MULTIFUNCTIONAL AGRICULTURE AT THE OUTSET OF XXI CENTURY: CHALLENGES AND RISKS

The international Scientific Conference

BOOK OF ABSTRACTS

DAUDZFUNKCIONĀLA LAUKSAIMNIECĪBA XXI GADSIMTA SĀKUMĀ: IZAICINĀJUMI UN RISKI

Starptautiskā zinātniskā konference
Jelgava, Latvija, 22. – 23.marts, 2007

REFERĀTU KOPSAVILKUMI

JELGAVA 2007
### Conference Organizing Committee

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chairman</td>
<td>Dainis Lapins, prof.</td>
<td>Latvia University of Agriculture</td>
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<td>Vice-Chairman</td>
<td>Aleksandrs Adamovics, prof.</td>
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<td>Members</td>
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<td>Andris Berzins assoc. prof.</td>
<td>Latvia University of Agriculture</td>
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<td>Ziedonis Grislis, doc.</td>
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<td>Kaspars Kampuss, doc.</td>
<td>Latvia University of Agriculture</td>
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<td>Aldis Karklins, prof.</td>
<td>Latvia University of Agriculture</td>
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<td>Daina Kairisa, assoc.prof.</td>
<td>Latvia University of Agriculture</td>
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<td>Latvia University of Agriculture</td>
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<td>Inara Lipenite, assoc.prof.</td>
<td>Latvia University of Agriculture</td>
</tr>
</tbody>
</table>

### Conference Scientific Committee

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Institution</th>
</tr>
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<tbody>
<tr>
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<td>Members</td>
<td>Mintauts Abolins, assoc. prof.</td>
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<td>Vaclovas Boguzas, assoc. prof.</td>
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<td>Ziedonis Grislis, Dr.agr.</td>
<td>All Russian Forage Research Institute</td>
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<td>Vladimir Kosolapov, prof.</td>
<td>University of South Bohemia, Faculty of Agriculture</td>
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<td>Stanislav Kuzel, prof.</td>
<td>Latvia University of Agriculture, Biotechnology and Veterinary Medecine Institute</td>
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<td>Janis Miculis, Dr.agr.</td>
<td>Feed Research Institute of UAAS, Ukraine</td>
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<td>Vasily Petrichenko, prof.</td>
<td>Estonian University of Agriculture</td>
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<td>Are Selge, Dr.agr.</td>
<td>Warsaw Agricultural University</td>
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<td>Piotr Stypinski, prof.</td>
<td>Latvia University of Agriculture</td>
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<td>Inara Turka, prof.</td>
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</tbody>
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Note

Authors are fully responsible for the content of abstract.

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Latvian Academy of Agricultural and Forestry sciences,
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LV-3001, Latvia
http://www.llu.lv

Association of Latvian Organic agriculture, Liela iela 2,
Jelgava, LV-3001, Latvia
http://www.ekoprodukti.lv

Research and Study farm “Vecauce” of Latvia
University of Latvia Agriculture, Akademijas iela 11 a, Auce,
LV-3708, Latvia
http://www.llu.lv/mps_vecauce/mps.htm
### Conference programme

<table>
<thead>
<tr>
<th>Session</th>
<th>Session and titles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wednesday, March 21</strong></td>
<td></td>
</tr>
<tr>
<td>till 17.00</td>
<td>Participants’ arrival and registration. Information about accommodation if needed.</td>
</tr>
<tr>
<td>18.00</td>
<td>Concert (Jelgava Palace). Performance of Students of the Latvia University of Agriculture.</td>
</tr>
<tr>
<td>~ 20.30</td>
<td>Welcome party in the Main Building (Jelgava Palace) of the Latvia University of Agriculture.</td>
</tr>
<tr>
<td><strong>Thursday, March 22</strong></td>
<td></td>
</tr>
<tr>
<td>8.30 – 9.30</td>
<td>Registration of the conference participants.</td>
</tr>
<tr>
<td><strong>Plenary session</strong></td>
<td></td>
</tr>
<tr>
<td>LLU Hall</td>
<td>Chair: Lapins D., Adamovics A., Karklins A. (Latvia)</td>
</tr>
<tr>
<td>9.30 – 9.40</td>
<td>Opening conference</td>
</tr>
<tr>
<td>Rivza P., LLU Research pro – rector</td>
<td></td>
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<tr>
<td>9.40 – 10.00</td>
<td>LATVIAN AGRARIAN RESEARCH IN EUROPEAN DIMENSION</td>
</tr>
<tr>
<td>Rivza P. (Latvia)</td>
<td></td>
</tr>
<tr>
<td>10.00 – 10.30</td>
<td>LATVIA’S ANIMAL HUSBANDRY AND VETERINARY MEDICINE SCIENTIFICAL AND PRACTICAL DEVELOPMENT</td>
</tr>
<tr>
<td>Jemeljanovs A. (Latvia)</td>
<td></td>
</tr>
<tr>
<td>10.30 – 11.00</td>
<td>AGRICULTURE MULTIFUNCTIONALITY IN LATVIA: PROBLEMS, RISKS AND CHALLENGES</td>
</tr>
<tr>
<td>Jirgena H. (Latvia)</td>
<td></td>
</tr>
<tr>
<td>11.00 – 11.30</td>
<td>Coffee break</td>
</tr>
<tr>
<td>11.30 – 12.00</td>
<td>USAGE OF ENERGETIC CROPS AS ALTERNATIVE SOURCE OF ENERGY IN CZECH REPUBLIC</td>
</tr>
<tr>
<td>Kuzel S. (Czech Republic)</td>
<td></td>
</tr>
<tr>
<td>12.00 – 12.30</td>
<td>CURRENT SITUATION OF THE FORAGE PRODUCTION IN RUSSIA</td>
</tr>
<tr>
<td>Kosolapov V. (Russia)</td>
<td></td>
</tr>
<tr>
<td>12.30 – 13.00</td>
<td>RESOURCES AND RISKS GROWING GENETICALLY MODIFIED (GM) CROPS IN LATVIA</td>
</tr>
<tr>
<td>Turka I., Ruza L. (Latvia)</td>
<td></td>
</tr>
<tr>
<td>13.00 – 14.00</td>
<td>Lunch</td>
</tr>
<tr>
<td><strong>Section meeting and poster presentation</strong></td>
<td></td>
</tr>
<tr>
<td><strong>1. SOIL SCIENCE, PLANT, FERTILIZER AND FIELD MANAGEMENT</strong></td>
<td></td>
</tr>
<tr>
<td>Auditorium: 123.</td>
<td>Chair: Karklins A. (Latvia), Bogdevitch I. (Belarus)</td>
</tr>
<tr>
<td>14.00 – 14.15</td>
<td>SOME ASPECTS OF HARMONIZATION AND STANDARTIZATION OF SOIL INFORMATION</td>
</tr>
<tr>
<td>Karklins A. (Latvia)</td>
<td></td>
</tr>
<tr>
<td>14.15 – 14.30</td>
<td>SOIL ORGANIC MATTER AND ITS STABILITY IN AEROBIC AND ANAEROBIC CONDITIONS</td>
</tr>
<tr>
<td>Kuzel S., Kolar L., Stindl P. (Czech Republic)</td>
<td></td>
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<tr>
<td>14.30 – 14.45</td>
<td>COMPARISON OF METHODS FOR DETERMINATION OF PHOSPHORUS IN CALCAREOUS SOILS</td>
</tr>
<tr>
<td>Vucans R., Lipenite I., Livmanis J. (Latvia)</td>
<td></td>
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<tr>
<td>14.45 – 15.00</td>
<td>APPLICABILITY OF VARIOUS AMENDMENTS TO IMPROVE CLAYEY SOIL PROPERTIES UNDER REDUCED TILLAGE MANAGEMENT IN NORTHERN LITHUANIA</td>
</tr>
<tr>
<td>Velykis A., Satkus A. (Lithuania)</td>
<td></td>
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<tr>
<td>15.00 – 15.15</td>
<td>RESPONSE OF SPRING RAPE SEED YIELD TO MAGNESIUM AND SULFUR FERTILIZERS</td>
</tr>
<tr>
<td>Bogdevitch I., Mishuk O. (Belarus)</td>
<td></td>
</tr>
</tbody>
</table>
15.15 – 15.30 THE EFFECT OF FERTILIZERS RATES CALCULATED BY DIFFERENT METHODS ON NUTRIENT BALANCE AND SOIL AGROCHEMICAL PROPERTIES
Mazvila J., Vaisvila Z., Staugaitis G., Arbacauskas J., Adomaitis T. (Lithuania)

15.30 – 15.45 Coffee break

15.45 – 16.00 EFFICIENCY OF REDUCED HERBICIDE DOSAGES IN BARLEY FERTILISED WITH DIFFERENT RATES OF NITROGEN
Malecka S., Bremanis G. (Latvia)

16.00 – 16.15 ГЕРБИЦИДЫ ПОЧВЕННОГО ДЕЙСТВИЯ В ПОСЕВАХ СОИ
Корпанов Р. (Belarus)

16.15 – 16.30 ПОРогI И КРИТИЧЕСКИЙ ПЕРИОД ВРЕДОНОСНОСТИ СОРНЫХ РАСТЕНИЙ В ПОСЕВАХ ПРОСА
Якимович Е.А. (Belarus)

16.30 – 16.45 POTENTIAL DATA SOURCES FOR FARMING AGRICULTURAL GEOGRAPHICAL INFORMATION SYSTEMS (GIS)
Sturmanis E. (Latvia)

16.45 – 17.00 STATISTICAL METHODS FOR ANALYSING VEGETATION DATA OF WEED FLORA IN ORGANIC AGRICULTURE FIELDS IN LATVIA
Pilkere D. (Latvia)

17.00 – 18.00 Poster presentation (near LLU Hall)

1.1 THE EFFECT OF ANTHROPOGENIC FACTORS ON SOIL ACIDIFICATION PROCESS
Koncius D. (Lithuania)

1.2 METHODOLOGICAL APPROACHES FOR MANURE REFERENCE VALUES CALCULATION
Lipenite I., Karklins A. (Latvia)

1.3 CHOICE OF SOIL TREATMENT DIFFERENCE CRITERIA USING GEOGRAPHICAL INFORMATION SYSTEMS (GIS)
Lapins D., Vilde A., Berzins A., Plume A. and Dinaburga G. (Latvia)

1.4 EFFECT OF FERTILIZER ON NPK BALANCE IN SPRING WHEAT CROP
Vucans R., Lipenite I., Livmanis J., Pogulis A. (Latvia)

1.5 AGROCHEMICAL AND CLIMATIC CHARACTERISTICS IMPACT ON SELENIUM CONCENTRATION IN SOILS
Antanaitis A., Lubyte J., Antanaitis S. (Lithuania)

1.6 MONITORING OF SOIL MINERAL NITROGEN IN VULNERABLE ZONES OF LATVIA
Timbare R., Busmanis M., Janevica V., Mikelsone A., Poriete S. (Latvia)

1.7 DEVELOPMENT AND UNIFICATION OF SOIL AGROCHEMICAL ANALYSIS METHODS
Timbare R., Jekabsone M., Dekovica S. (Latvia)

1.8 THE EFFECT OF THE LONG-TERM APPLICATION OF DIFFERENT INTENSITY FERTILIZATION SYSTEMS ON THE FERTILITY OF GLEYIC CAMBISOLS
Maiksteniene S., Kristaponyte I. (Lithuania)

1.9 COMBUSTION HEAT OF BIOMASS AND ITS CALCULATION FROM ELEMENTARY COMPOSITION
Kuzel S., Kolar L., Stindl P., Silovska S. (Czech Republic)

1.10 CHEMICAL COMPOSITION OF BIOMASS AND HYGIENE ASPECTS OF USE OF NATURAL SOURCES OF BIOENERGETICS
Kolar L., Kuzel S., Stindl P., Silovska S. (Czech Republic)

1.11 INFLUENCE DIFFERENT GENESIS SOILS ON CONCENTRATION OF BIOGENIC ELEMENTS ON FLOOD, DRAINAGE AND LYZIMETER WATER, DEPENDENT FROM A PLANT OF FERTILIZER
Kattus K., Baltramaityte D., Repsiene R. (Lithuania)

1.12 COMPARISON OF DIFFERENT SOIL TILLAGE METHODS ON ECONOMICAL PARAMETERS OF WINTER WHEAT PRODUCTION
Stasinsks E. (Latvia)

1.13 RESULTS OF INVESTIGATIONS ON INFLUENCE OF CROP ROTATION AND FERTILISATION SYSTEMS ON SPRING BARLEY ‘IDUMEJA’
Zarina L. (Latvia)
1.14 DYNAMICS OF SOIL ORDER AND PENETRATION RESISTANCE IN SOIL WITH AND WITHOUT SPRING BARLEY
Lapins D., Berzins A., Dinaburga G., Plume A., Melngalvis I., Sprincina A. and Sanzarevska R. (Latvia)

1.15 IT FOR THE FORECAST OF CROP YIELD IN COMPARISON WITH METEOROLOGICAL CONDITIONS
Korolova J., Lapins D. (Latvia)

1.16 THE INFLUENCE OF THE CROP ROTATION AND THE PLANT PROTECTION COMPLEX ON THE POTATO AND BUCKWHEAT YIELD
Lejiša A., Lejiša B. (Latvia)

1.17 THE INFLUENCE OF THE CROP ROTATION AND THE PLANT PROTECTION MEANS COMPLEX ON THE SPRING CROPS YIELD IN DIFFERENT KINDS OF CROP ROTATIONS
Lejiša A., Lejiša B. (Latvia)

1.18 СМЕШАННЫЕ ПОСЕВЫ ЯЧМЕНА С ГОРОХОМ, ПЕРСПЕКТИВЫ ИХ ВОЗДЕЛЬВАНИЯ И ЗАЩИТА ОТ СОРНОЙ РАСТИТЕЛЬНОСТИ
Терещук В. (Belarus)

1.19 THE INVESTIGATIONS OF CROP WEEDINESS IN CROP ROTATION OF ORGANIC FARMING SYSTEM
Ausmane M., Gaile Z., Melngalvis I. (Latvia)

1.20 EFFECT OF MINERAL SUPPLY THROUGH LEAVES ON THE AMOUNT OF PHOTOSYNTHETIC PIGMENTS IN SPRING WHEAT
Stramkale V., Pakarna G., Vikmane M. (Latvia)

1.21 PHYSIOLOGICAL ASPECTS OF THE WHEAT YIELD OBTAINED FROM SEEDS TREATED WITH PHOSPHORUS
Stramkale V., Stramkalis A., Vikmane M., Zeļonka L. (Latvia)

18.00 – 18.10 Closing of conference
19.00 – …. Discussions and dinner in the LLU

2. CROP PRODUCTION AND GRASSLAND MANAGEMENT
Auditorium: LLU Silver Hall
Chair: Gaile Z. (Latvia), Balezenie L. (Lithuania)

14.00 – 14.15 COMPARATIVE CHEMICAL COMPOSITION OF HULLED AND HULLESS CEREALS
Belicka I., Malecka S., Bleidere M. (Latvia)

14.15 – 14.30 HARVEST TIME EFFECT ON YIELD AND QUALITY OF MAIZE (ZEA MAYS L.) GROWN FOR SILAGE
Gaile Z. (Latvia)

14.30 – 14.45 ANALYSIS OF FESTULOLIUM AND LOLIUM X BOUCHEANUM YIELD FORMATION FOR FORAGE
Gutmane I., Adamovich A. (Latvia)

14.45 – 15.00 PERSPECTIVE MANAGEMENT AND UTILIZATION OF GRASSLAND IN THE CZECH REPUBLIC
Kohoutek A., Odstrcilova V., Pozdisek J. (Czech Republic)

15.00 – 15.15 PHOTOSYNTHETIC RADIATION USE EFFICIENCY OF DIFFERENT OAT CULTIVARS UNDER DIFFERENTIATED NITROGEN FERTILIZATION
Piotrowska W., Pietkiewicz S., Wyszyński Z., Michalska B. (Poland)

15.15 – 15.30 EPIDEMIOLOGY OF ERGOT (CAUSED BY CLAVICEPS PURPUREA)
Bankina B., Priekule I., Kokare A., Kronberga A., Lapins D. (Latvia)

15.30 – 15.45 Coffee break

15.45 – 16.00 INFLUENCE OF FERTILIZATION ON PERENNIAL RYEGRASS PHYTOMETRIC CHARACTERISTICS AND ITS DINAMICS
Bumane S., Adamovics A., Berzins P. (Latvia)

16.00 – 16.15 THE EVALUATION OF EFFECTIVENESS OF RHIZOBIUM LUPINI STRAINS
Steinberga V., Alsiņa I., Ansevica A., Dubova L., Liepina L. (Latvia)

16.15 – 16.30 FIELD EVOLUTION OF PLANTS RECOVERED IN VITRO FROM OLD RED AND ASLILE CLOVER SEEDS
Jansone B., Grauda D., Rancane S., Rashal I. (Latvia)

16.30 – 16.45 EVALUATION AND UTILISATION OF LATVIAN FLAX GENETIC RESOURCES IN BREEDING
Grauda D., Stramkale V., Mikelsone A., Rashal I. (Latvia)
<table>
<thead>
<tr>
<th>Session Time</th>
<th>Title</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.45 - 17.00</td>
<td>PARTICULARITIES OF HARVESTER SETTING DURING HARVESTING HULLESS BARLEY</td>
<td>Legzdina L., Gaile Z. (Latvia)</td>
</tr>
<tr>
<td>17.00 – 18.00</td>
<td>Poster presentation (near LLU Hall)</td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>ESTIMATION OF COMPETITIVE RELATIONS AND INDIVIDUAL PRODUCTIVITY OF FIELD BEANS IN MODEL EXPERIMENTS</td>
<td>Petrychenko V.F., Kobak S.Y. (Ukraine)</td>
</tr>
<tr>
<td>2.2</td>
<td>WINTER WHEAT GRAIN YIELD AND QUALITY INTERCONNECTION BETWEEN SOIL AND PLANT NITROGEN CONTENT</td>
<td>Skudra I. and Ruza A. (Latvia)</td>
</tr>
<tr>
<td>2.3</td>
<td>THE EVALUATION OF SOME GROWING METHODS IN POTATO SEED PRODUCTION FOR ORGANIC FARMING</td>
<td>Skrabule I. (Latvia)</td>
</tr>
<tr>
<td>2.4</td>
<td>TRITICALE CROP IDEOTYPE FOR ORGANIC FARMING</td>
<td>Kronberg A. (Latvia)</td>
</tr>
<tr>
<td>2.5</td>
<td>INFLUENCE OF AGROECOLOGICAL CONDITIONS ON WINTER WHEAT GRAIN GLUTEN QUANTITY AND QUALITY INDICES</td>
<td>Linina A. and Ruza A. (Latvia)</td>
</tr>
<tr>
<td>2.6</td>
<td>THE INFLUENCE OF PERMANENT GRASSES ON WINTER WHEAT PRODUCTIVITY IN ORGANIC AND SUSTAINABLE FARMING SYSTEMS</td>
<td>Repsiene R. (Lithuania)</td>
</tr>
<tr>
<td>2.7</td>
<td>THE POLISH CULTIVARS OF xTRITICOSECALE WITTM. IN LITHUANIA – EFFECTS ON BIOLOGICAL PROPERTIES AND RESISTANCE TO DISEASES</td>
<td>Janusauskaite D., Nekrosiene R., Skuodiene R. (Lithuania)</td>
</tr>
<tr>
<td>2.8</td>
<td>THE INFLUENCE OF DIFFERENT POTASSIUM FERTILIZER RATES ON GRAIN YIELD AND QUALITY OF WINTER CEREALS</td>
<td>Bremanis G., Malecka S., Vojevoda L. (Latvia)</td>
</tr>
<tr>
<td>2.9</td>
<td>SUBSEQUENT EFFECT OF CATCH CROP NITROGEN ON SOIL PROPERTIES AND SPRING BARLEY YIELD</td>
<td>Arlauskiene A., Maiksteniene S. (Lithuania)</td>
</tr>
<tr>
<td>2.10</td>
<td>BIO-MORFOLOGICAL PECULIARITIES OF NEW CULTIVARS OF FODDER GALEGA (GALEGA ORIENTALIS LAM.)</td>
<td>Baležentienė L. (Lithuania)</td>
</tr>
<tr>
<td>2.11</td>
<td>FLORISTIC DEVELOPMENT OF NATURAL AND SOWED SWARDS</td>
<td>Klimas E., Baležentienė L. (Lithuania)</td>
</tr>
<tr>
<td>2.12</td>
<td>INTEGRATED EFFECTS OF ACID SUBSTRATUM AND HEAVY METALS (COPPER AND CADMIUM) ON RED CLOVER</td>
<td>Slepetys J., Siksnianienė J., Brazaitytė A., Kadziuliene Z.and Duchovskis P. (Lithuania)</td>
</tr>
<tr>
<td>2.13</td>
<td>THE CHANGES IN FLORISTIC COMPOSITION OF MEADOWS AFTER DESISTANCE FROM FERTILIZATION FOR FIVE YEARS</td>
<td>Borawska-Jarmulowicz B. (Poland)</td>
</tr>
<tr>
<td>2.14</td>
<td>INFLUENCE OF POTASSIUM, MAGNISIUM AND SULFUR FERTILIZERS ON ECOLOGICALLY CULTIVATED PERENNIAL GRASSES</td>
<td>Pekarskas J., Spruogis V. (Lithuania)</td>
</tr>
<tr>
<td>2.15</td>
<td>PHOMA BLACKLEG (STEM CANKER) OF OILSEED RAPE IN LATVIA</td>
<td>Bankina B., Gaile Z., Balodis O., Vitola R. (Latvia)</td>
</tr>
<tr>
<td>2.16</td>
<td>OCCURRENCE OF FUSARUM SPECIES AND RISK OF MYCOTOXINS ASSOCIATED WITH HEAD BLIGHT IN WINTER WHEAT: MONITORING DATA IN LATVIA</td>
<td>Treikale O., Priekule I., Pugacova J., Lazareva L. (Latvia)</td>
</tr>
<tr>
<td>2.17</td>
<td>SEED PRODUCTION OF FODDER GALEGA (GALEGA ORIENTALIS LAM.) AND SEED STORAGE</td>
<td>Slepetys J. (Lithuania)</td>
</tr>
<tr>
<td>2.18</td>
<td>OATS VARIETY ‘STENDES DARTA’ AND RESULTS OF ITS EVALUATION</td>
<td>Zute S., Gruntina M., Malecka S. (Latvia)</td>
</tr>
<tr>
<td>18.00 – 18.10</td>
<td>Closing of conference</td>
<td></td>
</tr>
<tr>
<td>19.00 - ....</td>
<td>Discussions and dinner in the LLU</td>
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</table>
### 3. HORTICULTURE

**Auditorium: 107**

**Chair: Kampuss K. (Latvia)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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</thead>
</table>
| 14.00 – 14.15 | RASPBERRY AND BLACKCURRANT CULTIVARS FOR UTILIZATION OF FROZEN BERRIES IN DESSERT AND FOR GETTING PRODUCTS WITH HIGH CONTENTS OF BIO-ACTIVE COMPOUNDS  
Kampuss K., Kampuse S. (Latvia)                                          |
| 14.15 – 14.30 | ASSESSMENT OF DIVERSE POPULATIONS OF LATVIAN MARTAGONLILIES (L. MARTAGON L.) AND APPLICATION IN BREEDING  
Balode A. (Latvia)                                                        |
| 14.30 – 14.45 | GENETIC RESOURCES OF CULINARY HERBS IN LATVIA  
Zukauska I. (Latvia)                                                     |
| 14.45 – 15.00 | GENETIC MATERIAL HOMOGENIZATION OF LATGALES MELONS  
Balins A., Alsina I., Lepse L., Rungis D. (Latvia)                     |
| 15.00 – 15.15 | AGROTECHNICAL AND BIOCHEMICAL INVESTIGATIONS FOR JERUSALEM ARTICHOKE (HELIANTHUS TUBEROSUS L.) GROWING IN LATVIA  
Lepse L., Bite L. (Latvia)                                                |
| 15.15 – 15.30 | THE EFFECT OF SELENITE ON GROWTH AND STORAGE OF ONIONS  
Zegnere L., Alsina I. (Latvia)                                           |
| 15.30 – 15.45 | THE ASSORTMENT OF FRUIT AND BERRY CROPS IN LATVIAN ORCHARDS  
Skrivele M., Rubauskis E. (Latvia)                                       |
| 15.45 – 16.00 | ADAPTATION OF APPLE SCAB WARNING MODEL RIMpro FOR INTEGRATED PLANT PROTECTION IN LATVIA  
Eihe M., Rancane R., Jankovska L. (Latvia)                               |
| 16.00 – 16.30 | Discussion                                                                                   |
| 16.30 – 17.00 | Coffee break                                                                                 |
| 17.00 – 18.00 | Poster presentation (auditorium 109.)                                                        |
| 3.1          | TURF GRASS DISEASES ON THE GOLF COURSES IN LATVIA  
Rancane R. (Latvia)                                                     |
| 3.2          | EVALUATION OF Highbush blueberries (VACCINIUM CORYMBOSUM L.) CULTIVARS  
Liepniece M., Abolins M. (Latvia)                                       |
| 3.3          | NUTRIENT STATUS OF THE AMERICAN CRANBERRIES AND WILD CRANBERRIES IN PRODUCING PLANTINGS AND NATURAL BOGS OF LATVIA  
Karlsons A., Osvalde A. (Latvia)                                        |
| 3.4          | POTENTIAL APPLE ATTRACTIVITY CRITERIA FOR CONSUMERS  
Drudze I. (Latvia)                                                      |
| 3.5          | ESTABLISHED CRANBERRY DISEASES IN LATVIA  
Jankovska L., Eihe M., Bankina B. (Latvia)                              |
| 18.00 – 18.10 | Closing of conference                                                                    |
| 19.00 – ….   | Discussions and dinner in the LLU                                                           |

