

PROCEEDINGS OF ABSTRACTS



INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



LOTEx 2017



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



Impressum

International Conference On Long-Term Field Experiments “LOTEX 2017”

Proceedings of Abstracts Published by

University of Debrecen, Institutes for Agricultural Research and Educational Farm, Research
Institute of Nyíregyháza, 4400 Nyíregyháza, Westsik Vilmos u. 4-6. Hungary,

Editor in Chief

Marianna Makádi

Technical Editors

Ibolya Demeter
József Tibor Aranyos
Bernadett Fehér

Website

http://portal.agr.unideb.hu/research_institutes/riny/introduction/lotex2017/index.html?useLang=en

ISBN 978-963-473-973-9



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



Scientific Committee

Judit Dobránszki, Hungary
Márton Jolánkai, Hungary
Tamás Németh, Hungary
Péter Pepó, Hungary
Katalin Posta, Hungary
Kálmán Rajkai, Hungary
László Zsombik, Hungary

Organizing Committee

Tibor József Aranyos, Hungary
Zsuzsa Erdős, Hungary
István Henzsel, Hungary
Marianna Makádi, Hungary
Attila Tomócsik, Hungary
Bianka Véghné Tóth, Hungary



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



Preface

Long-term experiments have high importance in our changing world because they help us to model the results of our continuous activities. Although the maintenance of these experiments needs big efforts from the scientists, the results of these works are not in the focus.

The aims of this conference are to draw attention to the long-term experiments, to gather the soil and plant scientists and the representatives of the decision-making organisations to know each other, to share their knowledge and to disseminate the results of different topics.



LOTEx 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



Contents

Programme.....10

1th DAY, LECTURES OF INVITED SPEAKERS

THE IMPORTANCE OF LONG-TERM EXPERIMENTATION IN SUSTAINABLE AGRICULTURAL DEVELOPMENT (Long-term experiments: past, present, future)

Tamás Németh.....15

SUSTAINABLE AGRICULTURAL SYSTEMS: THE RELEVANT IMPORTANCE OF "LONG TERM EXPERIMENTS" AS INTEGRATED APPROACH TO UNDERSTAND THEIR FUNCTIONING

Roberto Mancinelli.....17

SESSION 1. SOIL-PLANT INTERACTIONS I.

THE EFFECT OF POTASSIUM SUPPLY AND PLANT DENSITY ON CORN YIELD AND NUTRIENT CONTENT

Péter Csathó, Tamás Árendás, Klára Pokovai, Anita Szabó.....18

THE EFFECT OF CROPYEAR AND FERTILIZER METHOD ON THE SPEAR YIELD OF ASPARAGUS (ASPARAGUS OFFICINALIS L.) HYBRID „GROLIM” ON SANDY SOIL

Zsuzsa Erdős.....19

EFFECT N, P AND K FERTILIZATION ON THE SUCCESSION OF AN ESTABLISHED SWARD OVER A DECADE

Péter Ragályi, Imre Kádár, László Szemán, Péter Csathó, Péter Csontos.....20

THE EFFECT OF GENOTYPE AND NITROGEN SUPPLY ON THE AGRONOMICAL PARAMETERS OF WINTER WHEAT (TRITICUM AESTIVUM L.)

László Zsombik, Emese Seres.....21

THE MANGANESE CONTENT OF RYE YIELD IN WESTSIK LONG-TERM CROP ROTATION EXPERIMENT

István Henzsel, Ágnes Hadházy.....22

LONG-TERM OPEN-FIELD FERTILIZATION EXPERIMENT WITH ENERGY WILLOW (SALIX SP.)-EXPERIENCES OF THE 2016 YEAR

László Simon, György Vincze, Zsuzsanna Uri, Katalin Irinyiné Oláh, Marianna Makádi, Tibor Aranyos, László Zsombik, Szabolcs Vigh.....23



LOTEx 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



SESSION 2. SOIL BIOLOGY

SOIL RESPIRATION IN A LONG-TERM TILLAGE EXPERIMENT

Márton Dencső, Györgyi Gelybó, Imre Potyó, Ilona Kása, Ágota Horel, Márta Birkás, Eszter Tóth.24

EFFECTS OF REPEATED DIGESTATE APPLICATIONS ON SOIL PROPERTIES, MICROBIAL COMMUNITIES AND GRAIN YIELD

Bente Foereid, Annbjorg Overli Kristoffersen.....25

LONG-TERM FIELD EXPERIMENTS: WHAT ABOUT SOIL MICROORGANISMS

Katalin Posta, Franco Magurno, Zoltán Meyer, Zita Sasvári26

CONCEPTUAL BASES OF FORMATION THE MECHANISMS OF RECOVERY AND MANAGEMENT OF SOIL FERTILITY ON LONG-TERM FIELD EXPERIMENTS

Nikolay Patyka, Gabriel Spassky, Sergei Kvasha, Aleksandr Kolodjzhnyi, Andrei Klyuvadenco, Aleksandr Subin, Sergei Veretyk, Tatyana Patyka27

EFFECT OF 10-YEAR- LONG SEWAGE SLUDGE COMPOST APPLICATION ON SOME SOIL MICROBIAL PROPERTIES

Marianna Makádi, Attila Tomócsik, Tibor József Aranyos, Bernadett Fehér, József Mészáros, Ibolya Demeter.....28

POSTER SESSION I.

INFLUENCE OF LONG-TERM FERTILIZATION ON WEED FLORA DIVERSITY IN MAIZE CULTIVATION

Nikolett Mazsu, Dóra Szentes, Anita Szabó, Csongor Gedeon, Éva Lehoczky29

SOIL MOISTURE CHANGES IN A LONG-TERM FERTILIZATION EXPERIMENT UNDER MAIZE AND MAIZE-WEED VEGETATION

Éva Lehoczky, Nikolett Mazsu, Renáta Sándor.....30

COMPOST TREATMENT FOR A SUSTAINABLE GROWTH IN NATURAL GRASSLAND IN KARCAG

Daniel Diaz Fernández, István Csízi, Géza Nagy31

EFFECT OF MOLYBDENUM TREATMENT ON THE ELEMENT CONTENT OF MAIZE AND GREEN PEA IN A LONG-TERM FIELD EXPERIMENT

Éva Bódi, Szilvia Várallyay, Áron Soós, Emőke Papp-Topa, Béla Kovács32



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



CARBON-DIOXIDE EMISSION OF THE SOIL IN THE LONG-TERM SOIL CULTIVATION EXPERIMENT AT KARCAG

József Zsembeli, Lúcia Sinka, Györgyi Kovács, Géza Tuba, Krisztina Czeller,
Csaba Juhász 33

