the partnership organizational mechanism of the LAG. Partnership organizational mechanism has been investigated as a phenomenon in order to understand the mechanistic mode of its internal properties and analyzed the differences of the partnership organizational mechanism, which were identified in the practice of the Lithuania's LAG.

Research results revealed that the partnership organizational mechanism in the LAG has specific organizational structure, which determines the principles of the partnership activities of the local action group, such as: logical consistency of activities, division of responsibilities and roles, function of each complex element and relationships between them, etc.



## Section A. AGRONOMY AND AGROBIOLOGY

### THE DEVELOPMENT OF WHEAT CROWN AND ROOT ROT DEPENDING ON SOIL TILLAGE AND CROP ROTATION

Laura Paulovska<sup>1,2</sup>, Biruta Bankina<sup>1</sup>

<sup>1</sup>Latvia University of Agriculture

<sup>2</sup>Agroķīmija Saldus SIA, Birzites

Wheat (*Triticum aestivum* L.) has been cultivated for over 5000 years. Wheat diseases, including crown and root rot, are one of the factors that can reduce wheat grain yield. Wheat crown and root rot is a harmful disease, which is widely spread over the world and infects wheat stem and roots. The disease can be caused by different pathogens and the symptoms depend on pathogens and the environment. Identification of the causal agents under field conditions is complicated and often impossible. Such agricultural practises as pre-crop and soil tillage system can decrease the incidence of wheat crown and root rot.

The field trials were conducted at the 'Peterlauki' research and study farm of the Latvia University of Agriculture.

Two factor field experiments were carried out in 2017 at 'Peterlauki': A – soil tillage system: 1 – with ploughing (at the depth of 22–24 cm); 2 – without ploughing (with disk harrowing at the depth of 10 cm); B – crop rotation: 1 – continuous wheat; 2 – wheat after oilseed rape; 3 – crop sequence (wheat/faba beans/spring barley/oilseed rape).

Wheat crown and root rot was determined visually and the incidence of the disease was calculated.

The level of wheat crown and root rot was high – 92.3% in average. *Fusarium* and *Oculimacula* genera were the most important causal agents of the disease pathogens.

Soil tillage system did not influence the level of crown rot significantly ( $p = 0.30413$ ).

Crop rotation reduced the incidence of wheat crown and root rot essentially ( $p < 0.001$ ). The highest incidence – 95.4% – of the disease was observed in continuous wheat, 94.1% in crop rotation with only wheat and oilseed rape, but 87.5% in the trial with short crop sequence.

Further investigations are necessary to clarify the factors that influence the level of wheat crown rot.

**Acknowledgements:** The research was supported by the State research programme 'Agricultural Resources for Sustainable Production of Qualitative and Healthy Foods in Latvia', Project No. 1 SOIL.

## FIELD EVALUATION OF PEA CULTIVARS (*PISUM SATIVUM* L.) FOR RESISTANCE TO THRIPS SPECIES

Mohammad Almogdad, Kristyna Razbadauskienė, Roma Semaškienė  
*Lithuanian Research Centre for Agriculture and Forestry*

Pea (*Pisum sativum* L.) is an annual plant that belongs to the family Fabaceae and is the main protein crop cultivated in the EU. The area sown with field peas has markedly increased in Lithuania in recent years, and so has the need for productive cultivars. One of the factors limiting the productivity of crops is pests. The importance of particular pests for the productivity of a host plant and cultivars must be evaluated in order to work out a successful control strategy. Peas have relatively few insect pests of economic importance and one of them is thrips (*Thrips* spp.). High abundance of this pest was recorded in peas during the 2017 season. The aim of this research was to evaluate the resistance of pea cultivars to thrips and to establish the effect of this pest on productivity indicators. The study was carried out at the Institute of Agriculture of the Lithuanian Research Centre for Agriculture and Forestry during the 2017 season. Fourteen cultivars of pea were evaluated. A 0–10 damage rating scale (0: no damage on pod, 10: completely damaged pod) was used. Our findings suggested Casablanca and Bluetooth to be the most damaged cultivars with significant differences compared to other cultivars ( $p \leq 0.05$ ). The three cultivars – Velvet, Ieva DS and Jūra DS – showed the highest resistance to thrips with significant differences compared to other cultivars ( $p \leq 0.05$ ). These cultivars can be used in future breeding programmes and can be recommended as a tool for integrated pest management. No significant differences in damage by thrips were detected among the other nine cultivars. According to the evaluation results on resistance to thrips, three cultivars (Jūra DS, Casablanca and Lump) that differed in resistance were selected for further testing. The thrips damage significantly reduced the number of grains in pods, but there was no significant effect on the seed weight. A strong correlation ( $r = 0.74$ ) was established between the number and the weight of grains. Our study provides further understanding of the effects of one of the most important pests toward the optimization of its future control.





## THE CHANGE IN MINERAL NITROGEN IN ORGANIC AND MINERAL SOILS AFTER FERTILIZATION

Andrius Šarka

*Agrochemical Research Laboratory, Lithuanian Research Centre for Agriculture and Forestry*

Mineral nitrogen ( $N_{\min}$ ) in the soil shows the amount of nitrogen that is easily absorbed by crops. It is important when choosing nitrogen fertilizer rates. The amount of mineral nitrogen in the soil varies depending on the nitrogen fertilizer and its rate, the soil group and granulometric composition, soil nitrogen, crops, microorganisms, climatic conditions, and other factors.

The aim of this study was to determine  $N_{\min}$  change in mineral soil and organic soil fertilizing at different nitrogen fertilizer rates.

The experiment was carried out in programmable and controlled climate plant growth chambers, at the temperature 15/10 °C day/night, with 80% relative humidity, moistening equally, mineral nitrogen concentration change in mineral and organic soils was observed. In mineral soil (IDg4-p), the determined amounts were: pH – 6.3, available phosphorus ( $P_2O_5$ ) 143 mg kg<sup>-1</sup>, available potassium ( $K_2O$ ) 187 mg kg<sup>-1</sup>, mineral sulphur  $S_{\min}$  – 31 kg ha<sup>-1</sup>. In terric histosols soil (HSs), the determined amounts were: pH – 4.7, available phosphorus ( $P_2O_5$ ) 293 mg kg<sup>-1</sup>, available potassium ( $K_2O$ ) 117 mg kg<sup>-1</sup>, mineral sulphur  $S_{\min}$  – 28 kg ha<sup>-1</sup>. In fibric histosols (HSf2), the determined amounts were: pH-5, available phosphorus ( $P_2O_5$ ) 190 mg kg<sup>-1</sup>, available phosphorus ( $K_2O$ ) 86 mg kg<sup>-1</sup>, mineral sulphur  $S_{\min}$  – 18 kg ha<sup>-1</sup>.

Soils were fertilized at different nitrogen rates,  $N_{\min}$  inserting 0, 60, 120 mg/l nitrogen (N). The experiment was repeated three times.  $N_{\min}$  was determined before the experiment and then 3, 10, 17, 24, 31, and 38 days after fertilization.

The experiment showed that mineral nitrogen  $N_{\min}$  concentration before fertilization ranged about 18 mg/kg and 17 days after fertilization increased to 261.4 mg kg<sup>-1</sup>. In terric histosols and fibric histosols, the ranges were 160.7 and 824.3 mg kg<sup>-1</sup>, and 127.8 and 798.2 mg/ kg<sup>-1</sup>, respectively. This shows that  $N_{\min}$  concentration in organic soils is several times higher than in mineral soils. In non-fertilized soils, the amount of  $N_{\min}$  remained the same in 38-day period. The highest  $N_{\min}$  concentration in soils after nitrogen fertilization was determined on days 18 and 24, later the amount decreased in all soils.

