



100 Atkurtai
Lietuvai



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

International Conference
of Young Scientists

YOUNG SCIENTISTS FOR ADVANCE OF AGRICULTURE

abstracts

SPONSORS:



LIETUVOS RESPUBLIKOS
ŽEMĖS ŪKIO MINISTERIJA

MINISTRY OF AGRICULTURE
OF THE REPUBLIC
OF LITHUANIA



Dotnuva
BALTIC

JSC
DOTNUVA BALTIC

INTERNATIONAL CONFERENCE
OF YOUNG SCIENTISTS

**YOUNG SCIENTISTS
FOR ADVANCE
OF AGRICULTURE**

ABSTRACTS

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

2018



ORGANIZING COMMITTEE
OF THE CONFERENCE:

Chaired by Prof. Dr. Zenonas Dabkevičius

Members: Prof. Dr. Baiba Rivža

Prof. Dr. Vidmantas Stanys

Prof. Dr. Henrikas Žilinskas

Prof. Dr. Darius Danusevičius

Prof. Dr. Arvydas Povilaitis

Secretary: Elena Narušytė

Compiled by Elena Narušytė

Design by Miglė Datkūnaitė

The language of the abstracts has not been edited

CONTENTS

FOREWORD	8
PLENARY SESSION	9
VENOUS HEMOGASOMETRY OF EQUINES BEFORE AND AFTER ENDURANCE RACES	9
Indrė Poškienė, Vida Juozaitienė, Jurgita Autukaitė, Rūta Undzėnaitė, Algis Noreika, Ramūnas Antanaitis <i>Large Animal Clinic, Lithuanian University of Health Sciences, Department of Animal Breeding and Nutrition, Lithuanian University of Health Sciences</i>	
EFFECT OF PLOIDY LEVEL ON DROUGHT RESPONSE IN <i>LOLIUM MULTIFLORUM</i>	10
Olakunle Kelvin Akinroluyo, Vilma Kemešytė, Gražina Statkevičiūtė <i>Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry</i>	
QUALITATIVE BEHAVIORAL ASSESSMENT AND ANIMAL TRANSPORT	11
Francesca Carnovale <i>Estonian University of Life Science</i>	
CUT-AWAY PEATLAND RE-CULTIVATION WITH FAST GROWING TREE SPECIES	12
Kristaps Makovskis, Dagnija Lazdina, Dina Popluga, Santa Neimane, Santa Celma <i>Latvian State Forest Research Institute Silava</i>	
THE EFFECT OF AGRICULTURAL FUTURES TRADING ACTIVITY ON THEIR PRICE VOLATILITY: A CURRENT REVIEW OF THEORETICAL AND METHODOLOGICAL CHALLENGES	13
Algirdas Justinas Staugaitis <i>Aleksandras Stulginskis University</i>	
IDENTIFICATION OF ALTERNATIVE HOSTS OF <i>FUSARIUM</i> SPECIES IN CEREAL-BASED CROP ROTATIONS	14
Povilas Švėgžda, Skaidrė Supronienė, Gražina Kadžienė <i>Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry</i>	
Section A. AGRONOMY AND AGROBIOLOGY	15
THE YIELD AND QUALITY OF WINTER WHEAT, DEPENDING ON CROP ROTATION AND SOIL TILLAGE	15
Madara Darguza, Zinta Gaile, Antons Ruza <i>Institute of Soil and Plant Sciences, Latvia University of Life Sciences and Technologies</i>	



THE HIGH-RESOLUTION MELTING (HRM) ANALYSIS: NEW METHOD FOR DETECTION OF GENETIC VARIANTS IN NUCLEIC ACID SEQUENCES 16

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

EFFECT OF NITROGEN RATE AND FORECROP ON NITROGEN USE EFFICIENCY IN WINTER WHEAT (*TRITICUM AESTIVUM* L.) 17

Linda Litke, Zinta Gaile, Antons Ruža
Latvia University of Life Sciences and Technologies

MINERAL NITROGEN CHANGE MONITORING IN DIFFERENT LITHUANIA'S TERRIC HISTOSOLS IN 2016–2018 18

Andrius Šarka
Agrochemical Research Laboratory, Lithuanian Research Centre for Agricultural and Forestry

FORMATION OF FABA BEAN YIELD DEPENDING ON VARIETY, SOWING RATE AND DISEASE CONTROL 19

Ieva Plūduma-Pauniņa, Zinta Gaile, Biruta Bankina, Reinis Balodis
Latvia University of Life Sciences and Technologies, Research and Study Farm “Pēterlauki”, Latvia University of Life Sciences and Technologies

COMPARISON OF DECOMPOSITION RATES ON DIFFERENT SOIL TYPES BY USING THE TEA-BAG METHOD 20

Monika Toleikiene
Lithuanian Research Centre for Agriculture and Forestry

THE EFFECTS OF MAIN AND WINTER COVER CROPS IN ORGANIC FARMING ON WATER-STABLE AGGREGATES 21

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

FERTILIZER IMPACTS ON THE MAIN NUTRIENT LEACHING IN SUSTAINABLE AGRICULTURE USED 22

Auksė Burakova (Sinkevičiūtė), Eugenija Bakšienė
Vokė Branch, Lithuanian Research Centre for Agriculture and Forestry

THE EFFECT OF HUMUS CONTENT ON WATER STABILITY OF SOIL AGGREGATES AFTER FREEZING-THAWING PROCESSES IN *CAMBISOL* 23

Mykola Kochiiaru
Lithuanian Research Center for Agriculture and Forestry

PHENOTYPIC VARIABILITY IN AUTOCHTHONOUS RED CLOVER POPULATIONS BASED ON BIO-AGRONOMICAL PARAMETERS 24

Giedrius Petrauskas, Kristina Jaškūnė, Eglė Norkevičienė
Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry

BIOCHAR AND POSSIBILITY TO USE IT FOR IMPROVEMENT OF SOIL PROPERTIES..... 25

Jelena Titova, dr. Edita Baltrėnaitė
Vilnius Gediminas Technical University

SECTION B. FORESTRY AND HORTICULTURE 26

THE EFFECT OF *CORIANDRUM SATIVUM* SEED ESSENTIAL OIL, EXTRACT, AND HYDROSOL ON *BOTRYTIS CINEREA* PERS. 26

Lina Šernaitė, Alma Valiuškaitė, Neringa Rasiukevičiūtė,
Edita Dambrauskienė, Pranas Viškelis
*Institute of Horticulture, Lithuanian Research Centre for Agriculture
and Forestry, Kaunas University of Technology, Institute of Agriculture
and Food Sciences, Aleksandras Stulginskis University*

FUNGI INHABITING RESIN TAPPING WOUNDS OF *PINUS SYLVESTRIS* L. IN LATVIA: PRELIMINARY RESULTS 27

Astra Zaļuma, Natālija Burņeviča, Tālis Gaitnieks
Latvian State Forest Research Institute Silava

THE INFLUENCE OF *BOTRYTIS CINEREA* TO CHLOROPHYLLS AND FLAVONOLS OF GREEN-LEAF LETTUCE..... 28

Asta Bylaitė, Aušra Brazaitytė, Alma Valiuškaitė,
Neringa Rasiukevičiūtė, Viktorija Vaštakaitė
Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry

INNOVATIONS IN FOREST REGENERATION MECHANIZATION 29

Karlis Duminņš, Toms Artūrs Štāls, Mārtiņš Augusts, Kristaps Makovskis, Dagnija Lazdiņa
Latvian State Forest Research Institute Silava, Latvia's State Forests

APPLICATION OF ESSENTIAL OILS FOR CONTROLLING STRAWBERRY ANTHRACNOSE 30

Armina Morkeliūnė, Neringa Rasiukevičiūtė, Alma Valiuškaitė
Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry

SEARCHING FOR CAUSAL AGENTS IN THE OAKS (*QUERCUS* SPP.) STANDS 31

Karolis Sivickis, Dovilė Čepukoitė, Zigmantas Gudžinskas, Daiva Burokienė, Tomas Bukys
*Laboratory of Plant Pathology, Institute of Botany, Nature Research
Centre, Laboratory of Flora and Geobotany, Institute of Botany, Nature
Research Centre, Vilnius Gediminas Technical University*

FUNGAL SPECIES DIVERSITY ON SMALL DIMENSION NORWAY SPRUCE LOGS INFECTED BY *HETEROBASIDION* SPP. 32

Lauma Brūna, Natālija Burņeviča, Alise Valdēna, Tālis Gaitnieks
Latvian State Forest Research Institute Silava



EVALUATION OF GREENHOUSE GAS EMISSION IN DIFFERENT BIO-SUBSTRATE FERTILIZATION OF SPRING WHEAT CULTIVATION	33
Modupe Olufemi Doyeni, Vita Tilvikiene, Skaidre Suprione <i>Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry</i>	
EFFECT OF EDAPHIC AND CLIMATIC FACTORS ON <i>THYMUS PULEGIODES</i> LINALOOL CHEMOTYPE	34
Vaida Vaičiulytė, Kristina Ložienė <i>Institute of Botany, Nature Research Centre</i>	
GENETIC DIVERSITY OF EUROPEAN BEECH POPULATIONS IN LITHUANIA	35
Rūta Kembrytė <i>Aleksandras Stulginskis University</i>	
A COMPARISON OF DIFFERENT DIMENSIONS OF HEALTH COVERAGE IN LATVIA, ESTONIA AND CZECH REPUBLIC	36
Monika Bišere <i>Latvian University of Agriculture</i>	
SECTION C. ANIMAL SCIENCE AND VETERINARY MEDICINE, FOOD SAFETY AND QUALITY	37
THE POSSIBILITIES OF SENSOR TECHNOLOGIES IN MODERN DAIRY FARMING	37
Lāsma Cielava, Daina Jonkus, Sandija Zēverte-Rivža, Baiba Rivža <i>Latvia University of Life Sciences and Technologies</i>	
DIAGNOSTIC THERMOGRAPHY: EVALUATION OF DISTAL FORELIMB TEMPERATURE OF STABLED AND FIELD LIVING HORSES	38
Rūta Undžėnaitė, Vaidas Oberauskas, Antanas Sederevičius, Judita Žymantienė, Indrė Stasiulevičiūtė, Jurgita Autukaitė <i>Large Animal Clinic, Lithuanian University of Health Sciences, Department of Anatomy and Physiology, Lithuanian University of Health Sciences</i>	
EVALUATION OF ANALGESIC FLUNIXIN EFFECT APPLIED AFTER CASTRATION IN HORSES	39
Martyna Štakonaitė, Zoja Miknienė, Zhadyra Abilova <i>Veterinary Academy, Lithuanian University of Health Sciences, Kostanay State University named after A. Baitursynov, Kazakhstan Republic</i>	
STATUS OF BLOOD MACRO AND TRACE ELEMENTS IN TWO DIFFERENT SHEEP BREED DURING EARLY SPRING PERIOD	40
Jurgita Autukaitė, Indrė Stasiulevičiūtė, Rūta Undžėnaitė <i>Large Animal Clinic, Lithuanian University of Health Sciences</i>	