COMPARISON OF THE DIFFERENT LAND USE MANAGEMENT AT MARTONVÁSÁR BY SOIL METABOLIC ACTIVITY PROFILES

Orsolya Gazdag, Tünde Takács, László Ködöböcz, Márton Mucsi, Ilona Villányi, Tibor Szili-Kovács ... 34

RESPONSE OF MICROBIAL BIOMASS AND IT'S ACTIVITY TO SEASONAL CHANGES SALT AFFECTED SOILS OF INDIA

Ravi Kumar Gangwar, Jaspal Singh, Marianna Makádi, Tamás Szegi 35

STUDIES ON PHOTOCHEMICAL ACTIVITY CHANGES IN MAIZE

Szilvia Veres, Attila Simkó 36

INVESTIGATION OF NDVI INDEX AND SPAD VALUE IN RELATION TO CHOROPHYLL CONTENT IN MAIZE

Attila Simkó, Karina Bodnár, Szilvia Veres 37

EFFECT OF NITROGEN NUTRITION ON SOME PHYSIOLOGICAL PARAMETERS OF DIFFERENT MEDICINAL PUMPKIN GENOTYPES

Soma Gáspár, László Zsombik, Szilvia Veres 38

CHANGES OF RELATIV CHLOROPHYLL CONTENT IN CORN SMUT INFECTED SWEET CORN

Dóra Frommer, László Radócz, Szilvia Veres 39

SOME RELEVANT RESULTS FROM THE ARDS LIVIDA LONG-TERM FIELD EXPERIMENTS

Ana Teodora David 40

DRY MATTER CONTENT OF POTATO TUBER IN WESTSIK LONG-TERM CROP ROTATION EXPERIMENT

István Henzsel, Gyuláné Györgyi 41

MICROBIOTA OF UPPER SOIL IN A LONG-TERM OPEN-FIELD FERTILIZATION EXPERIMENT WITH ENERGY WILLOW (SALIX SP.)

Maryna Kryvtsova, Nadija Bobrik, Angela Kolesnik, László Simon 42



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



2th DAY, LECTURES OF INVITED SPEAKERS

AGRONOMIC BENEFITS OF LONG TERM TRIALS

Márton Jolánkai.....43

APPLICATION OF LYSIMETERS IN SOIL MANAGEMENT

József Zsembeli, Krisztina Czeller, Lúcia Sinka, Györgyi Kovács, Géza Tuba.....44

SESSION 3. SOIL-PLANT INTERACTIONS II. SOIL PHYSICS AND CHEMISTRY

CHANGES OF SOME CHARACTERISTICS OF SOIL BY THE EFFECTS OF CHEMICAL FERTILIZATION AND IRRIGATION IN A LONG TERM FIELD EXPERIMENT

Andrea Balla Kovács, Evelin Juhász, Ida Kincses, Orosz Tóth Mihály, János Kátai, János Nagy, Tamás Rátonyi.....45

SOIL PHYSICAL MEASUREMENTS IN A LONG-TERM SEWAGE SLUDGE COMPOST EXPERIMENT

József Tibor Aranyos, Attila Tomócsik, Lajos Blaskó, József Mészáros, Marianna Makádi.....46

14-YEAR- LONG APPLICATION OF A SEWAGE SLUDGE COMPOST: CHANGES IN SOIL CHEMICAL PROPERTIES AND IN CROP YIELD

Attila Tomócsik, József Tibor Aranyos, Viktória Orosz, György Füleky, József Mészáros, Marianna Makádi.....47

THE ROLE OF WESTSIK LONG-TERM EXPERIMENT IN GREENING

Veronika Tótok.....48

SPATIAL DECISION SUPPORT FOR CROP STRUCTURE ADJUSTMENT- A CASE STUDY FOR SELECTION OF POTENTIAL AREAS FOR SORGHUM (SORGHUM BICOLOR (L.) MOENCH) PRODUCTION

János Jóvér, Elza Kovács, Péter Riczu, János Tamás, Lajos Blaskó.....49

POSTER SESSION II.

LONG-TERM EFFECT OF TILLAGE METHODS ON PHYSICAL PROPERTIES OF HEAVY SOIL

Danka Kotorová, Ladislav Kovács, Jana Jakubová, Pavol Balla.....50

THE ECONOMY OF MILLET CULTIVATION ON HEAVY SOILS

Ladislav Kovács, Danka Kotorová, Jana Jakubová, Pavol Balla.....51



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



PRODUCTIVITY OF MAIZE IN THREE-FACTOR MONOCULTURE LONG-TERM EXPERIMENT SET UP IN MARTONVÁSÁR

Tamás Árendás, Péter Bónis, Eszter Sugár, Györgyi Micskei, Csaba L. Marton, Zoltán Berzsényi, Nándor Fodor 52

EFFECT OF NITROGEN FERTILIZATION ON THE YIELD AND GROWTH OF WINTER WHEAT VARIETIES

Eszter Sugár, Tamás Árendás, Péter Bónis, Zoltán Berzsényi 53

STUDY OF YELLOW RUST INFECTION ON VARIOUS WINTER WHEAT GENOTYPES

László Kiss, László Zsombik, Szilvia Veres 54

EFFECT OF CLIMATIC FACTORS ON YIELD OF MAIZE IN LONG-TERM FERTILIZATION EXPERIMENT

Ildikó Béltéki, Szilárd Tóth, Sándor Holló, Andrea Ambrus 55



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



Programme

27. September 2017.

8:30-9:30 *Registration*

9:30-9:40 Opening of the conference László Zsombik, director

9:40-10:50 **Anniversary ceremony I.**

9:40-10:40 Greetings – Celebration of 90 years anniversary of the Research Institute of Nyíregyháza

10:40-10:50 Investiture of Westsik award

10:50-11:50 **Lectures of invited speakers**

10:50-11:20 Tamás Németh (Hungarian Academy of Sciences, Hungary): Long-term experiments: Past, present and future

11:20-11:50 Roberto Mancinelli (Tuscia University, Viterbo, Italy): Sustainable agricultural systems: the relevant importance of "long term experiments" as integrated approach to understand their functioning