### 4. ANIMAL SCIENCE

**Auditorium: 212.**

**Chair: Grislis Z. (Latvia), Jatkauskas J. (Lithuania)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
</table>
| 14.00 – 14.15 | REDUCTION OF NUTRIENT LOSSES IN GRASS-LEGUME SILAGES THROUGH INOCULATION  
Jatkauskas J. and Vrotniakienė V. (Lithuania)                             |
| 14.15 – 14.30 | FEEDING OF EXTRUDED RAPESEED OILCAKE FOR REDUCING NITROGEN SUBSTANCES IN POULTRY MANURE  
Vitina I., Krastina V., Nudiens J., Lagzdins D. (Latvia)                    |
| 14.30 – 14.45 | EVALUATION OF THE MICROSATELLITE POLYMORPHISM IN INTRON 1 OF THE MYOSTATIN GENE IN TWO LATVIAN CATTLE BREEDS  
Sjastke T., Grislis Z., Mazversite J., Sokolovska J., Sugoka O. (Latvia)  |
| 14.45 – 15.00 | STORAGE INDUCED CHANGES IN NUTRITION VALUE OF RAPE SEEDS AND CAKES PRODUCED IN LATVIA  
Dulbinskis J., Jemeljanovs A., Sterna V., Lagzdins D. (Latvia)            |
<table>
<thead>
<tr>
<th>Time</th>
<th>Session Title</th>
<th>Presenters</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.00 – 15.15</td>
<td>RESEARCH AND EXPERIENCE OF FODDER GALEGA INTRODUCTION IN FARMS</td>
<td>Auzinš V., Adamovičs A., Lejiš A. (Latvia)</td>
</tr>
<tr>
<td>15.45 – 16.00</td>
<td>CATTLE DRESSING PERCENTAGE AND MEAT YIELD, IT PREDICTION MODEL</td>
<td>Melece L., Bruņenieks J. (Latvia)</td>
</tr>
<tr>
<td>16.00 – 17.00</td>
<td>Discussion and coffee break</td>
<td></td>
</tr>
<tr>
<td>17.00 – 18.00</td>
<td>Poster presentation</td>
<td></td>
</tr>
<tr>
<td>18.00 – 18.10</td>
<td>Conferece tour in Riga (Old Town)</td>
<td></td>
</tr>
<tr>
<td>19.00 - ….</td>
<td>Discussions and dinner in the LLU</td>
<td></td>
</tr>
<tr>
<td><strong>Friday, March 23</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.30</td>
<td>Conference tour in Riga (Old Town)</td>
<td></td>
</tr>
<tr>
<td>12.30 – 13.30</td>
<td>Lunch in LIDO</td>
<td></td>
</tr>
</tbody>
</table>

Schedule of tour will be specified

Content

PLENARY SESSION

LATVIA’S ANIMAL HUSBANDRY AND VETERINARY MEDICINE SCIENTIFICAL AND PRACTICAL DEVELOPMENT
Jemeljanovs A.

RESOURCES AND RISKS GROWING GENETICALLY MODIFIED (GM) CROPS IN LATVIA
Turka I., Ruza L.

Session 1. SOIL SCIENCE, PLANT, FERTILIZER AND FIELD MANAGEMENT

AGROCHEMICAL AND CLIMATIC CHARACTERISTICS IMPACT ON SELENIUM CONCENTRATION IN SOILS
Antanaitis A., Lubyte J., Antanaitis S.

THE INVESTIGATIONS OF CROP WEEDINESS IN CROP ROTATION OF ORGANIC Farming SYSTEM
Ausmane M., Gaile Z., Melngalvis I.

RESPONSE OF SPRING RAPE SEED YIELD TO MAGNESIUM AND SULFUR FERTILIZERS
Bogdevitch I., Mishuk O.

SOME ASPECTS OF HARMONIZATION AND STANDARTIZATION OF SOIL INFORMATION
Karšlins A.

INFLUENCE DIFFERENT GENESIS SOILS ON CONCENTRATION OF BIOGENIC ELEMENTS ON FLOOD, DRAINAGE AND LYZIMETER WATER, DEPENDENT FROM A PLANT OF FERTILIZER
Katutis K., Baltramaitỹte D., Repsiene R.

THE EFFECT OF ANTHROPOGENIC FACTORS ON SOIL ACIDIFICATION PROCESS
Korolova J., Lapins D.

SOIL ORGANIC MATTER AND ITS STABILITY IN AEROBIC AND ANAEROBIC CONDITIONS
Kuzel S., Kolar L., Stindl P.

COMBUSTION HEAT OF BIOMASS AND ITS CALCULATION FROM ELEMENTARY COMPOSITION
Kuzel S., Kolar L., Stindl P., Silovska S.

CHEMICAL COMPOSITION OF BIOMASS AND HYGIENE ASPECTS OF USE OF NATURAL SOURCES OF BIOENERGETICS
Kolar L., Kuzel S., Stindl P., Silovska S.

DYNAMICS OF SOIL ORDER AND PENETRATION RESISTANCE IN SOIL WITH AND WITHOUT SPRING BARLEY
Lapins D., Berzins A., Dinaburga G., Plume A., Melngalvis I., Sprincina A. and Sanzarevska R.

CHOICE OF SOIL TREATMENT DIFFERENCE CRITERIA USING GEOGRAPHICAL INFORMATION SYSTEMS (GIS)
Lapins D., Vilde A., Berzins A., Plume A. and Dinaburga G.

THE INFLUENCE OF THE CROP ROTATION AND THE PLANT PROTECTION COMPLEX ON THE POTATOE AND BUCKWHEAT YIELD
Lejiņš A., Lejiņa B.
THE INFLUENCE OF THE CROP ROTATION AND THE PLANT PROTECTION MEANS COMPLEX ON THE SPRING CROPS YIELD IN DIFFERENT KINDS OF CROP ROTATIONS
Lejiņš A., Lejiņa B.

METHODOLOGICAL APPROACHES FOR MANURE REFERENCE VALUES CALCULATION
Lipenite I., Karklins A.

THE EFFECT OF THE LONG-TERM APPLICATION OF DIFFERENT INTENSITY FERTILIZATION SYSTEMS ON THE FERTILITY OF GLEYIC CAMBISOLS
Maiksteniene S., Kristaponyte I.

EFFICIENCY OF REDUCED HERBICIDE DOSAGES IN BARLEY FERTILISED WITH DIFFERENT RATES OF NITROGEN
Malecka S., Bremanis G.

THE EFFECT OF FERTILIZERS RATES CALCULATED BY DIFFERENT METHODS ON NUTRIENT BALANCE AND SOIL AGROCHEMICAL PROPERTIES
Mazvila J., Vaisvila Z., Staugaitis G., Arbcaauskas J., Adomaitis T.

STATISTICAL METHODS FOR ANALYSING VEGETATION DATA OF WEED FLORA IN ORGANIC AGRICULTURE FIELDS IN LATVIA
Piliksere D.

COMPARISON OF DIFFERENT SOIL TILLAGE METHODS ON ECONOMICAL PARAMETERS OF WINTER WHEAT PRODUCTION
Stasinskis E.

EFFECT OF MINERAL SUPPLY THROUGH LEAVES ON THE AMOUNT OF PHOTOSYNTHETIC PIGMENTS IN SPRING WHEAT
Stramkale V., Pakarna G., Vikmane M.

PHYSIOLOGICAL ASPECTS OF THE WHEAT YIELD OBTAINED FROM SEEDS TREATED WITH PHOSPHORUS
Stramkale V., Stramkalis A., Vikmane M., Zeļonka L.

POTENTIAL DATA SOURCES FOR FARMING AGRICULTURAL GEOGRAPHICAL INFORMATION SYSTEMS (GIS)
Sturmanis E.

DEVELOPMENT AND UNIFICATION OF SOIL AGROCHEMICAL ANALYSIS METHODS
Timbare R., Jekabsone M., Dekovica S.

MONITORING OF SOIL MINERAL NITROGEN IN VULNERABLE ZONES OF LATVIA
Timbare R., Busmanis M., Janevica V., Mikelsone A., Poriete S.

СМЕШАННЫЕ ПОСЕВЫ ЯЧМЕНЯ С ГОРОХОМ, ПЕРСПЕКТИВЫ ИХ ВОЗДЕЛЫВАНИЯ И ЗАЩИТА ОТ СОРНОЙ РАСТИТЕЛЬНОСТИ
Терещук В.

APPLICABILITY OF VARIOUS AMENDMENTS TO IMPROVE CLAYEY SOIL PROPERTIES UNDER REDUCED TILLAGE MANAGEMENT IN NORTHERN LITHUANIA
Velykis A., Satkus A.

COMPARISON OF METHODS FOR DETERMINATION OF PHOSPHORUS IN CALCAREOUS SOILS
Vucans R., Lipenite I., Livmanis J.

EFFECT OF FERTILIZER ON NPK BALANCE IN SPRING WHEAT CROP
Vucans R., Lipenite I., Livmanis J., Pogulis A.

RESULTS OF INVESTIGATIONS ON INFLUENCE OF CROP ROTATION AND FERTILISATION SYSTEMS ON SPRING BARLEY ‘IDUMEJA’
Zarina L.
Session 2. CROP PRODUCTION AND GRASSLAND MANAGEMENT

SUBSEQUENT EFFECT OF CATCH CROP NITROGEN ON SOIL PROPERTIES AND SPRING BARLEY YIELD
Arlauskiene A., Maiksteniene S. 32

BIO-MORPHOLOGICAL PECULIARITIES OF NEW CULTIVARS OF FODDER GALEGA (GALEGA ORIENTALIS LAM.)
Baležentienė L. 32

PHOMA BLACKLEG (STEM CANKER) OF OILSEED RAPE IN LATVIA
Bankina B., Gaile Z., Balodis O., Vitolā R. 33

EPIDEМИOLOGY OF ERGOT ( CAUSED BY CLAVICEPS PURPUREA )
Bankina B., Priekule I., Kokare A., Kronberga A., Lapins D. 33

COMPARATIVE CHEMICAL COMPOSITION OF HULLED AND HULLESS CEREALS
Belicka I., Malecka S., Bleidere M. 34

THE CHANGES IN FLORISTIC COMPOSITION OF MEADOWS AFTER DESISTANCE FROM FERTILIZATION FOR FIVE YEARS
Borawska-Jarmulowicz B. 34

THE INFLUENCE OF DIFFERENT POTASSIUM FERTILIZER RATES ON GRAIN YIELD AND QUALITY OF WINTER CEREALS
Bremanis G., Malecka S., Vojevoda L. 35

INFLUENCE OF FERTILIZATION ON PERENNIAL RYEGRASS PHYTOMETRIC CHARACTERISTICS AND ITS DINAMICS
Bumane S., Adamovics A., Berzins P. 35

HARVEST TIME EFFECT ON YIELD AND QUALITY OF MAIZE (ZEA MAYS L.) GROWN FOR SILAGE
Gaile Z. 36

EVALUATION AND UTILISATION OF LATVIAN FLAX GENETIC RESOURCES IN BREEDING
Grauda D., Stramkāle V., Mikelsone A., Rashal I. 36

ANALYSIS OF FESTULOLUM AND LOLIUM X BOUCHEANUM YIELD FORMATION FOR FORAGE
Gutmane I., Adamovich A. 37

FIELD EVOLUTION OF PLANTS RECOVERED IN VITRO FROM OLD RED AND ASLIKE CLOVER SEEDS
Jansone B., Grauda D., Rancane S., Rashal I. 37

THE POLISH CULTIVARS OF TRITICOSECALE WITTM. IN LITHUANIA – EFFECTS ON BIOLOGICAL PROPERTIES AND RESISTANCE TO DISEASES
Janusauskaite D., Nekrosiene R., Skuodiene R. 37

FLORISTIC DEVELOPMENT OF NATURAL AND SOWED SWARDS
Klimas E., Baležentienė L. 38

PERSPEKTIVE MANAGEMENT AND UTILIZATION OF GRASSLAND IN THE CZECH REPUBLIC
Kohoutek A., Odstrcilová V., Pozdisek J. 38

TRITICALE CROP IDEOTYPE FOR ORGANIC FARMING
Kronberga A. 39

PARTICULARITIES OF HARVESTER SETTING DURING HARVESTING HULLESS BARLEY
Legzdina L., Gaile Z. 39
INFLUENCE OF AGROECOLOGICAL CONDITIONS ON WINTER WHEAT GRAIN GLUTEN QUANTITY AND QUALITY INDICES
Linina A. and Ruza A.

INFLUENCE OF POTASSIUM, MAGNISUM AND SULFUR FERTILIZERS ON ECOLOGICALLY CULTIVATED PERENNIAL GRASSES
Pekarskas J., Spruogis V.

ESTIMATION OF COMPETITIVE RELATIONS AND INDIVIDUAL PRODUCTIVITY OF FIELD BEANS IN MODEL EXPERIMENTS
Petrychenko V.F., Kobak S.Y.

PHOTOSYNTHETIC RADIATION USE EFFICIENCY OF DIFFERENT OAT CULTIVARS UNDER DIFFERENTIATED NITROGEN FERTILIZATION
Piotrowska W., Pietkiewicz S., Wyszyński Z., Michalska B.

THE INFLUENCE OF PERMANENT GRASSES ON WINTER WHEAT PRODUCTIVITY IN ORGANIC AND SUSTAINABLE FARMING SYSTEMS
Repsiene R.

SEED PRODUCTION OF FODDER GALEGA (GALEGA ORIENTALIS LAM.) AND SEED STORAGE
Slepetys J.

INTEGRATED EFFECTS OF ACID SUBSTRATUM AND HEAVY METALS (COPPER AND CADMIUM) ON RED CLOVER
Slepetys J., Siksnišienė J., Brazaitytė A., Kadziulišienė Z. and Duchovskis P.

THE EVALUATION OF SOME GROWING METHODS IN POTATO SEED PRODUCTION FOR ORGANIC FARMING
Skrabule I.

WINTER WHEAT GRAIN YIELD AND QUALITY INTERCONNECTION BETWEEN SOIL AND PLANT NITROGEN CONTENT
Skudra I. and Ruza A.

THE EVALUATION OF EFFECTIVENESS OF RHIZOBIUM LUPINI STRAINS
Steinberga V., Alsina I., Ansevica A., Dubova L., Liepina L.

OCCURRENCE OF FUSARIUM SPECIES AND RISK OF MYCOTOXINS ASSOCIATED WITH HEAD BLIGHT IN WINTER WHEAT: MONITORING DATA IN LATVIA
Treikale O., Priekule I., Pugacova J., Lazareva L.

Session 3. HORTICULTURE

ASSESSMENT OF DIVERSE POPULATIONS OF LATVIAN MARTAGONLILIES (L. MARTAGON L.) AND APPLICATION IN BREEDING
Balode A.

GENETIC MATERIAL HOMOGENIZATION OF LATGALES MELONS
Balins A., Alsina I., Lepse L., Rungis D.

POTENTIAL APPLE ATTRACTIVITY CRITERIA FOR CONSUMERS
Drudze I.

ADAPTATION OF APPLE SCAB WARNING MODEL RIMpro FOR INTEGRATED PLANT PROTECTION IN LATVIA
Eihe M., Rancane R., Jankovska L.

ESTABLISHED CRANBERRY DISEASES IN LATVIA
Jankovska L., Eihe M., Bankina B.

RASPBERRY AND BLACKCURRANT CULTIVARS FOR UTILIZATION OF FROZEN BERRIES IN DESSERT AND FOR GETTING PRODUCTS WITH HIGH CONTENTS OF BIO-ACTIVE COMPOUNDS
Kampuss K., Kampuse S.

NUTRIENT STATUS OF THE AMERICAN CRANBERRIES AND WILD CRANBERRIES IN PRODUCING PLANTINGS AND NATURAL BOGS OF LATVIA
Karlsons A., Osvalde A.

AGROTECHNICAL AND BIOCHEMICAL INVESTIGATIONS FOR JERUSALEM ARTICHOKE (HELIANTHUS TUBEROUS L.) GROWING IN LATVIA
Lepse L., Bitė L.

EVALUATION OF HIGHBUSH BLUEBERRIES (VACCINIUM CORYMBOSUM L.) CULTIVARS
Liepniece M., Abolins M.

TURF GRASS DISEASES ON THE GOLF COURSES IN LATVIA
Rancane R.

THE ASSORTMENT OF FRUIT AND BERRY CROPS IN LATVIAN ORCHARDS
Skrivele M., Rubauskis E.

THE EFFECT OF SELENITE ON GROWTH AND STORAGE OF ONIONS
Zegnere L., Alsina I.

GENETIC RESOURCES OF CULINARY HERBS IN LATVIA
Zukauska I.

Session 4. ANIMAL SCIENCE

RESEARCH AND EXPERIENCE OF FODDER GALEGA INTRODUCTION IN FARMS
Auziņš V., Adamovičs A., Lejiņš A.

STORAGE INDUCED CHANGES IN NUTRITION VALUE OF RAPE SEEDS AND CAKES PRODUCED IN LATVIA
Dulbinskis J., Jemeljanovs A., Sterna V., Lagzdins D.

REDUCTION OF NUTRIENT LOSSES IN GRASS-LEGUME SILAGES THROUGH INOCULATION
Jatkauskas J. and Vrotniakienė V.

ANALYSES OF INFLUENCING FACTORS OF MILK COMPOSITION AND QUALITY
Kairisa D., Jonkus D.

CHARACTERISTICS OF FORAGE IN THE ASPECT OF MILK COSTS
Latvietis J., Auzins V., Strikauska S., Eihvalde I.

INFLUENCE OF COMBINED CONSERVATION ADDITIVES ON GRASS FERMENTATION AND OBTAINED SILAGE QUALITY
Oismane B., Jemeļjanovs A.

LATVIAN BREED HORSE GENETIC RESOURCE ANALYSIS
Rozitis G., Klavina I.

MILK QUALITY INDICES OF GERMAN WHITE NOBLE AND ALPS GOAT
Selegovska E., Spruzs J., Remeza I., Vasiljeva S.

WELFARE OF GOAT AND PRODUCTION OF PRODUCTS IN THE ORGANIC AND CONVENTIONAL FARMS
Selegovska E., Spruzs J.

EVALUATION OF THE MICROSATELLITE POLYMORPHISM IN INTRON 1 OF THE MYOSTATIN GENE IN TWO LATVIAN CATTLE BREEDS
Sjakste T., Grislis Z., Mazversite J., Sokolovska J., Sugoka O.

FEEDING OF EXTRUDED RAPESEED OILCAKE FOR REDUCING NITROGEN SUBSTANCES IN POULTRY MANURE
Vitina I., Krastina V., Nudiens J., Lagzdins D.
PLENARY SESSION

LATVIA’S ANIMAL HUSBANDRY AND VETERINARY MEDICINE SCIENTIFICAL AND PRACTICAL DEVELOPMENT

LATVIJAS LOPKOPĪBAS UN VETERINĀRMEDICĪNAS ZINĀTNISKĀS UN PRAKTISKĀS ATTĪSTĪBAS GALVENIE VIRZENI

Jemeljanovs A.

Research Institute of Biotechnology and Veterinary Medicine „Sigra” of Latvia University of Agriculture, Instituta iela 1, Sigulda, Latvia, LV-2150

To ensure Latvia consumers a milk production must be increased from 810.3 thousands t in the year 2005 up to 1025.0 thousands t in the year 2013 and up to 1310 thousands t in the year 2020 mainly based on cows milk yield productivity increasing. Analogically beef production pork, poultry meat and egg production must be increased, too. Such production increasing dynamics will ensure our country population necessary for these kinds of products. As a second most important indice that must be evaluated is a production quality. The scientists of the Research Institute “Sigra” are carried out wide investigations to determine and recommend quality criteria of the animal food products for consumers: production safety, non pollution and healthy. For this purpose the investigations are carried out in the field of production biochemical, microbiological and other factors evaluation by determination all risk factors “chain”. Obtained conclusions gave a possibility for producers to receive recommendations for correct animal selection, welfare and health preconditions observing. Simultaneously research development strong and weak sides possible threats are determined of the animal husbandry and veterinary medicine branches, the methodological solutions of these situations for rear and further future are given.

Key words: animal products, quantity and quality, research, future development.

RESOURCES AND RISKS GROWING GENETICALLY MODIFIED (GM) CROPS IN LATVIA

ţGENĒTISKI MODIFICĒTO (ÇM) AUGU AUDZĒŠANAS IESPĒJAS UN RISKI LATVIJĀ

Turka I., Ruza L.

Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

Due to the fast development of biotechnology agricultural market fills with new know-how concerning crop cultivation. Recently, genetically modified (GM) crops take a great domain of this competence. When dealing with GM crops one should however consider a series of conditions in order to prevent uncontrolled spread of GM genes in the environment. Nowadays there is a vast commercial supply with GM plants. It covers fruit-trees, vegetables, cereals, trees, and grasslands. From the latter, soy, maize, rape, and potatoes bearing modified agronomic properties can be found also in Europe. Analysis of the situation shows that there might be possible to grow herbicide-tolerant maize for feed needs in Latvia. Similarly, cultivation of GM-potatoes with optimized starch content for technical needs still does not endanger the production process of organic and conventional farms and environment in general. On the other hand, data analysis indicates that cultivation of GM rape is inappropirate in those regions of Latvia where one also grows its conventional or biological counterpart. Due to the climate, soil, and relief conditions a great portion of acreage that at the moment is not used for agriculture in any ways is not suitable for rape and particularly for winter rape. In Latvia like in central Europe in general, one commonly finds populations of wild rape that can cross with its GM equivalent thus stimulating the resistance against herbicides from glyphosate and glyphosinate groups. Taking in account all the requirements that should be made to prevent an incidental spread of GM rape in conventional, biological and wild rape populations and environment as such, it is nearly impossible to cultivate the GM rape in the regions already partially occupied by the its conventional counterpart. One should mention that there is a negative attitude toward GM rape among the farmers dealing with the conventional one: only 14% of respondents tolerate idea about cultivation of GM rape if that is going to bring a profit, but the majority (86%) does not intend to do it.

Key words: GMO crops, risks, farmer attitude
Session 1. SOIL SCIENCE, PLANT, FERTILIZER AND FIELD MANAGEMENT

AGROCHEMICAL AND CLIMATIC CHARACTERISTICS IMPACT ON SELENIUM CONCENTRATION IN SOILS
Antanaitis A., Lubytė J., Antanaitis S.
Agrochemical Research Centre of Lithuanian Institute of Agriculture, Savanoriu 287, LT- 50127, Kaunas, Lithuania

Wider scale research on selenium concentration in soil, plants and other objects was started last century. In the beginning selenium issue was viewed only from the toxicity point, and then it was found, that selenium impedes the liver necrosis in rats. Research on selenium concentration in soil was started even later. Till now selenium concentration in Lithuanian soils was studied very little. One should keep in mind, that variation of physical and agrochemical properties of Lithuanian soils is substantial. The aim of our study is to determine selenium concentration in soils and to assess selenium relation to soil agrochemical properties as well as to some of climatic characteristics. Results of this research will be used as a basis for forecasting of approximate selenium content in not tested soils, not only nationwide, but also regionally.

Keywords: selenium, soil, texture.