TENDENCIES IN THE DAIRY SECTOR IN LATVIA.....	41
Aleksandra Rizojeva-Silava <i>Latvian University of Life Science and Technologies</i>	
PEDIGREE ANALYSIS OF TRAKEHNER HORSES IN LITHUANIA.....	42
Alma Račkauskaitė, Rūta Šveistienė, Šarūnė Marašinskienė, Audronė Rekešiūtė <i>Animal Science Institute, Lithuanian University of Health Sciences, Veterinary Academy, Lithuanian University of Health Sciences</i>	
THE INFLUENCE OF THERMAL PROCESSING TECHNOLOGIES ON ENTERAL FOOD SHELF-LIFE.....	43
Liene Ozola, Solvita Kampuse <i>Latvia University of Life Sciences and Technologies</i>	
RUMINAL PH CHANGES INFLUENCED BY FRESH GRASS AND TOTAL MIXED RATION	44
Ignas Šilinskas, Rasa Želvytė, Ingrida Monkevičienė <i>Department of Anatomy and Physiology, Lithuanian University of Health Sciences, The Research Center of Digestive Physiology and Pathology, Lithuanian University of Health Sciences</i>	
THE USAGE OF ANTIOXIDANTS FOR IMPROVEMENT OF HOT-SMOKED SAUSAGES QUALITY INDICATORS	45
Sonata Gustienė <i>Lithuanian University of Health Sciences</i>	
CONTENT OF ESSENTIAL OIL OF OREGANO (ORIGANUM VULGARE L.) OVER THE YEARS	46
Irina Sivicka <i>Latvia University of Life Science and Technologies</i>	
EFFECT OF ECG ON CONCEPTION RATE IN ANGUS HEIFERS INSEMINATED WITH SEXED SEMEN	47
Audronė Rekešiūtė, Aloyzas Januškauskas <i>Veterinary Academy, Lithuanian University of Health Sciences</i>	



FOREWORD

The Division of Agricultural and Forestry Sciences of the Lithuanian Academy of Sciences is organizing the 7th 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. This publication contains abstracts of the 39 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

PLENARY SESSION

VENOUS HEMOGASOMETRY OF EQUINES BEFORE AND AFTER ENDURANCE RACES

Indrė Poškienė¹, Vida Juozaitienė², Jurgita Autukaitė¹, Rūta Undžėnaitė¹,
Algis Noreika¹, Ramūnas Antanaitis¹

¹*Large Animal Clinic, Lithuanian University of Health Sciences*

²*Department of Animal Breeding and Nutrition,
Lithuanian University of Health Sciences*

During the exercise, the organic systems may suffer water – electrolyte and acid-base imbalances, particularly in the case of blood gases, demonstrating variations from different causes, whether respiratory and/or metabolic. Understanding the physiological adaptations to exercise is essential in the search for the optimum performance. In this way, this study measured the venous blood gases (pO_2 , pCO_2), as well as the oxygen saturation ($SatO_2$) and HCO^{-3} (bicarbonate concentration) in healthy equines, Arabian horses before and after endurance races. A total of forty nine Arabian horses were evaluated, between six and sixteen years old, finalists in endurance races. There was a significant reduction in pO_2 , pCO_2 , $SatO_2$ and HCO^{-3} after the exercise, however, the values remained within the normality range, and did not change the athletic performance of the animals, indicating a temporary alteration, assuming thus a character of physiological response to the exercise performed. The equines, finalists in endurance races, demonstrated efficient ventilatory process, without any alterations in the athletic performance, being adapted to the type of exercise imposed.



EFFECT OF PLOIDY LEVEL ON DROUGHT RESPONSE IN *LOLIUM MULTIFLORUM*

Olakunle Kelvin Akinroluyo, Vilma Kemešytė, Gražina Statkevičiūtė
Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry

Most environmental and climatic change studies predicted that the earth will be hotter and drier in the near future; this indicates that the severity of heat and drought are expected to increase in intensity. Polyploid induction has been used as a tool to improve the productivity of plants leading to the development of plant varieties that have superior characteristics and possessing a better adaptability to environmental stress.

Annual ryegrass (*Lolium multiflorum*) is forage grass species, from the family *Poaceae* and is widely cultivated in temperate regions such as southeast of North America, South America and New Zealand. Annual ryegrass is self-incompatible and occur naturally as diploids ($2n = 2x = 14$) that sets seed in the year of sowing. Drought is one of the major abiotic stresses that affects the growth and development of annual ryegrass and can greatly limit their production.

Fields trials and experiments under controlled conditions were carried out to evaluate and understand the response of both diploid and their respective induced tetraploids to drought. Morphological parameters such as the plant height, flag leaf length, flag leaf area and the inflorescence length were measured during the field experiment while the leaf elongation, chlorophyll fluorescence, relative water content and the antioxidant activity were measured during the mild drought simulation in a controlled environment.

The result showed that the tetraploids exhibited superior morphological parameter in the field trials. However, variations were observed in the both diploids and tetraploid performance in experiments under controlled conditions. This indicate that the drought response is a complex trait and a single physiological response not enough to understand the mechanism of drought tolerance in *Lolium multiflorum*. Also the the resistance to drought depends more on genotype rather than ploidy.

QUALITATIVE BEHAVIORAL ASSESSMENT AND ANIMAL TRANSPORT

Francesca Carnovale

Estonian University of Life Science

This review concerns, improvement of animal welfare, discussed by consumers and scientists. The increase live animals transport and the distances of journey, is worrying. The improvement and analysis of risks of animal welfare during transport must be carried out.

In particular, the observation of animal behavior can give important information about animal welfare.

Subsequently various studies carried out on numerous livestock animals, the QBA (Qualitative Behavioral Assessment) is a valid method to monitor and control the behavior of the animal in different environmental conditions.

Using methodology Free Choice Profiling which consists, ability of observers (Composed mostly by scientists, students, experts or breeders, after a training) to describe animal with certain words, to infer the emotion and intentions of animal. Afterwards a careful analysis of the descriptors, one could understand and approve changes to the transport procedure.

Discussing various scientific studies carried out in recent years to obtain guidelines for the application of the QBA method in animal transport in long distance, where climatic conditions external vehicle can be one of the main problems of mortality.



CUT-AWAY PEATLAND RE-CULTIVATION WITH FAST GROWING TREE SPECIES

Kristaps Makovskis, Dagnija Lazdina, Dina Popluga,
Santa Neimane, Santa Celma

Latvian State Forest Research Institute Silava

Peat production is historically important economic sector in Latvia giving significant contribution to external trade balance and providing with workplaces peoples in rural areas, where other job opportunities are limited. However, based on economical, social or ecological assumptions every peat extraction field has certain lifespan, after which peat extraction is not feasible any more. Current legislation in Latvia requires re-cultivating of places, where minerals resource, including peat, was extracted. According to this legislation, following peat field re-cultivation possibilities are allowed: afforestation, farmland or berry plantation installation, watercourse or recreational areas creation.

Aim of the study is to evaluate afforestation as one of the cut-away peatland re-cultivation possibility. This evaluation was done on the basis of cost-benefit analysis for afforestation with fast growing woody species and other tree species in plantations, like, birch, black alder, grey alder, pine, spruce, hybrid aspen, poplar and willow. Different plantation models (planting material, harvest cycles, plantation age and final timbers product) were considered. Gross profitability, benefit-cost ratio, net present value and other economical values for each tree specie and management model were calculated and compared. Afforestation economic models were also compared with other re-cultivation possibilities, like farmland and berry plantations.

Study results show that there can be identified several cost items that are important for afforestation of cut-away peatlands, like, cut-away peatland site preparation to make it suitable for planting trees, tree planting, agrotechnical care and harvesting.

THE EFFECT OF AGRICULTURAL FUTURES TRADING ACTIVITY ON THEIR PRICE VOLATILITY: A CURRENT REVIEW OF THEORETICAL AND METHODOLOGICAL CHALLENGES

Algirdas Justinas Staugaitis
Aleksandras Stulginskis University

Agricultural futures price volatility plays an important role in farmers' risk management as well as agricultural commodities price discovery. Trading activity as a factor for agricultural futures price volatility has been studied extensively since the emerge of commodity index traders followed by commodity markets becoming more volatile in the last decade.

The aim of this review is to present the current situation in the research of agricultural futures trading activity effect on their price volatility, focusing on methodological progress and related challenges.

This review provides a comparative analysis of empirical research articles on agricultural futures price volatility and its determinants published in 2008 and later.

The results provide a number of theoretical and methodological issues, specifically, the peculiarities of fundamental factors and their assessment in agricultural commodity markets in comparison to other commodity markets, the use of trading volume and open interest as main indicators for agriculture futures trading activity and their adjustment for seasonality while assessing trading activity effect on futures price volatility. On the other hand, several aspects of empirical research are left unexplored, such as lack of methodology for analyzing nonlinear and non-stationary data of agricultural futures trading as well as assessment of volatility spillover among agricultural commodity markets. Other significant findings revealed that the majority of research papers investigate major grain futures only and many agricultural commodity market segments such as dairy products are still unexamined.

Although there is no universal approach to assessing the effect of agricultural futures trading activity on their price volatility, recent advancements lead to a better understanding of the processes causing agricultural futures price volatility. Different approaches not only provide insights into the complex nature of causal relationships between futures trading activity and price volatility but also specify their peculiarities in agricultural commodity markets. However, methodological issues, including low comparability, substantially slow down the progress in the field.



IDENTIFICATION OF ALTERNATIVE HOSTS OF *FUSARIUM* SPECIES IN CEREAL-BASED CROP ROTATIONS

Povilas Švėgžda, Skaidrė Supronienė, Gražina Kadžienė

Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry

Fusarium spp. are known as causal agents of devastating cereal disease – Fusarium head blight (FHB). This disease may cause grain yield losses from 2 to 100% and reduce the grain quality through the changing of chemical composition and contamination of grains with mycotoxins.

The objective of this study was to determine the potential role of weeds and non-cereal crops present within cereal-based CR as alternative hosts. Asymptomatic weeds and non-cereal crop plants were collected in the fields managed using four different crop rotations in 2015 and 2016.

This study yielded 1309 single-spore *Fusarium* spp. isolates obtained from weed plants, 389 – from non-cereal plants and 298 – from FHB affected ears. Each of 21 weed species obtained in cereal-based crop rotation fields harboured the *Fusarium* fungi, over 95% of plant species harboured 5–7 *Fusarium* species. In weeds sampled from cereal crops (2016) was detected the considerably higher proportion of cereal-associated *Fusarium* species sampled from non-cereal crops mostly consisted the more generalist species. In 2015 and 2016, *Fusarium* fungi were also detected in 19.6–37.5% of asymptomatic plants. *F. culmorum* was the leading pathogen in all investigated non-cereal crops. Weed density and species composition varied between fields, however, *Viola arvensis*, *Lamium* spp., *Tripleurospermum inodorum* and *Veronica arvensis* were found in most of the fields. The highest density of weeds was found in spring wheat field II-CR (60.0%) and potato field IV-CR (54.4%), the lowest – in spring wheat field III-CR (4.3%). In 2016 winter wheat (I-CR) were less affected by FHB infection than spring wheat (II and III-CR) and spring barley (IV-CR). In diseased heads prevailed *F. culmorum*, *F. graminearum* and *F. poae*. Overall, the results of this study demonstrated that with FHB associated *Fusarium* species may be harboured by wide range of asymptomatic weed species and non-cereal crops grown within the cereal-based crop rotations. Since *Fusarium* fungi were isolated from asymptomatic plants, future research to identify the real associations between fungal and weed species would be needed.