# INVESTIGATION INTO AERODYNAMIC FEATURES OF GRANULAR MANURE FERTILIZERS

Raimonda Zinkevičienė, Eglė Jotautienė  
Aleksandras Stulginskis University

The *object of research* is a spreader of granular organic fertilizer from agricultural waste products. Granular organic fertilizers are normally prepared using natural materials. Biologically active nutrients are very important ingredients of organic fertilizers. Nitrogen, phosphorus, potassium, calcium, trace elements, and amino acids must be mentioned as very important content of organic fertilizers.

The *aim* of the research is to analyse and measure the aerodynamic features of granular manure fertilizers. To accomplish it, an experimental and numerical granular spreaders simulation model was chosen. This method simulates the sprinkled pellets spreader. Centrifugal discs are normally used to spread the fertilizers. The analysis of the variance method was used to investigate and evaluate all the data of the research. During the data analysis, the arithmetic averages were evaluated. Also, the standard deviation and confidence intervals at the probability level of 0.95 were set. To explore the characteristics of the pellets, 500 pellets were randomly chosen. All the measurements were repeated five times. The average values were evaluated. The test stand – classification K-293, the air flow meter Delta OHM DO 9847, and electronic scales IPC 3WP were used to evaluate the aerodynamic properties of the pellets. The evaluation of the results showed that the diameter of the granular compost fertilizer was  $5.28 \pm 0.8$  mm for Manure I and  $4.75 \pm 0.12$  mm for Manure II. The prevailing length of the pellets was also rated: it was 10 to 12.5 mm for Manure I and 5 to 7.5 mm for Manure II. It was set that most of the granules (60.1%) were vacuumed at 17.4 m s<sup>-1</sup> critical air velocity for larger diameter pellets in Manure I. The results showed that the diameter of the pallet influences the coefficient of the flow rate of an organic granular fertilizer. The density of organic granules is different from mineral granules and that it is the most influencing factor of the aerodynamic properties and the quality of the application of granular fertilizer.

The FEM aerodynamic and ballistic models of pallets were created during the research. SOLIDWORKS software with the complement FlowSimulation was selected to create the model of pellet aerodynamic properties. It was found that the pellet diameter has a statistically meaningful influence on the coefficient of the flow rate of the organic granular fertilizer.



# THE INFLUENCE OF FERTILIZATION WITH SEWAGE SLUDGE COMPOST ON THE FORMATION OF THE BIOMASS OF PERENNIAL ENERGY GRASS AND CHEMICAL PARAMETERS OF SOIL

Jelena Titova, Eugenija Bakšienė

*Lithuanian Research Centre for Agriculture and Forestry*

An experiment was performed in sandy loam Haplic Luvisol at the Vokė Branch of the Lithuanian Research Centre for Agriculture and Forestry from 2012 to 2015. Mugwort (*Artemisia dubia* Wall.), Virginia fanpetals (*Sida hermaphrodita* (L.) Rusby), and Giant miscanthus (*Miscanthus x giganteus*) were planted from seedlings in the spring of 2012. The fertilization rate: control (no fertilizer);  $N_{90}P_{60}K_{90}$  (90 kg ha<sup>-1</sup> N, 60 kg ha<sup>-1</sup> P<sub>2</sub>O<sub>5</sub>, 90 kg ha<sup>-1</sup> K<sub>2</sub>O); 20, 40 and 80 t ha<sup>-1</sup> sewage sludge compost (SSC) dry matter (DM). Mineral fertilizers were applied every year from 2012 and SSC was used once in 2012 for three years. The aim of the experiment: to assess the possibilities to cultivate perennial energy grass in light-textured unfertile soils of south-eastern Lithuania using SSC for fertilization.

On the third year of the experiment, the biomass DM yield of giant miscanthus was the highest among the tested herbaceous plants (14.9 t ha<sup>-1</sup>). The biomass of giant miscanthus was the most suitable for solid biofuel as it was characterized by the significantly lowest ash, sulphur, and total nitrogen content. However, the calorific value of these plants was only 18.4–18.7 MJ kg<sup>-1</sup>.

Fertilization with SSC significantly increased only the mugwort biomass DM yield and only in the third year of the experiment. The use of SSC affected biomass parameters important for solid biofuel in different ways.

Fertilization of grass with 40 and 80 t ha<sup>-1</sup> of SSC reduced the accumulation of chromium, copper, lead, nickel, and iron in their biomass ( $p < 0.05$ ). Mugwort accumulated more copper, lead, nickel, cadmium and iron in its biomass than other herbaceous plants. Giant miscanthus accumulated chromium, zinc and nickel most intensively.

During the three-year experiment the soil pH decreased. Fertilization of perennial energy grass with SSC weakened soil acidification or even increased its pH ( $p < 0.05$ ). Concentrations of total nitrogen and mobile phosphorus (P<sub>2</sub>O<sub>5</sub>) in the soil substantially increased. Compared with unfertilized soil, higher concentrations of chromium, copper, lead, zinc, nickel and cadmium were recorded ( $p < 0.05$ ) in the soil under herbaceous plants fertilized with 20, 40 and 80 t ha<sup>-1</sup> of SSC. Mugwort reduced the concentrations of heavy metals in soil more markedly than other species of grass ( $p < 0.05$ ).

## EFFECTIVE USE OF *ARTEMISIA DUBIA* WALL. FOR BIOFUEL

Živilė Černiauskienė, Vita Tilvikienė  
Aleksandras Stulginskis University

Constantly increasing energy consumption, expanding industry and declining fossil fuel reserves increase the demand for forest biomass. Since wood is widely used in various industries, a constant search for new and alternative energy plants is being conducted. These plants have to produce high biomass yields and high energy value; they must be easy to use for biofuel production and have a low environmental impact. These qualities are characteristic of *Artemisia dubia* Wall., which is a perennial plant that does not require annual planting.

Lithuania is characterized by changing natural conditions. They influence physical properties of the biomass and its harvesting time. Harvesting begins in October. The average moisture content of such biomass is  $62.75 \pm 3.51\%$ . The biomass can be harvested in March-April at the latest, but then its average humidity is only  $14.28 \pm 2.42\%$ , i.e., from September to March-April the moisture content of biomass can be reduced by an average 4.4 times (48.47%) under natural field conditions. However, if the harvesting time of the biomass from *Artemisia dubia* Wall. is postponed until March or April, the opportunity to enter fields should be evaluated.

In Lithuania, *Artemisia dubia* Wall. can produce up to 27.6 t/ha of dry biomass per year. It depends on the soil, growing years, the chosen technology of cultivation, and other conditions.

Also, it was important to assess energy efficiency of the biomass produced from *Artemisia dubia* Wall., that is, to assess the energy consumed in growing and preparation of the biomass compared to the energy content during thermal conversion. Depending on the growing year and selected processing technologies (in the case of *Artemisia dubia* Wall., direct burning of the biomass or granulation of the raw material), the energy efficiency varies from 3.1 to 15.



## INVESTIGATING CULTIVARS AND INOCULUM FOR SOYBEAN PRODUCTION IN LITHUANIA

Monika Toleikienė, Žydrė Kadžiulienė, Jonas Šlepetys, Lina Šarūnaitė  
*Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry*

Lithuania lies on the northern boundary of the soybean (*Glycine max* (L.) Merr.) distribution region, but soybean cultivation is questionable in temperate European climate. Research into soybean in Lithuania has been conducted since 1926. The National List of Plant Varieties includes four soybean cultivars: *Merlin*, *Violetta*, *Amandine*, and *Lajma*. However, soybean has not been widely adapted to the Lithuanian agricultural system and comprehensive studies are still needed.