THE INVESTIGATIONS OF CROP WEEDINESS IN CROP ROTATION OF ORGANIC FARMING SYSTEM
NEZĀLU IZPLATĪBAS PĒTĪJUMI BIOLOGISKĀS LAUKSAIMNIECĪBAS SISTĒMAS AUGSEKĀ
Ausmane M., Gaile Z., Melngalvis I.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

Field experiments were conducted during the period of 2004 – 2006 at the Research and Study Farm „Vecauce“. The aim of investigations was to establish the weediness’ dynamics of crops in six-field crop rotation of organic farming system. The field is certified organic. Crop rotation: 1. triticale/ rye (for green manure in spring), 2.oil radish (for green manure)/ rye (for green manure in autumn), 3.potatoes, 4.oats, 5.wetch-oats mix (for green forage) with undersown mixture of red clover and timothy, 6.red clover and timothy. The conventional soil tillage was done according to requirements of the crops. The weeds were counted two times during the vegetation period of crops: at the early development stages of crops (for instance, at the tillering of cereals) and before the crop harvesting. The composition of weed flora comprised from 59 species in the crops’ stands. The annual dicotyledonous were dominating groups of the weed flora. The most abundant weeds were Chenopodium album, Elitrygia repens, Barbarea vulgaris. The significantly smaller amount of weeds among crop rotation links was observed in the link rye/ oil radish/ rye – potatoes – oats. Much worse suppression of weeds was reached in the crop rotation link red clover and timothy – triticale/ rye – oil radish/ rye. The number of weeds in the fields of crop rotation in the organic farming system is dependent from cultivated crops, succession of crops in the crop rotation links, crop cultivation technologies.

Key words: organic farming system, weediness of crops, crop rotation

RESPONSE OF SPRING RAPE SEED YIELD TO MAGNESIUM AND SULFUR FERTILIZERS
Bogdevitch I., Mishuk O.
Research Institute for Soil Science and Agrochemistry, Kazintsja Str. 62, Minsk-220108, Belarus

The studies of efficiency of magnesium and sulfur fertilizers in model field experiment with four different levels of exchangeable magnesium content in Podzolumisol loam soil had been conducted.
in 2004-2006 at Minsk region of Belarus. The sulfur was applied in rate $S_{60}$ in form of phosphogypsum and in form of ammonium sulfate. Two foliar sprays with 4% solution of magnesium sulfate were used for application of Mg$_8$. It has been found significant (10-30%) seed yield response and oil yield response (10-37%) to Mg- and S-fertilizers in the limits of MgO content 128-250 mg kg$^{-1}$ of soil. Application of magnesium and sulfur fertilizers had been profitable. The net incomes as result of Mg- and S- fertilizers use were increased by 37-89 USD per hectare. The highest efficiency of tested fertilizers was on soil with low level of Mg supply. Further increase of magnesium content in soil up to 337 mg kg$^{-1}$ was excessive; it followed by significant reduction of rape seed yield.

**Key words:** spring rape, magnesium and sulfur fertilizers

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**SOME ASPECTS OF HARMONIZATION AND STANDARTIZATION OF SOIL INFORMATION**

**DAŽI AUGSNES INFORMĀCIJAS HARMONIZĀCIJAS UN STANDARTIZĀCIJAS ASPEKTI**

Karklins A.

Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

Within the period of 1998 – 2006 World Reference Base for Soil Resources (WRB) became the official reference soil nomenclature and soil classification for the European Commission and was adopted by the other international institutions as the preferred tool to harmonize and exchange soil information. For this reason position of WRB became very strong and for the future this system will be as common denominator for the all soil information flow outside of national borders. Therefore development of soil information inventory systems designed for national and international use should consider this priority and make their own national standards as close and compatible with WRB as possible. This is relevant also for Latvia. Now after joining of EU we realize the great need for exchange of high quality soil data consistent to the international standards and reality that our “traditional” data sets are far away from this approach and practically useless. Therefore development and implementation of new standards, harmonization of national methods with those used by WRB is necessary. This includes several steps and measures. Acceptance and use of new concepts and terminology, implementation of methodology recommended by FAO for soil diagnosis, description, use of other analytical methods, different interpretation approach, new system of soil (and land) data inventory and processing. And finally, to start the real national programs where new soil data are accumulated. Still we have separated activities, needs and priorities without any coordination framework and therefore result is only short-range and low-effective. Practical measures to solve this problem will be discussed.

**Key words:** soil classification; soil data inventory.

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**INFLUENCE DIFFERENT GENESIS SOILS ON CONCENTRATION OF BIOGENIC ELEMENTS ON FLOOD, DRAINAGE AND LYZIMETER WATER, DEPENDENT FROM A PLANT OF FERTILIZER**

Katutis K., Baltramaityte D., Repsiene R.

Lithuanian Agriculture Institute Vezaiciai Branch, Vezaiciai, Gargzdu 29, Klaipeda distr., Lithuania

In this article the data of experiences carried out in 1992-1999 years are generalized. Scientific experiences were carried out on polder Ruguliai in a lowland of the river Nemunas and on a stationary laboratory of lyzimeter and range of agricultural systems of the Vezaiciai Branch of the Lithuanian institute of agriculture. Between flood, drainage and lyzimeter water on a chemical compound determines an essential difference. In flood water not only is less mineralization in comparison with drainage or lyzimeter water, but also has a different chemical compound. In flood water was less calcium, magnesium and sulphates, but it is more potassium and chlorides in comparison with drainage or lyzimeter water. Concentration of biogenic elements in to lyzimeter water has overestimated from genesis soils and from them soil texture. Podzol formation processes of soils in Western and East parts of Lithuania are more intensive than the central part, and their fertilizer and liming increases migration of
nutrients matters. Leaching biogenic elements occurs and on carbonated loam soils in the winter-spring period. Concentration of ions of calcium in to lysimeter water was biggest of all researched cations (123-218 mg kg\(^{-1}\)), ions of magnesium has made only about 14 %, ions potassium – 2-6 %, at recalculation from general quantity ions.

Significant increase of anion concentrations in drainage water (SO\(_4^{2-}\)) and in ground water (NO\(_3^{-}\)) were established in sustainable agriculture. Total amounts of ions in drainage water were similar in organic and sustainable agriculture. However, higher total amounts of ions in ground water were determined in organic agriculture.

**Key words**: flooding, biogenic elements, leaching, soil, agriculture systems.

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**THE EFFECT OF ANTHROPOGENIC FACTORS ON SOIL ACIDIFICATION PROCESS**

Končius D.

Vezaiciai Branch, Lithuanian Institute of Agriculture, LT-5845 Vezaiciai, Klaipeda distr., Lithuania

Field and laboratory trials were carried out in the Vėžaičiai Branch of the Lithuanian Institute of Agriculture in 1977-2005. The soil of the trial site was the *Bathihypogleyi* - *Dystric Albelvisol* (ABd-gld), texture- morain loam. To evaluate the effect of various combinations of liming and fertilization on the change of soil chemical properties and crop rotation productivity was the aim of this investigation. The planned pH levels (factor A) - pH <4.7 (unlimed); 4.7-5.2; 5.2-5.7; 5.7-6.2; 6.2-6.7 and > 6.7 were received during primary liming by pulverized limestone in 1976. The mineral fertilization (factor B) was – 1NPK; 2NPK and 3NPK. The single rate of mineral fertilizers for crop rotation plant consist: for rape N\(_{70}\)P\(_{60}\)K\(_{90}\); for grain crops N\(_{45}\)P\(_{30}\)K\(_{30}\) and for red clover P\(_{45}\)K\(_{60}\). Organic fertilization - manure 60 tha\(^{-1}\) one time during 5 field crop rotation.

It was revealed that soil acidification process under the effect of intensive mineral fertilization (in the background with manure and without manure) was more intensive than in the non fertilized soil. Acidification process has a negative effect on the soil chemical properties. Systematic long-term manuring has a positive effect on the soil chemical state: decrease the soil acidification process and stops the increasing of mobile aluminium.

**Key words**: Soil acidification, primary liming, fertilisation, mobile Al.
Возможность выращивания сои в условиях умеренного климата появилась с выведением скороспелых сортов. Несмотря на то, что в настоящее время ее посевные площади в Беларуси еще незначительны, данная культура имеет большие перспективы с точки зрения увеличения производства зерна, растительного белка и повышения плодородия почвы. Однако серьёзной проблемой для возделывания сои в республике является засоренность посевов. Поэтому возникает необходимость поиска новых избирательных гербицидов с более эффективным действием на сложный тип засорения посевов сои.

В результате проведенного поиска в 2003-2005 гг. было установлено, что максимальную эффективность в условиях Северной агроклиматической зоны Республики Беларусь показали гербициды почвенного действия Команд, КЭ (кломазон, 480 г/л) – 1,0 л/га и Трофи 90, КЭ (ацетохлор, 900 г/л) – 2,0 л/га. Используя полученные результаты в 2006 г. проведены исследования по изучению биологической эффективности комбинированного гербицида Клоцет, КЭ (ацетохлор, 720 г/л + кломазон, 60 г/л) с целью рекомендации гербицида в «Каталог пестицидов и удобрений, разрешенных для применения в Республике Беларусь».

Результаты исследований показали, что гербицид Клоцет, КЭ является эффективным в защите посевов сои против однолетних злаковых и двудольных сорняков при внесении до всходов культуры. Применение гербицида Клоцет, КЭ в норме 1,5 л/га обеспечило снижение численности всех сорных растений на 99,1%, массы – 99,9%.

**Ключевые слова**: соя, засоренность, гербициды
CHEMICAL COMPOSITION OF BIOMASS AND HYGIENE ASPECTS OF USE OF NATURAL SOURCES OF BIOENERGETICS
Kolar L., Kuzel S., Stínl P., Silovska S.
Faculty of Agriculture, University of South Bohemia in České Budějovice, Studentská 13, 37005 České Budějovice, Czech republic

In nine different samples in repetition from different locations an average elementary composition of biomass was determined and the results were evaluated from the point of view of possibility of formation of persistent organic pollutant (PAU, PCD/F, BTX), emissions NOx and SOx, tars, high-temperature corrosion, sulphidization, decrease of combustion temperature and decrease of temperature of softening of ash during combustion and gasification. Only wood matter of poplar and partially of spruce was satisfying. The worst case was the one of straw of Swedish turnip and also all culm crops were very unsatisfactory. The construction of the equipment must eliminate the inadequancies of biomass.

Key words: composition of biomass – sulphate – chlorine – corrosivity – alkaline – cinder – pollutant emissions

DYNAMICS OF SOIL ORDER AND PENETRATION RESISTANCE IN SOIL WITH AND WITHOUT SPRING BARLEY
AUGSNES SAKĀRTAS UN PENETROMETRISKĀS PRETESTĪBAS IZMAIŅU DINAMIKA AUGSNĒ AR UN BEZ VASARAS MIEŽIEM
Lapins D., Berzins A., Dinaburga G., Plume A., Melngalvis I., Sprincina A. and Sanzarevska R.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

Changes of dynamics of soil bulk density as well as soil penetration resistance with and without spring barley has been investigated in the 30 stationary observation points in Research and Study farm “Vecauce” of Latvia University of Agriculture in 2005-2006. Distance between points was 5 m. Observations have been accomplished at the stage of 2 till 3 leaves of spring barley, at the end of tillering, at the stem elongation stage (2 till 3 node stage), as well as before harvesting. Soil penetration resistance and moisture has determined till 50 cm deep. Area of flag leaves was determined with software WinFOLIA, but yield and its structure elements – using sample sheaf from 0.1 m². Content of organic matter, soil pHKCl, P2O5 and K2O have been determined in certified laboratory of State Soil agricultural chemistry research. It was established that in areas sown with spring barley soil moisture losses from topsoil and also from subsoil in result of plants’ transpiration promoted soil penetration resistance increase substantially in the conditions of 2005 and 2006. Essential differences of soil penetration resistance in plant root action zone were established if compared with observation points without plants in development stage of spring barley after tillering. It means that plants with their own roots’ action restrict the placement depth of roots. Consequently correlations between plants’ biomass and grain yield in 15 stationary observations points (with different availability of nutritive elements in soil) with spring barley is low and inessential.

Key words: spring barley, soil moisture, soil penetration resistance, yield formation

CHOICE OF CRITERIA FOR SOIL TREATMENT DIFFERENCE USING GEOGRAPHICAL INFORMATION SYSTEMS (GIS)
AUGSNES APSTRĀDES DIFERENCES KRITĒRIJU IZVĒLE LIETOJOT GEOFONĀCIJAS INFORMĀCIJAS SISTĒMAS (GIS)
Lapins D., Vilde A., Berzins A., Plume A. and Dinaburga G.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

Research with the aim to detect factors influencing yield differences of winter wheat was carried out in the production fields of Research and Study farm „Vecauce” of LUA from 2004-2006. Possibility of soil tillage differences in connection with soil properties was investigated. The trials were
performed in the field “Kurpnieki” at 47 stationary observation points. GPS was used for the grids determination. Crop yield was detected using yield maps made by GPS of combine Class Lexion 420. Specific softwares AGROCOM and for detecting of flag leaf area WinFOLIA was used. As yield affecting factors, such parameters as soil Ap horizon depth, organic matter content, penetration resistance in soil layers till 50 cm depth and soil moisture in topsoil and subsoil were investigated. Soil resistance investigations were significantly affected by the implementation time of observations and soil moisture. Complicated estimation on selection of increased or reduced soil loosening depth has to be made taking into account soil resistance in connection with soil Ap horizon density and loosening technology. It was established that different soil penetration resistances in subsoil more affected yield differences in comparison with soil resistance in topsoil horizons. Efforts for soil resistance reduction have to be planned if soil resistance in topsoil (from 30 till 50 cm deep) is in limits from 600 till 700 kPa cm$^{-1}$.

Degree of factors’ influence on crop yield and its differences was established. Maps based on local GIS were made. Increased soil penetration resistance in subsoil also had negative influence on yield formation. Area of flag leaf and features determining its formation affected winter wheat yield.

Key words: GPS, GIS, yield affecting conditions

THE INFLUENCE OF THE CROP ROTATION AND THE PLANT PROTECTION COMPLEX ON THE POTATO AND BUCKWHEAT YIELD

AUGU MAIŅAS UN AUGU AIZSARDZĪBAS LĪDZEKLŪ KOMPLEKSA IETEKME UZ GRIĶU UN KARTUPEĻU RAŽU

Lejins A., Lejina B.
Latvia University of Agriculture, Research Institute of Agriculture, Skriveri, Aizkraukle distr., Latvia, LV-5126

Buckwheat and potatoe researches were carried out in the long-term crop rotation stationary which was established in 1969 as a part of the Research Institute of Agriculture. Buckwheat proportion in the particular crop rotations is up to 22%, proportion of potatoes - up to 16%. The highest buckwheat yields were obtained from the variants where buckwheat was cultivated after winter rye and from the buckwheat monocultural experimental plots. A considerable yield decreasement was noticed when cultivating buckwheat after potatoes. Weeds are effectively brought under control in buckwheat sowings by the herbicide Butisane 400 (1,5 l ha$^{-1}$) applied right after sowing.

The highest potatoe yields are get by cultivating them after winter rye, if compared to potatoe monocultural growing. A considerable yield decreasement has been noticed in the crop rotations which contain buckwheat. Herbicide Titus (50g ha$^{-1}$) treatment on potatoes provided us with a yiel increasement up to 17% and a fourfold usage of fungicides increased the yield up to 37%. In potatoe monocultural experimental plots there were noticed up to 4 times more perennial weeds, moreover – usage of pesticides does not provide the increasement of the yield which can be obtained by growing potatoes in a proper crop rotation.

Key words: crop rotation, monoculture, potatoes, buckwheat, weedyness, herbicides.

THE INFLUENCE OF THE CROP ROTATION AND THE PLANT PROTECTION MEANS COMPLEX ON THE SPRING CROPS YIELD IN DIFFERENT KINDS OF CROP ROTATIONS

AUGU MAIŅAS UN AUGU AIZSARDZĪBAS LĪDZEKLŪ KOMPLEKSA IETEKME UZ VASARĀJU LABĪBU RAŽU DAŽĀDAS SPECIALIZĀCIJAS AUGSEKĀS

Lejins A., Lejina B.
Latvia University of Agriculture, Research Institute of Agriculture, Skriveri, Aizkraukle distr., Latvia, LV-5126

The complex crop rotation experiments in the Research Institute of Agriculture have been started on 1969. The barley foreplants according to their influence on the crop yield can be ranged as follows (descending): clover-timothy; oats; winter rye. A remarkable yield decreasement starts with winter rye. Barley monocultural sowings give us a yield decreasement up to 1.17 t ha$^{-1}$. Treatment of herbicides Grodil and MCPA at tillering provides us with a constant yield increasement in average
The greatest barley yield increase (1.05 t ha\(^{-1}\)) was noticed in the monocultural experimental plot after herbicides and fungicides treatment. Weediness increases in those barley sowings where the cereal proportion of the whole crop rotation is over 83%. Mostly in the monocultural sowings there are noticed perennial weeds, especially quick grass \textit{Elytrigia repens}. In the crop rotations with the cereal proportion up to 83% oats had a particularly small reaction upon different foreplants. A remarkable yield decrease was noticed in the monocultural oat sowings. The greatest oat yield increase (0.86 t ha\(^{-1}\)) was noticed in the monocultural plots after a complex herbicides and fungicides treatment, however, it did not reach the yield index as in the best crop rotation variants. Weediness is much lower in the oat sowings with potatoes as a foreplant, than in the monocultural plots or when growing oats after winter rye. In general there are 10 times more weeds in the monocultural oat sowings than in the plots with a proper crop rotation. The highest spring wheat yields are get from the plots where the foreplants are buckwheat or lupine. Herbicides and fungicides are more effective in the monocultural spring wheat sowings than in the crop rotations. Weediness of the spring wheat sowing is higher in those crop rotation variants with a higher cereal proportion.

Key words: crop rotation, barley, oats, spring wheat, weediness, herbicides.

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**METHODOLOGICAL APPROACHES FOR MANURE REFERENCE VALUES CALCULATION**

**DAŽI KŪTSMĖSLU NORMATĪVU NOTEIKŠANAS METODISKIE ASPEKTI**

Lipenite I., Karklins A.

Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

The Nitrate Directive (91/676/EEC) sets a limit for livestock manure application to agricultural land. According to the Directive and policy of European Commission nitrogen and phosphorus in manure should be taken into account for definition of livestock units, development of crops’ fertilization recommendations, performing of fertilizer planning and monitoring nutrient cycling in agriculture. Quantification of nutrients in manure is difficult because of great heterogeneity of product. Manure sampling and analyzing is the simplest approach but practically quite unreliable method due to the heterogeneity of product and great variability in chemical composition. Currently in Latvia manure nutrient content reference values has been generalized from sample analytical data. Despite of quite numerous data sets if all sample data is merged together some groups are represented only by the few analytical replicates. Another approach for development of reference values, recommended by EC, is based on relation: \[ NP_{\text{manure}} = NP_{\text{diet}} - NP_{\text{animal products}} - NP_{\text{losses}} \] Attempt was made to assess the possibility of using EC methodology for elaboration of new manure reference values. Calculation of nitrogen and phosphorus excretion for cows, growing cattle, sows and slaughter pigs was based on normatives of animal feed (dray matter, protein, phosphorus) requirement. Higher dry matter consumption and lower diet nitrogen content was found in comparison to the default values in some EU countries (Denmark, Netherlands, Germany). The results of nutrient excretion obtained were similar to EU manure nutrient production standard values. Accounting and collecting of information on actual feed used for each category of animals in real farms, feed composition, and nutrient losses is necessary for determination of reference value.

Key words: manure, animal feed requirement, reference values, nitrogen, phosphorus.

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**THE EFFECT OF THE LONG-TERM APPLICATION OF DIFFERENT INTENSITY FERTILIZATION SYSTEMS ON THE FERTILITY OF GLEYIC CAMBISOLS**

Maikštienė S., Krištaponytė I.

Joniskelis Experimental Station of the Lithuanian Institute of Agriculture, Joniskelis, Pasvalys distr. 39301, Lithuania

At the Lithuanian Institute of Agriculture’s Joniskelis Experimental Station trials were carried out over the period of 1995-2001 on a \textit{Endocalcaric-Endohypogleyic Cambisol (CMg-n-w-can)}, in a five-course crop rotation, in which we investigated mineral, organic and organic-mineral fertilization systems. It was found that the mineral fertilization (N56P48K60) had no significant effect on the content of humus in the soil; the contents of phosphorus and potassium decreased insignificantly. In
the organic-mineral fertilizing system, the application of 40, 60 and 80 t ha$^{-1}$ manure together with N56P48K60 reliably increased the content of humus 7,1-10,0 %, phosphorus, and potassium by 7,1-10,0, 23-25, and 4,6-7,6 %, respectively. The soil bulk density declined by 4,6 – 4,6 – 4,0 %, and the total porosity increased by 6,7 – 6,0 – 5,3 per units respectively than in unfertilised treatments. The organic fertilization (80 t ha$^{-1}$ manure per rotation cycle) increased the content of humus by 6,3 % and had no significant effect on the content of phosphorus and potassium. Fertilisation with farmyard manure only at a rate of 80 t ha$^{-1}$ soil reduced bulk density by 3,3 %, and increased total porosity by 3,8 %, than in unfertilised treatments. Application of different rates of farmyard manure (40, 60 and 80 t ha$^{-1}$) in the organic – mineral fertilisation systems resulted in 3,4 – 3,6 – 5,5 % increase in average crop rotation content of metabolisable energy and in the organic system – 11,2 %, compared with the mineral fertilisation system.

**Keywords:** Gleyic Cambisols, fertilization systems, agrochemical and agrophysical properties, metabolisable energy.

**EFFICIENCY OF REDUCED HERBICIDE DOSAGES IN BARLEY FERTILISED WITH DIFFERENT RATES OF NITROGEN**

SAMAZINĀTU HERBICIDA DEVU EFIEKTIVITĀTE MIEŽU SĒJUMĀ DAŽĀDOS SLĀPEKLA MĒSLOMA FONOS

Malecka S., Bremanis G. 
State Stende Cereals Breeding Institute, p.n. Dizstende, Talsi distr., Latvia, LV-3258

The objective of this work was to evaluate how the different nitrogen rates and herbicide dosages affect weed density in spring barley. Barley ‘Ansis’ was grown in rotation of the experimental fields at State Stende Cereals Breeding Institute near Talsi in Latvia (2001-2004). Four levels of nitrogen, 0, 60, 90, 120 kg ha$^{-1}$, in the form of complex mineral fertilizer (N18: P9: K9) was applied at the time of seeding. The weed control was realized with two different herbicides at growth stage 26 – 29 by Zadoks. Methyl-tribenuron (Granstar) was applied at 0, 3.75, 7.5, 15.0 g ha$^{-1}$; dichorprop- P+MCPA+mekoprop-P (Duplazan Super) at 0, 0.5, 1.0, 2.0 L ha$^{-1}$. The density of emerged weed seedlings was counted prior to post-emergence herbicide application which has been at the 2 – 4 leaf stage of weeds in a 0.25 m$^2$ circle frame placed in 8 replication. The number and and green mass of weeds that survived weed control was counted 6 weeks after herbicide treatment and efficacy of weed control was calculated for each variants. The effect of herbicides on annual dicotyledonous weeds increased according the amount of used nitrogen fertilizer. In control, the dichorprop- P+MCPA+mekoprop-P and methyl-tribenuron showed medium effect for full and ½ doses, very low effect for ¼. The treatments that got 60N kg ha$^{-1}$ dichorprop- P+MCPA+mekoprop-P and methyl-tribenuron showed medium effect for full and ½ doses, for ¼ dose dichorprop- P+MCPA+mekoprop-P showed low but methyl-tribenuron showed very low effect. In treatments with 90 and 120N kg ha$^{-1}$, the both herbicides showed medium effect for all doses of herbicides. The four year experiment showed that reduced herbicide dosages control well annual dicotyledonous weed density at high N supply rates.

**Key words:** barley, nitrogen fertilizer, reduced herbicide dosages

**THE EFFECT OF FERTILIZERS RATES CALCULATED BY DIFFERENT METHODS ON NUTRIENT BALANCE AND SOIL AGROCHEMICAL PROPERTIES**

Mazvila J., Vaisvila Z., Staugaitis G., Arbacauskas J., Adomaitis T. 
Lithuanian Institute of Agriculture, Savanoriu prosp. 287, Kaunas-50127, Lithuania

Experiments were conducted on an Endohypogey-Calcaric Luvisol in two sities. In the first site the soil tested high in phosphorus and medium in potassium (P$_2$O$_5$ 188-247; and K$_2$O – 112-163 mg kg$^{-1}$), while in the second site the soil tested low in phosphorus and potassium (P$_2$O$_5$ 68-98; and K$_2$O – 80-112 mg kg$^{-1}$). It was found, that the best nitrogen balance (close to zero) was obtained having adjusted nitrogen fertilizer rates according to the mineral nitrogen status present in the soil in spring. In terms of phosphorus balance, most efficient were moderate fertilizer rates adjusted according to mobile
phosphorus content, since in the soils testing high in phosphorus, the balance of phosphorus was close to zero or negative, and in the soil testing low in this nutrient, the contents of phosphorus incorporated with fertilizers were by much as 23.6-47.2 higher than those accumulated in crop yield. The best potassium balance was identified also in the treatment applied with moderate rates of potassium of potassium fertilizers adjusted according to soil agrochemical indicators, since in the soil testing medium in potassium was close to zero. However, in the soil testing low in potassium the content of potassium incorporated with fertilizers was by 26.8 kg ha\(^{-1}\) higher than that incorporated in the crop yield. The correlation between phosphorus mobile phosphorus content in the soil was R = 0.85 and R = 0.86; and between potassium balance and mobile potassium contents R = 0.93 and R = 0.82.