Section A. AGRONOMY AND AGROBIOLOGY

THE YIELD AND QUALITY OF WINTER WHEAT, DEPENDING ON CROP ROTATION AND SOIL TILLAGE

Madara Darguza, Zinta Gaile, Antons Ruza

Institute of Soil and Plant Sciences, Latvia University of Life Sciences and Technologies

Wheat is an important crop globally due to baking properties of flour. The quality of wheat grain is strongly related to growing conditions, which can be improved by choosing, e.g. an appropriate type of soil tillage and using a well-planned crop rotation. The aim of the research was to compare whether soil tillage method and crop rotation have an impact on grain yield and quality of winter wheat.

This study was based on two season data (2016/2017 and 2017/2018) from two factor long-term trial started in 2009, with two soil tillage methods (traditional and reduced) and three crop rotation schemes (repeated wheat sowings (W–W), oilseed rape–wheat–wheat (OR–W–W), faba bean–wheat–oilseed rape–barley (FB–W–OR–B). Winter wheat fore-crops in 2017 were wheat (**W**–W), oilseed rape (**OR**–W–W) and faba bean (**FB**–W–OR–B), but in 2018 – wheat (**W**–W), wheat (OR–**W**–W) and oilseed rape (**OR**–W–W). Winter wheat variety ‘Zentos’ was used in 2017, and ‘Skagen’ in 2018. Soil type was Cambic Calcisol, nitrogen rate was 197 kg ha⁻¹ in 2017, and 180 kg ha⁻¹ in 2018. Yield was harvested by direct combining, and recalculated at 100% purity and 14% moisture. Two-factor Anova was used for mathematical data processing. The year impact was significant on yield and quality parameters, due to the different weather conditions, varieties and nitrogen rates used. Crop rotation scheme had a significant impact on wheat yield in both years ($p < 0.001$), but soil tillage method impact was not found ($p > 0.05$). The lowest grain yield was in repeated wheat sowings (on average – 5.2 t ha⁻¹ in 2018, and 6.4 t ha⁻¹ in 2017), but the highest – after faba bean in 2017 – 8.06 t ha⁻¹. Crop rotation scheme and fore-crop had a significant effect ($p < 0.05$) on grain yield, volume weight and on *Zeleny* index, lower results were found in variant W–W, or if fore-crop was wheat (OR–**W**–W). Gluten content was influenced ($p < 0.01$) by fore-crop and soil tillage method and it was higher in variant where reduced tillage was used. Protein content differed a little, but mathematically significantly only between years (10.9% in 2017, 10.2% in 2018). Falling number was not dependent on studied factors, an average result was 333 s.

Use of crop rotation schemes with different field crops included showed an improvement on grain quality indicators. Soil tillage method influence was found only on gluten content. The majority of results (except falling number) were influenced by conditions of the year.



THE HIGH-RESOLUTION MELTING (HRM) ANALYSIS: NEW METHOD FOR DETECTION OF GENETIC VARIANTS IN NUCLEIC ACID SEQUENCES

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

Genetic and genomic studies consider valuable understanding into the inheritance, structure, organization, and function of genes. The knowledge obtained from the analysis of plant genes is useful to all aspects of plant research, including crop improvement. The high-resolution melting (HRM) analysis of DNA is a method that allows detecting polymorphism in double stranded DNA by comparing profiles of melting curves (1)structure, organization, and function of genes. The knowledge gained from the analysis of plant genes is beneficial to all aspects of plant research, including crop improvement. Here, I review the recent progress in the application of high-resolution melting (HRM). High-resolution melting analysis is a post-polymerase chain reaction (PCR) method that was developed for detection of genetic variants in nucleic acid sequences. First, PCR is performed in the presence of a dye that binds to double-stranded DNA (dsDNA). This dye demonstrates low levels of fluorescence when unbound, yet is highly fluorescent in the bound state (2)methods, instruments and software for DNA melting analysis have created versatile new tools for variant scanning and genotyping. High resolution melting analysis (HRM or HRMA. After PCR is completed the amplicon (typically 50 to 500 bp long) is slowly denatured by rising temperature in steps of 0.01 °C to 0.2 °C. During this stage, termed melting analysis, the slowly denaturing amplicon releases the fluorescent dye. A melting curve can be charted from the diminishing fluorescence emission values plotted against increasing temperature. The unique shape of the melting curve belongs of the amplicon's length, sequence, GC content, and complementarity of DNA strands.

Mutagenized populations of two winter wheat cultivars ('Kena' DS and 'Gaja' DS) were developed using ethyl methane sulfonate treatment in order to create nucleotide changes in winter wheat genome. In this study four winter wheat genes (*WRKY71*, *ZCCT2*, *HSP90*, *1-FEH*) associated with cold tolerance were chosen for genetic variants detection in nucleic acid sequences by HRM analysis with gene-specific primers. Genotyping was made using HRM V.2.0.2 software (Life Technologies). Positive samples were selected by analysing the melting temperature profiles; the sample containing a nucleotide change shows lower melting temperature compared to the non-mutagenized sample. Samples identified as putative mutants were selected, reamplified and sequenced at GATC Biotech for the identification of nucleotide change.

EFFECT OF NITROGEN RATE AND FORECROP ON NITROGEN USE EFFICIENCY IN WINTER WHEAT (*TRITICUM AESTIVUM* L.)

Linda Litke, Zinta Gaile, Antons Ruža

Latvia University of Life Sciences and Technologies

The growth and development of any plant requires optimal supply of plant nutrients. Significant effect of nitrogen containing mineral fertilizers on grain yield and its quality is well-known, but at the same time nitrogen is one of the most dynamic elements of plant nutrition in the soil. Excessive application of it leads to nitrogen leaching and it affects the quality of groundwater and surface water. The objective of this research was to evaluate the effect of nitrogen fertilizer rate on nitrogen use efficiency in winter wheat after two fore-crops. The experiment was conducted at the Research and Study farm 'Peterlauki' of Latvia University of Life Sciences and Technologies (56° 30.658' N and 23° 41.580' E) during 2014/2015, 2015/2016 and 2016/2017. Researched factors were crop rotation (wheat/wheat and oilseed rape (*Brassica napus* ssp. *oleifera*)/wheat) and nitrogen fertilizer rate (altogether 6 rates: No or control, N60, N90, N120(90+30), N180(90+60+30), and N240(120+60+60). Soil at the trial site was *Endocalcaric Abruptic Luvisol*, loam; it was suitable for winter wheat growing. In spring, when the vegetation had renewed, nitrogen fertilizer (NH_4NO_3 ; N 34%) was applied for all variants, except the control (No). The whole rate of fertilizer was applied once for variants N60; rate was divided into two applications for variants N120, but into three applications – for variants N180 and N240.

The results indicated that application of the nitrogen fertilizer had significant ($p < 0.001$) effect on winter wheat grain yield, and mean grain yield significantly increased until nitrogen rate N180. Forecrop did not affect significantly ($p = 0.47$) the average winter wheat grain yield. Increasing nitrogen fertilizer rate also removal of N, P_2O_5 and K_2O with wheat biomass significantly ($p < 0.001$) increased. Significant increase of nitrogen removal with grain yield depending on forecrop was observed until nitrogen rate N180 – N240; removal of P_2O_5 and K_2O significantly increased until N-rate N120 – N180. Results showed that the nitrogen fertilizer rate significantly ($p < 0.001$) affected nitrogen use efficiency and the higher nitrogen use efficiency was noted at the lowest nitrogen rates. Forecrop had a significant ($p < 0.05$) impact on nitrogen use efficiency. In all fertilizers rates, higher nitrogen use efficiency was obtained growing wheat after wheat if compared to wheat growing after oilseed rape.



MINERAL NITROGEN CHANGE MONITORING IN DIFFERENT LITHUANIA'S TERRIC HISTOSOLS IN 2016–2018

Andrius Šarka

Agrochemical Research Laboratory,

Lithuanian Research Centre for Agricultural and Forestry

In Lithuania schedules for fertilising mineral soils with nitrogen (N_{\min}) are prepared based on the amount of mineral nitrogen (N_{\min}) in the soil, annual N_{\min} monitoring is performed in order to observe the change of N_{\min} . Whereas, rating scales for terric histosols, that make 8% in Lithuania, are not designed, this needs extra research. Therefore, the research on how different temperature, moisture and season influence the amount of mineral nitrogen has been carried out and concentration of soil organic material (SOM) in terric histosols compared to mineral soils.

For this reason, terric histosols in different places in Lithuania were chosen and compared to alongside mineral soils. 12 pitches (as options) were investigated: 4 pitches in Southern Lithuania (E21°98'9603; N55°14'5806), 4 pitches in Eastern Lithuania (E21°98'9603; N55°14'5806) and 4 pitches in Western Lithuania (E21°98'9603; N55°14'5806). The size of the pitch was 20 m² (5 x 4 m), where soil sampling was repeated 3 times. (N_{\min}) in terric histosols was sampled 6 times: autumn 2016, spring 2017, summer 2017, autumn 2017, spring 2018 and 2018 summer.

As it was expected, the research showed that N_{\min} concentration in 0 – 30 cm layer was the highest and varied from 86 to 121 mg kg⁻¹ in grassland and from 103 to 270 mg kg⁻¹ in the land under the plough in summer 2017. Whereas in mineral soils N_{\min} concentration was 7.3 times lower. In spring 2017, when the average temperature was not higher than 8–11 °C, in eight from twelve pitches, N_{\min} concentration in 0–30 cm layer was 7% lower than in autumn 2016.

In September and October 2017, high rainfall significantly increased soil moisture. This influenced autumn 2017 data, which showed that where SOM was higher (more than 70%) N_{\min} was similar or higher compared to autumn 2016 results, and in soils where SOM was low N_{\min} decreased, especially in 0 – 30 cm layer, where N_{\min} was 35% lower compared to summer 2017.

In June 2018, the rainfall was very low, but comparing N_{\min} concentration in summer 2017 to summer 2018, there are no evident differences.

FORMATION OF FABA BEAN YIELD DEPENDING ON VARIETY, SOWING RATE AND DISEASE CONTROL

Ieva Plūduma-Pauniņa^{1,2}, Zinta Gaile¹, Biruta Bankina¹, Reinis Balodis¹

¹*Latvia University of Life Sciences and Technologies*

²*Research and Study Farm “Pēterlauki”, Latvia University of Life Sciences and Technologies*

Faba beans (*Vicia faba* L.) are one of the most important legume in the world. Despite the growing interest about this crop, few studies have been carried out about it during last decades in Baltic – Nordic region. The aim of this study was to estimate how variety, seeding rate and disease control affect faba bean yield and its components.

Research was carried out at the Research and Study Farm (RSF) “Pēterlauki” of the Latvia University of Life Sciences and Technologies (LLU) during 2015–2017. Three factors were researched: A – variety (‘Laura’, ‘Boxer’, ‘Isabell’), B – seeding rate (30, 40 and 50 germinable seeds m⁻²), C – treatment with fungicide (with and without application of fungicide Signum (boscalid, 267.0 g kg⁻¹, pyraclostrobin, 67.0 g kg⁻¹), 1 kg ha⁻¹). Beans’ yield (t ha⁻¹) was detected in the trial and yield components were determined using sample sheet (10 plants from each plot). Meteorological conditions were mostly suitable for high faba beans’ yield formation in all three trial years. Three- and four- factor analysis of variance and correlation was used for data processing.