Experimental plots of soybean were established in the organically-managed sites of the Lithuanian Research Centre for Agriculture and Forestry in 2015. New European cultivars *Merlin*, *Violetta*, *Bohemians*, *Silesia*, *Brunensis*, *De-013-130660*, and *H-15-007-0072* were tested in mixture with two sorts of *B. japonicum* inoculum and without inoculation. Yield components, maturity and nodulation measured in the vegetation of 2015, 2016, and 2017.

Despite different meteorological conditions, soybeans were able to produce crops each year. The yield of the treated cultivars varied from 1,208 to 2,661 kg ha<sup>-1</sup>. The most productive was cultivar *Merlin* and *Violetta* was the least productive. Cultivars *Silesia* and *Bohemians* gained the biggest seeds: their 1000-seed weight was 229 g and 215 g, respectively. *Merlin* and *Bohemians* reached the earliest maturity. German cultivars *Brunensis*, *De-013-130660*, and *H-15-007-0072* matured last and the harvesting was technically hard.

Due to favourable growing conditions, the inoculation effect was stronger in 2016 than in 2015. The nodules biomass varied from 23.3 to 46.6 g/m<sup>2</sup> in different soybean cultivars. Cultivar *Merlin* gained the biggest nodules biomass. Soybean *Merlin* grain productivity significantly correlated with *B. japonicum* nodules biomass. In most productive year, inoculated soybean *Merlin* gained 57 g/m<sup>2</sup> of *B. japonicum* nodules on average and accumulated 112 g/m<sup>2</sup> additional bean yield on average compared with non-inoculated cultivars. A comparison of two *B. japonicum* strains showed that 'AGF78' was more effective inoculation than '2490'.

Research results suggest that among the investigated soybean, *Merlin*, *Silesia* and *Bohemians* could be the most productive in Lithuanian organic farms. Further treatments are held in Dotnuva on the above-mentioned soybean cultivars. New cultivars are being investigated as well.

# STUDIES INTO THE CHEMICAL COMPOSITION AND STRUCTURE OF DIFFERENT LIMING MATERIALS

Donata Drapanauskaitė

*Lithuanian Research Centre for Agriculture and Forestry*

Soil acidity is a major environmental and economic concern. Approximately 51.0% of agricultural land in eastern Lithuania and 66.0% in the western part of the country has surface pH values lower than or equal to 5.5.

Liming is the most economical method of ameliorating soil acidity. The amount of lime required will depend on the soil pH profile, lime quality, the soil type, the farming system and rainfall. An agricultural liming material is defined as a material containing calcium and/or magnesium compounds capable of neutralizing soil acidity. Nowadays it is important to find the best way of how to use industrial waste and improve soil quality.

The objective of this study is to investigate the chemical composition and structure of different liming materials.

For the experiment we used five different liming materials: ground chalk, dolomitic lime, granulated cement dust (two different fractions), and granulated cement dust with a potassium additive. Chemical composition was analyzed: the neutralizing value, reactivity, heavy metals, calcium, and magnesium. Calcium and magnesium content were determined using the atomic absorption spectrometric method. Heavy metals were determined in aqua regia using the atomic-emission spectrometer.

The studies show that ground chalk has the highest reactivity 99.46% and neutralizing value 52.19%. The calcium content in different liming materials was from 20.48% to 38.82%. However, the effectiveness of a liming material also depends on its structure and physical properties.



## LEAN AND ECO-CONSTRUCTION

Artjoms Ustinovs, Baiba Rivža

*Latvia University of Agriculture*

Eco-construction has significantly revolutionized the entire construction industry turning it into high-technology innovators. The green building is unlikely to be built if there is a cheaper alternative. In the construction industry, one of the key factors is to keep low cost and the quality of the raw materials at the same time, especially in the context of non-commercial buildings. Therefore the management team of an eco construction company has to think how to maximize customer value while minimizing wastes.

One of the appropriate and advanced methods is to implement the principles of lean management into the construction process. In general, lean should be considered as a comprehensive management philosophy which requires a long-term strategy in order to achieve competitive advantage. It is also very important to pay attention to the leadership and the way people are recruited, to develop their professional skills through the training process. The main idea of using lean in eco-construction is to reduce costs.

Costs cutting, the reduction of construction time, increase in productivity and efficiency and effective project management can be only achieved through successful implementation of lean principles.

By introducing lean principles, eco-construction companies can expect:

- Higher utilization of investment
- Higher production output
- Reduction of equipment down time
- Improved quality
- Reduction in human resources requirements
- Reduction in Changeover and Set-up down time
- Safer work environment, etc.

Specific lean methods such as just-in-time inventory management, Kanban scheduling systems, 5S workplace organization can help eco-construction companies become more successful and profitable.

With the introduction of the lean principles, eco-friendly construction not only brings benefits to the environment, but also has a great potential for both improved profitability of the business and the high-quality standards of the end product.

## Section B. FORESTRY AND HORTICULTURE

### DETECTION OF ENDOPOLYPLOIDY OF *DIANTHUS ARENARIUS* PLANTS FROM DIFFERENT ECOLOGICAL CONDITIONS

Nikole Krasņevska<sup>1</sup>, Dace Grauda<sup>1</sup>, Alesya Kruchonok<sup>2</sup>, Isaak Rashal<sup>1</sup>

<sup>1</sup>*Institute of Biology, University of Latvia*

<sup>2</sup>*Central Botanical Garden of the National Academy of Sciences of Belarus*

Ecological conditions can influence the endopolyploidy of growing plants. We studied plants of *Dianthus arenarius* collected from different populations in several regions (Latvia, Lithuania, and Belarus). *D. arenarius* is an endangered perennial plant species, included in Annex II of the European Council Habitats Directive 92/43/EEC as well as in the Latvian and Lithuanian endangered plant lists. In Latvia, Lithuania, and Belarus, *D. arenarius* create a complex of several perennial subspecies. The genetic diversity of *D. arenarius* has not been studied in Europe until now. Changes on the chromosome level, including endopolyploidy, can reflect adaptation under pressure of different stress conditions and ongoing processes in the population of *D. arenarius* through the territory of Latvia and the neighbouring countries. Information about endopolyploidy is also crucial for validation of genetic variability of the species. The goal of this study was to compare the endopolyploidy level of the populations of *D. arenarius* in the target territory. Leaf samples of *D. arenarius* were collected in middle of June of 2015 and 2016 from 12 populations: eight from Latvia, three from Lithuania, and one from Belarus. Determination of DNA content (C-value) level of individual cells in the leaves of mature plants was performed by the BD FACSJazz® cell sorter (BD Biosciences, USA) with a flow cytometer function. Samples for flow cytometry were prepared with the DNA staining kit (SysmexPartec, PI Absolute, GmbH, Germany), cells nuclei were stained with 10 µL propidium iodide. Endopolyploidy measurements were triggered by a forward-scattered signal. The excitation of the cell fluorescence was made by the 488 nm Coherent Sapphire Solid State (blue) laser. Flow cytometry analysis of the DNA content in *D. arenarius* leafs from different localities revealed the presence of several relative fluorescence peaks from 2C up to 18C. The percentage of 14C DNA nucleus across all samples was very low, represented by only less than 1%. Peaks of 16C, 17C, and 18C DNA were observed only in several specimens and were found only in Latvian populations. Statistically significant differences in endopolyploidy were found between *D. arenarius* populations.





# THE COLONIZATION ABILITY OF *HETEROBASIDION ANNOSUM* (FR.) BREF. AND *HETEROBASIDION PARVIPORUM* NIEMELÄ & KORHONEN ON CONIFERS AND DECIDUOUS TREES AFTER ARTIFICIAL INOCULATION: PRELIMINARY RESULTS

Astra Zaļuma, Natālija Burņeviča, Lauma Brūna, Kristīne Kenigšvalde, Agrita Kenigšvalde, Dārta Lukstiņa, Tālis Gaitnieks  
*Latvian State Forest Research Institution Silava*

The complex of *Heterobasidion* species is the most common butt and root rot agent of conifers; however, some broadleaves, like *Betula* spp., *Populus* spp., may also become infected. The aim of this study was to investigate the colonization ability and the growth rate of *Heterobasidion annosum* (Fr.) Bref. and *Heterobasidion parviporum* Niemelä & Korhonen in functional sapwood of nine tree species in order to further understand the behaviour of these two important pathogens.