11:50-12:20 **Anniversary ceremony II.**

11:50-12:00 Appreciation of the life and professional career of Vilmos Westsik.
László Zsombik, director

12:00-12:20 Wreathing the Statue of Vilmos Westsik, founder of the Westsik crop rotation

12:20-13:50 *Lunch*

13:50-15:20 **Session 1. Soil-plant interactions I.**

Chair: Marianna Makádi (University of Debrecen, Hungary)

13:50-14:05 Péter Csathó, Tamás Árendás, Klára Pokovai, Anita Szabó: The effect of potassium supply and plant density on corn yield and nutrient content

14:05-14:20 Zsuzsa Erdős: The effect of crop year and fertilizer method on the spear yield of asparagus (*Asparagus officinalis* L.) hybrid "Grolim" on sandy soil

14:20-14:35 Péter Ragályi, Imre Kádár, László Szemán, Péter Csathó, Péter Csontos: Effect N, P and K fertilization on the succession of an established sward over a decade

14:35-14:50 László Zsombik, Emese Seres: The effect of genotype and nitrogen supply on the agronomical parameters of winter wheat (*Triticum aestivum* L.)



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



14:50-15:05 István Henzsel, Ágnes Hadházy: The manganese content of rye yield in Westsik long-term crop rotation experiment

15:05-15:20 László Simon, György Vincze, Zsuzsanna Uri, Katalin Irinyiné Oláh, Marianna Makádi, Tibor Aranyos, László Zsombik, Szabolcs Vigh: Long-term open-field fertilization experiment with energy willow (*Salix* sp.)-experiences of the 2016 year

15:20-15:40 *Coffee break*

15:40-16:40 **Session 2. Soil biology**

Chair: Katalin Posta (Szent István University, Hungary)

15:40-15:55 Márton Dencső, Györgyi Gelybó, Imre Potyó, Ilona Kása, Ágota Horel, Márta Birkás, Eszter Tóth: Soil respiration in a long-term tillage experiment

15:55-16:10 Bente Foereid, Annbjorg Overli Kristoffersen: Effects of repeated digestate applications on soil properties, microbial communities and grain yield

16:10-16:25 Katalin Posta, Franco Magurno, Zoltán Meyer, Zita Sasvári: Long-term field experiments: what about soil microorganisms

16:25-16:40 Nikolay Patyka, Gabriel Spassky, Sergei Kvasha, Aleksandr Kolodjazhnyi, Andrei Klyuvadenco, Aleksandr Subin, Sergei Veretyk, Tatyana Patyka
Conceptual bases of formation the mechanisms of recovery and management of soil fertility on long-term field experiments

16:40-16:55 Marianna Makádi, Attila Tomócsik, Tibor József Aranyos, Bernadett Fehér, József Mészáros, Ibolya Demeter: Effect of 10-year-long sewage sludge compost application on some soil microbial properties

16:55-17:15 *Coffee break*

17:15-18:00 **Poster session I.**

Chair: László Zsombik (University of Debrecen, Hungary)

Nikolett Mazsu, Dóra Szentés, Anita Szabó, Csongor Gedeon, Éva Lehoczky: Influence of long-term fertilization on weed flora diversity in maize cultivation

Éva Lehoczky, Nikolett Mazsu, Renáta Sándor: Soil moisture changes in a long-term fertilization experiment under maize and maize-weed vegetation

Daniel Diaz Fernández, István Csízi, Géza Nagy: Compost treatment for a sustainable growth in natural grassland in Karcag

Éva Bódi, Szilvia Várallyay, Áron Soós, Emőke Papp-Topa, Béla Kovács: Effect of molybdenum treatment on the element content of maize and green pea in a long-term field experiment



LOTEx 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



József Zsembeli, Lúcia Sinka, Györgyi Kovács, Géza Tuba, Krisztina Czeller, Csaba Juhász: Carbon-dioxide emission of the soil in the long-term soil cultivation experiment at Karcag

Orsolya Gazdag, Tünde Takács, László Ködöböcz, Márton Mucsi, Ilona Villányi, Tibor Szili-Kovács: Comparison of the different land use management at Martonvásár by soil metabolic activity profiles

Ravi Kumar Gangwar, Jaspal Singh, Marianna Makádi, Tamás Szegi: Response of microbial biomass and its activity to seasonal changes salt affected soils of India

Szilvia Veres, Attila Simkó: Studies on photochemical activity changes in maize

Attila Simkó, Karina Bodnár, Szilvia Veres: Investigation of NDVI index and SPAD value in relation to chlorophyll content in maize

Soma Gáspár, László Zsombik, Szilvia Veres: Effect of nitrogen nutrition on some physiological parameters of different medicinal pumpkin genotypes

Dóra Frommer, László Radócz, Szilvia Veres: Changes of relative chlorophyll content in corn smut infected sweet corn

Ana Teodora David: Some relevant results from the ARDS Livada long-term field experiments

István Henzsel, Gyuláné Györgyi: Dry matter content of potato tuber in Westsik long-term crop rotation experiment

Maryna Kryvtsova, Nadija Bobrik, Angela Kolesnik, László Simon: Microbiota of upper soil in a long-term open-field fertilization experiment with energy willow (*Salix sp.*)

19:00-23:00 Conference dinner at the Hotel Central



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



28. September 2017.

9:00-10:00 Lectures of invited speakers

9:00-9:30 Márton Jolánkai (Szent István University, Hungary): Agronomic benefits of long term trials

9:30-10:00 József Zsembeli, Krisztina Czeller, Lúcia Sinka, Györgyi Kovács, Géza Tuba (University of Debrecen, Hungary): Application of lysimeters in soil management

10:00-10:20 *Coffee break*

10:20-11:35 Session 3. Soil-plant interactions II. Soil physics and chemistry.