**Key words:** soil, fertilization, balance.

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**STATISTICAL METHODS FOR ANALYSING VEGETATION DATA OF WEED FLORA IN ORGANIC AGRICULTURE FIELDS IN LATVIA**

Pliksere D.

State Priekuli Plant Breeding Institute, Zinatnes iela 1a, Priekuli, Cesis distr., Latvia, LV-4126

The ecological approach to the agriculture supports a conservation of biodiversity in agro-ecosystems. The biodiversity is a part of a well-balanced organic system and thereby ensures more stable yields of the crop. The diversity of vegetation within and around agro-ecosystem is an important component of biodiversity. Natural plants provide many animal species with a habitat and food resources. Therefore it is important to investigate the diversity of weed and their impact on ecological processes in crop fields, as well as on amount and quality of yield.

It is possible to use the same statistical methods for analyzing vegetation diversity of weed flora as in phytosociology. These methods are used in agriculture only for some last years in Europe. There are no similar investigations in Latvia.

TURBOVEG is a comprehensive database management system designed for the storage, selection, and export of vegetation data – among them also weeds. Indicator values of Ellenberg characterize the ecological optimum of plants concerning climatic and edaphic factors. Two-way indicator species analysis TWINSPAN and software JUICE can be used for classification of weed flora. Direct and indirect ordination – CCA and DCA – can be used to find main ecological factors that determine the variation in the data set. SPSS is now widely used in the nature sciences and includes many possibilities of data analyzing. MS Excel is suitable for analyzing small amount of data.

There are characterized different statistical methods for analyzing vegetation data to determine their advisability for investigations of diversity of flora in organic agriculture in this article. To compare the results, using of these methods is also useful for research of weediness in fields of conventional agriculture.

**Key words:** weed flora, statistical methods, organic agriculture

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**COMPARISON OF DIFFERENT SOIL TILLAGE METHODS ON ECONOMICAL PARAMETERS OF WINTER WHEAT PRODUCTION**

Stasinskis E.

Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

Reduced soil tillage in cereals comes more significant and popular in last years in Latvia and EU. Many new minimum tillage and no-till machines are able to use for Latvian farmers. Real efficiency and economical aspects to compare those technologies against traditional ploughing are very important.

The research of soil tillage- sowing technologies on winter wheat was done on heavy clay soils in Dobele region of Latvia during years 2000 - 2003. Field trials were established after two different
previous crops – winter wheat and winter rape (factor A). Three different soil tillage-sowing technologies were compared. Traditional tillage with soil ploughing and cultivating compared against minimum soil surface tillage with using Simba Discs 34C 4.6 + Simba double press 4.6 and no-till sowing with direct drilling (factor B). Vaderstad Rapid 600P seed drill was used for all experiments. Impact of the weed infestation was investigated comparing herbicide Secator 0.3 kg ha\(^{-1}\) usage and no herbicide treatment (factor C).

Meteorological conditions were different in all trial years with great deflection from long term observations. That was a reason of variation of the obtained results.

Traditional soil tillage has advantages in years with great amount of precipitation (growing season 2000 - 2001 and especially 2001 - 2002) but in dry conditions (autumn 2002) significant higher yield gave direct sowing.

Compare additional expenses for soil tillage and additional obtained yield both treatments – minimal tillage and traditional tillage – gave additional profit in average on three years. The highest increase of winter wheat grain yield from additional expenses was observed in treatment with minimal soil tillage growing winter wheat in recurrent sowing and using herbicide – 81.2 kg from 1 additionally expended Ls. There is highest profit from additionally expended resources in this treatment on average in three years.

**Key words:** wheat, tillage, previous crop, economical evaluation.

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**EFFECT OF MINERAL SUPPLY THROUGH LEAVES ON THE AMOUNT OF PHOTOSYNTHETIC PIGMENTS IN SPRING WHEAT**

**FOTOSINTĒZES PIGMENTU SATURA IZMAINAS VASARAS KVIEŠOS ATKARĪBĀ NO MINERĀLELEMENTU PIEGĀDES CAUR LAPĀM**

Stramkale V.\(^{1}\), Stramkalis A.\(^{1}\), Pakarna G.\(^{2}\), , Vikmane M.\(^{2}\)

\(^{1}\)Scientific centre of agriculture of Latgale, LLZC, Vilani, Rezeknes distr., Latvia

\(^{2}\)University of Latvia, Kronvalda bulvaris 4, Riga, Latvia, LV-1586

Mineral supply trough leaves increases the availability of minerals and it is better for the environment.

This was the first investigation of the influence of mineral supply trough leaves on amount of photosynthetic pigments in spring wheat leaves in Latvia. There were field tests and laboratory investigations.

The supply of macronutrients “Phosific” and micronutrients “DDMn” trough leaves increased the amount of photosynthetic pigments in spring wheat leaves (variety ‘Jasna’). The yield of wheat grains increased by 3 to 5 % in comparison with the control.

Optimal doses of minerals through leaves during wheat heading phase insure positive correlation between grain yield and amount of photosynthetic pigments. Negative influence on the environment is reduced.

**Key words:** fertilization through leaves, spring wheat, yield, photosynthetic pigments.

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**PHYSIOLOGICAL ASPECTS OF THE WHEAT YIELD OBTAINED FROM SEEDS TREATED WITH PHOSPHORUS**

**AR FOSFORU APSTRĀDĀTU KVIESU SĒKLU RAŽAS FIZIOLOGISKIE ASPEKTI**

Stramkale V.\(^{1}\), Stramkalis A.\(^{1}\), Vikmane M.\(^{2}\), Zelonka L.\(^{2}\)

\(^{1}\)Scientific centre of agriculture of Latgale, LLZC, Vilani, Rezeknes distr., Latvia

\(^{2}\)University of Latvia, Kronvalda bulvaris 4, Riga, Latvia, LV-1586

The phosphorus is an important macronutrient for the wheat. In the most occasions there are low availability of the phosphorus in the soils. Therefore the seed coating with well available phosphorus is used in the agricultural practice.

The aim of this work is to investigate the influence of the wheat seed coating with phosphorus on germination process, the amount of pigments of green plastids in shoots, the yield of seeds and the presence of after-effect on the second generation of barley.
The coating of wheat seeds with phosphorus depressed the germination in the beginning of the development of plants, but there is the positive influence of the coating on the amount of pigments of green plastids in the shoots and yield of wheat seeds increased by 2.6 to 102%.

The treatment of wheat seeds with the phosphorus influences positively the physiological activity of the next generation seeds. The usage of phosphorus treated wheat seeds is effective: physiological activity of the seeds increases as well as the yield of the seeds. Besides, phosphorus usage is improved and accordingly, it contributes to better nature protection.

**Key words:** mineral nutrition, spring wheat, seed germination, pigments of green plastids, yield.

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**DEVELOPMENT AND UNIFICATION OF SOIL AGROCHEMICAL ANALYSIS METHODS**

**AUGSNES AGROĢĪMISKO ANALIŽU METOŢU PILNVEIDOŠANA UN UNIFICĒŠANA**

**Timbare R., Jekabsone M., Dekovica S.**

Agrochemical Research Centre, 14a Struktoru iela, Riga, Latvia, LV-1039

In order to estimate the possibilities of introduction of the widely applied in Europe the Mehlich III method in the soil agrochemical investigation in Latvia, the content of the plant available phosphorus, potassium, magnesium and calcium was determined in 60 representative soil samples simultaneously at the Agrochemical Research Centre by currently used methods (P, K and Mg – according to the DL method, using as extractant 0.04 M Calcium lactate), Ca – using for extraction 1 M KCl) and at the Estonian Agricultural Research Centre by the Mehlich III method. A close correlation ($r = 0.949 - 0.951$) was between the methods of determination of potassium and calcium, but medium correlation ($r = 0.609 - 0.680$) between the methods of determination of phosphorus and magnesium.

In 2005 the mineral nitrogen monitoring in the vulnerable zones has been started in Latvia and the international standard ISO/TS 14256-1 method for determination of content of nitrates and ammonium nitrogen has been introduced. On the ground of 288 soil tests there was established a close correlation ($r = 0.958$) between the nitrate nitrogen amount by international standard ISO/TS 14256-1 method and branch standard method LV ST ZM 90 - 97 method in the sand soils, and a bit weaker correlation in loamy sand ($r = 0.895$) and loamy ($r = 0.818$) soils. A weak correlation was
found between the ammonium amount in soils by both methods. ISO/TS 14256-1 method shows a lower amount of mineral nitrogen in soils than method of the branch standard LV ST ZM 90 – 97, used in Latvia so far.

**Key words:** soil, agrochemical analyses, determination methods

**MONITORING OF SOIL MINERAL NITROGEN IN VULNERABLE ZONES**

**AUGSNES MINERĀLĀ SLĀPEKĻA MONITORINGS ĪPAŠĪJUTĪGĀS TERITORIJĀS**

Timbare R., Busmanis M., Janevica V., Mikelsone A., Poriete S.

Agrochemical Research Centre, 14a Struktoru iela, Riga, Latvia, LV-1039

The studies have been carried out according to the task "Monitoring of soil mineral nitrogen" set out within the Action Programme for vulnerable zones in order to implement the requirements of EU Nitrate Directive (91/676/EEC). There were 48 places of study selected in the vulnerable zones, representing the soils of each administrative district (Bauska, Dobele, Jelgava, Riga). The coordinates and the height above the sea level have been determined in the places of study by the global position system receiver, the type of the soil (according to the soil maps of the State Land Service) and the soil texture, the historical data of fields have been recorded concerning the cultivated crops, its productivity, fertilizing, as well as the meteorological data from the meteorological stations, situated in the proximity of the places of study. In order to estimate the potential risk of soil and waters pollution, in late autumn, before winter of 2005-2006 the soil samples were taken from the soil layers of 0-30, 30-60 and 60-90 cm. The content of nitrates and ammonium nitrogen was determined in all the layers of the soil, according to the method set out by ISO/TS 14256-1, expressing the results mg kg\(^{-1}\) of the dry soil. In soil layer 0-30 cm the low nitrate nitrogen content (≤10 mg N - NO\(_3\) kg\(^{-1}\) soil) has been in the 54 % of cases. "Pollution risk" (>50 mg N- NO\(_3\) kg\(^{-1}\) soil) has been found in 10 % of cases. In the deeper layers (30-60 and 60-90 cm) the low nitrate nitrogen content has been in 65-94 % of cases. "Pollution risk" has been found only in the lowland bog soil (2 % of cases).

**Key words:** soil, monitoring, autumn, nitrate nitrogen content

**СМЕШАННЫЕ ПОСЕВЫ ЯЧМЕНЯ С ГОРОХОМ, ПЕРСПЕКТИВЫ ИХ ВОЗДЕЛЬВАНИЯ И ЗАЩИТА ОТ СОРНОЙ РАСТИТЕЛЬНОСТИ**

**MIEŽU UN AUZU MAISĪJUMU AUDZĒŠANAS PERSPEKTĪVAS UN TO AIZSARDŽĪBA PRET NEZĀLĒM**

Терещук В.

Лаборатория герболожии, РУП «Институт защиты растений», Мира 2, 223011 д. Прилуки, Минский р-н, Республика Беларусь

Около 70% растениеводства в республике Беларусь используется на корм животным. Низкое содержание протеина в фуражном зерне можно восполнить за счет производства протеина растительного происхождения: возделывания зернобобовых культур, бобовых кормовых трав.

В последние годы весьма актуальным и перспективным считается возделывание смешанных посевов зерновых и бобовых культур, но высокая засоренность является основным фактором, сдерживающим их возделывание. В 2004-2006 гг. на опытном поле РУП «Институт защиты растений» в смешанных посевах ячменя с горохом мы испытывали ряд гербицидов почвенного действия, которые вносили после сева до всходов культур. Гербициды Гезагард, КС (прометрин, 500 г/л), Стомп, 33% к. э. (пендиметалин), Марафон, 375 г/л в. к. (пендиметалин, 250 г/л)изопротурон, 125 г/л), Рейсер, 25% к. э. (флуорохлоридон) показали хорошую биологическую эффективность, снижали засоренность смешанных посевов ячменя с горохом на 64,5-99,5%.
APPLICABILITY OF VARIOUS AMENDMENTS TO IMPROVE CLAYEY SOIL PROPERTIES UNDER REDUCED TILLAGE MANAGEMENT IN NORTHERN LITHUANIA

DAŽĀDU PASĀKUMU LIETOŠANA MĀLAINU AUGŠNU ĪPAŠĪBU UZLABOŠANAI MINIMALIZĒJOT AUGSNES APSTRĀDI LIETUVAS ZIEMEĻOS

Velykis A., Satkus A.
Joniskelis Experimental Station of the Lithuanian Institute of Agriculture, Joniskelis, Pasvalys distr. 39301 Lithuania

Experiments to improve clayey soil physical properties were carried out at Joniskelis Experimental Station of the Lithuanian Institute of Agriculture over the period 1997-2003. The soil of the experimental site is characterized as glacial lacustrine clay loam on silty clay, lying under morainic sandy loam. Amendments for soil improvement: farmyard manure - 60 t ha\(^{-1}\), green manure - 27 t ha\(^{-1}\) and lime-mud - 10 t ha\(^{-1}\) incorporated by a moldboard and segment plough at 25 and 40 cm depths, respectively, also different primary soil tillage methods (moldboard ploughing at 25 cm and ploughless loosening at 25 and 15 cm depths) were investigated. Incorporation of amendments resulted in decrease of soil bulk density, improvement of soil aeration and water conductivity. With incorporation of amendments by a segment plough at 40 cm depth, subsoil physical properties improved. Lime-mud was more effective for subsoil improvement. However, the segment ploughing resulted in a worsening of topsoil properties due to a mixing subsoil layer with topsoil. Reduced ploughless soil tillage determined the increase of soil bulk density, worsening the soil structure and seedbed quality. Incorporation of amendments, especially farmyard manure, helps to avoid or lessens the negative effect of reduced tillage on the clayey soil physical condition and on the decrease of spring crop yield.

Key words: clay loam, incorporation of amendments, reduced tillage, soil properties, crop yield.

COMPARISON OF METHODS FOR DETERMINATION OF PHOSPHORUS IN CALCAREOUS SOILS

FOSFORA NOTEIKŠANAS METOŽU SALDŽINĀJUMS KARBONĀTUS SATUROŠĀS AUGSNĒS

Vucans R., Lipenite I., Livmanis J.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

Plant available phosphorus determination by the Egner−Riehm (DL) method (LV ST ZM 82-97) is provided for use in agrochemical research of sod-podzolic and other soils. However, as indicated by the gained experience and results of research, the above mentioned method is not suited for characterizing resources of available phosphorus in calcareous soils. Thereby, as calcareous soils occupy a small area out of all agricultural land in Latvia, these soils are not distinguished as a specific soil group and the most corresponding method for available phosphorus extraction is not adapted and determined for them. Research goal was to develop method for estimating available phosphorus supply in calcareous soils. By the standard method (Egner-Riehm) the obtained results of phosphorus content were compared with those presented by the Olsen and Mehlich-3 method. Analysis of correlation and regression were employed for comparing data of available phosphorus content in soil samples determined by different methods, as well as t-test was used for the change of phosphorus content. When analysing Paired Samples T Test (n=145) most significant correlation (r=0.95) was determined between amounts of phosphorus obtained by the Egner-Riehm and Olsen methods. All the three methods employed in the research showed that the proportion of the extractable phosphorus decreased from the total phosphorus with the increase of organic matter content in soil. Changes in the results obtained by the Egner-Riehm and Olsen methods revealed that in alkaline (pH 7.5) soils with CaCO\(_3\) content above 5%, certain amount of available phosphorus does not pass into calcium lactate extraction. Results obtained by DL method can reduce in deeper soil samples higher in carbonate content. The Olsen method is the most suited method for phosphorus extraction in calcareous soils using NaHCO\(_3\) as an extracting agent.

Key words: available phosphorus, Olsen, Mehlich-3, Egner-Riehm
EFFECT OF FERTILIZER ON NPK BALANCE IN SPRING WHEAT CROP
MĒSLOJUMA IETEKME UZ NPK BILANCI VASARAS KVIEŠU SĒJUMOS

Vucans R., Lipenite I., Livmanis J., Pogulis A.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

The use of ecologically reasoned fertilizer rates in Zemgale soil region is topical both following the intensity of management in the region and in connection with the increased risk of getting plant food elements into water bodies. Unwanted excess of nitrogen and phosphorus in soils which are rich in humus and available phosphorus is formed when the amount of these plant food elements incorporated into soil with fertilizer is exceeding the amount which is removed with a part of yield harvested from the field. The goal of the research was to clarify the effect of the nitrogen and phosphorus fertilizer rates on plant nutrient removal as well as NPK balance in soil in spring wheat crop. Field experiments were conducted (1998–2006) in LLU Study and research farm Peterlauki in crop rotation long-term field experimental plots of the Institute of Soil and Plant Sciences on a heavy loam (sM1) sod-pseudogley soil (GLx) with spring wheat varieties ´Eta´ and ´Vinjett´. For both the varieties the nitrogen removal constituted averagely 89.0–122.5 kg ha\(^{-1}\), that of phosphorus and potassium – 34.7–48.8 and 21.7 –26.0 kg ha\(^{-1}\), respectively. It was significantly affected by meteorological conditions of the definite year, which directly influenced the yield and chemical composition of grain, and fertilizer rates for the variety ´Eta´ as well. Fluctuations in the nitrogen and phosphorus balance for the variety ´Eta´ under the influence of fertilizer were higher than those in the removal: averagely from −89.0 kg ha\(^{-1}\) up to −2.5 kg ha\(^{-1}\) N, and from −41.7 to 47.4 kg ha\(^{-1}\) P\(_2\)O\(_5\), but the potassium balance from 21.7 to 66.7 kg ha\(^{-1}\) K\(_2\)O. For the variety ´Vinjett´, in its turn, NPK balance was respectively from −100.8 to 9.0 kg ha\(^{-1}\) N, from 40.9 to 51.8 kg ha\(^{-1}\) P\(_2\)O\(_5\), and from −20.4 to 73.1 kg ha\(^{-1}\) K\(_2\)O. The nitrogen balance was significantly affected only by the nitrogen fertilizer rate, but the phosphorus balance − by the phosphorus fertilizer rate. Removal with 1 tonne of the main product for the variety ´Eta´ was averagely 22.0 − 24.8 kg N, 8.7 − 10.0 kg P\(_2\)O\(_5\), and 5.3 − 5.5 kg K\(_2\)O, but for the variety ´Vinjett´: 20.5 − 23.7 kg N, 7.2 − 8.6 kg P\(_2\)O\(_5\) and 3.5 − 4.3 kg K\(_2\)O.

Key words: spring wheat, fertilizer, removal, NPK balance

RESULTS OF INVESTIGATIONS ON INFLUENCE OF CROP ROTATION AND FERTILISATION SYSTEMS ON SPRING BARLEY ‘IDUMEJA’
PĒTĪJUMU REZULTĀTI PAR AUGŠEKA UN MĒSLOŠANAS SISTĒMU IETEKMI UZ MIEŽIEM ‘IDUMEJA’

Zarina L.
State Priekuli Plant Breeding Institute, Zinatnes iela 1a, Priekuli, Cesis distr., Latvia, LV-4126

On a base of long term experimental field in five different crop rotations and using five different fertilisation systems there was in Priekuli Plant Breeding Institute a new variety of spring barley ´Idumeja’ tested. The objectives of this study were to: (1) find conformity to natural laws in obtaining of economically and ecologically based qualitative yield of new variety in context of sustainable agriculture; and (2) fix the yield level in different backgrounds of fertilizing. Since the beginning of experiments (in 1958) herbicides and fungicides were not used at the field. It was found that despite disusing of chemical plant protection tools and suboptimal for crop growth climate conditions in some seasons as well, there were comparatively high yield level obtained- 4 t ha\(^{-1}\) in average in all variants of fertilising. Under influence of fertiliser significant differences were found between barley yield obtained in the fields without fertilising, using stable manure (20 t ha\(^{-1}\) and fertiliser doses 2NPK (N132P180K270). In tested conditions the early spring barley variety ´Idumeja’ presents properties that point on possibility to use this variety in organic farming systems. Investigations are partly financed by Latvian Council of Science.

Key words: Spring barley “Idumeja”, fertilization systems, crop rotations
Возделывание проса в Беларуси в последнее время приобретает особую актуальность, поскольку позволяет восстановить сырьевую базу для производства такой крупы как пшено и отказаться от его закупок за рубежом. Рост производства зерна проса ограничивается главным образом засоренностью посевов этой культуры. Однако данные, касающиеся критических периодов и порогов вредоносности сорных растений в посевах проса, отсутствуют.

Установлено, что чем продолжительнее совместная вегетация проса с сорняками, тем выше потери урожая зерна культуры. Критический период вредоносности сорных растений в 2001 г. составил 22 дня совместной вегетации, что соответствует фазе 3-4 листьев, в 2002 г. – 26 дней (фазе 6-7 листьев), в 2003 г. 21 день (фазе 5-6 листьев культуры). Прополка посевов после этого периода сопровождается, как правило, достоверным снижением урожайности.

Между численностью сорняков в посевах и урожайностью зерна проса наблюдается тесная обратная зависимость ($r = 0,84–0,89$). Биологический порог вредоносности однолетних двудольных сорняков (количество сорняков, при превышении которого наблюдается достоверное снижение урожайного проса) различался по годам исследований и в 2001 г. составлял 18, в 2002 г. - 9, в 2003 г. - 12 сорняков на 1 м$^2$. В неблагоприятных для развития проса погодных условиях (засуха, заморозки и др.) показатели порога снижаются, при интенсивном росте культуры увеличиваются.

Ключевые слова: проса, сорняки, вредоносность
Session 2. CROP PRODUCTION AND GRASSLAND MANAGEMENT

SUBSEQUENT EFFECT OF CATCH CROP NITROGEN ON SOIL PROPERTIES AND SPRING BARLEY YIELD
Arlauskienė A., Maikštienė S.
Lithuanian Institute of Agriculture, Joniškėlis Experimental Station, LT-39301 Joniškėlis, Pasvalys distr., Lithuania

During the period 2001-2004 field experiments were carried out at the Lithuanian Institute of Agriculture’s Joniskelis Experimental Station on clay loam soil. The experiments were designed to elucidate the mobilization of soil nitrogen by cover crops (Raphanus sativus L., Sinapis alba L., Trifolium pratense L., Dactylis glomerata L., Lolium multiflorum Lam.) and their subsequent effect on soil organic carbon and spring barley grain yield. Of all catch crops red clover was noted for the highest total dry matter content, which was by 1.6-2.4 times higher compared with the other catch crops. Measurements of nitrogen contents accumulated in the biomass of individual crops suggest that the highest nitrogen concentration was in red clover underground and overground biomass. The N\textsubscript{2} fixation rate of red clover was 128 kg ha\textsuperscript{-1}. Of the non-legume crops, the highest nitrogen content was found in white mustard biomass (89 kg ha\textsuperscript{-1}). The ranking among the different catch crops according to nitrogen content in biomass was: red clover > white mustard > oil radish = cocksfoot > Italian ryegrass. Averaged data of the experiments indicate that with increasing root and overground plant mass the C to N ratio widened (r=0.66*, r=0.68*, respectively) and fibre content increased (r=0.59*, r=0.692*). Experimental evidence suggests that having incorporated the biomass of various crops (with C:N ratio = 17.0-25.7) - oil radish, white mustard and red clover at flowering stage and that of cocksfoot and Italian ryegrass at heading stage, the content of soil organic carbon in the soil increased (4.0-5.6 %). Catch crops biomass ploughed in as green manure increased spring barley yield: oil radish -1.6 %, white mustard – 3.4 % and red clover 8.5 %, as compared with the treatments without catch crop.