Variety ‘Boxer’ provided significantly ($p < 0.001$) higher faba bean yield (6.10–7.74 t ha⁻¹) in every trial year. Variety ‘Isabell’ showed the lowest yield (5.57–7.15 t ha⁻¹). Use of higher seeding rate (50 germinable seeds m⁻²) provided higher yield of all varieties in all years. Fungicide application also increased the yield significantly by 0.17–0.58–0.95 t ha⁻¹ (in 2015, 2016, 2017 respectively), if compared to variant without fungicide. Number of pods per plant increased significantly with each trial year. Number of pods per plant was higher when lower seeding rates were used. Number of seeds per plant had a close positive correlation with number of pods per plant; whereas number of seeds per pod was a relatively stable and typical characteristic for variety. Its value was significantly influenced by the variety and it increased when fungicide was used.

Faba bean yield was significantly ($p < 0.001$) affected by all four (including trial year) researched factors. The highest yield was provided by variety ‘Boxer’ when higher seeding rates and fungicide was used. Also number of pods and seeds per plant was affected by all researched factors, being significantly higher when lower seeding rate and fungicide was applied. Number of seeds per pod is a fairly stable characteristic of faba beans – three seeds per pod was noted.



COMPARISON OF DECOMPOSITION RATES ON DIFFERENT SOIL TYPES BY USING THE TEA-BAG METHOD

Monika Toleikiene

Lithuanian Research Centre for Agriculture and Forestry

Decomposition rate is one of the main factors that qualify the sustainability of nutrient cycles, especially in organic farming. The rate of decomposition must be considered when choosing crop species in the rotation and agricultural management tools for a specific location.

For this reason, the tea-bag method (*Keuskamp et al.*, 2013) was used to compare the decomposition rates in different soils of Lithuania and some of the EU countries. Green and rooibos tea was used as a standardized organic material to show the differences in recalcitrant fractions.

The trial was carried out at Lithuanian Research Centre for Agriculture and Forestry, in two locations of Lithuania – Dotnuva and Joniškėlis. The aim was to study the decomposition rate in light loam (Akademija) and heavy loam (Joniškėlis) soils, at two soil depths (4–7 and 14–17 cm) and two management types (with red clover biomass incorporation and without) during the non-vegetation period in 2016 and 2017.

During 120 days of the study period, 44.02% of green and 16.71% of rooibos tea was decomposed in light loamy soil in Dotnuva. For comparison, 33.1% of green tea and 11.5% of rooibos tea mass was digested in heavy loam soil in Joniškėlis. This suggests that plant residues incorporated in the autumn, are actively mineralized during the non-vegetation season. The decomposition rate depended on the chemical composition of the organic matter, soil texture and the weather conditions. In December, the decomposition rate of green tea was 19.7–21% and that of rooibos tea 5.1–9.2%. In January, the mean monthly temperature was negative, therefore, the mineralization of organic materials was low, it became more intensive during the period of warmer weather in February and March.

In addition, this research compares the decomposition rates of different local green manures used in organic farming. In agreement with the previous results, the study showed that in the light loam soil organic manure from red clover, pea or wheat decomposed faster than in the heavy loam soil.

In collaboration with the European countries, a wide study comparing tea-bag decomposition data, obtained during the same periods in 2016 and 2017, was conducted. The study placed Lithuania's light loam soil in the category of moderate decomposition rate, while the decomposition rate in heavy loam reflected the trends of boreal climate countries.

THE EFFECTS OF MAIN AND WINTER COVER CROPS IN ORGANIC FARMING ON WATER-STABLE AGGREGATES

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

Organic farming is getting increasingly popular in Estonia. However, compared with conventional farming, organic farming has more challenges in maintaining a sustainable soil management. Due the absence of mineral fertilizers, greater emphasis must be placed in manure applications, main crops in crop rotation and in the use of winter cover crops (WCC). This all affects differently the soil properties, foremost the soil structure, which consists of the arrangement of soil aggregates. Therefore soil aggregate stability is one of the most important soil properties as it is directly influencing other soil physical and chemical properties and biological processes. Concurrently, aggregate stability is also one of the most complex soil properties. For that reason, previous studies, especially under organic farming, have given controversial results. Therefore, this study was conducted in Estonia near Tartu on a sandy loam *Stagnic Luvisol*, with the purpose to research the effects of main and winter cover crops in organic farming on water-stable aggregate stability (WSA). The experiment (established in 2008) had a crop rotation which contained in sequel the following main crops: 1) pea, 2) potato, 3) spring barley with red clover undersown, 4) red clover and 5) winter wheat. All main crops were treated by three different treatments: 1) without WCC, 2) WCC and 3) WCC + Farmyard manure (40 Mg ha^{-1} within the crop rotation). The study focused in period of 2012–2015. To determine WSA, soil samples, from depths 5–10 and 30–35 cm were analyzed with wet sieving method. The results showed that: 1) potato had significantly lowest (57.1%) WSA in 5–10 cm depth, while highest (50.6%) WSA in 30–35 cm, however other main crops had limited effect on WSA; 2) there was a high annual variability in WSA; 3) the WSA among winter cover crop treatments, was significantly lower (51.5%), than in control (55.6%) on in WCC with manure (55.5%) and 4) there was a positive correlation ($r = +0.39$) between WSA and phosphorous content and regardless of treatments phosphorous balance was negative, although decline was no significant in WCC with manure treatment. Based on this study, it can be concluded that main and winter cover crops have some effect on WSA, but it is complicated and further research on a longer time period is needed.



FERTILIZER IMPACTS ON THE MAIN NUTRIENT LEACHING IN SUSTAINABLE AGRICULTURE USED

Auksė Burakova (Sinkevičiūtė), Eugenija Bakšienė

Vokė Branch, Lithuanian Research Centre for Agriculture and Forestry

The main object of this lysimeters experiment is to show that the organic fertilizers can achieve excellent harvest results by fertilizing the light granular soil with the sustainable agriculture principles, which restores the natural biological activity of the soil. Adding the organic fertilizers can increase organic matter formation in the soil and help to reduce the leaching of materials. The lysimeter experiment was set up at the Vokė Branch of the Lithuanian Research Centre for Agriculture and Forestry (LAMMC) in 2016. Were placed in sandy loam and in light loam *Haplic Luvisol* soil. Each soil was represented by three replications, which monitored and evaluated the effects of organic fertilizers (Provita, phosphorite powder, potassium magnesia (NPC sources), sapropel and manure) leaching tendencies of biogenic elements in four option plots with one control (no fertilizer). Considering to the average amount of leaching during the hydrological year, significantly lower nitrogen leaching with all organic fertilizers is observed; 166, 36–104, 18 kg ha⁻¹ in sandy loam; in light loam 135.22–92.75 kg ha⁻¹. Looking at the seasonal nitrogen loss, in spring we can see lower leaching amount with all fertilizers in the sandy loam and in light loam, but the differences were not significant.

In the summer the rainfall reduced, if we compared with the spring period, leaching quantity of infiltration has decreased by about four times, but the difference between fertilized and non-fertilized soils has had increased. If we compared with not fertilized plots, in sandy loam soil, we will see the lower nitrogen leaching losses (about 50%) with all fertilize variants, but not essential; in the light loam essential decrease was (about 40–50%, $P < 0,05$) with the all fertilizers as well. The lower losses of nitrogen leaching are due to the fact that in fertilized soils a formed denser and thickness plant of crop, which significantly reduces the precipitation of infiltration, as well as the loss of material, respectively.

The most intensively phosphorus leaching process is in spring and autumn time, over the next seasons the concentration content in infiltration water decreased. The experiment showed that, in summer in intensive growing process of agricultural plants, significantly higher potassium content can be leached through out from soils with low humus content.

THE EFFECT OF HUMUS CONTENT ON WATER STABILITY OF SOIL AGGREGATES AFTER FREEZING-THAWING PROCESSES IN *CAMBISOL*

Mykola Kochiiaru

Lithuanian Research Center for Agriculture and Forestry

The goal of this study was to evaluate the effect of humus content on water stability of aggregates after 3 cycles of freezing-thawing in different land use methods (forest, reduced tillage (RT) and conventional tillage (CT)), at different water contents (field capacity and near saturated) and different soil depths (0–10, 10–25 and 25–40 cm) in *Cambisol*, Central Lithuania.

Land use method and soil depth had an effect on the water stability of aggregates (WSA) at different water content. The greatest values of WSA averaged across the depth amounted from 27.6 to 97.2% in the forest and 23.4–41.3% under RT application, while the lowest values – 20.9–28.8% were observed under CT. The percentage of WSA in all land uses and depths at field moisture content was less than at near saturated soil moisture content.

The contents of humus amounted to 6.52% in the depth of 0–10 cm, to 1.94% at the 10–25 cm depth and to 0.97% in the soil depth of 25–40 cm in the forest. The contents of humus amounting to 2.09% at the 0–10 cm depth, to 1.91% at the depth of 10–25 cm and to 0.82% at the depth of 25–40 cm were recorded under RT, while humus content under CT was 1.87% at the 0–10 cm depth, 2.3% at the 10–25 cm depth and 0.48% at the 25–40 cm soil depth. The content of humus value averaged across the land use in the 10–25 cm of depth amounted to 2.1% and was lower by 1.4 percent in the 25–40 cm soil layer, but it was higher by 1.3 percent than in the 0–10 cm of depth.

The relationship between WSA and the content of humus in different depths and land use can be described by a linear regression models during soil freezing-thawing processes at field moisture content ($y = 8.37x + 21.32$, $R^2 = 0.62$) and near saturated soil moisture content ($y = 11.96x + 16.30$, $R^2 = 0.57$). WSA was directly related to humus content in soil and increased when the content of humus increased.



PHENOTYPIC VARIABILITY IN AUTOCHTHONOUS RED CLOVER POPULATIONS BASED ON BIO-AGRONOMICAL PARAMETERS

Giedrius Petrauskas, Kristina Jaškūnė, Eglė Norkevičienė

Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry

High selection pressure in natural habitats causes the higher resistance of wild red clover populations to stressors than of cultivated genotypes therefore they could be used as an excellent initial breeding material. While breeding for the higher yields made the cultivars less adaptable to changing environmental conditions and lead to a lower susceptibility for pests, diseases and drought or for overwintering which is primary importance for sustainable crop production in stress environment. Red clover population growing in particular habitats may have the specific morphological characteristics and economically important traits. Therefore this study aimed at characterizing autochthonous red clover populations based on 13 morphological and bio-agronomic parameters in Lithuania.

Field experiment was carried out at Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry (LAMMC ŽI) *Endocalcari-Epihypogleyic Cambisol* (RDg4-k2) with a texture of moderately heavy loam predominates in the fields. In total 30 wild red clover populations which were collected from various regions of Lithuania, 11 accessions from GeneBank and 12 cultivars were planted in a row in three replications in randomized complete block design. Population was represented by 15 individuals where each of them was evaluated for whole plant, stems, and leaves.

The results show significantly higher overwintering of several autochthonous red clover populations compared to local bred cultivars *ex situ*. Population no. 2892 overwintered only 50%, meanwhile no. 2170 and 2884 overwintered 100% of plants. Due to early and warm spring red clover started to flower earlier than anticipated and most of the populations were earlier than the cultivars. Principal component analysis of red clover populations ($n = 55$) based on morphological and economically useful traits have shown high phenotypic diversity within the populations and only three of all populations (no. 2206, 2875, 2902) was significant different at 95% level. It means that diversity between populations is low despite existing high phenotypic variability within populations.