Chair: Elza Kovács (University of Debrecen, Hungary)

10:20-10:35 Andrea Balla Kovács, Evelin Juhász, Ida Kincses, Orosz Tóth Mihály, János Kátai, János Nagy, Tamás Rátonyi – Changes of some characteristics of soil by the effects of chemical fertilization and irrigation in a long term field experiment

10:35-10:50 József Tibor Aranyos, Attila Tomócsik, Lajos Blaskó, József Mészáros, Marianna Makádi: Soil physical measurements in a long-term sewage sludge compost experiment

10:50-11:05 Attila Tomócsik, József Tibor Aranyos, Viktória Orosz, Györgyi Füleky, József Mészáros, Marianna Makádi: 14-year-long application of a sewage sludge compost: changes in soil chemical properties and in crop yield

11:05-11:20 Veronika Tótok: The role of Westsik long-term experiment in greening

11:20-11:30 János Jóvér, Elza Kovács, Péter Riczu, János Tamás, Lajos Blaskó – Spatial decision support for crop structure adjustment- a case study for selection of potential areas for sorghum (*Sorghum bicolor* (L.) moench) production

12:30-13:50 *Lunch*

13:50-14:20 Poster session II.

Chair: József Tibor Aranyos (University of Debrecen)

Danka Kotorová, Ladislav Kovács, Jana Jakubová, Pavol Balla: Long-term effect of tillage methods on physical properties of heavy soil

Ladislav Kovács, Danka Kotorová, Jana Jakubová, Pavol Balla: The economy of millet cultivation on heavy soils

Tamás Árendás, Péter Bónis, Eszter Sugár, Györgyi Micskei, Csaba L. Marton, Zoltán Berzsenyi, Nándor Fodor: Productivity of maize in three-factor monoculture long-term experiment set up in Martonvásár



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



Eszter Sugár, Tamás Árendás, Péter Bónis, Zoltán Berzsenyi: Effect of nitrogen fertilization on the yield and growth of winter wheat varieties

László Kiss, László Zsombik, Szilvia Veres: Study of yellow rust infection on various winter wheat genotypes

Ildikó Bélteki, Szilárd Tóth, Sándor Holló, Andrea Ambrus: Effect of climatic factors on yield of maize in long-term fertilization experiment

14:20-14:30 Closing of the conference

László Zsombik, director (University of Debrecen, Hungary)



LOTEx 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



27. September 2017
Lectures of invited speakers

THE IMPORTANCE OF LONG-TERM EXPERIMENTATION IN SUSTAINABLE AGRICULTURAL DEVELOPMENT (Long-term experiments: past, present, future)

Tamás Németh

Hungarian Academy of Sciences, Hungary

Corresponding author: nemeth.tamas@agrar.mta.hu

In the past few years many European countries were (and nowadays are, as well) undergoing changes in agricultural practice. The changes have occurred in wide range; in the EC current policy seeks to avoid the over-production of cereals via different political and economical ways, while in the Central and Eastern European countries the driving force of the changes is the damaged economy together with restructurization of the agricultural sector. LÁNG (1994) summarized the new factors having influenced the Hungarian agriculture in early 90`s:

- profound changes in the country`s economy,
- privatization, changes in ownerships and former market,
- expressive decrease of general consumption.

In the Hungarian economy the role of agricultural production is a long-term basic and traditional constituent. The land resources in Hungary are relatively favourable, the indicators relating to land resources are good, both in respect of arable land per capita (0,47 hectare) and in that of its utilization. As a result of research carried out for several decades, precise scientific knowledge is available on the properties as well as on the nutrition status and supplying capacities of the Hungarian soils.

The basis of human life is to use the natural ecosystem for meet the upgrowing demands of mankind, this process results removal of nature bond materials and embodied energy. Most of them are later not returned to, or modified, as well as broken down on the place of the origin. The driving force of these changes are fortunately slow release, so these positive and negative changes may be detected only in long-term experiments. Long-term field experiments are suitable to follow the cumulative effects, the usual and unusual events caused by human use, especially agricultural practice, such as cultivation, manure, fertilizer and pesticide applications, etc.

From soil fertility and plant nutrition point of view the long-term experiments provide useful informations and tools to follow the longevity of supplying capacity of soils. They are also able to serve as fundamental, basic constituents and data bank for environmental policy.

This statement can be proved, while most of the long-term experiments have been successfully maintained over long time, this is partly because crop yield can be used to indicate the sustainability of a particular system, i.e. the crop integrates across all those factors affecting its growth. From the other hand, crop yield does not necessarily give advance warning of factors that will lead to non-sustainability.

It can be worth to summarize the necessary management of long-term agricultural field experiments. It came from their nature that long-term field experiments must remain in the original place for many years. Supposing that it can happen, this ensure the application of treatments, methods of cultivation and harvest as far as possible from year to year. However,



LOTEX 2017

**INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY**



during the experimental years, management will include some needed changes for a number of reasons; mainly to address newly emerging issues.

One of the reasons of the changes could be the decreasing pH value (strong acidity) because of the non-satisfactory lime management in fertilizer treatments, while newly emerging issue could be the appearance of environmental side-effects.

Basic requirements before the start the uniformity of site (homogenous soil, lack of shading and slope). If the plots at the beginning large enough it allows subsequent modification of the whole experiments (or some of the plots) if this becomes necessary. This is one of the method which gives a good possibility (i.e. dividing into sub-plots) to find answer the new scientific questions addressed through the lifetime of the experiments.



LOTEX 2017



**INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY**

**SUSTAINABLE AGRICULTURAL SYSTEMS: THE RELEVANT
IMPORTANCE OF THE “LONG TERM EXPERIMENTS” AS
INTEGRATED APPROACH TO UNDERSTAND THEIR
FUNCTIONING**

Roberto Mancinelli

*University of Tuscia, Department of Agricultural and Forestry Sciences (DAFNE), Via San Camillo
De Lellis, 01100 Viterbo, Italy.*

Corresponding author: mancinel@unitus.it

Sustainable agriculture is taken into account everywhere around the world as a very important aspect. It is possible briefly summarize that a sustainable agriculture system refers to a multitude of strategies addressed for reducing problems by the agricultural activity, such as loss of soil quality, surface and ground water pollution from chemicals, non-renewable resources consumption, and low farm income. This orientation, corroborated by scientific and agroecological basis which recognise its feasibility, can be also called environmental-friendly agriculture and represents the ideal model to be pursued in practice. This theoretical reference framework highlight the importance of the ecosystemic paradigm approach, in which the soil is considered the intersection point between the chains of pasture and detritus which proceed within the physical context of the terrestrial environment and therefore it is the inevitable convergence point of all inputs biotic and abiotic factors that operate in the agroecosystem. Then, it must be never forget that a reductionist approach in the studies of a agroecosystem does not allow to understand concretely the reality with the easy risk of run into errors. Consequently, the holistic (or systemic) approach must be always adopted when we refer to an agroecosystem which must be considered as whole.