Key words: clay loam, catch crops, nitrogen, organic carbon, yield

BIO-MORFOLOGICAL PECULIARITIES OF NEW CULTIVARS OF FODDER GALEGA (GALEGA ORIENTALIS LAM.)
Baležentienė L.
Lithuanian University of Agriculture, Studentų 11, Akademija, Kaunas distr., Lithuania

The first Lithuanian fodder galega (Galega orientalis Lam.) high-yielding cultivars: ‘Vidmantai’, ‘Laukiai’ and ‘Melsviai’ were bred in 1986-1999 at the Research Station of the Lithuanian University of Agriculture by applying group and individual selection of progeny from the wild populations. A good adaptability to Lithuanian agro-climatic conditions are established for the new fodder galega cultivar ‘Vidmantai’, ‘Laukiai’ and ‘Melsviai’. ‘Vidmantai’, ‘Laukiai’ and ‘Melsviai’ guarantee early, heavy, protein-rich yield and high resistance to phytopathogens and pests. In the competitive variety trials the cultivar ‘Vidmantai’, ‘Laukiai’ and ‘Melsviai’ was tested during the period of 1996-2001. The aim of this research was to investigate and compare characteristics of new bred Lithuanian cultivars with improved, economically– valuable characteristics.

Average data of 5 years of the competitive trials of dry matter yield varied from 12.0 up to 12.4 t ha\textsuperscript{-1} depending of the climatic conditions. The stable yield of seeds (0.56-0.62 t ha\textsuperscript{-1}) was established. The protein content on average consist 219.0 g kg\textsuperscript{-1}.

Chlorophyll fluorescence of leaves of different age and different cultivars of fodder galega (Galega orientalis Lam.) was measured in the cultivars Vidmantai, Laukiai, Melsviai and the breeding line L04-4. The level of fluorescence can be used to estimate the intensity of photosynthesis and is related with biosynthetic activity and biomass yield. The maximum level of fluorescence was that of the 2nd and the 3\textsuperscript{rd} leaf ranks. The indices of fluorescence (F\textsubscript{t} in steady-state light and maximal F\textsubscript{m} fluorescence, quantum yield of electron transport Y and electron transport rate ETR) The cultivars differed significantly for fluorescence levels.
The cultivars ‘Vidmantai’, ‘Laukiai’ and ‘Melsviai’ were registered in Lithuania in 2001. The breeders of ‘Vidmantai’, ‘Laukiai’ and ‘Melsviai’ are L. Baležentienė, V. Spruogis, O. Kažemėkas and J. Levinskas. These cultivars have been sent for DUS testing in 2006.

Key words: fodder galega, morphology, cultivars, fluorescence

PHOMA BLACKLEG (STEM CANKER) OF OILSEED RAPE IN LATVIA
RAPŠA STUBLĀJU PUVE (FOMOZE) LATVĪJĀ

Bankina B., Gaile Z., Balodis O., Vitola R.

Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

Development of diseases becomes one of the most important risk factor for oilseed rape cultivation under conditions of intensive management.

Assessments and first investigations of rape diseases were started during autumn 2005, and especially in summer 2006.

Assessments of diseases were carried out in production fields as well as in field trial in research and study farm “Vecauce” of LLU. Identification of causal agents of diseases and study of life cycle were done in the laboratories and semi-field trials in Department of Plant Protection of Institute of Soil and Plant Sciences, LUA.

Before unnoticed symptoms of disease on the rape stems were observed in 2006. Pale grey blotch were detected on the lower parts of stems, heart of stem also was grey. Black pycnidia with large amount of single-cell, roundish conidia were developed on the lesions. Visible symptoms and, in particular, shape and size of conidia answered the description of causal agent of oilseed rape blackleg (stem canker) *Phoma lingam*. Investigations were continued and teleomorph of causal agent of blackleg was observed and described in late October 2006. Pseudotecchia of *Leptosphaeria* genus were found on the remained stems of rape. Pseudotecchia were developed coterminous with pycnidia. Generative stage of causal agent of blackleg (pseudotecchia with asci and asco spores) were detected for the first time in Latvia.

Infection with *Leptosphaeria* spp. were observed during autumn 2006, incidence of disease was 1-61 %, but severity only 0.01 – 1.23 %.

Research is continued to clarify importance and biological role of different development stages of oilseed rape blackleg.

Key words: oilseed rape, diseases, *Leptosphaeria*, *Phoma lingam*, life cycle

EPIDEMIOLOGY OF ERGOT ( CAUSED BY CLAVICEPS PURPUREA)
MELNO GRAUDU (IEROS. CLAVICEPS PURPUREA) EPIDEMIOLAĢIJA

Bankina B.1, Priekule I.2, Kokare A.3, Kronberga A.3, Lapins D.1

1Latvia University of Agriculture, Liela iela-2, Jelgava, Latvia, LV-3001
2Latvian Plant Protection Research Centre, 3State Priekuli Plant Breeding Institute

Ergot of triticale and rye is caused by *Claviceps purpurea* (Fries: Fries) Tulasne; anamorph *Sphacelia segetum*.

Voluminous observations were done in commercial fields of rye in Latvia (2005 – 2006). Different factors – vegetation in surrounding areas, crop rotation, sowing density and so on were described. Delayed development of side tillers is very significant factor increasing sclerotia incidence. Optimal crop management is important to avoid ergot occurrence in rye and triticale. Density of sowings affects disease development. Rye pre-crops affected ergot infection level. Statistically different infection level was observed in various locations in a field. More sclerotia were found near a field margin (> 1 m) in comparison with zone more deep in the field (at least 30 m from field margin). Density of pollens, accumulation of natural infection sources determines “side effect”. Separate harvesting of field borders (3-4 m zone) could significantly decrease ergot admixture in the yield.

Peculiarities of *C. purpurea* development were clarified in semi-field trials. Sclerotia germination was noted in the beginning of May, but perithecia with asco spores developed considerably later. Releasing of first mature asco spores was observed only in the middle of June (2006) therefore an infection is possible long period - from the end of May till the end of June. Significant differences
between cultivars (testing in natural and artificial infection conditions) were not established. Higher ergot incidence was observed in hybrid and tetraploid cultivars; it is related with different pollens morphology and peculiarities of their development.

All tested fungicides for seed treatment significantly decreased sclerotia germination and stromas formation.

**Key words:** rye, ergot, incidence, development, field factors

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**COMPARATIVE EVALUATION OF CHEMICAL COMPOSITION OF HULLED AND HULLESS CEREALS**

PLĒKŠŅAINO UN KAILO GRAUDAUGU KĪMISKĀ SASTĀVA SALĪDZINOŠS NOVĒRTĒJUMS

Belicka I., Malecka S., Bleidere M.

State Stende Cereals Breeding Institute, Dizstende, Talsi distr., Latvia, LV – 3258

The aim of experiment was to evaluate and compare grain chemical composition (crude protein, starch, crude fat, crude fibre, crude ash and phosphorus) of hulled and hulless cereals. The four hulless barley varieties and lines – ‘Gainer’ (Canada), ‘KM-2084’, (the Czech Republic), ‘L-302’ (Latvia), ‘SW-1291’ (Sweden), one hulled barley variety – ‘Linga’ (Latvia), hulless oat line ‘L-28156’ (Latvia), hulled variety ‘Laima’ (Latvia) and spring wheat variety ‘Vinjett’ (Sweden) were included in this study. Field experiments were carried out at the State Stende Cereals Breeding institute in 2004 – 2006. All plots were received 60 kg ha\(^{-1}\) nitrogen (N). The average crude protein content for hulless barley ranged from 129.7 - 171.0 g kg\(^{-1}\) and depended on varieties. The hulled variety ‘Linga’ contained 140.7 g kg\(^{-1}\) crude protein. The content of crude protein for hulless oat line was 170.9 g kg\(^{-1}\) and it was significantly higher than for covered oat (120.9 g kg\(^{-1}\)), but spring wheat ‘Vinjett’ (133.3 g kg\(^{-1}\)) took place between hulled barley and hulled oat. In 2006, hot summer temperatures increased the crude protein content in all cereal varieties. There were differences in starch content among cereals. Regarding to starch content the species were ranked in following order: wheat, hulless barley, hulled barley, hulless oat and hulled oat (668, 623-686, 598, 589, 454 g kg\(^{-1}\), respectively). The hulless line L-28156 showed the highest fat content – 91.7 g kg\(^{-1}\). This value exceeded 1.5 to 3.8 fold the content of fat found in hulled oat, hulled and hulless barley and spring wheat. The hulless barley, hulless oat and spring wheat had the lowest crude fibre content 18.3-24.3 g kg\(^{-1}\), 20.3 g kg\(^{-1}\) and 28.5 g kg\(^{-1}\), respectively. The hulled barley and oat contained from 2 to 5 fold more crude fibre than hulless types. Hulled varieties of barley and oat had higher crude ash content (23.0-25.2 g kg\(^{-1}\)) than hulless type (17.6-22.2 g kg\(^{-1}\)). The results of grain chemical composition suggest that the hulless varieties of barley and oats might awake interest for food and feed producers.

**Key words:** barley, chemical composition, hulled and hulless cereals, oat, wheat

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**THE CHANGES IN FLORISTIC COMPOSITION OF MEADOWS AFTER DESISTANCE FROM FERTILIZATION FOR FIVE YEARS**

Borawska-Jarmulowicz B.

The Warsaw Agricultural University, Nowoursynowska 159, 02 – 776 Warsaw, Poland

The changes in the botanical composition of meadow sward are caused by environmental factors and human activities. The aim of this study is to estimate floristic composition of four meadow types in 2006 in comparison with the composition in 2001. During the five years the meadows were desisted from fertilization and were cutting only once a year. The studies were carried out in central Poland on a semi-natural moderately wet meadow site. As a result of different grass mixtures the four of meadow sward with the following dominated species have been established: type 1 – *Arrhenatherum elatius* and *Festuca arundinacea*, type 2 - *Festuca arundinacea* and *Arrhenatherum elatius*, type 3 – *Festuca rubra* and *Dactylis glomerata*, type 4 - *Festuca rubra* and *Festuca arundinacea*. In 2006 after the five years desistance from fertilization the samples were taken from the four types of meadow sward. The changes in botanical composition after desistance from fertilization for five years showed the decreasing in the total number of grass species and their share in sward. The percentage of dicotyledonous (weeds and herbs) increased very strong as a result of cutting and lack of fertilization.
THE INFLUENCE OF DIFFERENT POTASSIUM FERTILIZER RATES ON GRAIN YIELD AND QUALITY OF WINTER CEREALS

DAŽĀDU KĀLIJA PAMATMĒSOLOJUMA DEVU IETEKME UZ ZIEMĀMU GRAUDU RAŽU UN KVALITĀTI

Bremanis G., Malecka S., Vojevoda L.
State Stende Cereals Breeding Institute, Dizstende, Talsi distr., Latvia, LV – 3258

Potassium fertiliser is used together with other basic fertilisers but the necessity of it is not really investigated for many of the new winter cereal varieties. Also different needs of it may occur for winter wheat, triticale and ray species. The aim of this work was to investigate the influence of different dosages of potassium basic fertilization on the yield and quality of the whole crop biomass of wheat, triticale and rye.

Winter wheat ‘Zentos’, ‘Kobra’, ‘Bangas’; triticale ‘Falmoro’, ‘Lamberto’, ‘Disco’ and rye ‘Amilo’, ‘Kaupo’, ‘Walet’ were grown in rotation of the experimental fields at State Stende Cereals Breeding Institute near Talsi in Latvia, in 2005 and 2006. Five levels of potassium, 0, 60, 120, 180 kg ha⁻¹, in the form of ammonium-phosphate (N₁₂P₂O₅₂) and potassium chloride (K₆O) mineral fertilizer were applied before time of seeding. The nitrogen fertilizer was applied, 90 kg ha⁻¹ at re-growth of vegetation, 60 kg ha⁻¹ at heading stage of winter wheat and triticale and 30 kg ha⁻¹ of rye in the form of ammonium nitrate. The standard technology (herbicide, retardant, fungicide) of growing was used.

The following data were collected: grain yield (t ha⁻¹) at a moisture content of 14 %, potassium content (%, DM) in grain, starch and protein content (%, DM), 1000 grain weight (g), volume weight (g l⁻¹).

A rate of 120 kg ha⁻¹ K significantly increased the yield of all cereal varieties compared with control in 2005. Another rates of K fertilizer affected cereals’ varieties in different ways. K fertilization had not any effect on grain yield of all cereal varieties because of very hot and dry weather in growing season 2006.

Key words: Winter wheat, triticale, rye, potassium fertilizer rates.

INFLUENCE OF FERTILIZATION ON PERENNIAL RYEGRASS PHYTOMETRIC CHARACTERISTICS AND ITS DINAMICS

MINERĀLMĒSOLOJUMA EFEKTIVITĀTE UZ GANĪBU AIRENES FITOMETRISKAIJEM RĀDĪTĀJIEM UN TO DINĀMIKA

1Bumane S., 2Adamovics A., 1Berzins P.
1Latvia University of Agriculture, Agriculture Research Institute, Skrīveri–1, Latvia, LV–5126
2Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

The aim of the present research was to study photosynthesis activity – leaf area index, net photosynthesis productivity, number of stems, stem formation dynamics and seed yield of perennial ryegrass ‘Spidola’ at different rates of fertilizer application under agro-ecological conditions of Latvia.

Field experiments were carried out on sod podzolic sandy loam soil (Luvic Phaeozem, WRB 1998), pH_KCl - 6.5, plant available, P-95 and K-132 mg kg⁻¹ (Egner-Riehm), soil organic carbon -20 g kg⁻¹ (Tyurins’ method). Perennial ryegrass ‘Spidola’ seeds were (12 kg ha⁻¹) planted using a Nordsten seed drill in May 1999, 2000 and 2001 after field preparation. The following mineral fertilizer rates were used: N and P₂O₅, each 0, 30, 60, 90, 120, K₂O – 0, 40, 80, 120, 160 kg ha⁻¹. A randomized complete block design with four replications was used. Perennial ryegrass ‘Spidola’ in the first year (2000–2002) produced seed yield from 311 to 727 kg ha⁻¹ (3-year average), but during second year (2001–2003) production was from 102 to 617 kg ha⁻¹ at the fertilizer treatment level N₁₂₀ P₁₂₀ K₁₆₀. The highest 3–year average seed yield was 727 kg ha⁻¹. Leaf area average index, was from 4.86 to 10.03 and from 1.12 to 6.21 m² m⁻² per leaf surface for years 2002 and 2003 respectively. Net photosynthesis productivity was from 1.98 to 3.84 g m⁻² / day, and from 1.56 to 5.43 g m⁻² / day for years 2002 and 2003. Average number of ryegrass stems
depending on applied nitrogen was 2356 per m$^{-2}$, and –1064 per m$^{-2}$ for years 2002 and 2003.

Average mass of one stem was 0.90 g m$^{-2}$ and – 0.85 g m$^{-2}$ for years 2002 and 2003.

Key words: perennial ryegrass, mineral fertilizers, phytometric characteristics

**HARVEST TIME EFFECT ON YIELD AND QUALITY OF MAIZE (ZEA MAYS L.) GROWN FOR SILAGE**

NOVĀKŠANAS LAIKA IETEKME UZ KUKURŪZAS (ZEA MAYS L.) RAŽU UN TĀS KVALITĀTI

Gaile Z.

Research and Study farm “Vecauce” of Latvia University of Agriculture, Akademijas iela 11a, Auce, Latvia, LV-3708

Growing manner of maize (Zea mays L.) for silage production is widely investigated in the USA and more Southern countries of Europe. Due to changes in attitude toward this crop over the last 10 to 15 years, Latvia lacks expertise in this field. The aim of our research arranged in the Research and Study farm “Vecauce” of Latvia University of Agriculture (2005 to 2006), was to define more accurately the harvest time of maize grown for silage production. Four maize hybrids with different maturity rating defined by FAO number (Earlystar (FAO 160), RM-20 (FAO 180), Tango (standard, FAO 210), Cefran (FAO 340)) were harvested at four different times beginning on 1 September at ten day intervals. Strong harvest time effect on maize yield was observed (p<0.05); harvest time affected obtained maize yield by 32 to 48% depending on year. Our results have shown yield increase until the end of September. However, in some years (2005) maize yield increase could be stopped by fall frosts. Quality of maize yield, measured by dry matter content, corn-cob yield percentage within the total dry matter yield and net energy in lactation, increased in the similar manner. Such parameters as neutral detergent fiber, acid detergent fiber and crude protein content decreased with the maturity of maize during September. Harvest of maize late after the fall frosts deteriorated quality. The main criterion for selection of proper maize harvest time should be dry matter content of maize (min 25%, optimum 28-30%). We concluded that in central and western part of Latvia harvest of maize for silage mainly should be delayed up to the third ten-day period of September thus improving both, yield and its quality.

Key words: maize, hybrid, harvest time, yield, quality

**EVALUATION AND UTILISATION OF LATVIAN FLAX GENETIC RESOURCES IN BREEDING**

LATVIJAS LINU ĢENĒTISKO RESURSU NOVĒRTĒŠANA UN TO IZMANTOŠANA SELEKCIJĀ

Grauda D.1,2, Stramkale V.2, Mikelsone A.1, Rashal I.1

1Institute of Biology, University of Latvia, Miera iela 3, Salaspils, Latvia, LV-2169
2Agricultural Science Centre of Latgale, Kulturas sq. 1, Vilani, Rezekne distr., Latvia, LV-4650

Repatriated flax accessions of the Latvian origin from the N. I. Vavilov Institute of Plant Industry (Russia), the Flax Research Institute (Russia) and the Institute of Plant Genetics and Crop Plant Research (Germany), and best flax lines breed in the Agricultural Science Centre of Latgale were investigated. Several qualitative and quantitative traits, such as total plant height, technical plant height, number of seed vessels, logging resistance, vegetation period, yield of straws and seeds, 1000 seeds weight, bast fibre, number of seeds in a seed vessel, oil content and quality were evaluated. Results of three years field trials were summarized. All investigated local genotypes shown good ecological plasticity. Some local genotypes and best lines were better than standard fibre flax variety ‘Vega-2’ and standard oil flax variety ‘Lirina’ in several agriculturally important traits. For intensification of the breeding process we are looking for a possibility to use biotechnology methods for obtaining additional flax breeding source material. After cultivation in calli culture regenerated plants could perform higher variation, so-called somaclonal variation. We applied this method to the Latvian local line Riger B. Best explants, medium compositions as well as calli growing and regeneration conditions were detected.

Key words: flax, breeding, genetic resource, calli culture, somaclonal variation
ANALYSIS OF FESTULOLIUM AND LOLIUM X BOUCHEANUM YIELD FORMATION FOR FORAGE
Gutmane I., Adamovich A.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

Under conditions of Latvian climate, forage grasses are the main fodder source in cattle breeding. Festulolium hybrids are among the most persistent and productive grasses of the grasses used in many Europe countries, especially in adverse environments.

The objective of this research was to investigate dry matter yield structure and sward persistency of Festulolium and Lolium x boucheanum varieties under agro-ecological conditions of Latvia. Field trials were established on the sod–podzolic soil and fertilized with N 120 \((60+60)\), N 180 \((60+60+60)\), P 78 and K 90 kg ha\(^{-1}\). Forages were harvested three times during the growing season. On the basis of the experiments in the years 2003-2006, significant differences in DM yield and winter hardiness were found between first, second and third year of yielding.

Longevity of Festulolium swards could be affected by different aspects, such as suitability of each variety to specific conditions, different stress conditions, fertilization regime. The DM yield was influenced substantially by both – the used variety as well as by nitrogen fertilization rate. The N fertilizer dose increase from 120 to 180 kg ha\(^{-1}\) contributed to significant DM yield increase for all investigated varieties. On average the N fertilizer dose increase to 180 kg ha\(^{-1}\) contributed to DM yield increase by 1.91 t ha\(^{-1}\) or 20 percent. Differences between varieties in DM yield were highly significant and keep similar tendency during three yielding years.

Analysis of yield distribution between three cuts showed that year of sward use had very great effect on DM yield of the first cut. For first year it accounted 51% of the annual yield, in second year first cut yield reach only 39 % of the annual yield.

Key words Festulolium, Lolium x boucheanum, fertilization, yield

FIELD EVOLUTION OF PLANTS RECOVERED IN VITRO FROM OLD RED AND ASLIKE CLOVER SEEDS
LAUKA NOVĒRTĒŠANA AUGIEM, KURI ATJAUNOTI IN VITRO KULTŪRĀ NO PRAKTISKI NEDĪGSTOŠĀM SARKANĀ UN BASTARDA ĀBOLĪNA SĒKLĀM.
Jansone B.¹, Grauda D.², Rancāne S.¹, Rashal I.²
¹Latvia University of Agriculture, Agriculture Research Institute, Skriveri–1, Latvia, LV–5126,
²Institute of Biology, University of Latvia, Salaspils, Miera iela.3, Latvia, LV-2169

Several red and aslike clover accessions of the Latvian origin were repatriated from the N. I. Vavilov All-Russian Institute of Plant Production. The received seeds were very old (more than 20 years from the last reproduction) and did not germinate in soil. Therefore a method based on in vitro tissue culture was developed for obtaining red and aslike clover plants from old seeds. In vitro plantlets were obtained from several red and aslike clover accessions. After acclimatization plants were planted in field conditions. Field trials of three aslike and one red clover accession were conducted in 2005 and 2006. Several traits, such as winter hardness, plant height, ripening, flowering period, colour of flowers, shape of leaves, seed production and powdery mildew resistance were evaluated. High level of phenotypical variation among different plants of the same accession was found, especially in red clover. Several plants with favourable trait combination were selected. Best of those plants could be included in red and aslike clover breeding programs.

Key words: red clover, aslike clover, in vitro, old seeds, field evolution

THE POLISH CULTIVARS OF xTRITICOSECALE WITTM. IN LITHUANIA – EFFECTS ON BIOLOGICAL PROPERTIES AND RESISTANCE TO DISEASES
Janusauskait D.¹, Nekrosienė R.², Skuodienė R.¹
¹Lithuanian Institute of Agriculture, Instituto al. 1, LT-58344 Akademija, Kėdainiai distr., Lithuania
²Botanical Garden of Klaipeda University

During the period 2001–2002 and 2004–2005 experiments were carried out at the Vėžaičiai Branch of the Lithuanian Institute of Agriculture with a view to studying the differences of biological
properties and diseases incidence between the ×Triticosecale Wittm. cultivars ‘Tewo’, ‘Alzo’ and ‘Tornado’. According to the research data, triticale cultivar with higher 1000 grain weight values was ‘Alzo’ and cultivar ‘Tewo’ has a higher number of grain per ear, but this cultivar was affected by some diseases most of all. It was studying ecological significance of perennial grasses used as green manure for the biological properties of triticale ‘Tewo’ too. Preceding legume crops had a positive effect on the formation of productivity elements of winter triticale ‘Tewo’, compared with their identical cultivation after timothy. Different growing conditions of triticale, i.e. different preceding crops, had a significant effect on the occurrence of scald, leaf rust and septoria leaf blotch.

**Key words:** Cultivar, ×Triticosecale Wittm., biological properties, disease.

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**FLORISTIC DEVELOPMENT OF NATURAL AND SOWED SWARDS**

Klimas E., Baležentienė L.

Lithuanian University of Agriculture, Studentų 11, LT-53361 Akademija, Kaunas distr. Lithuania

Investigations carried out during 2003-2005 at Research Station of Lithuanian University of Agriculture. The impact of monomial N, P, K fertilisers, their combinations and rates on feeding, well-composed sowed sward as well on natural, more than 10 yr not improved, poor nutrient value was examined. Accordingly to the investigation data, the decreasing of legumes share was determined and increasing of grasses in the 3rd yr after sowing irrespective of fertilising background. The legumes flood in was not determined neither of any treatment. The grasses part increased from 4 to 14 %. The share of legumes ranged 4-12 % higher in P and K background in compare with other treatments. In the 3rd yr after sowing the legumes percent decreased sequentially with increasing N rates. The biggest share of legumes remained in treatments with P medium rates, K background supported legumes persistence less. Impact of fertilizer background on floristic composition had the same tendencies in natural swards as in sowed one.

**Key words:** sowed sward, floristic composition, natural sward, grasses, legumes, dry matter.

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**PERSPEKTIVE MANAGEMENT AND UTILIZATION OF GRASSLAND IN THE CZECH REPUBLIC**

Kohoutek A., Odstrčilová V., Pozdíšek J.

Crop Research Institute, Prague 6 - Ružyně, Research Station in Jevíčko, Czech Republic

Research Institute for Cattle Breeding, Ltd., Rapotín, Czech Republic.