BIOCHAR AND POSSIBILITY TO USE IT FOR IMPROVEMENT OF SOIL PROPERTIES

Jelena Titova, Edita Baltrėnaitė
Vilnius Gediminas Technical University

Currently, the problem of utilization of sewage sludge is very important all over the world. Sewage sludge composting is becoming more and more popular. Research of biochar becomes also popular. It is considered, that when biochar is produced by pyrolysis and incorporated into the soil, the emission of greenhouse gases into the atmosphere reduces. Incorporation of biochar into the soil reduces also nutrient leaching, improves soil structure, soil fertility and vitality and abundance of microorganisms.

Biochar in this study was produced at 450 °C and 700 °C temperatures from Vilnius sewage sludge compost (SSC), from biomass of willow cultivar 'Tora' and mugwort *Artemisia dubia* Wall., fertilized with SSC. Biochar was produced also from biomass of unfertilized willow and mugwort and was studied for comparison. Biomass of plants was obtained from the Vokė branch of the Lithuanian Research Centre for Agriculture and Forestry.

Previous researches showed, that 'Tora' and *Artemisia dubia* accumulate very active the heavy metals (HM), absorbed from the soil. As these plants grow very well in Lithuanian conditions and form a large yield of biomass, these plants can be used for cleaning the soil from HM and biomass of these plants later can be used for production of biochar.

During the scientific experiment was studied, how feedstock type and temperature during biochar production influenced chemical and physical properties of biochar. Also we studied possibilities of biochar insertion into the soil, with the aim to improve the soil properties.

In the course of the study, it was found that the concentrations of N, C and Cu, Cd ir Zn in willow biomass were significantly higher than those in mugwort biomass ($p < 0.05$). The concentrations of Pb, Ni, ir Cr in mugwort biomass were higher than those in willow. The yield of biochar decreased with the increase of pyrolysis temperature from 450 °C to 700 °C.

This research is funded by the European Social Fund under the No 09.3.3-LMT-K-712 "Development of Competences of Scientists, other Researchers and Students through Practical Research Activities" measure. Number of project: 09.3.3-LMT-K-712-02-0030.



Section B. FORESTRY AND HORTICULTURE

THE EFFECT OF *CORIANDRUM SATIVUM* SEED ESSENTIAL OIL, EXTRACT, AND HYDROSOL ON *BOTRYTIS CINEREA* PERS.

Lina Šernaitė¹, Alma Valiuškaitė¹, Neringa Rasiukevičiūtė¹,
Edita Dambrauskienė¹, Pranas Viškelis^{1, 2, 3}

¹*Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry*

²*Kaunas University of Technology*

³*Institute of Agriculture and Food Sciences, Aleksandras Stulginskis University*

Botrytis cinerea is the causal agent of the strawberry (*Fragaria x ananassa* Duch.) grey mold, which could result in damaging plants and fruits during the growth and storage. It is important to find alternative means from nature to control berries pathogens and to avoid the use of harmful to human and environment synthetic products. Coriander (*Coriandrum sativum* L.) seeds are the source of lipids, essential oils, and other bioactive compounds. The aim of this research was to test alternative plant protection means obtained from dried coriander seeds on *Botrytis cinerea* obtained from strawberry. Three preliminary plant protection means were produced by different methods: 1) coriander seed extract was gained by subcritical CO₂ extraction, 2) essential oil and 3) hydrosol were obtained by hydrodistillation. All obtained preliminary products separately mixed with potato dextrose agar (PDA) medium from 200 µl up to 1800 µl/1000 ml concentrations. The 7 days old mycelium disc (6 mm) of the pathogen was placed on each Petri dish with tested mean and incubated at 22 °C in the dark. The growth of *B. cinerea* and the effectiveness of each tested alternative protective agents was evaluated after 2, 4 and 6 days. The research data showed that coriander seed essential oil was most effective: it demonstrated 100% inhibition at 1600 and 1800 µl/1000 ml concentrations while at lower concentrations showed effectiveness from 48.53 to 93.24%. The highest effect of coriander seed extract was 54.16%. at 1600 µl/1000 ml, however other investigated concentrations did not reveal inhibitory effect. Hydrosol did not inhibit the growth of *B. cinerea* at all investigated concentrations.

The results demonstrated the antifungal activity differences between alternative plant protection means extracted by various methods. Coriander seed essential oil showed the greatest effect against *B. cinerea*, however, the further research is needed to evaluate the composition of the substances and its impact on the growth of pathogen and antifungal activity.

FUNGI INHABITING RESIN TAPPING WOUNDS OF *PINUS SYLVESTRIS* L. IN LATVIA: PRELIMINARY RESULTS

Astra Zaļuma, Natālija Burņeviča, Tālis Gaitnieks
Latvian State Forest Research Institute Silava

In the century of global warming the development of renewable polymers from natural resources has increasingly gained attention of the society. Resins are used to produce turpentine, feedstock, cleaners, pine oil, compounds for fragrances and pesticides, solvent and thinner for paints, and pharmaceuticals products, etc. moreover it have been proposed as renewable alternative source of biofuel. Traditionally resins collect by tapping pine trees. Pines can be used for resin tapping for several years and after that benefit from other purposes, like timber harvesting. Although resin secretion is the part of defence mechanism against fungal and insect attack, huge wounds (like after resin tapping) are unlikely to be occluded and are subjected to infection by stem decay causing fungi.

The aim of this study was to evaluate the decay incidence and associated fungi in over-mature *Pinus sylvestris* L. more than 30 years after resin tapping. In total, 90 trees were evaluated and all resin tapping wounds of pines were measured. From every resin tapping wound one wood sample was collected (1 cm bellow injury) for evaluation of presence of decay and subsequent fungal isolation. One to two representatives of each fungal morphotype were subjected to molecular identification.



THE INFLUENCE OF BOTRYTIS CINEREA TO CHLOROPHYLLS AND FLAVONOLS OF GREEN-LEAF LETTUCE

Asta Bylaitė, Aušra Brazaitytė, Alma Valiuškaitė,

Neringa Rasiukevičiūtė, Viktorija Vaštakaitė

Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry

The objective of this study was to determine chlorophyll and flavonols difference in green-leafy lettuce after artificial fungus infection.

The green-leaf lettuce (*Lactuca sativus* L., 'Little Gem') were inoculated with pathogenic fungus *Botrytis cinerea* LT13B_FRA_76 (BC). Lettuces were grown for 4 weeks in closed controlled environment growth chamber. Day/night temperatures of 21 ± 2 °C/ 17 ± 2 °C were established with the 16-h photoperiod and a relative humidity 50–60%. The single-spore BC isolate cultivated on Potato Dextrose Agar (PDA) at 22 °C in the dark for 7 days. The 20 mm diameter isolate disk was used for inoculation on plants. The indexes of chlorophylls and flavonols were determined each seven days after inoculation (DAI) by non-destructive method (DualEx®4). Healthy index (HI) was measured seven days after inoculation by non-destructive method (CID-710).

Results revealed that chlorophylls and flavonols indices significantly ($P < 0.05$) increased in infected lettuce 1 DAI. The growing of chlorophyll and flavonol indices confirmed rising of healthy index. Indices of green-leaf infected lettuces significantly increased ($P < 0.05$) and showed the same tendency 2 DAI. Curiously the chlorophyll index decreased in infected lettuces, but flavonol index increased in comparison to healthy lettuces 3 DAI. At 4 and 5 DAI index of chlorophylls decreased; however, the index of flavonols increased in infected plants. At 6 DAI flavonol index significantly decreased in comparison to healthy lettuces. To sum up, the indices of chlorophylls and flavonols, and green vegetation HI showed the earliest *Botrytis cinerea* disease symptoms at the first day after infection. Chlorophyll index had a tendency to decrease; however the flavonols index increased. This dynamic of photosynthesis pigments indices needs more researches.

INNOVATIONS IN FOREST REGENERATION MECHANIZATION

Karlis Duminš¹, Toms Artūrs Štāls¹, Mārtiņš Augusts²,
Kristaps Makovskis¹, Dagnija Lazdiņa¹

¹*Latvian State Forest Research Institute Silava*

²*Latvia's State Forests*

Forest regeneration method planting has many benefits. Although in Latvia planting in furrows made by disc trenching is the most common antropogen forest regeneration method, soil preparation in spot mounds is becoming more widely used each year, especially in wet areas, because created mound pit collects the excessive water and improves growth conditions for planted trees. Usually the soil is prepared before planting, but it is possible to use mechanical planting, when planting occurs during preparation of planting spot. Mechanical planting could solve the problem of labour availability and increase productivity of forest management. The aim of this study was to compare two forest planting strategies, their impact on quality of planting spot, productivity of reforestation, seedling survival and growth rate. A field study was undertaken at six forest stand sites, and reforestation was conducted in the spring of 2017. Mechanical planting was done with M-Planter 120 and manual planting was done using planting tube where planting spots were previously prepared by LSFRI Silava developed mounding device MPV600 that has a similar shaped blade. At all stands the same origin Scots pine (*Pinus sylvestris*) and Norway spruce (*Picea abies*) containerised seedlings were planted. The evaluation of planting spots, survival and growth rate was conducted in the spring of 2018, but planting productivity was measured during planting process. Results showed that the average time spent to plant one hectare mechanically was 11.9 hours compared to 11.2 hours for manual planting combined with soil preparation. Average survival rate of spruce was higher where planting was done manually but pine survival rate was similar between both methods, and quality of planting spot was also similar. In conclusion, mechanical planting could be used as alternative and efficient forest regeneration method.



APPLICATION OF ESSENTIAL OILS FOR CONTROLLING STRAWBERRY ANTHRACNOSE

Armina Morkeliūnė, Neringa Rasiukevičiūtė, Alma Valiuškaitė

Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry

The anthracnose caused by *Colletotrichum* spp. pathogens infect several parts of a strawberry plant, the rotten fruits are visible only on ripe berry, yield losses can reach up to 80%. Under warm and rainy vegetation season conditions for the disease, the spread is very quickly and may destroy the entire plant. Anthracnose becomes one of the significant pathogens necessitates exploring novel control strategies. It can be partially controlled by applying protective fungicides from flowering through to harvest, but the chemical control is often not sufficient.

The essential oils antiseptic properties play an essential role in protection against fungal pathogens. Essential oils can be used as one of the bio-control agent controlling plant pathogens. The aim of this study was to evaluate the inhibition of *Colletotrichum* spp. by different essential oils: *Thymus vulgaris*, *Salvia officinalis*, *Coriandrum sativum*, *Mentha piperita* and *Hyssopus officinalis*. The research was carried out at the LAMMC Institute of Horticulture Laboratory of plant protection. The inhibition of mycelial growth was evaluated at concentrations 200 µl/l, 400 µl/l, 600 µl/l, 800 µl/l and 1000 µl/l. The small purified isolate fragment (10-mm diameter) placed at the center Petri with different essential oil concentrations. Petri plates incubated 25 °C in darkness and evaluated after 2, 4, 6 days.

T. vulgaris essential oil completely inhibited *Colletotrichum* spp. growth at concentrations > 200 µl/l. The results show that *T. vulgaris* essential oil could control anthracnose till 6 days after application. The results show that *S. officinalis*, *C. sativum*, *M. piperita* and *H. officinalis* essential oils at different concentrations inhibited *Colletotrichum* spp., but not so efficient as *T. vulgaris*. The results show that *S. officinalis* and *C. sativum* essential oils efficiency against anthracnose were very similar. The *C. sativum* concentrations at 600 and 800 µl/l inhibited the growth of *Colletotrichum* spp. after 2 days till 0,8 cm. However, *S. officinalis* growth at 1000 µl/l was 1,4 cm. Our data indicate that after 5 days *H. officinalis* growth at 800 µl/l was 2.96 cm and *M. piperita* at 1000 µl/l–2.81cm. Our findings indicate that *T. vulgaris* essential could be an effective biocontrol agent to control strawberry *Colletotrichum* spp.