*Picea abies* (L.) Karst., *Pinus sylvestris* L. *Larix decidua* Mill., *Alnus incana* (L.) Moench., *Alnus glutinosa* L., *Fraxinus excelsior* L., *Betula pendula* Roth, *Populus tremula* L., and *Quercus robur* L. were inoculated with *H. annosum* and *H. parviporum*. We studied the colonization ability and virulence of *Heterobasidion* sp. in functional sapwood of all tree species. Inoculation was undertaken during May 2007. In total, 450 trees were used. A total of 40 trees of each tree species were inoculated (20 with *H. annosum* and 20 with *H. parviporum*). For control, 90 trees (10 trees for each species) were used. Ten years after the inoculation the fungal occurrence was estimated for each tree.

Only conifers became infected with *H. annosum* and *H. parviporum*. To comply with Koch's postulates and confirm re-isolation of inoculated isolate, isolations were attempted from all infected trees.

# MORPHOLOGICAL DIFFERENTIATION OF MITOCHONDRIAL DNA HAPLOTYPES OF THE SCOTS PINE

Monika Raškauskaitė

*Aleksandras Stulginskis University*

Evolutionary lines may have preserved distinct features or neutral morphological markers attributable to the post-glacial environments. The objective of the study was to assess morphological traits of trees, cones, and seeds of the two mitotypes of the Scots pine separated at the Nad7.1 locus of the mtDNA. The mtDNA mitotypes represent the southern refugium (type A) and the northerly refugium west of the southern Ural Mountains (type B, lacking the 5bp indel at the Nad7.1 locus). For the adult trees, 200 individuals were selected in 10 natural stands in Lithuania and their bark type and stem form were assessed together with the mtDNA mitotype. For the cone traits, 40 clones of local origin were sampled in a seed orchard, the mtDNA mitotype assessed, and the following traits were scored: cone colour (dry) and size, cone symmetry, apophysis shape, depth and sealing band, number of cone scales, shape of umbo, direction of cone scale spiral, seed colour, seed wing colour and shape. The results revealed no significant differences between the mitotypes in all the traits scored, except for the bark type. High proportion of the trees of the mitotype A possessed bark with deep flakes. There was a tendency for the type B mitotype to produce more seeds per cone (at similar cone size) with long and narrow seed wings. Our study shows no significant association between the present-day morphotype and the post-glacial origin in the Scots pine. However, there were tendencies that need to be investigated in a greater detail.



# PHENOTYPIC PLASTICITY OF DIFFERENT FOREST TREE SPECIES UNDER HEAT AND DROUGHT SIMULATED IN PHYTOTRON

Gintarė Bajerkevičienė<sup>1</sup>, Alfas Pliūra<sup>1</sup>, Vytautas Suchockas<sup>1</sup>, Jurga Janėauskienė<sup>2</sup>

<sup>1</sup>*Institute of Forestry, Lithuanian Research Centre for Agriculture and Forestry*

<sup>2</sup>*Institute of Botany of the Nature Research Centre*

Climate change results in an increasing occurrence and amplitude of summer drought and heat waves, which can be stressful to forest tree species at different stages of their ontogenesis. The study aimed at the evaluation of phenotypic plasticity of juvenile progeny of deciduous forest tree species *Quercus robur*, *Fraxinus excelsior*, *Alnus glutinosa*, *Betula pendula*, and *Populus tremula*, and conifers *Pinus sylvestris* and *Picea abies* to summer heat and drought simulated in phytotron. At the end of treatments, transpiration, stomatal conductance and photosynthesis were measured on site with LCpro-SD system, and water use efficiency (WUE) was estimated. Concentrations of photosynthetic pigments, malondialdehyde (MDA), and hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) in sampled leaves were measured in order to evaluate the oxidative stress. The tree height and diameter increment was measured at the end of the vegetation season to estimate final consequences of applied stressful treatments.

The stem diameter increment of all tree species was to the greater extent negatively affected by both hot wet and hot dry treatments than the tree height increment. Drought had a negative impact on the production of pigments, which, together with increased concentrations of MDA and H<sub>2</sub>O<sub>2</sub>, indicated the presence of an oxidative stress. ANOVA revealed that species effect and species-by-treatment interaction were strongly significant for most of dendrometric growth, physiological and biochemical traits studied, indicating significant differences among tree species in reaction norms and phenotypic plasticity. Drought caused significant defoliation in fast-growing tree species *P. tremula*, *A. glutinosa*, and *B. pendula*. The photosynthetic rate in *P. tremula*, *B. pendula*, and *A. glutinosa* was the highest, although it was much more negatively affected by water deficit compared to other tested species. WUE in *P. abies*, *P. sylvestris*, and *B. pendula* was lower following drought than following both hot wet treatment and control, while WUE was higher in *P. tremula*, *A. glutinosa*, and *Q. robur*.

## **STUDIES OF FUNGAL COMMUNITY IN DECLINING *QUERCUS ROBUR* L. STANDS**

Karolis Sivickis, Dovilė Čepukoit, Antanas Matelis, Daiva Burokienė  
*Laboratory of Plant Pathology, Institute of Botany, Nature Research Centre*

*Quercus robur* decline, a disease that for a few decades has been observed in Europe and North America, is already spreading in Asia. The decline has a huge impact on ecological and economical loss of hardwood stands. Studies suggest that oak mortality is triggered by biotic (e.g., pathogens) and abiotic (climate change, drought, air pollution) factors. The decay has been spreading in Lithuania for a long time. The first instance of oak decline was registered in 1976–1980 and the last outbreak was recorded in 2003–2004. In 2015, it was observed that infectious diseases affected 352 ha of oak stands. The infected oak trees show crown dieback and die within a few years.

Thus, the cause of oak decline has to be identified. Our research primarily aimed to assess the health condition of the affected stands: (1) to estimate the diversity of fungal community in the soil and wood of the affected *Quercus robur* trees; (2) to compare if there are any differences in the composition of the causal agents of the infected oak trees.

During 2016–2017, soil and wood samples from five locations were collected. Fungal isolates were obtained from five trees showing crown defoliation, wilting of skeletal branches, and bleeding from the trunk in each location. Fungal isolates from wood and soil – 136 in all – are under further analysis.



## **WHAT VOLATILES ARE USED BY RHAGOLETIS BATAVA, A PEST OF SEA BUCKTHORN, IN SEARCHING FOR HOST PLANT *HIPPOPHAE RHAMNOIDES* BERRIES?**

Dominykas Aleknavičius, Violeta Apšegaitė, Rita Butkienė, Vincas Būda  
*Nature Research Centre*

In Europe, economic demand for sea buckthorn (*Hippophae rhamnoides*) berries has been growing permanently because of its wide use in cosmetics, food, and medicine industry. Besides, sea buckthorn shrubs can grow in poor soil and can be planted in eroded fields. Sea buckthorn berries are damaged by non-native pest sea buckthorn fly, *Rhagoletis batava* (both in Europe in general, and in Lithuania in particular this pest appeared and started to spread in 2009 to 2013). After maggot feeding inside of a berry, it loses its nutritional and economical value. In this way *R. batava* can destroy about 80–100% of harvest in organic farms. According to our data, parasitoids destroy only 9.4–10.9% of the pest larvae in Lithuanian populations of organic farms.