Permanent grasslands in the Czech Republic (CR) cover the area of 950,000 ha, that is 22.2 % of agricultural land (4,280,000 ha). In our paper we evaluate the influence of three levels of intensity of utilisation (two, three and four cuts) permanent grassland in Czech Republic with homogeneous level of fertilizing PKN90 on yield, quality and utilisation of fodder by cattle. We carried out a model calculation of the need of cattle herd for farming utilisation of grasslands on the basis of exact results completed with accessible literary sources on fodder intake by cattle at the stated intensity of utilisation. Dry matter production of economic yield in the average of evaluated sites and treatments decreases from a two-cut to four-cut utilisation from 8.05 t.ha⁻¹ to 6.42 t.ha⁻¹ and calculated dry matter production of economic yield for the model area of 500 thousand ha of grasslands is 4,025 thousand t at the two-cut system, 3,665 thousand ha at the three-cut system and 3,210 thousand ha at the four-cut system. The cow herd size necessary for the conversion of feedable dry matter is 382 thousand t in the treatment without grain and extensive utilisation in a two-cut system, 306 thousand in a three-cut system and 231 in a four-cut system, the difference is then 151 thousand of dairy cows. By this given number of suckler cow is possible management 300 thousands hectares of grassland at the all-year need of 4.5 t productive solid on 1 LU, providing that a forage from grassland at the average long-time yield will be exclusive all-year feed.

**Key words:** grasslands, botanical composition, fodder quality, cattle, moulding of farming system.
TRITICALE CROP IDEOTYPE FOR ORGANIC FARMING
OPTIMĀLA TRITIKĀLES GENOTIPA IZVELE BIOLOGISKAJAI LAUKSAIMNIECĪBAI

Kronberga A.
State Priekuli Plant Breeding Institute, Zinatnes iela 1a, Priekuli, Cesis distr., Latvia, LV-4126

In last 50 years the most of cereals varieties are created for conventional farming and their yield stability depends on the level of artificial fertilisers and agro-chemicals. Currently only the small number of varieties is suited to organic farming system, mostly the varieties from conventional farming are grown in organic fields. For further optimisation of organic product quality and yield stability new varieties are required that are adapted to organic farming systems. To ensure the successful breeding, suitable genotypes for organic farming should be found.

The evaluation of triticale genotypes in organic farming was done in Priekuli Plant Breeding Institute during 2005 and 2006. The aims of research:

1) to research reaction of different genotypes on various growing conditions (organic and conventional);
2) to find desired traits for organic triticale varieties breeding program;

In our trials there are 25 different winter triticale (xTriticosecale Wittm.) breeding lines, selected from conventional breeding. The different traits were tested for each genotype. The influence of different traits on yield and grain quality were analyzed. 19 breeding lines were grown in organic and conventional field and effect of growing conditions on yield and other traits were tested.

The gained results have shown, that genotypes reaction on different growing conditions differ. Analysis of genotypes suited for organic and conventional conditions was done. Such traits as winterhardiness, yield stability, resistance to snow mould, leaf size, prostate growth habit, weed suppression ability are important for triticale genotypes in organic farming. It is not approved, that the plant height is important trait for triticale genotypes, well suited for organic farming.

Key words: triticale, organic breeding, traits

PARTICULARITIES OF HARVESTER SETTING DURING HARVESTING HULLESS BARLEY

Legzdina L.1, Gaile Z.2
1 State Priekuli Plant Breeding Institute, Zinatnes iela 1a, Priekuli, Latvia, LV-4126
2 RSF “Vecauce” of Latvia University of Agriculture, Akademijas iela 11a, Auce, Latvia, LV-3708

Requirements for harvesting hulless and covered barley are significantly different. Hulless barley for consumption and for seed has to be harvested differently. For consumption it is more necessary to separate hulls from the grain and to increase volume weight, but for seed production retention of germination is essential. In our experiment we analyzed the yield of three hulless barley varieties harvested by using five different harvester settings during four growing seasons. Harvester drum speed and distance between threshing drum and concave was varied. Quality features essential for consumption for feed and food (volume weight, amount of kernels with undetached hulls and broken kernels) and for seed production (germination ability, amount of kernels with germ damage and broken kernels) were determined. Our results indicate that meteorological conditions during harvesting influenced all tested features significantly (p<0.05). If grain was harvested with lower moisture content, the amount of kernels with undetached hulls was lower and volume weight higher, but the amount of kernels with damaged germ was higher. The variety features also influenced the investigated parameters significantly (p<0.05). Grain volume weight correlated significantly negative with the amount of kernels with undetached hulls. Increase of harvester drum speed had significant positive effect on grain parameters important for consumption in more cases, than reduction of distance between threshing drum and concave. Best results for consumption were reached mainly by using harvester settings recommended for covered spring barley. Reduction of distance between threshing drum and concave improved separation of hulls in some cases, but also increased amount of broken kernels. Amount of kernels with damaged germs and germination ability was influenced significantly by increase of drum speed in more cases than by change of distance between threshing drum and concave. More appropriate for harvesting hulless barley grain for seed production were harvester settings with lower drum speed.

39
Wheat is the major field crop grown in Latvia. High quality wheat grains are required for the milling and baking industries. Gluten quantity and quality are important qualities indices for technological processing of wheat.

Our objectives were to determine relative influence of variety (V), environment (E), nitrogen fertilizer (N) on variation winter wheat (Triticum aestivum. L) of gluten quantity and quality indices. Field experiments with 9 winter wheat varieties with different origin were conducted on brown lessive soils of the Study and Research farm “Peterlauki” of the Latvia University of Agriculture in 2000, 2001, 2002 and 2004. Split nitrogen fertilization was applied in the following way: early in spring at the beginning of vegetation period, at the end of tillering and at the end of shooting into stems. The N fertilizer amount applied was four nitrogen fertilizer (90, 90+30, 90+60 and 90+60+30 N kg ha⁻¹) treatments for all the studied winter wheat varieties. Wet gluten content (WG), gluten index (GI), dry gluten (DG), water binding capacity in wet gluten (WBC) were measured at Latvia University of Agriculture, Institute of Agrobiotechology, Grain and Seed Research Laboratory by ICC No. 155 and. No. 137 /1 (LV ST-275).

Highly significant differences were detected among the environments, N fertilizer and varieties for each of the quality variables. Variety and environment and nitrogen fertilizer had a significant effect on wet gluten quality indices. Our results show, that gluten quantity and quality indices were mostly influenced by genetic peculiarities of a crop variety, in less extent by meteorological conditions in the growing season and by the rate of split N fertilizer.

Close positive correlations were determined between the wet gluten and dry gluten, water binding capacity and dry gluten, water binding capacity and wet gluten.

**Key words:** environment, nitrogen fertilizer, wet gluten content, gluten index, dry gluten, water binding capacity

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**INFLUENCE OF POTASSIUM, MAGNISN AND SULFUR FERTILIZERS ON ECOLOGICALLY CULTIVATED PERENNIAL GRASSES**

Pekarskas J., Spruogis V.

Lithuanian University of Agriculture, Studentu 11, LT-53061 Akademija, Kaunas distr, Lithuania

Research of the influence of fertilizers certified in ecological farms on the harvest of mix of clover and thimothy of the first year, its quality and botanical composition was carried out in 2000-2005 on the farm of ecological production of Agroecological center at the Lithuanian University of Agriculture. Fertilizers of potassium magnesium oxide, potassium sulphate and kieserite (magnesium sulphate) were used for this research. The influence of different norms of such fertilizers on perennial grasses was tested. Perrennial grasses were fertilized in spring in the beginning of their vegetation. Different norms of potassium magnesium oxide and potassium sulphate essentially increased the hay harvest, while different nors of kieserite did not have significant difference on the hay harvest. The greatest hay harvest was received when K₉₀ norm of potassium magnesium oxide and potassium sulphate. Fertilizers under consideration increased amount of green proteins and green fats, and decreased the amount of green fiber in perennial grasses. Under the influence of potassium sulphate potassium accumulated in perennial grasses and potassium magnesium oxide and kieserite decreased the amount of it. Fertilizers researched did not have any influence on the botanical composition of the grasses.

**Key words:** perennial grasses, fertilizers, chemical composition, botanical composition.
ESTIMATION OF COMPETITIVE RELATIONS AND INDIVIDUAL PRODUCTIVITY OF FIELD BEANS IN MODEL EXPERIMENTS
Petrychenko V.F., Kobak S.Y.
Feed Research Institute of UAAS, Yunosti avenue, 16, Vinnytsya, Ukraine, 21100

Investigation of competitive relations between the plants of field beans was carried out in a model experiment, the scheme of which included sowing by ray-stretching method. Offered method of plant location which takes into account peculiarities of modern intensive varieties of the crop enables to evaluate a great number of densities from 2061 to 269 thousand plants per hectare, inter-row width from 10 to 77 sm and areas of nutrition from 48 to 386 sm² in wide diapason and describe their competitive relations. This approach can be used when carrying out similar experiments with other grain-legume and fodder crops. It is determined that the increase of nutrition area and inter-row width and the reduction of plant density results in the increase of plant mass, thickness of stem, quantity of productive nodes, beans, seed mass per plant and the mass of 100 seeds. It is established that the character of the change of these indices is rectilinear. But plant height, height of the low bean location, quantity of nodes on a plant and the level of grain productivity have parabolic character. It is mentioned that under conditions of Forest-Steppe on grey forest soils there is a certain interval of the nutrition area, inter-row width and plant density which facilitates the increase of grain productivity of field beans. The highest grain productivity of field beans of variety Orion is formed at the nutrition area from 176 to 278 cm² with inter-row width 33-35 sm and plant density 596-359 thousand per hectare. Further increase or reduction of nutrition area, inter-row width and plant density results in changes of the elements of individual productivity of field bean plants towards reduction which has negative influence on the formation of grain yield formation per unit of area.

PHOTOSYNTHETIC RADIATION USE EFFICIENCY OF DIFFERENT OAT CULTIVARS UNDER DIFFERENTIATED NITROGEN FERTILIZATION
Piotrowska W.¹, Pietkiewicz S.¹, Wyszyński Z.², Michalska B.²
¹ Plant Physiology Department, ² Warsaw University of Life Science, 02-776 Warszawa, Nowoursynowska 159, Poland

In field experiment conducted with two oat morphotypes (naked and hulled), fertilized with differentiated nitrogen rates (0, 30, 60, 90 i 120 kg N ha⁻¹) biomass production of canopy was evaluated using indices of energetic analysis. It was found hulled morphotype of oat characterizes with better degree of solar energy into biomass than naked one. Maximum value for traditional morphotype (cv. Chwat) was at 90 kg N ha⁻¹, while for naked one (cv. Akt) already at 30 kg N ha⁻¹. Radiation use efficiency (RUE) for grain was higher in cv. Chwat than in cv. Akt, 2.77 g.s.m MJ⁻¹. Also RUE for biomass production was higher in hulled than naked morphotype (3.36 g.s.m MJ⁻¹ u morfotypu nagoziarnistego). Morphotypes differed also in the view of canopy PAR absorption and its modification by nitrogen rate. Key words: RUE, nitrogen, fertilization, oat, cultivar

THE INFLUENCE OF PERMANENT GRASSES ON WINTER WHEAT PRODUCTIVITY IN ORGANIC AND SUSTAINABLE FARMING SYSTEMS
Repsiene R.
Vezaiciai Branch, Lithuanian institute of Agriculture, LT 5845 Vezaiciai, Klaipeda district, Lithuania

The trial was executed in light loamy Dystric Albeluvisol in Western Lithuania. The influence of mixture (80 % Trifolium pratense L. (Tp) cv. Liepsna + 20 % Phleum pratense L. (Pp) cv. Gintaras II) as fore crop on the productivity of wheat was investigated in organic and sustainable farming systems. No pesticides and mineral fertilisers were used in organic farming system; only 60 t ha⁻¹ of cattle manure was applied. Red clover regrowth was used as green manure. Mineral fertilisers and pesticides according to the plant needs and 60 t ha⁻¹ of cattle manure were applied in sustainable farming system. Perennial grasses were grown for hay. Independently on farming system red clover
content in sward during trial execution was 98.0-99.4%. The DM yields of red clover regrowth were low (1.17-1.24 t ha⁻¹), because of the lack of precipitation. Higher winter wheat yield (6.27 t ha⁻¹) was obtained in sustainable farming system. The maintenance with nutrients was better in sustainable than in organic farming system, where wheat yield was 1.8 times lower. Less nitrogen and phosphorus (2.7 and 2.6 times respectively) were applied to soil with green manure in organic farming system if comparing with sustainable farming system.

**Keywords:** red clover, organic and sustainable farming systems, winter wheat

### SEED PRODUCTION OF FODDER GALEGA (GALEGA ORIENTALIS LAM.) AND SEED STORAGE

**Slepetsys J.**

Lithuanian Institute of Agriculture, LT-58344 Akademija, Kedainiai distr., Lithuania

The objectives of this work were as follows: 1) to identify fodder galega optimal seed harvesting time and method; 2) to study changes in seed germination during storage. Experiments were carried out during 1996-2006. Seed harvesting was studied for four years in the seed production crop of the first-fourth year of use. Fodder galega seed was harvested using two methods after 60%, 80%, and 90% of pods had matured and 14 days after the last term. In 1999 the harvested seed was placed for storage. Seed quality changes were studied for seven years, storing the seed in a heated and unheated storage in paper bags. The highest seed yield was obtained when fodder galega was harvested using direct combine harvesting with prior defoliation, when 90% of pods had matured. In drier weather the seed can be harvested using the swath harvesting method. Due to the low seed shattering it is not expedient to hasten fodder galega harvesting, and is better to adjust to more favourable weather conditions. In the dry year of 1999 seed germination was not dependent on the harvesting time and method and was 92.98%. After five years’ storage in a heated storage seed germination (82-89%) changed little, in an unheated storage seed germination declined to 19-40%. In an unheated storage the seed preserved best when was completely mature. A conclusion can be made that in an unheated storage in paper bags the seed can be securely stored for only two years and in a heated storage – for five -six years.

**Key words:** Galega orientalis, seed yield, harvesting time, seed storage

### INTEGRATED EFFECTS OF ACID SUBSTRATUM AND HEAVY METALS (COPPER AND CADMIUM) ON RED CLOVER

**Slepetsys J¹, Siksnišienė J², Brazaitė A.², Kadžiulienė Z.¹, Duchovskis P.²**

¹Lithuanian Institute of Agriculture, LT-58344 Akademija, Kedainiai distr., Lithuania

²Lithuanian Institute of Horticulture, LT-54333 Babtai, Kaunas distr., Lithuania

The aim of the present work was to study the integrated effects of substratum acidity and heavy metals (copper and cadmium) on the adaptation of red clover (*Trifolium pratense* L.) variety Liepsna at different environmental temperatures in the phytotron of the Lithuanian Institute of Horticulture. Changes in photosynthetic pigment system, plant height and shoot mass were indicators of plant adaptation to unfavourable environmental factors. It was identified the number of clover inflorescences, concentration of nitrogen and sulphur in stems, leaves and inflorescences. At temperatures above (27-20°C) clover produced a lower shoot mass and was more sensitive to the effect of pollutants and adapted less to this effect than clover growing at optimal temperatures (21-17°C). Higher temperature enhanced sulphur accumulation in clover stems and inflorescences. Copper increased shoot mass of clover and acted as a fertilizer at optimal temperature. Copper decreased clover mass at higher temperature. It was established that in many cases after primary effect of pollutants plant photosynthetic pigment system adjusted to any additional effects of other pollutants.

**Key words:** Trifolium pratense, heavy metals, substratum acidity, carotenoids, chlorophylls.
THE EVALUATION OF SOME GROWING METHODS IN POTATO SEED PRODUCTION FOR ORGANIC FARMING

DAŽU AGROTEHNISKO METOŽU IZVĒRTĒJUMS KARTUPEĻU SĒKĻAUDZĒŠANĀ BIOLOGISKĀJĀ LAUKSAIMNIECĪBĀ

Skrabule I.
State Priekuli Plant Breeding Institute, Zinatnes iela 1A, Priekuli, Cesis, Latvia, LV-4126

The application of mineral fertilisers and pesticides is not allowed in organic farming. The exploitation of some crop management methods were evaluated in potato seed production. The choice of potato variety using nutrition from soil effectively and being resistant to most harmful pathogens is essential in organic farming. Three varieties with different maturity time and relative resistance to the most dangerous potato disease – late blight (LB) were included in trials: ‘Borodjanskij Rozovij’ (early, LB sensitive), ‘Lenora’ (second early, LB medium resistant), ‘Sigunda’ (medium late, LB resistant). The shortening of growing season would help avoid potato plant from pest’s attacks. The potato seed tuber presprouting hastens plant development on field. Two weeks presprouted tubers and tubers without sprouting were used as seed material. The microclimate between sparse plants is less favourable for pest development. Three different planting distances were used in trial: 0.30, 0.15, 0.45 m. The yield, starch content, tuber size and pest damages were evaluated and compared between variants. The potato variety determined LB and early blight damages on potato leaves, yield, potato size, starch content in tubers, common scab and black scurf damages on tubers and other tuber disasters. The presprouting of seed tubers influenced germination speed, beginning of flowering, diseases damages on sprouts, in some cases yield, early blight damages on leaves, tuber size. The planting distance had an impact on tuber size; furthermore starch content, in some cases yield, pest’s damages on tubers and amount of unspoilt tubers in yield.

Key words: organic farming, potato, maturity, resistance, presprouting, planting distance.

WINTER WHEAT GRAIN YIELD AND QUALITY INTERCONNECTION BETWEEN SOIL AND PLANT NITROGEN CONTENT

ZIEMAS KVIEŠU GRAUDU RAŽAS UN KVALITĀTES SAKARĪBAS AR SŁAPEKĻA SATURU AUGSNĒ UN AUGOS

Skudra I.1, Ruza A.2

1 Latvia Rural Advisory and Training centre, Rigas iela 34, Ozolnieki, Latvia
2 Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV3001

Warranty of mineral nutrition is one of the most important factors affecting plant processes. The grain yield and especially quality are dependent on plant available nitrogen content and possibility to use it. In winter wheat, especially in different plant parts response to plant nutrients is different in the growing season. The research direction is to explain nitrogen content changes in different winter wheat varieties and in process of plant yield and quality formation. The research studied nitrogen uptake process in parts of wheat plant and in soil in vegetative growth. The studies were conducted as a field trial at the Experimental Station of Latvia University of Agriculture “Peterlauki” for three years on sod-calcareous medium loam. There were five winter wheat varieties with different nitrogen applications. The material for nitrogen analyses in the above ground plant parts were collected at the Zadoks Growth Stage (ZGS) 32, 51 and 69, but the soil samples at 0-20, 20-40, 40-60 cm depth layers at the same time.

Concentration of nitrogen increased till the shooting into ears stage and its depends on mineral fertilizer and from varieties duration of vegetative period. The relation of the mineral nitrogen content in the whole plant has a high correlation with grain yield in ZGS 51 for medium intensive varieties. The relation of the mineral nitrogen content in the soil has a high negative correlation with grain yield. Close correlation was found among the distribution of nitrogen concentration in leaves and stems and nitrogen application, but it depends from varieties and plant growth stages.

Key words: mineral nutrition, winter wheat, nitrogen.
THE EVALUATION OF EFFECTIVENESS OF RHIZOBIUM LUPINI STRAINS
RHIZOBIUM LUPINI CELMU EFektivitātes Novērtējums
Steinberga V., Alsina I., Ansevica A., Dubova L., Liepina L.
Latvia University of Agriculture, 2 Liela iela, Jelgava, LV-3001, Latvia

Legume-Rhizobium symbiosis generates more useful nitrogen for plants than all the nitrogen fertilizers produced industrially. The biological nitrogen fixation is very important in organic agriculture crop rotations. Rhizobium is host plant dependent. The symbiosis is determined by the Rhizobium reaction to the particular host plant. The inoculation of plant seeds with an active Rhizobium strain before sowing increases the legume’s productivity and yield quality.

The experiments were placed in 5L Mitcherlih type vegetation pots filled with flushed river sand, mixed with Kemira GrowHow NPK 0-12-24-(1.5 Mg) –(13 S) with microelements. The nitrogen was added as ammonium nitrate, 0.024 g per 1 kg of sand.

Three generics of lupines: yellow lupine – Lupinus luteus, white lupine- Lupinus. albus and narrowleafed lupine - Lupinus angustifolius were used in experiments. Seeds of lupines were treated with one of two Rhizobium strains. Control – plants without Rhizobium, but with 10 times larger dose of ammonium nitrate.

The experiments showed that control plants were smaller in height and sprouted later in comparison with plants whose seeds were treated with an active Rhizobium strains. Till florescence the symbiotic system was not fully developed to cover plants’ needs for nitrogen; therefore, at the end of the experiment the inoculated plants had less weight than the control plants.

Key words: Rhizobium, lupine, inoculation.

OCCURRENCE OF FUSARIUM SPECIES AND RISK OF MYCOTOXINS ASSOCIATED WITH HEAD BLIGHT IN WINTER WHEAT: MONITORING DATA IN LATVIA
VĀRPU FUZARIOZES MONITORINGS UN MIKOTOKSĪNU RISKS
ZIEMAS KVIEŠU SĒJUMOS LATVIJĀ
Treikale O., Priekule I., Pugacova J., Lazareva L.
Latvian Plant Protection Research Centre, Lielvardes iela 36/38, Riga, Latvia, LV 1006

During 2005-2006 the monitoring study conducted by Latvian Plant Protection Research Centre. The occurrence of Fusarial head blight in winter wheat was investigated in various Latvian regions under the different agricultural practices and meteorological conditions. This paper describes the distribution of Fusarium species that were isolated from samples representing several winter wheat varieties in Latvia and identified by V.Bilai (1977) methods. In 2005 in winter wheat 7 Fusarium species caused Fusarial head blight: F. culmorum, F. avenaceum var. herbarum, F. gibbosum, F. poae, F. oxysporum var. orthoceras, F. sambucinum, F. sporotrichoides were occurred. The most frequent were: F. poae, F. culmorum, F. gibbosum, F. avenaceum var. herbarum. In 2006 in winter wheat F. poae and F. culmorum were prevailed.

The efficacy of fungicides applied at the stage of full anthesis of wheat was investigated. Experimental plots (plot size 24 m², four replicates) were artificially inoculated with suspension of conidia of four Fusarium species, that were collected in winter wheat, at the concentration of 2.5 mil. conidia/ml. Disease development, level of infected grains after harvesting and contamination of grain with deoxynivalenol (DON) mycotoxin were examined. There was observed that both number of grain per ear and their weight were significantly decreased by severe infection of ear with Fusarium species. Fungicides which contain tebuconazole or metconazole gave good control of Fusarial head blight that was reflected in reduction of DON contamination in grain. The concentration of DON in yield was associated with incidence of F. culmorum in harvested grain of winter wheat.

Key words: Fusarium species, occurrence, fungicides, mycotoxin, winter wheat
Session 3. HORTICULTURE

ASSESSMENT OF DIVERSE POPULATIONS OF LATVIAN MARTAGONLILIES (L. MARTAGON L.) AND APPLICATION IN BREEDING

LATVIJAS MARTAGONLILIJAS (LILIUM MARTAGON L.) DAŽĀDU POPULĀCIJU NOVĒRTĒJUMS UN IZMANTOŠANA SELEKCIJĀ

Balode A.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

Lily breeders are very interested to find bulbs in the wild collect them and use them to for breeding purposes. The genus Lilium L. includes approximately a hundred species distributed throughout the cold and temperate parts of the northern hemisphere. One of the best known of wild lilies is L. martagon L. Of all the lily species, it is distributed across the largest growing area – from western Portugal through Europe and Asia including the 57° northern latitude in Latvia. It was discovered in 1839, and is the only wild species in Latvia. The stem is erect, up to 200 centimetres, and there are as many as 50 pendent-like turk’s-cup flowers on a stem. This martagonlily is hardy and disease-resistant and is recommended as a donor in breeding programs. To evaluate survival potential of L. martagon L., research was carried out in locations at Aizkraukle, Ventspils, Kuldiga and Tukums. The original data were obtained from the laboratory of Botany of the Institute of Biology of the Latvia University. Research results indicate that diversity in genotypes vary according to location and distribution. According to morphological traits, these martagonlilies were classed into three groups: plants found on the left bank of Daugava near Vigante Park and Staburags (areas which belong to the region of Aizkraukle), plants found in the regions of Ventspils, Kuldiga and Tukums, plants found at Aizkraukle on the right bank of Daugava near Klintaine.

Crosses between wild martagons with light pink flowers are widespread in locations near Klintaine. The martagonlily (L. martagon var. album West.) with white flowers is used as a cultivar. Obtained hybrids vary in colour, diameter, flower shape, flowers number, plant height and resistance to grey mold. Colours found: 75 % pink with dark red spotting, and 25 % pure white without spotting. It is significant that the pink comes from the mother plant – L. martagon L. – and is dominating the white of the father plant – Daugavas lilija – L. martagon var. album West.