In accordance with Smuts (In: Smuts J. C. 1926. Holism and Evolution. Cape Town, N&S Press) the agroecosystem view opens wide interpretative and explicative horizons of the agricultural reality that would otherwise be difficult to detect. Thus, through systemic study of agricultural reality, it is possible to learn and understand the most important contents related to the basic elements of knowledge and implications which derive from rural environment management at any scale level.

These are the concrete real reasons for which is relevant to approach the studies of the reality in integrated way using “long term experiments” able to provide answers concerning the functioning of all agroecosystem components.



LOTEx 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



Session 1. Soil-plant interactions I.

THE EFFECT OF POTASSIUM SUPPLY AND PLANT DENSITY ON CORN YIELD AND NUTRIENT CONTENT

Péter Csathó¹, Tamás Árendás², Klára Pokovai¹, Anita Szabó¹

¹HAS CAR, Institute for Soil Science and Agricultural Chemistry, 15 Herman Ottó Str., H-1022

Budapest²HAS CAR, Agricultural Institute, 2 Brunszvik Str., H-2462 Martonvásár

Corresponding author: szabo.anita@agr.ar.mta.hu

The effect of potassium supply and plant density was investigated on corn flowering stage leaf weight, grain and stalk yield and their K, Ca and Mg contents, as well as grain yield components in a field trial, set up at Nagyhócsök, Hungary, in a calcareous chernozem soil with medium potassium supply. Different potassium supply levels were achieved by initial build-up 0-240-460-960-1440 kg K₂O ha⁻¹ application in autumn 1989. The present study was conducted in 1991. Adequate NP supplies were provided by yearly NP fertilization. The year of 1991 was favourable for corn growth and development. Pioneer SC 3732 (FAO 450) corn hybrid was sown with a plant density of 24-48-72-96 thousand per hectare.

The effect of different plant densities was more pronounced on grain yield than that of different K supplies. When increasing plant density from 24 to 72-96 thousand per hectare grain yield increased from 5.3 to 8.6-8.7 t ha⁻¹. As an effect of K fertilization, grain yields increased only from 7.1 to 7.7-7.9 t ha⁻¹. Stalk yields showed similar trends. On the other hand, the effect of plant density on flowering stage corn leaf weight was adverse: changed in an opposite way. While 81 g 20 leaves⁻¹ on the lowest plant density, only 48 to 54 g 20 leaves⁻¹ at the 72 to 96 thousand per hectare plant number.

K fertilization increased the K contents mostly in the vegetative parts (leaf and stalk), while increasing plant density had a reverse effect. K supplies and plant densities affected K / (Ca+Mg) ratios as well.

According to the results obtained in the field trial, it seems that in our grandmother's time food contained more minerals than nowadays, because of the fact that plant density affects grain mineral composition more than mineral fertilization.



LOTEX 2017

**INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY**



**CHANGE OF SPAER YIELD OF THE GRO LIM ASPARAGUS HYBRID
(*ASPARAGUS OFFICINALIS L.*) ON ACIDIC SANDY SOIL BETWEEN
2013-2016**

Zsuzsa Erdős¹

*University of Debrecen Institutes for Agricultural Research and Educational Farm Research Institutes
of Nyíregyháza*

H-4400 Nyíregyháza Westsik Vilmos str. 4-6.

Corresponding author: erdoszs@agr.unideb.hu

Research of blanched asparagus has begun at the University of Debrecen Institutes for Agricultural Research and Educational Farm Research Institutes of Nyíregyháza in 2011. Establishment of the plantation took place in May 2011. Grolim hybrid was used in the trial, 16 medium plot trial area has been formed under field conditions, with four repetitions and 36 m² plot size. In the course of our studies, the effect of different nutriment supply methods (untreated, manure, sheep manure compost, artificial fertilizer) has been analysed on the spear yield of the Grolim asparagus hybrid between 2013 and 2017.

In our studies, the beginning of vegetative growth has been recorded upon the constant presence of 10 °C of average soil temperature in the case of the Grolim asparagus hybrid. The beginning and length of spear harvesting are both influenced by the time and dynamics of initial development in spring. During the analysed period, the dates of spear harvesting were various, the earliest being on 23rd March, 2014 and the latest on 23rd April, 2015; the rest of the three years have been varied within this one month interval. The total of heat units required for the vegetative development of spears has been determined; it provides important information for cultivation practice.

Spear yields turned out to be hectic during the analysed period. In 2013 and 2014, yields have surpassed the amount of 50kg/harvest period/plot in the case of every treatment version. However, in 2015 a significantly lower specific yield has been recorded due to the unfavourable weather conditions in spring; a yield decline of nearly 50% was recorded in the case of the control treatment compared to the previous years. Yield was also lower in the rest of the fertilization treatments compared to 2014, however in these cases the degree of yield decrease was around 5-10%, which suggests the yield stabilising effect of fertilization. In 2016, a slight yield increase was measured in comparison with the base year. In 2017 there was a decline of yield in the control treatment; however the different fertilization treatments resulted in yield increase as compared to previous years.

On the basis of our studies, it is clear that the best yield results have been provided by the artificial fertilization treatment in all of the five analysed years. It was followed by the sheep manure compost and manure treatments in terms of their effect on spear yield. During the three harvesting periods the lowest yield on acidic sandy soil was recorded in the case of the control treatment. The most remarkable effect of nutriment treatments has been realised in terms of the decreased deviation of yield results, which perfectly represents the yield stabilising effect of nutriment supply in the case of perennial crops – asparagus – as well, even on a poor nutriment supply characteristic sandy soil.



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



EFFECT OF N, P AND K FERTILIZATION ON THE SUCCESSION OF AN ESTABLISHED SWARD OVER A DECADE

Péter Ragályi, Imre Kádár, László Szemán, Péter Csathó, Péter Csontos,
Institute for Soil Sciences and Agricultural Chemistry, Centre for Agricultural Research, Hungarian
Academy of Sciences, 1022 Budapest, Herman Ottó út 15.
Corresponding author: ragalyi@rissac.hu

Effects of different N, P and K supply levels and their combinations were examined on the species composition of a grass sward between 2001 and 2015 in a long term field experiment. The grass was established in autumn of 2000 with seed mixture of eight grass species. The calcareous chernozem loamy soil of the growing site contained around 3% humus, 3–5% CaCO₃, 20–22% clay in the ploughed layer and was originally moderately supplied with available N and K, and relatively poorly supplied with P. The trial included 4N×4P×4K=64 treatments in 2 replications, giving a total of 128 plots. The cover of grass species was surveyed every year at the end of May before the first cut.