Like many other plant pests, the fruit flies, use their host plant volatiles to detect berries. The data on the volatiles could be useful for the fruit fly monitoring or even for biological control by application in special traps. Besides, knowledge of the pests' olfactory active volatile blends ability to affect its behaviour can help to make both new trapping baits and/or repellent preparations.

Both ripe and unripe sea buckthorn berries were extracted by hydrodistillation. Linked gas chromatographic and electroantennographic detection analysis of the extracts and *R. batava* revealed 23 bioactive compounds. Thirteen compounds from unripe berries evoked olfactory reactions in females and 15 in males. Also, 13 compounds from ripe berries evoked olfactory reactions in females and 21 compounds in males. In total, 18 compounds evoked the reactions in females and 23 in males. Sexual dimorphism is clear and noticeable in host plant volatiles perception by *R. batava* adult flies. Males of *R. batava* perceived more chemical compounds emitted by host plant berries compared to females. Further analysis evaluation of behavioural responses to the compounds are in progress.

# QUANTITATIVE AND QUALITATIVE DIFFERENCES OF BIOACTIVE COMPOUNDS IN APPLES (CV. 'AUKSIS') GROWN IN DIFFERENT GEOGRAPHICAL LOCATIONS

Jonas Viškelis<sup>1</sup>, Mindaugas Liaudanskas<sup>2</sup>, Darius Kviklys<sup>1</sup>

<sup>1</sup>*Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry*

<sup>2</sup>*Faculty of Pharmacy, Medical Academy, Lithuanian University of Health Sciences*

The aim of this research was to evaluate the differences of bioactive compound accumulation in apple fruits of cv. 'Auksis' grown in three different geographical locations: Skierniewice (Poland), Babtai (Lithuania), and Polli (Estonia). The apple-trees were planted under uniform scheme (4 x 1,5 m) on B.396 rootstock. The trial was performed in 2015–2016. Statistical differences were evaluated using Tukey's HSD test at  $p = 0.95$ . The amounts of all compounds are given in absolute dry weight.

*Evaluation of phenolic compounds.* The amount of quercetin glycosides significantly varied from 0.275 mg g<sup>-1</sup> (Poland) to 0.630 mg g<sup>-1</sup> (Estonia). The same trend was also observed with flavan-3-ols (from 0.881 mg g<sup>-1</sup> to 2.676 mg g<sup>-1</sup>), phlorizin (from 0.077 mg g<sup>-1</sup> to 0.184 mg g<sup>-1</sup>), and chlorogenic acid (from 1.436 mg g<sup>-1</sup> to 3.149 mg g<sup>-1</sup>). The total amount of investigated phenolic compounds also significantly varied from 2.668 mg g<sup>-1</sup> in the southern location (Poland) to 6.638 mg g<sup>-1</sup> in the northern location (Estonia). Apples from the northern growing site accumulated approx. 2.5 times higher amount of phenolic compounds.

*Evaluation of triterpenic compounds.* The apples from Poland accumulated a significantly lesser amount of investigated triterpenic compounds in comparison to the apples from Lithuania or Estonia: corosolic acid varied from 0.292 mg g<sup>-1</sup> to 0.479–0.488 mg g<sup>-1</sup>, betulinic acid – from 0.105 mg g<sup>-1</sup> to 0.099–0.129 mg g<sup>-1</sup>, oleonolic acid – from 1.405 mg g<sup>-1</sup> to 1.959–2.101 mg g<sup>-1</sup>, and ursolic acid – from 7.078 mg g<sup>-1</sup> to 9.535–9.676 mg g<sup>-1</sup>. The total amount of investigated triterpenic compounds in the apples from Poland was 8.880 mg g<sup>-1</sup>, from Lithuania – 12.386 mg g<sup>-1</sup>, and from Estonia – 12.082 mg g<sup>-1</sup>.

In conclusion, apples grown in Poland accumulated a significantly lesser amount of both phenolic and triterpenic compounds in comparison to Lithuanian or Estonian apples. This can be explained by different climatic conditions and possible apple-tree stress, whereas growing conditions in Estonia are more unfavourable than those in Poland or Lithuania.



# VACUUM COOKING (COOK-VIDE) AS A POTENTIAL FOOD PROCESSING METHOD FOR OBTAINING MICROBIOLOGICALLY SAFE PRODUCTS

Liene Ozola, Solvita Kampuse  
*Latvia University of Agriculture*

Nowadays there exist several thermal treatment methods used in food production to ensure microbiologically safe and enjoyable products and vacuum cooking is one of them. It is based on product cooking in temperatures under 100°C, where a lower concentration or almost complete absence of oxygen allows the product to boil at a lower temperature. This factor is particularly important for protection of bioactive heat-sensitive compounds. The use of vacuum technologies could provide a better flavour, pigment retention and could improve the overall quality of the final product.

*The aim* of this research was to investigate the influence of cook-vide on microbiological safety of plant-based purée and juice.

Cook-vide (CV) is a method used in this research, where a product is boiled below 100°C by lowering the pressure to reach the vapour point of water. The experimental part of CV product production and analyzing was carried out in Latvia University of Agriculture and 'Natural Food manufacturer' Ltd 'KEEFA'. Two types of products were treated using CV: pumpkin-guelder rose sauce and enteral food, both vacuum-cooked in laboratory conditions under two modes: 0.06 MPa pressure, product temperature during cooking  $79 \pm 2^\circ\text{C}$  maintained for 15 min; 0.02 MPa, product temperature during cooking  $67 \pm 2^\circ\text{C}$  maintained for 15 min. The samples were prepared using fresh ingredients. Products were microbiologically tested for total plate count (TPC), *Escherichia coli*, moulds and yeasts; product pH was also detected.

The obtained data showed opposite results. For the pumpkin-guelder rose sauce (pH  $3.4 \pm 0.1$ ), the tested parameters were normal. No TPC, *E. coli*, moulds or yeasts were detected after the used treatment methods. However, for enteral food (pH  $5.0 \pm 0.1$ ) these modes showed to be insufficient. After CV treatment, no *E. coli* or moulds were found, TPC and yeasts decreased, but the used modes were not successful for creating microbiologically safe products.

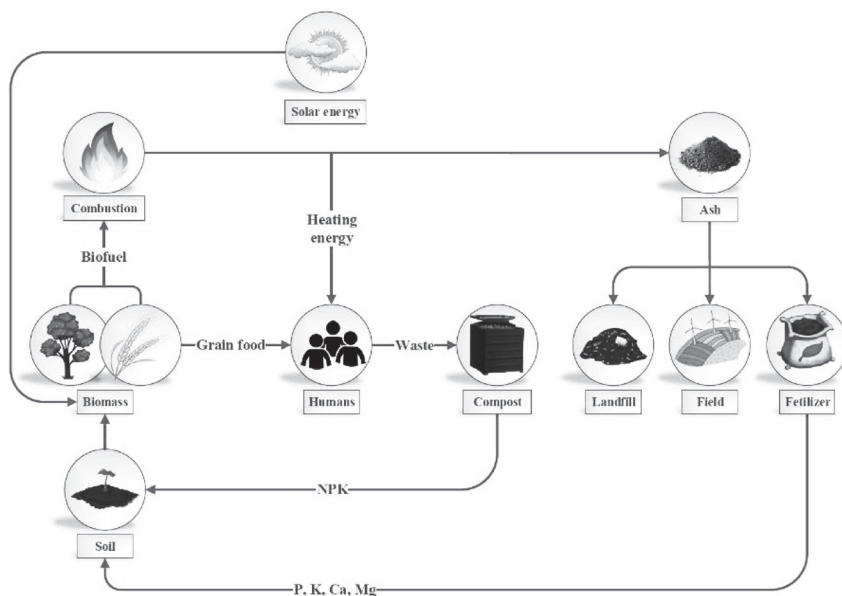
It can be concluded that product pH plays an important role when using CV. For products with  $\text{pH} \leq 4$ , the modes used in this research can be applicable for creating safe products; however, for products with  $\text{pH} > 4$  additional modifications need to be made, for example, extending the treatment time.