Key words: diversity, L. martagon, morphological traits, wild species

GENETIC MATERIAL HOMOGENIZATION OF LATGALES MELONS

LATGALES MELOŅU ĜENETISKĀ MATERIĀLA HOMOGENIZĀCIJA

Balins A.1, Alsina I.1, Lepse l.2, Rungis D.3
1Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001, 2Pure Horticultural Research Centre, Abavas iela 2, Pure, Latvia, LV-3124, Latvia Forestry Research Institute "Silava", Rīgas iela 111, Salaspils, Latvia, LV-2169

In the middle of the last century in the region of Daugavpils well known grape breeder - Pauls Sukatnieks bred several melon (Cucumis melo) varieties. He also developed the open field growing system for these vegetables in Latvia. These sorts were sustainable for agroclimatic conditions of Latvia – low night temperature, short period of high temperatures and wet weather. During several decades these genotypes were destroyed because of cross-pollinating of different varieties. This unique genetic material was saved by gardener Ė.Piļka, and scientists U.Dēķens and I.Drudze. Since 2003, renovation of Latgale’s melons was started in Pure Horticultural Research Station. Since 2003, inbreeding and sibling was carried out. The aim of the investigation is to homogenize the genetic material of Latgale’s melons. In 2006, genetic distance between 3 lines of Latgale’s melons and 5 South European varieties was detected by using 15 microsattelite markers.

Key words: Cucumis melo, Latgale, cross-pollination, microsattelite.
There were consumers questionnaires performed during 2006-2007 with the aim to detect apples of which appearance and taste local consumers prefer. Each respondent was asked to choose five cultivars he liked visually most of all and five most unattractive. The same evaluation was done also for taste. All cultivars cultivated in Latvian commercial orchards, and new cultivars from trials collections were included in the questionnaire. Totally 120 cultivars in five expositions were offered for rating. There were two types of questionnaires performed – with and without knowing of varieties name for persons involved. Results in both cases were similar. Accordingly to frequencies for appearance/taste choices, which likes and dislikes, the sympathy index was calculated for each of cultivar tested. It was analysed in relation to fruit size, shape, skin colour intensity, tone, skin glossiness, acid and sugar ratio, crispiness, firmness, and aroma. Most attractive for local consumers were large-fruit cultivars with bright red or orange red blush. The ground colour must be as yellow as possible, because green colour often was associated by consumers to acid taste, even it was not. Dark red, purple red, brownish red blushes were unacceptable. Neutral semisweet taste without specific aromas was most likable. Cultivars ‘Rubin’ (from Kazachstan), ‘Saltanat’, ‘Auksis’, ‘Ausma’ and ‘Zarja Alatau’ were selected as most appropriate.

Key words: Malus, cultivars, rating, marketing

Investigation of simulation model RIMpro for adaptation in integrated plant protection in Latvia were carried out in Latvian Plant Protection Research Centre during 2003 – 2006. The aim was to determine the conformity of primary scab infection risk indices given by RIMpro to real scab ascospores discharge and to state the RIMpro risk value as signal for necessary fungicide application. In the spraying program curative fungicide Chorus 75 WG (a.i. cyprodinil) was used during 2 – 3 days after presumed RIMpro risk signal as well as noteworthy amount of scab ascospores on spore traps – microscope slides. Further appearance and extension of scab on apple leaves and fruits was evaluated.

The terms of noteworthy RIMpro infection risk signals and real ascospores discharge coincided. Difficulties caused specification of the risk value. 300 RIM presumed in Central Europe, was unconformable. The risk value yearly was decreased to 100 RIM, but apple scab was not sufficiently controlled. After 2006 findings, showings above 70 RIM were presumed as the risk signals. The infection agent was more aggressive, adapted to more rigorous conditions during comparably short primary infection period – 1.5 months from late April to mid June. Amount of released ascospores widely varied per years. There were 4 – 5 critical infection periods with risk value above 50 RIM during the whole primary infection period each year. Some of those could be covered by one treatment. Subsequently, fungicides applications during the primary scab infection period in addition to the first protective treatment before ascospores discharge are necessary at least 3 times, i.e. 4 times in total.

Key words: apple scab, RIMpro, infection risk, fungicide application terms
ESTABLISHED CRANBERRY DISEASES IN LATVIA
LATVIA IDENTIFICĒTĀS LIELOGU DZĒRVEŅU SLĪMĪBAS
Jankovska L.1, Eihe M.1, Bankina B.2
1 Latvian Plant Protection Research center Lielvārdes 36/36, Riga, Latvia, LV – 1006
2 Latvia University of Agriculture Liela 2, Jelgava, Latvia, LV – 3001

Cranberry (Oxycoccus macrocarpon) is well known in Europe, and plantations enlarge recently in Latvia. Cranberry diseases were imported together with plants. There are little investigations about specific structure of cranberry diseases causal agents. A.Ripa slightly described cranberry diseases. Some plant tests are made in State Service of Plant Protection, Quarantine department.

Our investigation was made in cranberry bog “Kalna purvs” Aluksne region. Fungi identified in Latvian Plant Protection Research Center.

The most economically important disease of cranberry is upright dieback (symptoms can be caused now by parasitic fungus, now abiotic factors) and berry rot. In “Kalna purvs” were determined some symptoms of upright dieback (0.5 %), but fungal initial was not identified. The most important production losses caused berry rot. They appeared in the field and developed after harvesting in storage. During harvest (13.10.06.) rotten berries were on average 1.7 %. After a month storage (22.11.06.) at room temperature (18 – 20 °C) damage level was 24.8 %, but in 28.12.06. - 62.0 %. Visual symptoms of damages were different – black, yellow, pale red to dark red rots and different speckles. Some berries were soft and watery. Identification of causal agents continues in pure culture. From black rot fungi Allantophomopsis spp. were identified. On the cranberry leaves protoventuria leaf spot (Protoventuria myrtilli (Cooke) Barr, syn. Gibbera myrtilli (Cooke) Petr.) is identified. The first symptoms appeared in early autumn as small, distinctly red to purple lesions on the upper surface of current season leaves. During the spring spots of previous year had enlarged.

Key words: cranberry diseases, berry rot, storage rot

RASPBERRY AND BLACKCURRANT CULTIVARS FOR UTILIZATION OF FROZEN BERRIES IN DESSERT AND FOR GETTING PRODUCTS WITH HIGH CONTENTS OF BIO-ACTIVE COMPOUNDS

AVEŅU UN UPEŅU ŠĶIRŅU PIEMĒROTĪBA SALDĒTU OGU IZMANTOŠANAI DESERTĀ UN PRODUKTU AR AUGSTU BIOLOGISKI AKTĪVO VIEĻU SATURU IEGUŠANAI
Kampuss K., Kampuse S.
Latvia University of Agriculture, Liela iela 2, Jelgava LV-3001, Latvia

Many blackcurrant and raspberry cultivars are recommended for commercial growing in Latvia. Unfortunately, neither commercial nor other cultivars are tested for suitability to frozen storage and production of different products, including functional foods. Frozen berries of 15 raspberry and 32 blackcurrant cultivars, grown at Latvian Fruit growing institute, Dobele, Latvia, were tested for chemical composition (ascorbic acid, anthocyanins, soluble solids) and physical properties (drip loss and friability for raspberries, berry weight for all berries). Agronomical parameters (productivity, winter hardiness, disease and pest hardiness) were included in an overall evaluation of cultivars as an average from experts’ estimates. Multi-criteria analysis was used to establish a complex value of genotypes; each trait group and individual trait has specific contribution coefficient in the final evaluation. The best variety will appear to be close as possible to the desired (optimum) value in parameters as many as possible. Multi-criteria analysis was performed to select the best cultivars for utilization of frozen berries in dessert and in production of product with high contents of bioactive components. The most suitable cultivars for utilisation berries in dessert are raspberry cultivars ‘Tomo’, ‘Brigantina’ and ‘Bryanskii Rubin’, and blackcurrant cultivars ‘Detskoslė skaya’, ‘Yadrenaya’, ‘Joniniai’, ‘Chernii Kentavr’, ‘Selechenskaya’ and ‘Mara’. They were conspicuous with big berries and low acid/sugar ratio as well as with little drip loss after thawing and low friability level in frozen raspberries. The most suitable cultivars for utilisation of berries in production of products with high contents of bioactive components: ascorbic acid and anthocyanins, are raspberry cultivars ‘Sputnitsa’, ‘Ariadne’, ‘Bryanskii Rubin’ and ‘Brigantina’ and blackcurrant cultivars ‘Iunskyaya’, ‘Detskoslė skaya’, ‘Vernisazh’, ‘Vakariai’, ‘Triton’, ‘Titania’ and ‘Joniniai’.

Key words: Raspberries, blackcurrants, Rubus, Ribes, multi-criteria analysis, bioactive components.
NUTRIENT STATUS OF THE AMERICAN CRANBERRIES AND WILD CRANBERRIES IN PRODUCING PLANTINGS AND NATURAL BOGS OF LATVIA

Karlsons, A., Osvalde, A.
Institute of Biology, University of Latvia, Miera iela 3, Salaspils, Latvia, LV-2169

The commercial cultivation of American cranberry (*Vaccinium macrocarpon* Ait.) in Latvia is mostly developed in high bog territories. American cranberry, fruit indigenous to North America, are characterized as high yielding crop with significantly higher productivity (to 40 t·ha$^{-1}$) in comparison with wild cranberry (*Vaccinium oxycoccos* L.). Investigations on optimal cultivation and fertilization technologies of cranberry crop appropriate for sphagnum peat are scarce. Therefore studies on mineral nutrition regime of American cranberries and wild cranberries in Latvia are very important. Investigations were done to find out the actual mineral nutrition status of American cranberries and wild cranberries in Latvia as well as to evaluate the peculiarities of cranberry mineral nutrition in producing beds and native bogs. 120 (peat and plant) samples were collected from 4 main cranberry producing sites and 3 native bogs during autumn 2004. Plant tissue analysis and soil testing were used to evaluate the cranberry supply with all of the biogenous elements (N, P, K, Ca, Mg, S, Fe, Mn, Zn, Cu, Mo, B). Our results suggest that only 50 % of cranberry producing plantings in Latvia were optimal provided with all of the nutrients. Insufficient level of N, P, S, Cu and Mo, and increased concentrations of Mn as main problems were stated. Although high bogs were characterized as particularly nutrient poor environment, wild cranberries showed high efficiency of Fe, Zn and Mn accumulation.

**Key words:** American cranberry, wild cranberry, mineral nutrition, plant analysis, soil testing.

AGROTECHNICAL AND BIOCHEMICAL INVESTIGATIONS FOR JERUSALEM ARTICHOKE (*HELIANTHUS TUBEROSUS* L.) GROWING IN LATVIA

Lepse L., Bite L.
Pure Horticultural Research Centre, Abavas iela 2, Pure, Latvia, LV-3124

Jerusalem artichoke (*Helianthus tuberosus* L.) is an important source of functional active food component – during the storage Jerusalem artichoke tubers inulin transforms into fructose, which is easy absorbed without insulin implication. Therefore it is highly recommended for diabetes mellitus patients. The surface of Jerusalem artichoke tuber is highly rough with protuberances and it makes difficult tubers cleaning and following processing. Therefore evaluation of several genotypes is actually for finding genetically smooth and inulin rich tubers. Tubers quality and yield are strongly influenced by soil cultivation and planting system. Investigation is carried out with the aim to find most effective growing technology and to detect the content and percentage of carbohydrates in different genotypes. Investigation was carried out for two vegetation seasons with different meteorological conditions. As the summer of 2006 was extremely dry, the obtained yield was for 20 % less than in the vegetation period of 2005. Local clone “Lāču” was found as the most yielding in both years in all variants. The yield of Western Europe cv. ‘Dag Neutral’ was insignificantly lower, but cv. ‘Red French’ yielded significantly less. Stable, qualitative and higher yields were obtained from the ridged field without previous rototilling.
EVALUATION OF Highbush Blueberries (Vaccinium corymbosum L.) CULTIVARS

Krūmmeļenu (Vaccinium corymbosum L.) Šķirņu Novērtējums

Liepniecē M., Abolins M.
Latvia University of Agriculture, Liela iela 2, Jelgava LV-3001, Latvia

The highbush blueberries and cranberries have recently become some of the most popular berries to grow in Latvia, because of the suitable growing conditions in large areas high moss peat bogs. There are many introduced cultivars grown in ours plantations, but there isn’t sufficient evaluation of winter hardness and yield components in our conditions. A high bush blueberry experiments was established year 2002 at the Research and Training Base of the Department of Horticulture of Latvia University of Agriculture. The trial with cultivars ‘Jersey’, ‘Chippewa’, ‘Bluecrop’, ‘Patriot’, ‘Northland’, ‘Northblue’, ‘Polaris’ and ‘Blueray’ was established. The highest berry weight average of 100 fruits – 194.8 g obtained for cultivars ‘Bluecrop’ but lowest for cultivars ‘Blueray’ – 125,3 g. The largest size of berries, higher than 18 mm obtained for cultivars ‘Bluecrop’ and ‘Chippewa’, but the best taste showed cultivar ‘Patriot’. The best winter and frost hardness obtained for cultivars ‘Patriot’, ‘Northland’, ‘Northblue’ and ‘Polaris’. The lowest winter and frost hardness showed cultivar ‘Chippewa’. The highest cumulative yield, years 2005-2006 indicated for cultivars ‘Patriot’ 4525 g m⁻².

Key words: Vaccinium corymbosum L., cultivars, yield, winter hardness, fruit size.

Turf Grass Diseases On The Golf Courses In Latvia

Zāliena Slimbās Golfa Laukumos Latvijā

Rancane R.
Latvian Plant Protection Research Centre, Lielvardes iela 36/38, Riga, Latvia, LV – 1006

The aim of research work was to determine the most widespread turf grass diseases on golf courses, identify causal agents under conditions of Latvia and to analyze peculiarities of diseases development during the vegetation season. The incidence of diseases was determined during the vegetation season. For detection of pathogens specific methods were used. Pink snow mold (Microdochium nivale (Fr.) Samuels & I.C.Hallett), root and foot rot (complex infection of Rhizoctonia solani Kuhn and Fusarium avenaceum (Fr.) Sacc), fairy rings (mainly Marasmius oreades), and red thread (Laetisaria fuciformis (McAlpine) Burdsall) were identified. Localized dry spots (non-parasitic disease) were also detected. Pink snow mold symptoms were observed at the beginning of April on all golf courses. During June–July, the rate of infection decreased. In August distribution of snow mold on the golf course “Ozo” was observed. On golf courses “Viesturi” and “Denderi” the rate of snow mold infection increased during September and October. The root and foot rot for first time was observed in June on golf course “Denderi” and in September on golf course “Ozo”. The disease was widely distributed in October. On the golf course “Viesturi” the root and foot rot was not noted. The most serious injuries of localized dry spots were observed during June – October on the golf course “Viesturi” and during September on “Ozo”. On the golf course “Denderi” localized dry spots were not noted. Following research results can be concluded that the most important diseases of turf grass under conditions of Latvia are pink snow mould, root and foot rot, and also dry spots.

Key words: turf grass diseases, golf course

The Structure of Fruit and Berry Crops In Latvian Orchards

Kultūru Un Šķirņu Struktūra Latvijas Augu un Ogu Dārzo

Skrivele M., Rubauskis E.
Latvia State Institute of Fruit-growing, Graudu iela 1, Dobele, LV 3701

The aim of the research was to evaluate the commercial orchards of fruit trees and berries in Latvia, to appraise their cultivar and species structure and to launch a data base. During the years 2005 –
2006, 276 farms were surveyed in the different regions with focus mainly on farms with integrated fruit and berry production. During the survey farmers were asked to fill special questionnaire. The obtained data showed that most of the farms grow apples and berries (currants and raspberries), 35 and 18 %, respectively. Most of the farms are narrow-specialized and cultivate only one plant species (58 %) or two species (24 %). Majority of farms (42 %) had one to three ha of orchard area and only 6 % were larger than 15 ha.

In Latvia the assortment of cultivars is not stabilized yet. In most of the farms initial plantations had many cultivars, what allowed evaluating their suitability to particular growing conditions. Thus the number of cultivars decreased in new plantations. Autumn and winter apple cultivars were dominating in the orchards. The five most popular apple cultivars occupy 37 % of the total orchard area. The cultivar ‘Auksis’ is the most planted apple cultivar. The winter pear cultivar ‘Belorussskaya Pozdnaya’ is the mostly grown pear cultivar, which occupies 33 % of the total pear orchard area. The six most grown plum cultivars occupy 69 % of the total plum orchard area. The most planted plum cultivars are ‘Kometa’ and ‘Victoria’, which occupy 46 % of the total plum orchard area. In comparison, high number of cultivars was also in raspberry and red and white currant plantations, but in black currant plantations 95 % of total area occupies only three cultivars – ‘Zagadka’, ‘Titania’ and ‘Ojebyn’. The established data base is supplemented and improved in each year.

THE EFFECT OF SELENITE ON GROWTH AND STORAGE OF ONIONS
SELENĪTA IETEKME UZ SĪPOLU AUGŠANU UN GLABĀŠANOS
Zegnere L., Alsina I.
Latvia University of Agriculture, 2 Liela iela, Jelgava, Latvia, LV-3001

Two years trials were carried out to evaluate the growth, development and storage of onions cultivars ‘Stuttgarter Riesen’, ‘Red Baron’ and ‘Albion FI’ or ‘Snow Ball’. Two year experiments were placed at the experimental field and greenhouse of Institute of Soil and Plant Sciences Latvia University of Agriculture. During growth season onions were once treated with 50 mg m\(^{-2}\), 100 mg m\(^{-2}\) or 200 mg m\(^{-2}\) of sodium or iron selenite. Control - without selenite application. The length and number of spring onions and plant weight was determined during plant growth. Fresh and dry weight of onions and content of ascorbic acid were tested after harvest. Onion bulbs were stored at different temperatures: +5 \(^{\circ}\)C, +15 \(^{\circ}\)C or +25 \(^{\circ}\)C. The loses of onion’s weight during storage were examined. The results showed that the weight of onions, weight and number of spring onions didn’t depend on cultivar’s feature. Sodium or iron selenite had not significant influence on spring onions parameters. Onions of cultivar ‘Stuttgarter Riesen’ were the heaviest ones.

There were significant differences in content of dry matter between cultivars, but effect of selenite wasn’t observed. Onions of cultivar ‘Red Baron’ contained the largest amount of ascorbic acid. The less amount of vitamin C was observed in cultivar ‘Stuttgarter Riesen’. There was significant influence of storage temperature on the ascorbic acid content. The content of ascorbic acid did not significantly change during storage. There was correlation between the dose of selenite and selenium content in onions. The positive correlation between storage temperature and the onion weight loses during storage were observed. The onions storage depended on cultivar. Onions dressed with large dose of sodium selenite lost more weight in comparison with control. Onions treated with iron selenite were kept better as sodium selenite treated ones.

Key words: onions, selenite, storage

GENETIC RESOURCES OF CULINARY HERBS IN LATVIA
GARŠAUGU ĢENĒTISKIE RESURSI LATVIJĀ
Zukauska I.
Latvian University of Agriculture, Liela iela 2, Jelgava LV-3001, Latvia

Collections of both wild and cultivated aromatic and medicinal species are maintained in institute of Agrobiotechnology of LUA. Genetic resources of culinary herbs have not been inventoried officially in Latvia. At the same time our activities are concentrated on a selection priority list of species accompanied by background information on the selection criteria used. The specialist group collected basic information about the most important culinary herbs used in our country by centuries.
According to this information as genetic resources were approved local and foreign wild and cultivated species, which historically were used as culinary herbs and were multiplied vegetatively. At present the ex situ collection is represented by 100 accessions representing 13 genera. Species composition of the culinary herbs: lemon balm (*Melissa officinalis*), southernwood (*Artemisia abrotanum*), tarragon (*Artemisia dracunculus*), hyssop (*Hyssopus officinalis*), catmint (*Nepeta catarica*), spearmint (*Mentha spicata*), lavender (*Lavandula angustifolia*), bear’s garlic (*Allium ursinum*), lovage (*Levisticum officinale*), thyme (*Thymus serpyllum, Thymus pullegioides*), peppermint (*Mentha x piperita*), oregano (*Origanum vulgare*).

The main priorities in the conservation genetic resources of culinary herbs are: an inventory of existing collections and selection of plants for ex situ conservation, establish characterization and evaluation system at propagation and maintenance sites, adapt existing or developing new descriptor lists, investigation of the obtained material, development of a database and participation in research on biodiversity conservation.

**Key words**: aromatic and medicinal plants, culinary herbs, genetic resources, biodiversity.
Session 4. ANIMAL SCIENCE

RESEARCH AND EXPERIENCE OF FODDER GALEGA INTRODUCTION IN FARMS
PĒTĪJUMI UN PIEREDZE GALEGAS LOPBARĪBAS IEVIEŠANĀ ZEMNIEKU SAIMNIECĪBĀS

Auzins V., Adamovics A., Lejins A.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

The aim of the research was to clear opportunities of introduction of fodder galega in regions of Latvia for prevention of protein deficiency and feed shortage risk. Fodder galega in wider areas was firstly started in 2004- 75 ha, in 2005- 62.5 ha, in 2006- 84.4 ha, totally- 221.9 ha in 23 farms. Research objects include all regions from farm “Denevo” in Kraslava district in the Eastern part to farm “Rese” in Liepāja district in the West. Main problems of galley gathering are connected with sour soil (30-40%) that have to be limed, seed deficiency and fight with weeds in the sowing arranging season. Pure galley gives comparatively low harvest in first two, three years. It is suggested to sow galley and culmiferous plants mix. But in the next years, the swards overcame clover and culmiferous plants in respects of perenniality and productivity. One ton protein in galley ensilage costed 2-10 times less than the same in ensilage of culmiferous plants and clover, pies or special fodder for cows. Galley fodder was successfully fed to many productive agricultural animals (cows, goats, sheep, horses, pigs, hens, geese and rabbits). Feeding galley fodder to cows, 9 LVL were saved up per a ton of milk.

At research farm “Peterlauki” of Latvia University of Agriculture, galley produces fodder and seed already for 27 years without over-sowing and using pesticides or mineral fertilizers. Part of culmiferous plants and clover sward “burned out” in dry seasons (also in 2006) after first harvesting but galley gave sufficient after grass harvest. In farm “Sinkas” (Madona district), part of galley aftergrass haylage was successfully kept in good quality as a forage reserve till the summer and the autumn of the next year.

Key words: Galega orientalis Lam. forage, production

STORAGE INDUCATED CHANGES IN NUTRITION VALUE OF RAPE SEEDS AND CAKES PRODUCED IN LATVIA
LATVIJĀ RAŽOTO RAPŠA SĒKĻU UN RAUŠU BARĪBAS VĒRTĪBĀS IZMAIŅU DYNAMIKA UZGLABĀJOT

Dulbinskis J., Jemeljanovs A., Sterna 1, Lagzdins D.2
1Research Institute of Biotechnology and Veterinary Medicine „Sigra” of Latvia University of Agriculture, Instituta Street 1, Sigulda, Latvia, LV-2150, 2“Iecavnieks” Ltd., Pulkveza Brieza 17-16, Riga, Latvia, LV-1045

The EU directives determines that till the year 2010 part of biofuel must increase up to 5.75% from all utilized fuel. 240000t of rape seeds necessary will grow for this purpose in Latvia. Without that rapeseeds oil is used in human diet also. Therefore amount of rape seeds, well as amount of rapeseed cake will increase in the near future. Rapeseed cake is a significant protein source in the animal feed. Investigations showed that content of protein in dry matter of rape seeds was 26.50±4.43%, content of fat was 40.03±1.26%, fiber 8.3±0.1%, nitrogen free extract 20.50±3.65 % and 190.6±25.6g degradable protein per kg. Content of protein in rapeseed cakes was significantly higher (p<0.05), but content of fat lower (p<0.05) in comparison with rape seeds. Difference between summer and winter rape seeds was observed in chemical composition as well as in nutrition value. Content of crude protein and degradable protein were higher but NDF and ADF were lower in summer rape seeds in comparison with winter rape seeds. Significant changes in chemical composition and nutrition value were not observed after 9 and 12 month storage. Contamination rate between fungi and microorganisms produced butiric acid was significantly (p<0.05) higher in summer rape seeds. Investigations showed that content of saturate fatty acids was 18.43%, content of unsaturated fatty acids was 67.30% in rape seeds, correspondingly in rapeseed cake content of fatty acids was 22.34
% and 72.56%. Production of milk and content of unsaturated fatty acids was increased, after 2 month 2kg rapeseed cakes including in cows diet. 

**Key words:** rapeseed, rapeseed cakes, cows, fatty acids, milk

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**REDUCTION OF NUTRIENT LOSSES IN GRASS-LEGUME SILAGES THROUGH INOCULATION**

Jatkaukas J., Vrotniakienė V.