SEARCHING FOR CAUSAL AGENTS IN THE OAKS (*QUERCUS* SPP.) STANDS

Karolis Sivickis¹, Dovilė Čepukoit¹, Zigmantas Gudžinskas²,
Daiva Burokienė¹, Tomas Bukys³

¹Laboratory of Plant Pathology, Institute of Botany, Nature Research Centre

²Laboratory of Flora and Geobotany, Institute of Botany, Nature Research Centre

³Vilnius Gediminas Technical University

Oaks (*Quercus robur* L.) have been affected by oak dieback or decline for much of the past century. Disease is observed in Europe and North America also in Asia.

The decline has a marvelous impact on ecological and economical damages. Researches purpose that biotic (e.g. pathogens, pests) and abiotic (global warming, high winds, disturbed environments and air pollution are factors for oaks decline. The infected oak trees are showing leaf defoliation and dry of with- in a few years. Elongated dieback and secondary diseases are weakening trees. In certain areas it leads to death lately years.

Therefore, the ground causal agents impact of causal agents of must be define to evaluate of oak decline should be assessed. The main objectives of our study are to evaluate the health condition of an affected stands: (1) to estimate the diversity of fungal community in the soil and oak trees; (2) to compare if there are any differences in the composition of the causal agents of the infected oak trees.

During 2016–2018 samples of soil and trees showing crown defoliation, wilting of skeletal branches from 15 locations (75 trees in total) were collected. 599 fungal isolates from *Q. robur*, *Q. rubra*, *Q. petraea* and *Fagus sylvatica*, belonging to Fagaceae family, are under further analysis.



FUNGAL SPECIES DIVERSITY ON SMALL DIMENSION NORWAY SPRUCE LOGS INFECTED BY *HETEROBASIDION* SPP.

Lauma Brūna, Natālija Burņeviča, Alise Valdēna, Tālis Gaitnieks
Latvian State Forest Research Institute Silava

Heterobasidion spp. is one of the most important fungal pathogen in Latvia and causes great economical losses in managed conifer stands. One of the ways to limit *Heterobasidion* spp. primary infection by spores is to remove decayed spruce logs. However, removing residues from forest stands could decrease diversity of other wood inhabiting fungi. Our previous studies reveal that the highest *Heterobasidion* spp. fruit body production is 2–3 years after felling. The aim of this investigation was to evaluate *Heterobasidion* spp. development and determine fungal diversity on small dimension (with diameter less than 12 cm) Norway spruce (*Picea abies* (L.) Karst.) logs left in different forest types.

Experiment was established in 2013. Decayed and healthy looking 80 cm long spruce logs were left in four forest sites. In total, 336 spruce logs were used: 42 decayed and 42 healthy looking logs in each forest site. Logs were inspected every year in autumn since 2014 by visual evaluation of fungal fruit bodies.

Obtained results show relatively small species richness on small diameter spruce logs. *Heterobasidion* spp. fruit bodies were found on 50% of infected logs in 2014, and 20% in 2016. The succession of fungal species has been observed. *Phlebiopsis gigantea* and *Stereum sanguinolentum* have been found on logs only 3–4 years after felling. Due to extreme weather conditions (prolonged dryness) in 2018, species richness and *Heterobasidion* spp. development on small diameter Norway spruce logs has been limited. In forest stands with abundant vegetation cover most commonly *Armillaria* spp. rhizomorphs were observed.

EVALUATION OF GREENHOUSE GAS EMISSION IN DIFFERENT BIO-SUBSTRATE FERTILIZATION OF SPRING WHEAT CULTIVATION

Modupe Olufemi Doyeni, Vita Tilvikiene, Skaidre Suprione

Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry

One of the major sources of Greenhouse gas emissions (GHG) is Agriculture. The increase in the use of agricultural crops in bioenergy generation has resulted in effective land use, more productive energy biomass and increased GHG emissions. The progressive rise in digestate volume following biogas production has informed their use as biofertilizers in Agriculture. Recent studies have focused on the cultivation of energy crops with specific parameters in terms of productivity, quality and land use leading to the production of first and second-generation biofuels while minimizing GHG emissions. The monitoring of the GHG index from soil represent an important part in soil-plant reactions that takes place as a result of bio-substrate fertilization. GHG are lost from the soil through both natural and biogeochemical processes to the atmosphere. In this study, GHG emissions associated with the cultivation of spring wheat with bio-substrate fertilization are quantified and compared. The experiment field had a random design of five treatments (Control, Mineral Nitrogen, Chicken bio-substrate, Cow bio-substrate and Pig bio-substrate) each with three replicates. Each plot size was 3m x 10 m (30 m²). The experiment field was split fertilized as N90 and N80 at wheat tillering and stem elongation stages. Greenhouse Gas measurements at two weeks interval for crop growing period were taken in glass vial via a syringe and subsequently analysed via gas chromatography. Methane, Carbon (IV) oxide and Nitrous Oxide were the major greenhouse gases measured. The results showed that CO₂ and N₂O emissions increased after digestate fertilization due to the mineralization of organic material with a drop thereafter. CH₄ emissions increased from the initial drop after the second split fertilization with the highest CH₄ emission peak from Cow bio-substrate. The primary results suggest that bio-digestate can be applied to agricultural land as a fertilizer for spring wheat cultivation with no short-term risks arising from GHG emissions.



EFFECT OF EDAPHIC AND CLIMATIC FACTORS ON *THYMUS PULEGIOIDES* LINALOOL CHEMOTYPE

Vaida Vaičiulytė, Kristina Ložienė
Institute of Botany, Nature Research Centre

Chemical polymorphism is characteristic of essential oil bearing medicinal and aromatic species *Thymus pulegioides* (Lamiaceae). Linalool chemotype is one of six *Thymus pulegioides* chemotypes found in Lithuania. Linalool is the main chemical compound of *Thymus pulegioides* linalool chemotype; it is widely used in cosmetic, perfumery as well as the insect repellent. Although the chemotype of the plant is determined genetically however quantitative and qualitative composition of essential oils can be influenced by climatic conditions and soil chemical composition.

The aim of the study was to establish distribution individuals of linalool chemotype in Lithuania and determine the influence of edaphic and climatic factors on the percentage of linalool in *T. pulegioides*.

One hundred and thirty one different habitats of *T. pulegioides* were investigated in Lithuania. The study of the habitats was carried out in all climatic sub-districts of Lithuania. The individuals of linalool chemotype were also grown in open ground under same field conditions at the Field Experimental Station of the Nature Research Centre. Aerial parts of these individuals were collected six years annually. Essential oils were isolated by hydrodistillation and analysed by GC/MS. Meteorological data were obtained from meteorological bulletins of closest station of meteorology of Lithuanian Hydrometeorological Service under the Ministry of Environment.

The individuals of *T. pulegioides* linalool chemotype are rare in Lithuania. The highest distribution of this chemotype and percentage of linalool were established in the Nemunas Lowland and Mūša-Nevėžis climatic sub-districts.

The amount of essential oil in the individuals of linalool chemotype varied from 0.55 to 1.09% across years and significantly correlated with sunshine duration in the period from April to July ($r = 0.83$, $p < 0.05$). The amount of linalool varied from 60.86 to 73.52%. Influence of edaphic and climatic factors on the percentage of linalool was not established.

GENETIC DIVERSITY OF EUROPEAN BEECH POPULATIONS IN LITHUANIA

Rūta Kembrytė

Aleksandras Stulginskis University

Due to climate warming, especially milder winters, European beech is spreading northwards to Lithuania. This spreading is especially strong in the western part of Lithuania due to more favourable climate in sea side lowland. In western Lithuania, European beech stands were planted by German foresters before the Second World. European beech is economically and ecologically valuable deciduous forest tree species in all Europe which is likely to occupy niche of endangered European ashes stands and Norway spruce stands which has already started to decrease because of negative environmental factors. There are two scientific problems with plantations of European beech in Lithuania. The first problem is the unknown origin. If these plantations originate from too far south, their adaptability can be compromised due to its southern origin. If we will use these planted stands as the main introduction source of beech in Lithuania, our new beech forests may suffer from maladaptation. The second problem could be low genetic diversity. Again, low genetic diversity will lead to a failure because of injuries (low adaptability), low viability, inbreeding depression (low genetic diversity) and poor economic value. The main aim of the study is to investigate and conclude on the genetic suitability of the main mature European beech stands and groups of trees introduced to Lithuania for the further introduction of European beech in Lithuania based on DNA and morphological markers. First results of the project revealed high morphological and phenological variation among and within the European beech stands in Lithuania. Variation in stem morphotype varied from multi-cormic trees of no commercial value to straight single stem trees of superior commercial quality. Spring leaf onset phenology varied from early flushing form (leaves fully open) to late flushing form (no bud burst at all over whole tree crown). This indicates high genetic diversity of introduced beech stands to Lithuania and diverse material for further genetic improvement of this tree species. DNA samples were taken for genetic studies.



A COMPARISON OF DIFFERENT DIMENSIONS OF HEALTH COVERAGE IN LATVIA, ESTONIA AND CZECH REPUBLIC

Monika Bišere

Latvian University of Agriculture

Latvia, Estonia and Czech Republic share many similarities in a geopolitical context: 1. they are located in central and eastern Europe; 2. have a shared historical inheritance; 3. underwent a social, political and economic transition following the collapse of communist regimes; 4. joined the EU at the same time, in 2004. The three countries are similar in many ways but experience markedly different levels of financial hardship. The incidence of catastrophic and impoverishing out-of-pocket payments is very low in the Czech Republic, higher in Estonia and among the highest in the European Region in Latvia. Catastrophic spending on health is heavily concentrated among the poorest households in all three countries and heavily concentrated among pensioner households in Estonia and Latvia, but not in the Czech Republic. The degree of financial hardship experienced by catastrophic spenders varies across countries. On average, Estonian and Latvian households with catastrophic out-of-pocket payments are spending a much larger share of their budget on health than Czech households.

References:

WHO. Financial protection in high-income countries. A comparison of the Czech Republic, Estonia and Latvia. WHO Regional Office for Europe: 2018.

Kutzin J, Cashin C, Jakab M (eds) (2010). Implementing health financing reform: Lessons from countries in transition. Copenhagen: WHO Regional Office for Europe on behalf of the European Observatory on Health Systems and Policies.