# THE USE OF BIOFUEL ASH AND ITS INFLUENCE ON SOIL

Kristina Cirtautaitė, Romas Mažeika

*Lithuanian Research Centre for Agriculture and Forestry*

Biofuel ash is alkaline waste (pH ~ 13). Biomass (5–10%) returns to the environment in the form of ash. Ash is considered waste. It is poured directly onto fields, into the landfills and is used for the production of building materials and for soil liming and fertilization. Ash is considered a means of soil acidification. It is processed into fertilizer products: loose fertilizer, liquid fertilizer, and compost mixtures. Fertilizer products are produced from bulk biofuel ash. They contain nutrients K, P, Ca, Mg, and other microelements, which are necessary for plants and soil. Therefore, the changes in these compounds and their influence of are analyzed.



Bioenergy cycle





# THE IMPACT OF THE EU BIOFUEL POLICY ON THE PRICES OF AGRICULTURAL COMMODITIES IN THE EUROPEAN UNION

Asta Bendoraitytė

*Aleksandras Stulginskis University*

Rapidly growing world population and consumers' increasing purchasing power determine the growth of food demand and dietary changes and expand the need of energy. Considering the limited nature of traditional energy source, the need for renewable energy is increasing. Biofuel was suggested and received political support as the main alternative for fossil fuel in the transport sector due to its environmental benefits, support for the agriculture sector and contribution to reaching energy independence goals. Despite expected positive effects of biofuel promotion, concerns on food versus fuel debate are growing. Although there is an increasing interest in cellulose and waste processing (second-generation biofuel), first generation biofuel, the production of which rests on food crops processing, remains the most widely used renewable energy source in the transport sector. This means that production of biofuel diverts limited arable land, labour and technical resources from alimentary to energy needs. Because of competition on arable land and agricultural products, the additional demand for agricultural commodities increases. Additional demand, created using mandatory biofuel policies, is supposed to influence the prices of agricultural commodities at a specific level.

Worldwide interest in the prices of agricultural commodities and their drivers increased after the rapid growth of prices of agricultural commodities in 2007–2008. Nevertheless, the literature on the role of biofuel policies on the level of prices of agricultural commodities takes very different approaches and reaches a wide range of conclusions. Since the biggest part of studies are focused on the USA market, there is a lack of research analysing the impact of the biofuel policy on the prices of agricultural commodities in leading region of biodiesel producers, the European Union.

The problem of research is to determine the impact of biofuel policies on the prices of agricultural commodities. The aim of the research was to evaluate how the promotion of biofuel through the biofuel policies affects the prices of agricultural commodities in the European Union and its member-states.

## Section C. ANIMAL SCIENCE, VETERINARY MEDICINE, FOOD SAFETY AND QUALITY

### GENETIC DIVERSITY OF *MACOMA BALTHICA* WITH A DIFFERENT SHELL SHAPE

Oksana Fokina<sup>1</sup>, Dace Grauda<sup>1</sup>, Ingrīda Puriņa<sup>2</sup>, Isaak Rashal<sup>1</sup>

<sup>1</sup>*Institute of Biology, University of Latvia*

<sup>2</sup>*Latvian Institute of Aquatic Ecology*

Human activity has caused irreparable damage to our planet, including environmental changes in the Baltic Sea. Over the past 50 years, the ecosystem of this sea has been severely degraded. Many scientists make great efforts to conserve biological diversity by improving their knowledge in this field. Population genetics is just one of the opportunities for studying genetic differences within and between populations using traditional and the newest methods in molecular biology.

One of the widely distributed species of the Gulf of Riga is a representative of bivalve molluscs. Despite the variety of shell colours, the standard form of the 'armour' is oval, although the presence of shells with a morphological defect has long been documented. At the moment, the reason of the deformation is still unclear, but there are many hypotheses that can explain the causes of these changes. Like most bivalve molluscs, these clams are filter feeders and water quality is an important factor for these organisms. This fact explains why the change in the environment is one of the most common hypotheses in the cause of the shell shape deformation.

The purpose of the work was to use retrotransposon-based molecular markers for analysis of genetic diversity between deformed and normal shape shells. Over 100 samples from all over the Gulf of Riga were collected and analysed with previously chosen retrotransposon-based primers. PCR products were electrophoresed on an agarose gel, visualized using ethidium bromide, and documented with digital photosystem. Genetic diversity of allelic distribution among and between populations was analysed. All 40 detected loci were polymorphic; however, no positive correlation was observed between samples with different shell shapes.



# CLINICAL AND LABORATORY DIAGNOSIS OF BLOOD MICROFILARIAE IN DOGS

Urtė Liaudanskaitė

*Lithuanian University of Health Sciences*

In the last decade, the presence of the zoonotic disease caused by *Dirofilaria* genus nematodes has been increasing. Epidemiological data show that *Dirofilaria* nematodes are widespread around the globe. Countries, especially from North Europe, that have never encountered them are reporting unprecedented cases of dirofilariasis. New cases confirm the hypothesis that in spite of preventative and control measures, the infection continues to spread. These changes may be attributed to climate change, growing pet populations, and increased travelling with pets.

The main aim of the paper is to evaluate dirofilariasis cases in dogs using clinical and laboratory methods.

The study was carried out in the veterinary practice 'Kaivana' in 2015–2016. A total of 103 randomly selected dogs were examined for microfilariae. Direct microscopic examination of peripheral blood was used. Also, morphologic blood examination was performed, using an automated analyzer. All cases were registered and detailed medical histories were collected from the owners of these dogs.

The analysis of clinical findings showed that, with regard to the age of dogs, the biggest incidence of microfilariae was in the group of dogs that were 36–120 months old. The prevalence of microfilariae was 65.22% in males and 34.78% in females. Mixed-breed dogs showed a higher prevalence (43.48%) than pure-breed dogs ( $p > 0.05$ ).

Obtained data indicate that 30.43% of dogs with microfilariae showed no clinical signs. 21.74% of the dogs had digestive tract disturbances and 17.39% of the dogs had haematological disorders.

Outdoors keeping conditions are an important risk factor. Dogs kept outside showed a higher prevalence of infestation than dogs kept inside ( $p < 0.05$ ). Obvious differences were observed between chemoprophylaxis- and non-chemoprophylaxis-receiving dogs groups. The microfilaraemia rates were much higher in non-chemoprophylaxis dogs (15.53%) than in chemoprophylaxis group (2.91%) ( $p > 0.05$ ).

When compared with healthy dogs, a complete blood count was not a significant diagnostic indicator of dirofilariasis.

## SEX DIFFERENTIATION FROM DRUMSTICKS IN THE NEUTROPHILS OF CATS' BLOOD

Rita Ivanauskaitė, Zoja Miknienė  
*Lithuanian University of Health Sciences*

Sex chromatin is an approximately 1-micron clump of chromatin usually seen at the periphery of female nuclei in certain tissues and called 'Barr body' and as a drumstick in polymorphonuclear neutrophils nuclei in blood smears. Sex chromatin is derived from one of the two X chromosomes in the female, which replicates its deoxyribonucleic acid much later than the other and is thus positively heteropyknotic. In 1954, Davidson and Smith were the first to identify and report the presence of neutrophil drumsticks and nonspecific appendages, and their differences in sexes. The inactive X chromosome in neutrophils appears in one of the five forms: drumsticks, racquet forms, sessile nodules, small clubs, and minor lobes. Only the drumstick appendage is sex-specific and considered for sex diagnosis.