Institute of Animal Science of Lithuanian Veterinary Academy, LT-82317 Baisogala, Zebenkos 12, Radviliskis distr., Lithuania

The first cut 8 to 10 h wilted grass- legume sward (20% Festuca pretense, 30% Trifolium pretense, 50% Lolium perenne) was baled in round bales (1.2 m in diameter and 1.2 m high) and either left untreated (C) or treated with inoculant containing a mixture of Lactobacillus plantarum Milab 393, Pediococcus acidilactici P6 and P11, Eterococcus faecium M74, and Lactococcus lactis SR3.54(L). The rate of inoculation was 5x10^5 cfu/g fresh herbage. Dairy cows were used in feeding experiment to evaluate utilization of nutrients. Silage inoculated with Lactisil 300 showed a lower final pH, significantly higher (P<0.05) concentrations of total acids and lactic acid and numerically lower concentrations of butyric acid and ammonia-N than uninoculated silage. A higher fermentation quality of the inoculated silage decreased significantly (P<0.01) fermentation (DM) losses and significantly increased (P<0.01) energy concentration in silage DM. Inoculated silage was more aerobically stable than untreated.Inoculation increase DM intake of grass- legume silage and benefit of the inoculated silage was the rising in milk yield by 1.16 kg energy-correct milk per cow^-1 day^-1 compared with untreated silage.

**Key words:** grass-legume silage, inoculant, dairy cows, intake.

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**ANALYSES OF INFLUENCING FACTORS OF MILK COMPOSITION AND QUALITY**

PIENA SASTĀVU UN KVALITĀTI IETEKMĒJOŠO FAKTORU ANALĪZE

Kairisa D., Jonkus D.

Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

Detailed evaluation of indicators of milk composition and quality at six different milk production farms was researched in time period from the July to the November, 2006. In common 2192 milk samples were analyzed for contents of fat, protein, casein and lactose (%), as well as urea (mg/dl) and somatic cells count (thousand ml^-1). Analyses of the results show that all the indicators of milk composition and quality were very variable during the research. It was cleared that a milk yield has medium or low negative phenotypic correlation with contents of fat, protein, casein and somatic cells count (r_p = -0.032 to -0.639, p<0.01), but positive correlation with contents of lactose (r_p = 0.014 to 0.418 p<0.01). Milk yield correlation with level of urea was from low negative to positive (r_p = -0.248 to 0.266, p<0.05). The higher correlation is between contents of protein and casein (r_p = 0.986 to 0.992, p<0.01) and fat and protein (r_p = 0.127 to 0.605, p<0.01). With multi-factorial analyses, it was cleared that composition and quality of cows’ milk differed significantly depending on the research months (p<0.001) and days of lactation (p<0.05).

**Key words:** dairy cattle, milk composition, quality.

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**CHARACTERISTICS OF FORAGE IN THE ASPECT OF MILK COSTS**

LOPBARĪBAS RAKSTUROJUMS PIENA IZMAKSU ASPEKTĀ

Latvietis J., Auzins V., Strikauska S., Eihvalde I.

Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

The analysis of statistical data testify to the fact that the situation in the dairy farming is starting to stabilise. The tendency of the decrease in the number of cows has disappeared in general and happens only mainly on the account of small farms. It is compensated by the increase of cow productivity. Therefore the milk production in the state in the last 4 years has remained within 800.000 tons. The milk sales price has reached 17 sant./kg and an essential increase of it is not
foreseeable, as it exceeds the average level of the countries of the European Union. The problems occur due to the milk production costs that endanger the competitiveness in the market of the European Union, as well as other countries.

One of the determinant reasons of the high milk production costs is the feed consumption (approx. 13%) and high costs of forage (average LVL 300 per cow per year). The high consumption is mainly caused by the deficit of protein, that exceeds 10%, but the reason of the increased costs of feed is the expensive forage (fodder, additives, etc.). To compensate the deficit of protein and decrease the forage costs, it is more gainful to use grass animal feed, that can be used in summer, as well as in the winter period. The increase of the proportion of grass animal feed in the area of cow feeding from 63% to 68% would increase the content of protein in the feed from 14.6 up to 15.7% and decrease the forage costs in the dairy production industry by 3%.

**Key words:** forage, milk, costs

**INFLUENCE OF COMBINED CONSERVATION ADDITIVES ON GRASS FERMENTATION AND OBTAINED SILAGE QUALITY**

**KOMBINĒTĀS DUBULTIEDARBĪBĀS PIEDEVU IETEKME UZ ZĀLES FERMENTĀCIJU UN IEGŪTĀS SKĀBBARĪBAS KVALITĀTI**

Osmane B., Jemeljanovs A.

Research Institute of Biotechnology and Veterinary Medicine „Sigra” of Latvia University of Agriculture, Instituta iela 1, Sigulda, Latvia, LV-2150

Use of biological inoculant can improve silage fermentation, but is not effective in protecting silage exposed to air. Aerobic instability is a problem on many farms. Aerobic deterioration generates losses and reduces hygienic quality during the feed-out. A combination of inoculant and chemical treatment has the potential to enhance aerobic stability. The aim of experiment was to evaluate the effect of combined use of biological inoculant and chemical additives Na benzoate and K sorbate on fermentation quality and aerobic stability of red clover/galega silage during the feed out. The application of an additives Na benzoate and K sorbate enhanced lactic acid content, reduced pH and eliminated butyric acid fermentation in silage. When the silages were open to air, a difference in the pH and mould growth was significant. After 6 days exposure in open air pH level on control variant (untreated silage) increased from 4.00 to 4.75, but of silage with inoculant and additives pH level was stable. After 6 days, when silage was open, the untreated silage contained higher count of moulds (1x10⁸ KFU g⁻¹), than silage with inoculant and additives (0 KFU g⁻¹). The treated silage quality and aerobic stability was not significantly (p>0.05) different between silage which open in 2,4,6,8 days. Silage with biological inoculant and Na benzoate or K sorbate provides significantly (p<0.05) increasing of milk yield about 1.1 kg per day from cow, comparision with not treated silage. It was concluded that the improvements in fermentation and aerobic stability resulted in a higher performance of dairy cows.

**Key words:** combined additives, second fermentation, silage quality.
According to data acquired in Latvian Breed horses association and Latvian Horse breeder society there were 303 mares and 42 stallions registered as genetic resource animals in Latvia in 2005. The research covers all horse genetic resource population in Latvia and includes analysis of genealogical lines and congenial groups, age and regional distribution. 

**Key words:** Genetic resource, horses, genealogical line, parentage

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**MILK QUALITY INDICES OF GERMAN WHITE NOBLE AND ALPS GOAT**

VĀCU BALTO DIŽCILTĪGO UN ALPU KAZU PIENA KVALITĀTES RĀDĪTĀJI

Selegovska E.¹, Spruzs J.¹, Remeza I.², Vasiljeva S.³

¹Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001, ²Rigas Stradiņa universitate, ³University of Latvia, Faculty of Biology

In our research we compared milk quality indices of German White noble and Alps goat in farm “Livi” of Madonas district. We tested amino acids, vitamins C, B₁, B₂, B₅, as also lizocim and amount of the circulating immune complexes (CIK) in milk of goats. Milk yields of goat firmly depend from correct and valuable feeding in the conventional farming. With optimized feeding in correlation in a short of time it is possible affect the goat’s carcass quality, health and in main, obtaining of high-quality, valuable (medical) goat milk. In milk yield German White noble and Alps goats are equivalent. In milk of the Alps goats by comparison to milk of the German White Noble goats it was for 18.9 % more fats, for 2.9 % more protein, for 1.7 % lactoses, for 9.7 % calcium, for 14.6 % phosphorus, for 3.8 % magnesium and for 10.2 % B₅ vitamin, this were biological more valuable and with higher nutritive value. In milk of the German White Noble goats by comparison to the Alps goats it was for 8.96 % a larger amino acid sum. In milk of the Alps goats only the amino acid methionin was for 9.1 % more by comparison to milk of the German White Noble goats, the all other amino acid were more in milk of the German White Noble goats. In milk of the German White Noble goats it was more for 8.1 % C vitamin, 28 % B₁ vitamin and 14.8 % B₂ vitamin. In milk of the Alps goats by comparison to milk of the German White Noble goats are for 5.0 % more ferrous and 10.5 % zinc, but for 4.5 % less Cu. In milk of the German white noble goats by comparison to milk of the Alps goats are for 4.5 % more Cu and for 5.0 % less ferrous and 10.5 % less zinc.

**Key words:** Goat, milk quality, immunity.

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**WELFARE OF GOAT AND PRODUCTION OF PRODUCTS IN THE ORGANIC AND CONVENTIONAL FARMS**

KAZU LABTURĪBA UN PRODUKCIJAS RAŽOŠANA BIOLOGISKAJĀS UN KONVENCIONĀLĀS SAIMNIECĪBĀS

Selegovska E., Spruzs J.

Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

A research purpose was to find out the difference of goat welfare and management in organic and conventional farms, and their impact on milk amount and quality. More than 30% organic goat farms realize goat products as organic products. Milk yield obtained from organic farms is by 17 % lower compare to conventional farms, opposite milk fats, lactoses and protein content of organic milk is substantial higher. In milk of the organic goats we can find more somatic cells than in the conventional milk. So as in the organic farms the use of the veterinary medicaments is not permitted in prophylaxis, in this farms there are problems both with animal digestion system parasites and with skin parasites. In the organic farms mainly in a winter period an optimum animal density is not provided on 1 m², this have an impact on animal welfare (stresses), as also on health (microclimate). In the conventional farms, what is not engaged in the crop growing, often the beddings failing looks after only, and in a winter period there are moist animal stands, what can take to the problems of legs and nails. In organic farms animal feeding factors are unacceptable – goats are not provided with free reached water and trace elements, which can cause health problem and productivity diminish in same queue. In a summer period in the both biological and in conventional farms animal management and feeding we can evaluate as acceptable. There is not difference between growing systems of organic and conventional animals and in the displays of the human mutual correlations. Animal welfare in inspected farms was acceptable.

**Key words:** goat, welfare, milk yield, milk quality.
EVALUATION OF THE MICROSATELLITE POLYMORPHISM IN INTRON I OF THE MYOSTATIN GENE IN TWO LATVIAN CATTLE BREEDS

Sjakste T.1, Grislis Z.2, Mazversite J.1, Sokolovska J.1, Sugoka O.1

1Institute of Biology of the University of Latvia, Miera 43, Salaspils, Latvia, LV-2169
2Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001

Myostatin (MSTN), a member of the transforming growth factor-beta (TGF-beta) superfamily, is a highly conserved, potent negative regulator of skeletal muscle growth in many species from rodents to humans. Loss of MSTN activity in cattle, mice, and humans leads to a profound phenotype of muscle overgrowth associated with more numerous and larger fibres and enhanced regenerative capacity. Several MSTN gene structural variations have been reported as potentially significant in cattle phenotype performance. Here we report data on the genotyping of the region encompassing intron I microsatellite locus in Latvian brown and Latvian blue cattle breeds. Newly described SNPs in 5' and 3' flanks of this gene portion seem exist in linkage block with microsatellite alleles. Genetic diversity of the revealed polymorphisms was evaluated within and between cattle breeds analyzed.

FEEDING OF EXTRUDED RAPESEED OILCAKE FOR REDUCING NITROGEN SUBSTANCES IN POULTRY MANURE

Vitina I.1, Krastina V.1, Nudiens J.1, Lagzdins D.2

1 Research Institute of Biotechnology and Veterinary medicine “Sigra” of Latvia University of Agriculture, Institute iela1, Sigulda, Latvia, LV-2150, 2SIA “Iecavnieks” LS “Kaltes” Iecava, Latvia, LV-3913

The trial was carried out of age of 1 to 49 days with broiler chickens of cross ROSS 308 and laying hens of cross Lohmann Brown at the age of 21 to 40 weeks. The control groups contain 5% cold – pressed rapeseed oilcake and trial group's 5% different extruded rapeseed oilcake. Rapeseed oilcake extrusion process by 112°C, 125°C, 137°C, pressure 10bar and time 30s. Extruded rapeseed oilcake additions supplement to broilers and layers daily ration promoted poultry productivity level, increased broiler chickens live weight and hens laying intensity average by 2.3 – 3.2% (p>0.005)

Extruded rapeseed oilcake nitrogen containing substances digestibility and utilization process in gastro - intestinal tract were evaluated by digestibility and availability coefficients. Comparing to the non processed rapeseed oilcake, extrusion process rapeseed oilcake increased nitrogen compounds digestibility and availability by 0.80 – 1.83% for broilers and by 0.80 – 2.59% for layers (p<0.05 – 0.01). Higher nitrogen substances digestibility coefficients by feeding extruded rapeseed oilcake by 125°C temperatures.

To go up extruded rapeseed oilcake excreted digestibility and utilization process in gastro – intestinal tract poultry, decreased nitrogen substances amount with manure. Feeding to broiler chickens feed which contain non processing rapeseed oilcake, at 42 days old, 1000 broiler chickens in twenty-four hours with optimal live weight 3022 g with manure in poultry farm excreted average 885g total nitrogen substances. Feeding to broiler chickens feed which contain extruded rapeseed oilcake nitrogen containing substances excretion with manure decreased by 5-7%. In trial time feeding feed which contain non processed rapeseed oilcake from 1000 laying hens in twenty-four hours excrete with manure on average 520g nitrogen substances. While feeding the feed contains extruded rapeseed oilcake nitrogen substances in hens manure decreased by 4-6%.

Consequently from other type to cut down environment pollution with poultry manure which contains nitrogen connection increase feed protein digestibility and availability level in gastro-intestinal tract. In that context into poultry feed content non processing rapeseed oilcake commendable to take extruded rapeseed oilcakes.
List of Participants

BELARUS

Bogdevitch I.
Research Institute for Soil Science and Agrochemistry
Kazintsa Str. 62, Minsk-220108, Belarus
brissa5@mail.belpak.by

Терешук В.
Министерство аграрной политики Республики Беларусь
Минск, Республика Беларусь
beliz@tut.by

Якимович Е.
РУП «Институт защиты растений»
Мира 2, Минск, Республика Беларусь
belizr@tut.by

Янкович В.
РУП «Институт защиты растений»
Мира 2, Минск, Республика Беларусь
belizr@tut.by

CZECH REPUBLIC

Kohoutek A.
Crop Research Institute, Prague 6 - Ruzyně, Research Station in Jevíčko
569 43 Jevíčko, Czech Republic
vste@seznam.cz

Kuzel S.
University of South Bohemia, Faculty of Agriculture
Studentská 13, 37005 České Budějovice, Czech Republic
kuzel@zf.jcu.cz

LATVIA

Adamovics A.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
Alessandra.Adamovics@llu.lv

Ansevica A.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
ausmane@apcentrs.lv

Balode A.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
antra@ram.lv

Balins A.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
balins.andris@inbox.lv

Balins A.
Latvia University of Agriculture, Strazdu iela 1, Jelgava, Latvia LV-3001
balins.andris@inbox.lv

Bremans G.
State Stende Cereals Breeding Institute, Dzestende, Talsi region, Latvia, LV – 3258
stende.selekcija@apollo.lv

Bremanis G.
State Stende Cereals Breeding Institute, Dzestende, Talsi region, Latvia, LV – 3258
stende.selekcija@apollo.lv

Bumane S.
Latvia University of Agriculture, Agriculture Research Institute, Skrīveri – 1, LV – 5126 Latvia.
skbumane@inbox.lv

Grauda D.
Institute of Agrobiotechnology, Latvia University of Agriculture, Skrīveri – 1, LV – 5126 Latvia.
szc@inbox.lv

Jankovska L.
Institute of Agrobiotechnology, Latvia University of Agriculture, Skrīveri – 1, LV – 5126 Latvia.
szc@inbox.lv

Janevica V.
Agrochemical Research Centre, 4a Struktoru iela, Riga, Latvia, LV-1039
apcentrs@apcentrs.lv

Grīslis Z.
Latvian Plant Protection Research Centre, State Ltd, Lielvārdes iela 36/36, Riga, Latvia, LV – 1006
maija.eihe@laapc.lv

Gutmane I.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
iveta@seklas.lv

Jansone B.
Institute of Agriculture, Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Maija. Ausmane
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
Maija.Ausmane@llu.lv

Alsina I.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
ina.alsina@llu.lv

Ansevica A.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
ausmane@apcentrs.lv

Ausmane M.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
mintaus.absolins@llu.lv

Auzins V.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
valdis.auzins@gmail.com

Balode A.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
antra@ram.lv

Balins A.
Latvia University of Agriculture, Strazdu iela 1, Jelgava, Latvia LV-3001
balins.andris@inbox.lv

Bankina B.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
Biruta.Bankina@llu.lv

Bankina B.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
Biruta.Bankina@llu.lv

Belicka I.
State Stende Cereals Breeding Institute, Dizstende, Talsi region, Latvia, LV – 3258
Ina.belicka@stendeselekcija.lv

Bremanis G.
State Stende Cereals Breeding Institute, Dizstende, Talsi region, Latvia, LV – 3258
stende.selekcija@apollo.lv

Bumane S.
Latvia University of Agriculture, Agriculture Research Institute, Skrīveri – 1, LV – 5126 Latvia.
skbumane@inbox.lv

Grauda D.
Institute of Biology, University of Latvia, Miera iela 3, Salaspils, Latvia
dace@email.lubi.edu.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.
Latvia University of Agriculture, Skrīveri-1, LV-5126,
szc@inbox.lv

Jānis K.

Jemeljanovs A.
Research Institute of Biotechnology and Veterinary Medicine „Sigra” of LUA, Instituta iela 1, Sigulda, Latvia, LV-2150
sigras@lis.lv

Karklins A.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001
Aldis.Karklins@llu.lv

Korolova J.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
jelena.korolova@llu.lv

Latvietis J.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
ljdek@llu.lv

Lepse L.
Pure Horticultural Research Centre, Abavas iela 2, Pure, Latvia, LV-3124
liga.lepse@puresdis.lv

Lipenite I.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
lnara.Lipenite@llu.lv

Osmane B.
LUA Research Institute of Biotechnology and Veterinary Medicine „Sigra”, Instituta iela 1, Latvia, LV-2150
sigras@lis.lv

Rashal I.
Institute of Biology, University of Latvia, Miera iela 3, Salaspils, Latvia
izaks@email.lubi.edu.lv

Rubauskis E.
Latvia State Institute of Fruit-growing, Graudu iela 1, Dobele, LV 3701, Latvia
dedars.rubauskis@lvai.lv

Skrivele M.
Latvia State Institute of Fruit-growing, Graudu iela 1, Dobele, LV 3701, Latvia
ballplant@latnet.lv

Steinberga V.
Latvia University of Agriculture, 2 Liela iela, Jelgava, Latvia-3001, Latvia
Ina.Alsina@llu.lv

Timbare R.
Agrochemical Research Centre, 14a Struktoru iela, Riga, Latvia, LV-1039
regina.timbare@apcentrs.lv

Jonkus D.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001
Daina.Jonkus@llu.lv

Kairīsa D.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001
Daina.Kairisa@llu.lv

Kronberga A.
State Priekuli Plant Breeding Institute, Zinatnes iela. 1a, Priekuli, Cesis distr., Latvia, LV-4126,
artakron@navigator.lv

Legziņa L.
State Priekuli Plant Breeding Institute, Zinatnes iela. 1a, Priekuli LV-4126, Latvia,
linda.legzenie@navigator.lv

Lipniece M.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
marta.lipniece@inbox.lv

Malecka S.
State Stende Cereals Breeding Institute, p.n. Dizstende, Talsi region, Latvia, LV-3258,
solveiga.malecka@stendeselekcija.lv

Pilksere D.
State Priekuli Plant Breeding Institute, Zinatnes iela. 1a, Priekuli, Cesis Distr., Latvia, LV-4126
DacePil@e-no.lv

Rozitis G.
Latvia University of Agriculture, Institute of Agrobiotechnology, Liela iela 2, Jelgava, Latvia LV-3001
egle@llu.lv

Selegovska E.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
Elita.Selegovska@llu.lv

Skudra I.
Latvia Rural Advisory and Training Centre, Rigas iela 34, Ozolnieki, Jelgavas region, Latvia LV 3018
Ilze.Skudra@llkc.lv

Sternakale V.
Scientific center of agriculture of Latgale, Vilani, Rezeknes raj., Latvia
strzin@apollo.lv

Treikāle O.
Latvian Plant Protection Research Centre, Liełvardes iela. 36/38, Riga, Latvia,
olga.treikale@laapc.lv

Kampuss K.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001
Kaspars.Kampuss@llu.lv

Karlsons, A.
Institute of Biology, University of Latvia, Miera iela 3, Salaspils LV-2169, Latvia;
augi@email.lubi.edu.lv

Lapins D.
Latvia University of Agriculture, Institute of Soil and Plant Sciences, Liela iela 2, Jelgava
Dains.Lapins@llu.lv

Lejūniš A., Lejūniš B.
Zemkopības institūts, Skrīveri 1, Aizkraukles rajons, LV 5126
andrislejuns@inbox.lv

Linina A.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
Anda.Linina@llu.lv

Mazversite J.
Institute of Biology of the University of Latvia, Miera iela 43, Salaspils, LV2169, Latvia
mazversite@email.lubi.edu.lv

Rancane R.
Latvian Plant Protection Research Centre, Liełvardes iela 36/38, Riga, Latvia, LV-1006
regina.rancane@laapc.lv

Ruza A.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia LV-3001
Antons.Ruza@llu.lv

Skrabule I.
State Priekuli Plant Breeding Institute, Zinatnes iela 1A, Priekuli, Cesis, Latvia, LV-4126
skrabule@navigator.lv

Stasinsks E.
Latvia University of Agriculture, Department of soil management, Liela iela 2, Jelgava, Latvia
eriks@dobeleagra.lv

Strumans E.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001
ervins@miko.lv

Turka I.
Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia, LV-3001
Inara.Turka@llu.lv

Vucans R.
Latvia University of Agriculture,
Liela iela 2, Jelgava, Latvia, LV-3001
Roberts.Vucans@llu.lv

Zarina L.
State Priekuli Plant Breeding Institute, Zatnaves iela 1a, Priekuli,
Cesis distr., LV-4126
livija@e-apollo.lv

Zegnere L.
Latvia University of Agriculture, Institute of Agrobiotechnology,
Liela iela 2, Jelgava, LV-3001
ieva.zukauska@llu.lv

LITHUANIA
Aralauskiene A.
Joniskelis experimental station of the Lithuanian Institute of Agriculture
joniskelio_lzi@post.omnitel.net

Balezentiene L.
Lithuanian University of Agriculture
Centre of Agroecology
Studentų g. 11, Akademija, Kauno raj. Lithuania
ligita.balezentiene@lzuu.lt

Katusis K.
Lithuanian Institute of Agriculture Institute Vezaiciai Branch, Vezaiciai,
Gargzdų 29, Klaipėda district, Lithuania
katusis@telesat.lt

Maiksteniene S.
Joniskelis experimental station of the Lithuanian Institute of Agriculture, Joniskelis, Pasvalys distr. 39301, Lithuania
joniskelio_lzi@post.omnitel.net

Slepetys J.
Lithuanian Institute of Agriculture,
LT58344, Akademija, Kėdainiai district, Lithuania
jonas.slepety@lzi.lt

POLAND
Borawska-Jarmułowicz B.
The Warsaw Agricultural University (SGGW), Department of Agronomy, Nowoursynowska 159, 02-776 Warsaw, Poland
barbara_borawska_jarmulowicz@sww.pl

RUSSIA
Kosolapov V.
All Russian Grassland research Institute
Lugovaja Moscow Region, Russia
vniikorm@mtu-net.ru

UKRAINE
Petrychenko V.
Feed Research Institute of UAAAS, Yunosti avenue, 16, Vinnitsya, Ukraine, 21100
fri@mail.vinnica.ua

Arbacauskas J.
Lithuanian institute of Agriculture,
Savanorių prosp. 287, Kaunas-50127, Lithuania
bandymai@agrolab.lt

Klimas E.
Lithuanian University of Agriculture,
Centre of Agroecology
Studentų g. 11, Akademija, Kauno raj. Lithuania
ligita.balezentiene@lzuu.lt

Repšien R.
Vezaiciai Branch, Lithuanian institute of Agriculture, LT 5845 Vezaiciai,
Klaipeda district, Lithuania
regina@vezaiciai.lzi.lt

Wyszynski Z.
Warsaw University of Life Sciences,
02-776 Warszawa,
Nowoursynowska 159, Poland
zdzislaw_wyszynski@sggw.pl
MULTIFUNCTIONAL AGRICULTURE AT THE OUTSET OF XXI CENTURY: CHALLENGES AND RISKS

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Lielā iela 2
Jelgava
Tālrunis 3005629, fakss 3005629
e-pasts: Dace.Sterne@llu.lv

Iespiests tipogrāfijā SIA “Dizians un Poligrāfija”
Iespiets SIA” Dizains un Poligrāfija”
Dobeles iela 43, Jelgava, LV -3001
Tāl.: 3022120, fakss: 3022139
E-pasts: dp@ml