By the 4th year *Phleum pratense*, by the 6th year perennial *Lolium perenne*, by the 8th year *Festuca pratensis* and *Festuca rubra* thinned away. *Phalaris arundinacea* germinated so poorly that it could not spread, however it remained in spots during the studied 15 years.

Agropyron pectiniforme expanded through the years and have become the dominant species from 2012 having 26% cover as an average of the whole experiment. The immigrant *Bromus inermis* could also anchor and spread through the years to the extent that it became the second most important species. *Festuca arundinacea* thrived in the 6th-8th years (35–32%), but was continuously suppressed (5%) by the year 2015. Coverage of *Dactylis glomerata* increased from about 6% in the first year to 8% by the 4th – 6th year, but by the 15th year it decreased to 1.5%. The presence of other species grew from 1–2% to 14–30% between 2010 and 2015 as a result of the thinning and aging of the grass. The total coverage decreased from 96–99% of the 1st year to 85% of the 15th year.

The species composition was drastically modified by the N, P and K supply. Tall fescue and cocksfoot favoured moderated N and P demand. However, smooth brome and crested wheatgrass could utilize extreme NP supply.



THE EFFECT OF GENOTYPE AND NITROGEN SUPPLY ON THE AGRONOMICAL PARAMETERS OF WINTER WHEAT (*TRITICUM AESTIVUM L.*) ON SANDY SOIL

László Zsombik¹, Emese Seres²

¹DE AKIT Research Institute of Nyíregyháza,

²Fitt-Agro Kft.

Corresponding author: zsombik@agr.unideb.hu

Our examinations were carried out in the Nyíregyháza region on acidic sandy soil, where we set up a winter wheat cultivation trial with provocation purposes between 2014 and 2016. The aim of the winter wheat trial, which is not typical within the region, was to investigate the nutrient reaction of a locally based extensive winter wheat line and a commonly cultivated variety in terms of the major yield forming elements and yield. Our small plot field trials were set on weak nutriment supply low-humus sandy soil. The agro-technical parameters were in conformity with the ones applied in practice; in terms of nitrogen supply control, 54 kg ha⁻¹ and 108 kg ha⁻¹ nitrogen versions were used in the form of MAS fertilizer for the two examined genotypes. In the course of our examinations we measured the weight of grains/ears via sampling, the extent of productive tillering, number of ears per area unit and the harvested yield. Based on the results, there was a significant production year effect on the examined parameters; in 2016 agronomic parameters were determined by extreme weather conditions. Based on the results of the correlation analysis, the most important yield determining factor on sandy soil was the number of ears/area unit, which showed a close positive correlation with the KG Széphalom winter wheat variety and in the case of the 1401HK winter wheat line it showed a moderate positive correlation. For both examined genotypes, the grain weight/ear and the number of ears showed moderate and positive correlation. Based on the results of the factor analysis, the observed factors (nitrogen supply, genotype, production year) had a similar effect on the indicator in terms of grain weight per ear. In terms of productive tillering, a dominant effect of production year on sandy soil (86%) was observed and similar effects were observed for the number of grain per area unit. In terms of harvested yield, genotype and production year had an almost identical effect (46 and 45%) on the index, while the role of nitrogen supply was modest (9%) in 2015-2016 on sandy soil.

Our tests were carried out in the scope of the AGR_Piac_13-1-2013-0002 project, “Production of adaptive winter wheat lines with excellent characteristics for the bakery industry” production of adaptive autumn wheat lines with excellent milling properties.



LOTEX 2017

**INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY**



THE MANGANESE CONTENT OF RYE YIELD IN WESTSIK'S LONG-TERM CROP ROTATION EXPERIMENT

István Henzsel, Ágnes Hadházy

University of Debrecen, IAREF, Research Institute of Nyíregyháza, 4400 Nyíregyháza, Westsik Vilmos u. 4-6. Hungary

Corresponding author: henzsel@agr.unideb.hu

The Westsik's crop rotation experiment was established in 1929. The experiment includes 14 three-year-long and 1 four-year-long crop rotations. The aim of the experiment is to maintain or increase soil fertility in an acidic sandy soil with low-humus content.

Manganese (Mn) has important role in enzymatic processes of plant metabolism, therefore availability in soil for plants in an adequate concentration is important for plant production. The Westsik's crop rotation experiment is conducted without Mn fertilization therefore it is an appropriate experimental site to study the relationship between the rye and available soil Mn content, rye and soil pH and rye and particles under 0.02 mm in different manured crop rotations. The manganese content of rye was between 40 and 83 mg kg⁻¹. The lowest Mn content of rye yield was measured in the crop rotations manured with farmyard or straw manure, without NPK fertilization. The Mn content of rye yield had negative correlation with soil pH ($r = -0.575$, $p < 0.01$) and with soil available Mn content ($r = -0.377$, $p < 0.01$). However, the relationship between the available Mn content of soil and the soil particles under 0.02 mm was positive ($r = 0.734$, $p < 0.01$),

The soil pH influenced the rye Mn uptake to a greater extent than the quantity of soil available Mn content. We could indirectly influence the Mn content of the rye in the experiment: in the crop rotations with higher soil pH the Mn content of rye were lower comparing to the crop rotations with lower soil pH.