Karyotyping, fluorescent *in situ* hybridization, and polymerase chain reaction (PCR) are considered confirmatory methods for sex determination. However, the use of routine cytological smears with various staining techniques is more feasible and cost-effective.

The *aim* of this investigation was to find out if sex determination can be done by routine cytology. Blood samples were taken at random method from healthy cats and blood smears were done. Cats were of different breeds (mostly mixed breed), age (from six months to eight years), and both sexes. Blood smears were examined by microscope, and leukocytic formulas were counted. In addition, drumstick appendages were counted in 300 neutrophils.

**Results.** In our research, 100% of female cats and 20% of males exhibited drumstick bodies. The incidence of drumsticks varied from 0.67% to 4.67%, with an average of 2.20% in females and between 0% to 1%, with an average of 0.15% in males. Results showed that numbers of drumsticks were greater in females than in males. These results confirm the fact that the drumstick count is certainly related to sex.

**Conclusions.** For sex determination, drumsticks are significantly higher in females than in males. Routine cytology is an easy and cheap method for sex determination.



# THE EFFECT OF DEOXYNIVALENOL ON THE CHEMICAL COMPOSITION AND TECHNOLOGICAL PROPERTIES OF SPRING WHEAT GRAINS

Yuliya Kochiieru, Audronė Mankevičienė, Jurgita Cesevičienė, Akvilė Jonavičienė  
*Lithuanian Research Centre for Agriculture and Forestry*

A research work was conducted to investigate the effect of different concentrations of deoxynivalenol (DON) on the chemical composition and technological properties of spring wheat grains and their products. The grains of spring wheat (cv. Triso) were collected at the Institute of Agriculture in 2016. In this study, 22 samples were analysed for DON contamination by the ELISA method. The chemical composition and such technological properties as hardness (PSI) and mass per hectolitre of grain, the concentrations of mineral elements (P, K, Ca, Mg, Zn, Fe), protein and wet gluten content, the gluten index (GI), the falling number (FN) of whole meal flour, sedimentation, the flour yield, farinograph water absorption of white flour, and farinograph mixing characteristics of dough were determined by standard methods (AACC, ICC, ISO). The mean values of DON contamination ranged from <100 to 13000  $\mu\text{g kg}^{-1}$ . Our data showed that the content of grain protein and mineral elements, wet gluten quantity and quality (GI) were not significantly affected by different concentrations of DON. The values of the falling number and Zeleny sedimentation were markedly reduced by 48.7% and 29.1%, respectively, in highly contaminated samples compared to the samples with the concentration of <100  $\mu\text{g kg}^{-1}$ . The grains of the samples with concentrations <100  $\mu\text{g kg}^{-1}$  were harder, the grain mass per hectolitre and flour yield were higher than in the contaminated samples. The farinograph analysis showed that flour water absorption and dough development time decreased by 7.49% and 31.1%, respectively, in the contaminated samples.

The results of this study indicated that with an increasing DON concentration, some technological properties of spring wheat grain deteriorate, especially due to the decrease in the values of flour sedimentation and the falling number.

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## THE EFFECT OF INHALATION (SEVOFLURANE) ANAESTHESIA ON PLASMA LEVELS OF CORTISOL AND VITAL SIGNS DURING SURGERY IN HORSES

Eglė Guskovaitė, Zoja Miknienė  
*Lithuanian University of Health Sciences*

Cortisol is a steroid hormone and exerts a variety of systemic effects. Horses are often subjected to physiological stressors during races or competitions and frequently suffer from a wide range of diseases following surgery, which may also induce considerable stress. This study was designed to evaluate the effects of sevoflurane anaesthesia on plasma levels of cortisol and vital signs during and after surgery in horses. Fourteen clinically healthy adult horses (11 male and 3 female), weighing ~450 kg were used. All horses were initially sedated with xylazine (1.1 mg/kg BW). Five minutes later, ketamine (2.2 mg/kg BW) plus diazepam (0.05 mg/kg BW) were used for induction. After that a horse was intubated and inhalation anaesthesia with sevoflurane was induced. Vital signs including the heart rate, the respiratory rate, and the rectal temperature (RT) were recorded 30 min before operation -; after induction of sevoflurane, 15 min and 30 min; 60 min after the end of surgery. Blood was sampled at the above- mentioned times and analysed using the AIA-360 Automated Immunoassay Analyser for cortisol. A non-significant decreasing trend in RT was observed during the studied times. Significant changes in the heart rate and the respiratory rate ( $p > 0.05$ ) were observed; in particular, at the time after operation (60 min) respiratory rates decreased significantly compared with the time before surgery ( $p < 0.05$ ). Cortisol levels were found to be insignificantly decreasing during operation and increasing after.



# INFRARED THERMOGRAPHY IN THE DIAGNOSTICS OF FRONT LIMB SUPERFICIAL DIGITAL FLEXOR TENDONITIS IN EQUINES OF DIFFERENT AGE

Rūta Undzėnaitė, Indrė Stasiulevičiūtė, Jurgita Autukaitė

*Large Animal Clinic, Veterinary Academy, Lithuanian Health Science University*

Superficial flexor tendonitis is a common career-ending injury in sport horses. Rapid detection of the inflammatory process helps to control the early stage of tendonitis. The prognosis is better and the treatment time is shortened. Infrared thermography is a non-contact technology that allows monitoring and control of physiological functions associated with skin temperature and its changes. Infrared radiation can be detected during an early stage of developing inflammation by a thermographic technique.

The *aim* of the study was to determine the inflammation of superficial digital flexor tendon using thermography and to assess the influence of age of horse on manifestation of lesion.

*Materials and methods.* One hundred horses were examined in five stables. Groups were formed of young (<8 years) and adult (>8 years) horses. The thermograms of the front legs of the horses were taken using the thermography device Testo 875-1. Thermograms were taken at a distance of 1 m from the caudal side of the legs. Thermograms were analyzed using TestolRSoft Software version 3.6. The Rainbow colour palette was chosen. Legs in thermograms were evaluated bilaterally. The isotherms – middle lines passing through the superficial digital flexor tendon from the proximal to the distal part – were measured and calculated.

*Results and conclusion.* In the investigation zone of healthy horses, the front legs had a uniform temperature pattern and the same temperature bilaterally. We can see higher temperature spots in the images of test limb group, which shows that an inflammation is present. The average temperature in test group of young horses was 0.9°C or 3.6% ( $p < 0.05$ ) higher than that of the adult horses in the test group. The average temperature in the control group of young horses was 0.5°C or 2.3% ( $p < 0.05$ ) lower than the average limb temperature in the adult horse control group. ANOVA analysis showed that the age of horses had 20.3% effect ( $p < 0.001$ ) for the results of the horse front legs thermography.

# FATTENING OF LAMBS OF DIFFERENT GENDER USING AN AUTOMATIC FEEDING STATION

Līga Šenfelde, Daina Kairiša  
*Latvia University of Agriculture*

The research was carried out on the 'Mežoki' farm located in Latvia (57.016996, 21.632202). Twelve lambs (seven female and five male) post weaning of XX crossbreed were used. The lambs were born in the flock on the 'Mežoki' farm in the period from 19 March 2017 to 15 May 2017 inclusive. The aim of this research was to study the possibility of using automatic concentrate feeding stations in lamb fattening. Research was carried out in production conditions from 17 July 2017 to 10 September 2017. Live weight monitoring of lambs was carried out before research and every two weeks (on 16 July 2017, 30 July 2017, 13 August 2017, 27 August 2017, and 10 September 2017). The frequency of visits to the automatic feeding station, the lambs' live weight changes and daily concentrate intake were analysed.