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

THE POSSIBILITIES OF SENSOR TECHNOLOGIES IN MODERN DAIRY FARMING

Lāsma Cielava, Daina Jonkus, Sandija Zēverte-Rivža, Baiba Rivža
Latvia University of Life Sciences and Technologies

The use of modern technologies in dairy farming is relatively new concept. With the development of technologies, the use of sensor technologies expands and covers various parts of livestock husbandry. With the widespread use of sensor technologies, it is possible to obtain and analyse real time data that covers dairy cow daily time budget, feeding and housing quality, the preservation of cow and youngstock health as well as monitoring cow milk productivity and quality. In European Union (EU) modern sensor technologies and the possibilities of their use is one of main research focuses as evidenced by different EU support for programs and projects that covers research and information dissemination about the possibilities of dairy sensors in dairy farms. One of examples is the “Horizon 2020” project “Data Driven Dairy Decisions for Farmers” or 4D4F, that is devoted to the education of farmers, consultants, researchers and veterinarians about the possibilities of different in-farm sensors and their possible use for different problem solving. In project are included 16 organizations from 9 European countries that works on the development of standard operating procedures and the best practice guides in total of 8 categories that covers almost every aspect of dairy cow health and welfare. There is a possibility to collect data about almost every aspect of individual animals’ life, but the benefits of them are only if the data are reviewed and analysed for the improvement of flawed aspects. In Latvia the automatic milking systems, step counters, cow activity sensors and herd management programs are taking irreplaceable place in dairy farms. The analysis of data from dairy sensors showed significant increase of cow longevity, milk productivity and quality as well as improved cow welfare conditions and lowered the need of human presence during different periods.



DIAGNOSTIC THERMOGRAPHY: EVALUATION OF DISTAL FORELIMB TEMPERATURE OF STABLED AND FIELD LIVING HORSES

Rūta Undzėnaitė¹, Vaidas Oberauskas², Antanas Sederevičius²,
Judita Žymantienė², Indrė Stasiulevičiūtė¹, Jurgita Autukaite¹

¹*Large Animal Clinic, Lithuanian University of Health Sciences*

²*Department of Anatomy and Physiology, Lithuanian University of Health Sciences*

Introduction. Diagnostic thermography is a noninvasive method to detect infrared radiation which can be directly correlated to blood flow. Motion is essential for horses as it improves blood circulation in distal limbs and distributes the load of work on joints equally through the day. Most of sport horses spend their all day in stable and goes out only for short training session. Long standing and short time of intensive training can lead to distal limb injury.

The aim of the study was to determine the distal limb temperature differences in horses stabled in boxes and living in a field.

Materials and methods. Horses that are living in a stable ($n = 32$), and horses that lives free in a field ($n = 21$) were examined. Thermograms of distal limbs were taken from the caudal side of the legs. Legs in thermograms were evaluated bilaterally. Temperature measurements were made at a total of 10 regions of interest (ROIs) at the distal parts of the limbs.

Results and conclusions. The average temperature in field-living horse group fetlock joints was $1.6\text{ }^{\circ}\text{C}$ ($p < 0.05$) higher than in the stabled horse group. The average temperature difference between bilateral limbs in fetlock joint region was $0.8\text{ }^{\circ}\text{C}$ ($p < 0.01$) lower in group of field- living horses compared to stabled horses group. The average temperature in field-living horse group hooves was $1.2\text{ }^{\circ}\text{C}$ ($p < 0.01$) higher than in the stabled horse group. The average temperature difference between bilateral limbs in hooves was $0.6\text{ }^{\circ}\text{C}$ ($p < 0.01$) lower in group of field- living horses compared to stabled horses group. In other ROIs no significant temperature difference was found between the groups. Results shows that motion helps to keep equal blood flow in horse limbs. Bilateral limb temperature difference in fetlock joint and hooves ROIs shows that short time intensive training can increase risk of injury.

EVALUATION OF ANALGESIC FLUNIXIN EFFECT APPLIED AFTER CASTRATION IN HORSES

Martyna Štikonaitė¹, Zoja Miknienė¹, Zhadyra Abilova²

¹*Veterinary Academy, Lithuanian University of Health Sciences*

²*Kostanay State University named after A. Baitursynov, Kazakhstan Respublic*

Aim: to compare the effectiveness of a single pre- or postoperative flunixin meglumine (FM) injection versus two injections preceding and following an orchiectomy in horses.

Materials and methods: 15 stallions presented to LSMU Large Animal Clinic for a routine castration were divided into three groups. Group I (6 patients) received FM *i.v.* one hour prior to premedication. Group II (5 patients) were injected one hour after they stood up after the operation. Group III (4 patients) received both doses. Their average behaviour, facial expressions, blood cortisol levels were compared before, one hour, 6 hours after the operation and on the next morning. Behaviour and facial expression were assessed by points in a pain scale suggested by Gleerup, 2015, which ranged from 0 to 12 (0 – no pain, 12 – most obvious pain recorded). Blood cortisol was measured by biochemical analysis from blood collected into tubes with no anticoagulant. Statistical analysis was performed using Microsoft Excel 2013.

Results: pain scale showed that before the operation average scores varied insignificantly (Group I – 2.6, Group II – 1.2, Group III – 1.3). The clear difference was observed on 6th hour after the operation as Group I had a score of 6.8 and Group II – 5.4, although Group III had a clearly lower score of 2.8.

Measurements of cortisol levels in blood serum showed no difference between the groups before the operation. On first hour Group I and III had lower levels (118.36 mmol/l and 116.48 mmol/l) than Group II – 159.69 mmol/l. On the 6th hour cortisol levels of Group I rose significantly to 173.52 mmol/l and went down in Group II to 132.93 mmol/l. Even lower cortisol levels were evident in Group III (113.87 mmol/l). The next morning Groups I and II did not differ significantly from one another (144.4 mmol/l and 165.27 mmol/l), although Group III still had low levels of cortisol (109.07 mmol/l).

Conclusion: a single FM injection before premedication (Group I) was effective only 1st hour after the operation. An injection after the operation (Group II) had still no effect on hour 1, but was already evident on hour 6. Consequently FM injected twice (Group III) was effective during the whole first day of postoperative period.



STATUS OF BLOOD MACRO AND TRACE ELEMENTS IN TWO DIFFERENT SHEEP BREED DURING EARLY SPRING PERIOD

Jurgita Autukaitė, Indrė Stasiulevičiūtė, Rūta Undzėnaitė

Large Animal Clinic, Lithuanian University of Health Sciences

The assessment of mineral needs of animals has come to include determination of the minerals in the tissues, fluids, and products. Many factors affect requirements, including kind and levels of production, age, level, and chemical form of elements, interrelationships with other nutrients, mineral intake, breed, and animal adaptation. Health problems caused by the excess or deficiency of mineral substances are called metabolic diseases. A major goal in mineral research has been to discover and develop simple and accurate biochemical measurements of the status of animals for the minerals in which there are important practical problems.

The aim of the study was to identify and compare status of trace and macro elements in two different sheep breeds blood serum in early spring before season of grazing.

Materials and methods. The study was conducted in April, before season of grazing, in order to evaluate the ratio of mineral substances in the body. Two sheep breeds were chosen for the study: Suffolks and Merino sheep. Sheep were kept and fed in similar conditions in both farms. Twenty clinically healthy sheep were used for the study purpose. Average body weights were 40–45 kg. About 6 ml blood samples were collected from 20 Suffolk, and 20 Merino sheep breed by jugular vein puncture into evacuated tubes. Blood serum was analysed for Ca, P, Mg, Fe, Cu and Zn using biochemical analyser. Studies were carried out at the LUHS Large Animal Clinic Laboratory.

Results and conclusion. Average Ca concentration in Merino breed was 0,23 mmol/l ($P < 0.01$) higher compare with Suffol sheep. Average P level in Suffolk was 0,1 mmol/l ($P < 0.01$) higher then in Merino sheep. Average Cu level in Merino sheep was 6,32 µg/dl lower ($P < 0.4$) compared with Suffolk sheep. Average Zn level in Merino sheep was 4,1 µg/dl lower ($P < 0.5$) than in Suffolk sheep. Mg level in blood serum Suffolk sheep was 0,12 mmol/l ($P < 0.001$) lower than in Merino sheep. The investigations show that differences in the concentration of all serum macrominerals exist between different sheep breed when retained on similar conditions. Variation in serum macromineral status may be attributed to many factors affecting mineral requirements, interrelationships with other nutrients.

TENDENCIES IN THE DAIRY SECTOR IN LATVIA

Aleksandra Rizojeva-Silava

Latvian University of Life Science and Technologies

Agriculture is an important sector of the economy in the European Union (EU) and milk production is one of the most significant agricultural sectors. In the structure of agriculture production in Latvia, milk production is the most important sector among animal farming sectors and the second after grain production in the structure of final production of animal products recalculated to basic prices, amounting at 19% of all agriculture products. After joining the EU dairy sector in Latvia has changed – small dairy farms could not complete the new technological requirements and hygiene standards of milk production and left the business thus reducing the amount of dairy cows in Latvia.

A strong impact on the milk sector in Latvia had milk quotas, which were introduced by EU on 1st of April, 2010. After five years of a preparatory increase in their level, milk quotas were abolished on 1st of April, 2015, which led to the increase of milk production all over EU between 2015 and 2016. In last five years the number of farms and dairy cows is decreasing in Latvia, but milk production continues to increase. It means that farmers generally choose cows with higher genetic potential that can produce more milk in a lactation and improve the feeding and welfare conditions that leads to higher productivity. The increase in productivity is also linked to the farm structure – as more and more small scale farmers with less productive cow herds and smaller milk yields are leaving the business, medium and large dairy farms with better and more precisely managed livestock farming and thus higher milk yields increase the overall productivity.

The changes in the milk purchase price in Latvia are to a big extent dictated by the milk price in EU and the key markets of EU. The milk purchase price in Latvia is closely related to the price of milk in the world and in the EU; therefore, global changes affect the local milk price and cause fast fluctuations in milk prices. The lowest milk purchase prices in Latvia during the reference period reached on July 2016, decreasing to 177.1 EUR / t. The main reasons for the decline in the milk purchase price were the import ban imposed by the Russian Federation (embargo) as of 7 August 2014 and the incoming volatility of the global dairy market and the sharp decline in demand in Asia, especially in China.

Without doubt dairy sector in Latvia is still the most important agricultural commodity production sector besides grain production.



PEDIGREE ANALYSIS OF TRAKEHNER HORSES IN LITHUANIA

Alma Račkauskaitė¹, Rūta Šveistienė¹,
Šarūnė Marašinskienė¹, Audronė Rekešiūtė²

¹*Animal Science Institute, Lithuanian University of Health Sciences*

²*Veterinary Academy, Lithuanian University of Health Sciences*

The knowledge of population structure is one of the most important goals for the conservation of animal genetic resources, especially in the context of natural ecosystem stability. Trakehners are a transboundary riding horse breed bred in accordance with the principles of pure breed. The aim of this study was to evaluate the parameters of small population of Lithuanian Trakehner horses based on pedigree records.

3500 Trakehners pedigree data with birthdates since 1923 to 2018 were analyzed by software system POPREP. The average pedigree completeness, population size, number of inbred horses, inbreeding coefficient, generation intervals and effective population size were calculated.

The average pedigree completeness for Trakehners born within the last 10 years: 1 generations deep 100%, 2 generations deep – 96%, 3 generations deep – 89.6%, 4 generations deep – 82.7%, 5 generations deep – 75.6%, 6 generations deep – 67.6%. The average Trakehners population size is 1062 horses. Since 2008 population decreased by 34%. The effective population size was 73 in 2017. At an average 79 Trakehners were born per year and at an average 68% of them were inbred. The average inbreeding coefficient among inbred horses was 0.04 (SD – 0.03) in 2008 and 0.03 (SD – 0.02) in 2017. The generation interval has decreased from 13 to 10 years within 10 years period.

Performed parameters indicated that population of Lithuanian Trakehner horses is in endangered-maintained state. The conservation program should be continued to keep it on the safe state in the future.