LONG-TERM OPEN-FIELD FERTILIZATION EXPERIMENT WITH ENERGY WILLOW (*SALIX* sp.) – EXPERIENCES OF THE 2016 YEAR

László Simon¹, György Vincze¹, Zsuzsanna Uri¹, Katalin Irinyiné Oláh¹, Marianna Makádi², Tibor Aranyos², László Zsombik², Szabolcs Vigh¹

¹University of Nyíregyháza Institute of Engineering and Agricultural Sciences, Department of Agricultural Sciences and Environmental Management, Nyíregyháza

²Research Institute of Nyíregyháza, University of Debrecen Centre of Agricultural Sciences
Corresponding author: simon.laszlo@nye.hu

An open-field small plot long-term fertilization experiment was set up during 2011 with willow (*Salix triandra* x *Salix viminalis* 'Inger'), grown as an energy crop. The 0.4 hectare experimental plots with 10 various treatments and 4 replications are located in Nyíregyháza city. The brown forest soil was treated three times (during June 2011, May 2013, May 2016) with municipal biocompost (MBC), municipal sewage sludge compost (MSSC), willow ash (WA), and two times (2011, 2013) with rhyolite tuff (RT). From 2011 to 2014 ammonium nitrate, from 2014 to 2016 urea (U), and during 2016 sulfuric urea (SU) artificial fertilizers were also applied to the soil, during May or June, as top-dressings (TD). These fertilizers and amendments were also applied to the soil during 2016 in combinations; MBC+SU, RT+SU, WA+SU, and MSSC+WA. During July of 2016 the highest nitrogen concentrations of willow leaves were measured in U (3.47 $\text{m}/\text{m}\%$ N) or SU (3.01 $\text{m}/\text{m}\%$ N) treatments, these values were significantly higher than in control (2.46 $\text{m}/\text{m}\%$ N). Excess of nitrogen considerably reduced Zn uptake of leaves; in U-treated culture 39.5 $\mu\text{g g}^{-1}$, in SU-treated culture 53.4 $\mu\text{g g}^{-1}$, while in control cultures 63.5 $\mu\text{g g}^{-1}$ Zn was detected. Except WA treatment, soil application of all other amendments or TDs enhanced the specific potassium concentrations in willow leaves, as compared to untreated control. From soil amendments or TDs were not transferred any significant quantities of toxic elements (As, Ba, Cd, Pb) to the leaves of willow. During 2016 the most intensive soil respiration was measured in WA, WA+SU or MSSC+WA treated cultures, while the lowest rate was observed in case of SU application. The highest rate of photosynthesis (A) in leaves was observed during July of this year in MSSC and in MSSC+WA treated cultures.



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



Session 2. Soil biology

SOIL RESPIRATION IN A LONG-TERM TILLAGE EXPERIMENT

Márton Dencső¹, Györgyi Gelybó¹, Imre Potyó¹, Ilona Kása¹, Ágota Horel¹, Márta Birkás², Eszter Tóth¹

¹*Institute of Soil Sciences and Agricultural Chemistry, Centre for Agricultural Research, Hungarian Academy of Sciences, Herman Ottó út 15., Budapest 1022;*

²*Institute of Crop Production, Faculty of Agricultural and Environmental Sciences, Szent István University, Páter Károly utca 1., Gödöllő 2100*

Corresponding author: dencso.marton@agrar.mta.hu

The effect of different tillage methods on soil carbon cycle can occur in different ways as they alter soil physical, microbial and chemical conditions. Long-term field experiments are ideal candidates to investigate this complex phenomenon and the underlying mechanisms.

Our study site, Józsefmajor Experimental and Training Farm operated by Szent István University is located nearby Hatvan, Northern Hungary. The experiment was set in 2002 with well-planned crop rotation, continuous monitoring of soil CO₂ emission and soil water and heat regime started in 2013. This study focuses on the influence of two contrasting tillage methods (ploughing and no tillage) on soil CO₂ emission. To measure soil respiration we used static chamber method with seven spatial replicates at each tillage treatments weekly. The chambers were permanently inserted into the soil surface between the annual tillage events. Soil moisture and temperature are the main environmental factors of soil CO₂ emission, thus we installed soil moisture and temperature sensors (5TM Decagon Devices Inc, WA, USA) as well, at five depths close to the sampling area.

We found that soil respiration has a peak in the middle of the growing seasons in each investigated year, with no tillage treatment showing higher soil respiration than ploughing especially in these periods. The difference disappears after harvest and with the decreasing temperature. We also found good exponential connection between the respiration and soil temperature.



LOTEx 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



EFFECTS OF REPEATED DIGESTATE APPLICATIONS ON SOIL PROPERTIES, MICROBIAL COMMUNITIES AND GRAIN YIELD

Bente Foereid, Annbjørg Øverli Kristoffersen

NIBIO, Norwegian Institute of Bioeconomy Research, Pb. 115, 1431 Ås, Norway

Corresponding author: bente.foreid@nibio.no

Digestates, residues from biogas production, are good fertilizers. They contain ample available nutrients and organic matter residue. There are few studies on the longer term effects on soil properties of digestate application. At Apelsvoll research station in Norway the fertilizer effect of digestate from household waste biogas production has been tested for seven years in a field experiment. The treatments were a control with no fertilizer, mineral fertilizer (80 kg N ha⁻¹), animal slurry (80 and 120 kg total N ha⁻¹) and digestate from two plants (80 and 120 kg total N ha⁻¹). Each treatment was replicated twice.

Grain yield from each plot was recorded each year. Soil samples were collected in early summer 2016 from each plot, both from planted and unplanted parts. Samples were analysed for total carbon and nitrogen and PLFA (phospholipid fatty acid, to detect changes in microbial community structure).

No significant effect of any of the treatment on total carbon and nitrogen, and no clear impact on the microbial community structure have been found. Yield data from 2014-2016 indicate that the fertilizer value of digestate was similar to that of animal manure, but one of the digestates produced yield that was not significantly lower than with mineral fertilizer.

The results indicate that some digestates can be an efficient fertilizers, but effects on the soil are not present or only occur after longer time.



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



LONG-TERM FIELD EXPERIMENTS: WHAT ABOUT SOIL MICROORGANISMS

Katalin Posta, Franco Magurno, Zoltán Mayer, Zita Sasvári

Institute of Genetics, Microbiology and Biotechnology, Szent István University, Páter K. street 1, H-2100, Gödöllő, Hungary,

Corresponding author: posta.katalin@mkk.szie.hu

Agricultural land management is one of the most significant human activities influencing soil characteristics, including physical, chemical and biological properties. Microorganisms living in the soil are involved in the maintenance of the productivity and health of agro-ecosystems, therefore an adequate understanding of soil biodiversity plays a key role in ensuring sustainable use of soil. Based on more than 50-years field experiment established in Martonvásár (Hungary) we try to estimate how different agricultural practices influence biodiversity of soil microorganisms. Structure and composition of the indigenous arbuscular mycorrhizal fungi (AMF) has been investigated by molecular markers on rDNA using nested PCR. Moreover, terminal restriction fragment length polymorphism (T-RFLP) fingerprint technique has been used to assess soil bacterial diversity and community structure. Agricultural practices, including mineral fertilization and incorporating stalk residues, significantly affected the diversity of AMF. Sixteen molecular operational taxonomic units (OTU) identified in maize roots grown under no fertilization, nine where mineral fertilization was applied, and 13 OTUs were recovered in plots where stalk residues were incorporated in the soil every year. Comparing the different crop rotation systems also highlighted remarkable differences in the composition and structure of the AMF assemblages. However, no differences in bacterium diversity detected between maize monoculture and crop rotations except the most intense rotation system (Norfolk type). In general, higher AMF community found in the soil than in the root suggesting the selection mycorrhizal fungi caused by target plant. Future experiments are required in order to gain a better understanding of microbial dynamics in response to the different agricultural practices.