Throughout the research, the average number of daily visits to the automatic feeding station was 14, but median – 13 visits per day and multiple modes – 10 and 12 visits per day. In the last quarter of the research, the average number of daily visits to automatic feeding station (10 visits) was significant different ( $p < 0.05$ ) from those in other quarters (15 visits). The number of visits to the automatic feeding station during all quarters differed ( $V > 10\%$ ): the number varied from 0 to 30 visits per day per animal.

Under the study the maximum daily concentrate feed rations for one animal were determined progressively from 1510 g on 17 July 2017 to 1780 g on 10 September 2017. The growth of daily rations was from 5 to 10 g. The results show that the average daily concentrate intake of one animal was: 88% of average ration (1642 g) in all research period total, 91% of average ration (1538 g) in the first quarter, 87% of average ration (1608 g) in the second quarter, 90% of average ration (1682 g) in the third quarter, and 85% of average ration (1749 g) in the last quarter. A significant difference ( $p < 0.05$ ) in average daily concentrate intake was observed in the third quarter (1521 g).

The average live weight of lambs before research was 24.1 kg. A significant difference ( $p < 0.05$ ) in the average live weight of lambs was observed after the first quarter (29.3 kg) and after the third quarter (37.2 kg). The lambs had the largest average live weight gain after the first quarter (5.2 kg), and the smallest average live weight gain was observed after the last research quarter (1.6 kg).





# SEASONAL VARIATIONS OF HAEMATOLOGICAL PARAMETERS IN EQUINES INVOLVED IN ENDURANCE RIDING

Indrė Stasiulevičiūtė, Jurgita Autukaitė, Rūta Undžėnaitė, Ramūnas Antanaitis  
*Lithuanian University of Health Sciences*

*Introduction.* Endurance riding is a big challenge to horses as racing tracks are getting trickier and the maximum allowed speed increases. In Lithuania, the season of endurance riding begins in April and ends in October. Morphological blood parameters are an important and reliable indicator for assessing the health status of a horse and the level of its physical fitness. Changes in the haematological parameters of a horse are associated with several factors: physical activity and training, feed, age, sex, breed, days and seasons, the temperature and physiological state, etc.

*The aim* of this study was to determine seasonal effects on horses riding in endurance competitions and haematological parameters before and after a prolonged physical activity.

*Materials and methods.* In this study, twenty clinically healthy horses competing in ) endurance competitions of different distances (18 km, 25 km, 40 km, and 80 km) were examined. Blood samples were taken three times: at the beginning of the season, in mid-season, and at the end of season. Blood tests were taken 30 minutes before and after competition. In the laboratory, total levels of RBC, WBC, LYM, PLT, Hb, HCT, MCV, MCH, MCHC were analyzed with Abacus Junior Vet Hematology Analyzer (Austria, 2006).

*Results and conclusion.* The obtained results confirmed that blood parameters were influenced by the time of year. The lowest amount of RBC was observed in the mid-season ( $p < 0.05$ ). At the end of the season, the RBC count in blood was 40.77% higher than at the beginning ( $p < 0.05$ ). Before the competition at the end of season, Hb was 35.1% higher than at the beginning of the season ( $p < 0.05$ ). At the beginning of the season, WBC increased by 13.3% ( $p < 0.05$ ). In the mid-season, the lowest number of WBC was observed before and after competition, and the change in the number of WBC during the competition was the smallest: the number increased by 6.2% ( $p < 0.05$ ). At the end of the season, the change in WBC was 28.9% lower than at the beginning ( $p < 0.05$ ). During the season, the PLT count in blood decreased: at the end of the season, the PLT count was 17.4% lower than at the beginning ( $p < 0.05$ ).

## THE MOST COMMON REPRODUCTIVE PROBLEMS OF ALPACAS

Jurgita Autukaitė, Indrė Stasiulevičiūtė, Rūta Undžėnaitė, Lina Maldžiūtė  
*Large Animal Clinic, Lithuanian University of Health Sciences*

*Introduction.* Alpacas have poor reproductive properties due to a relatively long gestation period. The proper maturation of females is essential in maintaining reproductive efficacy and achieving successful herd growth. The births of alpacas in natural herds rarely reach 40%, while in herds grown 70%. Alpacas' infertility amounts to 30–50%, of which 10% consists of abortions. In many cases the causes remain undetermined and idiopathic. Foreign scientists are more likely to study the quality of alpaca wool and the related genetic parameters. Reproductive disorders of alpacas are a common problem in herds, although they are not well investigated.

*The aim* of the study was to identify the most common reproductive problems of alpacas, which were identified in the Large Animal Clinic of the Lithuanian University of Health Sciences.

*Materials and methods.* Twenty-six alpaca females with such disorders of the reproductive system as insensibility, obstruction, premature birth, abortion, newborns with genetically inherited diseases and birth defects were selected for the study. Diagnosis of obstetric-gynaecological cases was based on the anamnesis collected by the clients, an alpaca clinical trial, and special tests: morphological and biochemical blood tests, ultrasound, and bacteriological examination. The bacteriological sample was taken from the vaginal lobe of a female alpaca and the uterus in order to isolate and identify microorganisms and to detect antimicrobial susceptibility.

*Results and conclusion.* The study found that the most common reproductive problems of alpacas are the following: infertility (53.85%), genetic disorders (19.23%), dystocia (15.39%), and premature fetch (11.54%). Infertility caused by endometritis accounts for 38.46%, metritis – 3.85%, and stress – 11.54%. In the infertile females diagnosed with endometritis, we found 37 microorganisms, among which *Bacillus cereus* and *Staphylococcus spp.* prevailed, with 13.51% each. Alpacas' reproductive disorders mostly occurred in the autumn season (42.32%), with 23.08% in September. Reproductive problems were commonly diagnosed in alpacas that were four years old (53.61%) and which were fed a specialized diet (84.61%).



# FERMENTATION CHARACTERISTICS OF BIG-BALE LUCERNE SILAGE USING LACTIC ACID BACTERIA BLEND INOCULANT

Robertas Stoškus

*Lithuanian University of Health Sciences*

*The aim* of this study was to determine the effect of the bacterial inoculant on the ensiled lucerne fermentation characteristics in big bales.

*Materials and methods.* The experiment was conducted in 2016 at the Institute of Animal Science of the Lithuanian University of Health Science. The silages were made from second growth cut lucerne wilted for 8–9 h (up to 328 g kg<sup>-1</sup> dry matter (DM)). The lucerne was harvested from one field and was baled into 1.2 m-wide and 1.2 m-diameter cylindrical bales as well as wrapped in six layers of white-coloured stretch film. The lucerne was ensiled without additives (C) or treated with a mix of the bacterial inoculant containing *Lactococcus lactis* and *Lactobacillus buchneri* (50:50) (I). Five replications without additive and five replications with added inoculant were prepared. Both silages were stored in big bales for 120 days at an outdoor temperature under farm conditions.

*Results and conclusion.* The inoculant treatment increased the fermentation rate with a significantly deeper pH ( $p < 0.01$ ), resulted in a significant increase in the total concentration of organic acids ( $p < 0.01$ ), more lactic acid ( $p < 0.01$ ), as well as much higher levels of acetic acid ( $p < 0.01$ ) compared to untreated silage. Inoculation significantly decreased the concentrations of undesirable fermentation products such as butyric acid ( $p < 0.01$ ) and ethanol ( $p < 0.01$ ) compared to the C. The treatment with the bacterial mix reduced proteolysis of plant proteins, because ammonia-N concentration was lower ( $p < 0.01$ ) in the inoculated silage compared to the C. The inoculant treatment reduced DM losses ( $p < 0.01$ ). Application of the bacterial inoculant resulted in a higher dry matter content ( $p < 0.01$ ). The results suggest that the addition of the bacterial inoculant improved the fermentation quality in lucerne silages.