THE INFLUENCE OF THERMAL PROCESSING TECHNOLOGIES ON ENTERAL FOOD SHELF-LIFE

Liene Ozola, Solvita Kampuse

Latvia University of Life Sciences and Technologies

Enteral feeding or enteral nutrition is nutritient delivery into the stomach. Products for enteral nutrition are designed to provide nutrients to human body in case of various diseases and after surgery, when the daily intake of food is affected [1;2;3]. Nowadays these products are supplemented with synthetic vitamins and minerals. However their bioavailability in the body is lower than that of natural organic complexes. Therefore, it is important to develop special dietetic products from natural materials [1;2;3]. The aim of this research was to investigate the influence of cook-vidé, pasteurisation and sterilisation methods on plant based enteral food shelf-life.

For this research two sets of samples with different recipes were prepared from semi-finished fruit, vegetable and berry based juices, provided by 'Ltd KEEFA' an added source of protein, vitamin D and salt was also used. Samples were prepared using cook-vidé (CV) (0.06 MPa pressure, product temperature during cooking 79 ± 2 °C withstood for 15 min) [2], pasteurization at 95 ± 2 °C, withstood for 5 and 20 min and sterilization at 105 °C for 20 min and at 120 °C for 5 min. The prepared samples were stored at room temperature in dark place and microbiologically tested on total plate count (TPC), *Escherichia coli*, lactic acid bacteria, moulds and yeasts, also product pH, soluble solids (Brix%) and titratable acidity was detected. Samples were initially tested 18 h after preparation and the quality changes during storage were evaluated every 2 weeks.

The obtained data showed a slight difference in product pH depending on the recipe. The microbiological testing of products showed no *E.coli* presence in products after their preparation. However TPC was still above the allowed norms in all CV samples therefore this method was deemed to be not successful. These findings do not coincide with previous experiments. Also pasteurization modes showed inconsistencies in product microbiological safety depending on the product recipe. This could be explained due to several reasons within the product preparation stages and therefore this experiment needs to be repeated. According to microbiological testing, product sterilization provided a minimum of 8 week shelf-life for these samples, this was also noticed in a pasteurized sample where the recipe a slightly lower pH of 4.4, pasteurization at 120 °C for 5 min.



RUMINAL PH CHANGES INFLUENCED BY FRESH GRASS AND TOTAL MIXED RATION

Ignas Šilinskas², Rasa Želvytė^{1,2}, Ingrida Monkevičienė^{1,2}

¹Department of Anatomy and Physiology, Lithuanian University of Health Sciences

²The Research Center of Digestive Physiology and Pathology,
Lithuanian University of Health Sciences

The ruminal pH is highly important for dairy cows health and productivity. The feeding type and strategy have to be focused on stabile ruminal pH for optimal fermentation process and animal wellness.

The aim of this study was to investigate effect of fresh grass and total mixed ration (TMR) on ruminal pH of the dairy cows.

Lithuanian red dairy cows ($n = 3$) with ruminal bolus for pH measurements were used for 60 days studies in dairy farm of Panevezys region.

The everyday feeding was based on two periods: grazing and TMR feeding. Pastured cows grazed fresh grass (40% red clover; 60% ryegrass) *at libidum* for 6 hours (10.45 a.m. – 4.45 p.m.) and then were herded to the barn and fed a TMR with grass silage (54%), corn silage (12%) and concentrates (34%) at 7.00 a.m. and 5.00 p.m. The water intake all the time was available *at libidum*.

Before the trial, a intraruminal wireless pH bolus (SmaXtec Premium Bolus, SmaXtec GmbH, Austria) was administrated to each cow. The ruminal pH values were continuous measured and recorded automatically during all trial period.

In total 12 960 records of ruminal pH values over 2 160 hours were analyzed. The results are presented as mean (\bar{X}) and standard deviation of the mean (SD), 95% confidencial interval (CI) and Pearson's correlation coefficient (r). The results were considered statistically significant when $p \leq 0.05$. The statistical analyses of the results were carried out using IBM Statistic SPSS version 15 (license No. 9900457; IBM, USA).

The ruminal pH at grazing period ($\bar{X} = 6.36$; [CI 6.35; 6.38]; SD = 0.22) was in 2.72% higher ($p < 0.001$; $r = 0.390$) to compare with TMR feeding period $\bar{X} = 6.19$; [CI 6.17; 6.21]; SD = 0.21).

The ruminal pH value below 6.00 has been recorded for 13.62% of total measured time, but it was for 5.92% longer ($p < 0.001$; $r = 0.747$) during TMR feeding period.

In conclusion, the ruminal pH was lower and being below 6.00 value for longer period during a TMR feeding. It might be caused by concentrates of TMR as well as drastic change of feeding type at the same day.

THE USAGE OF ANTIOXIDANTS FOR IMPROVEMENT OF HOT-SMOKED SAUSAGES QUALITY INDICATORS

Sonata Gustienė

Lithuanian University of Health Sciences

The aim of this study was to analyze selected antioxidants (extracts such as: pomegranate, rosemary, garlic, onion, green tea) and to apply bioactivating materials (protective bacterial cultures: *Staphylococcus carnosus*, *Staphylococcus vitulinus*) in hot-smoked sausage technology. Using physical chemical methods pH, color changes, nitrite content, antioxidant activity, peroxide number, fatty acid composition were evaluated during production and storage period, and using a profile analysis method – organoleptic properties. The applied bioactive substances and their mixtures effectively reduced the total number of aerobic bacteria, *E. coli*, and yeast and mold in hot smoked sausages compared to non-antioxidant samples ($p < 0.05$). These substances (of such extracts as: green tea, rosemary and pomegranate, garlic, onion) also had an effect on the reduction of nitrites, since the statistical analysis of the results of the study during the whole storage period showed a weak linear negative relationship between the amount of nitrites and the number of aerobic microorganisms in hot-smoked sausages during the storage period, respectively $R = -0.374$ and $R = -0.377$. Comparing DPPH active radical (antioxidant) activity in hot-smoked sausages with and without additives, a significantly higher antioxidant activity was observed in samples with rosemary and pomegranate extracts ($p < 0.05$ in both cases). These samples also showed a statistically significant decrease in peroxide and fatty acids. Lower pH was observed in the samples with the mixture of bioactive substances comparing with control ones without antioxidants ($p \leq 0.05$). Having used protecting cultures *Staphylococcus carnosus*, *Staphylococcus vitulinus* together with antioxidants, the organoleptic properties of the products ($p \leq 0.05$) and the stability of the colour were improved during the storage period ($p < 0.05$). Combining these cultures with rosemary extract in the production of hot-smoked sausages, not only organoleptic properties have been improved, but also the term of use has been prolonged.



CONTENT OF ESSENTIAL OIL OF OREGANO (*ORIGANUM VULGARE* L.) OVER THE YEARS

Irina Sivicka

Latvia University of Life Science and Technologies

Oregano (*Origanum vulgare* L.) is classified as paramount medicinal plant in Europe. In average, it contains 1.65% of essential oil. In Latvia, the fundamental *ex situ* collection of genetic resources of aromatic and medicinal plants contains 44 accessions of oregano. They were added from different places of Latvia. Soil at the trial site is strongly altered by cultivation loam with organic matter content 2.7 g kg^{-1} , pH KCl 6.3, P content 102 mg kg^{-1} and K content 207 mg kg^{-1} . Plant care is provided for this collection. For all analysis oregano samples had been prepared identically: the accessions were cut in the stage of full flowering. The samples were dried at $+26 \text{ }^{\circ}\text{C}$ temperature in a special drying cabinet with ventilation.

First research about the content of essential oil of oregano accessions from *ex situ* collection was realized in 2006 within the project of the Nordic Gene Bank "Spice- and medicinal plants in the Nordic and Baltic countries. Conservation of Genetic Resources". By this project, the content of essential oil in dry samples varied between 0.5% and 1.4% (average 0.9%). Next research was realised in 2011 by ECPGR project „Conservation and characterization of oregano (*Origanum vulgare* L.) wild populations in Europe". The average content of essential oil in dried samples varied from 1.9 to 4.4 mg g^{-1} (average 3.2 mg g^{-1}). The latest research was made in 2015 with cooperation with Warsaw University of Life Science. The results showed the average content of essential oil was $0.16 \text{ ml } 100 \text{ g } 10^{-1} \text{ d.m.}$ in 2012, $0.12 \text{ ml } 100 \text{ g } 10^{-1} \text{ d.m.}$ in 2013 and $0.14 \text{ ml } 100 \text{ g } 10^{-1}$ in 2014. The conclusion is that Latvian oregano is poor in essential oil. The results also have the tendency to decrease. On the one site, the content of essential oil depends on such factors as geographical place, meteorological conditions, genetic aspects, plant nutrition etc. On the other site, vegetative propagation can have negative effect on the content of essential oil because of the process of biological ageing of oregano.

EFFECT OF ECG ON CONCEPTION RATE IN ANGUS HEIFERS INSEMINATED WITH SEXED SEMEN

Audronė Rekešiūtė, Aloyzas Januškauskas
Veterinary Academy, Lithuanian University of Health Sciences

The objective of this study was to evaluate the effect of eCG used in combination with oestrus synchronization protocol for Angus heifers inseminated with sexed semen. We assessed heifer conception rate, average size of the ovaries, follicles and embryos, and progesterone concentration.

All heifers were synchronized by insertion of progesterone-releasing device for 7 days, and 1 day prior to removal, injected with 25 µg of PGF_{2α}, and on day 7 all heifers were injected with eCG. Heifers were randomly assigned to treatment groups based on the dose of eCG injected: Group L (n = 7) received 400 IU and Group H (n = 5) received 600 IU of eCG respectively. Heifers were inseminated 48–56 h following device removal, or observed in heat. Conception rate was confirmed by ultrasound scanner on day 28 post AI.

In total 91.6% of heifers were exhibiting oestrus signs and were inseminated during oestrus detection period. Conception rate differed numerically between the groups and was lower in Group L compared to the Group H (28.6% vs. 60%) (n.s.). Left (LO) and right (RO) ovaries area were assessed on the initiation of eCG administration (ieCG) and on the day of AI (dAI). RO area was higher on ieCG in Group L and was 418.86±40.85 mm² and Group H was 398.0±40.21 mm². On the dAI RO area was greater in Group H (441.0±51.39 mm²) compared to the Group L (373.71±40.90 mm²). LO area was larger on ieCG in Group L (444.29±58.6 mm² and in Group H (536.6±79.85 mm²) compared to the dAI in Group L (394.57±33.9 mm²) and in Group H (412.0±49.01 mm²).

Average size of the follicles was larger on the dAI compared to that of ieCG. The average size of follicles on ieCG in Group L was 9.54±0.19 mm and in Group H was 9.33±0.31 mm. On the dAI in Group L follicles size was 10.5±0.20 mm, in Group H was 12.13±0.38 mm. Mean P₄ concentration on ieCG for Group L was 4.473±0.73 ng/ml and in Group H was 3.5±0.36 ng/ml. Mean P₄ concentration on dAI in Group L was 1.0543±0.65 ng/ml and in Group H was 0.4760±0.067 ng/ml. Mean area of embryo on conception detection day in Group L was 100.00±20.0 mm² and in Group H was 78.0±13.317 mm².

There was a tendency of higher conception rate with higher eCG dose used in oestrus synchronisation protocol in Angus heifers.



Published by the Lithuanian Academy of Sciences
2018
lma.lt

Printed by UAB BMK leidykla
bmkleidykla.lt