LOTEX 2017

**INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY**



**CONCEPTUAL BASES OF FORMATION THE MECHANISMS OF
RECOVERY AND MANAGEMENT OF SOIL FERTILITY ON LONG-
TERM FIELD EXPERIMENTS**

*Nikolay Patyka¹, Gabriel Spassky², Sergei Kvasha¹, Aleksandr Kolodjzhnyi¹, Andrei Klyuvadenco¹,
Aleksandr Subin¹, Sergei Veretyk¹, Tatyana Patyka¹*

*¹National University of Life and Environmental Sciences of Ukraine,
03041, Kyiv, Ukraine*

*²Transcarpathian State Agricultural Experimental Station NAAS of Ukraine,
90252, Velyka Bakta, Berehove district, Transcarpathian region, Ukraine*

Corresponding author: npatyka@gmail.com

The development of high-tech biotechnology makes possible to uncover the mechanisms and provide new knowledge about the formation of an unprecedented rhizosphere interactions and systems, as well as to predict the effects of plant health. Agroecological bioengineering approaches, in turn, make it possible to overcome the limitations of traditional crop control strategies through the use and disclosure of the rhizosphere functions.

The successes in the molecular biology development enabled to elaborate molecular genetic methods of the microorganisms identification and to create the phylogenetic systematics classification. At the same time the opportunity appeared to explore the specific and the functional structure of the microorganisms mixed cultures and associations. Using PCR by means of the appropriate phylogenetic markers it is possible to locate, detect and study genes encoding ribosomal rRNA, that contributes to further development of studying of different isolates, including non-cultivated species of microbial coenoses of soil. These methods caused the appearance of a new branch in microbiology – metagenomics

The metagenome and functionally significant phylogenetic and taxonomic polymorphisms of prokaryotes in the modal chernozem in the agrocoenoses of winter wheat were evaluated using the method of pyrosequencing. 1708 operational taxonomic units and identified 335 taxons of prokaryote were detected. The structure of the prokaryote metagenome of the modal chernozem appeared to include the representatives of two Archaea and 22 bacterial phyla, absolute dominants among them being *Proteobacteria* – 79,6% and *Actinobacteria* – 12,9%. The polymorphism of the representation of prokaryotic taxons was observed at the level of families, the dominants being *Alcaligenaceae*, *Pseudomonadaceae*, *Solirubrobacteraceae*, *Gaiellaceae*, *Nitrososphaeraceae*.

The phylogenetic links between the main representatives of the prokaryote metagenome were detected which had formed in the modal chernozem in the winter wheat agrocoenoses. Thus, the use of pyrosequencing, in addition to the estimation of structure and diversity, opens perspectives for the research of the functional component of the metagenome prokaryote of soil.



EFFECT OF 10-YEAR-LONG SEWAGE SLUDGE COMPOST APPLICATION ON SOME SOIL MICROBIAL PROPERTIES

Marianna Makádi¹, Attila Tomócsik¹, Tibor József Aranyos¹, Bernadett Fehér², József Mészáros³, Ibolya Demeter¹

¹ *University of Debrecen, IAREF, Research Institute of Nyíregyháza, 4400 Nyíregyháza, Westsik Vilmos u. 4-6. Hungary,*

² *Kerpely Kálmán Doctoral School, University of Debrecen, 4438 Debrecen, Böszörményi út 138. 3 Nyírségyvíz Ltd., 4400 Nyíregyháza, Tó u. 5.*

Corresponding author: makadim@agr.unideb.hu

Microbes play a key role in the material and energy cycling of soil: they take place in the decomposition of organic matter and different poisons; in the immobilization of nutrients and toxic materials; they help plants to survive and stay healthy; they have significant role in the soil aggregation, and so on. Microbial processes are very complicated and depend on the soil physical and chemical properties and the changes of climatic conditions. Generally, microbial processes are sensitive to changes in soil properties caused by natural processes (e.g. decreasing of precipitation) or by human activities (e.g. soil cultivation, soil treatment). Therefore, these changes can be used for monitoring the effects of soil cultivation, especially treating soils with organic or inorganic wastes and by-products. A small plot sewage sludge compost experiment was established in 2003 in Nyíregyháza, where 0, 9, 18 and 27 t ha⁻¹ doses of compost contained 40% sludge, 25% straw, 30% rhyolite and 5% bentonite were applied in every 3rd year. In our presentation we analyse the microbial activity (represented by the activity of invertase and soil respiration) and community status (based on PLFAs) of ploughed layer of acidic sandy soil in the Nyírség region after 10 years of regular use of municipal sewage sludge compost.



Poster session I.

INFLUENCE OF LONG-TERM FERTILIZATION ON WEED FLORA DIVERSITY IN MAIZE CULTIVATION

Nikolett Mazsu¹, Dóra Szentes², Anita Szabó¹, Csongor Gedeon¹,
Éva Lehoczky^{1,3*}

¹Institute for Soil Sciences and Agricultural Chemistry, Centre for Agricultural Research, Hungarian Academy of Sciences, Herman O. út 15., 1022 Budapest, Hungary.

²Directorate of Plant Protection, Soil Conservation and Agri-environment, National Food Chain Safety Office, Budaörsi út 141-145, 1118 Budapest

³Faculty of Agricultural Sciences and Rural Development, Eszterházy Károly University, 3200 Gyöngyös, Mátrai út 36., Hungary

Corresponding author: lehoczky.eva@agr.ar.mta.hu

Investigations on weed diversity and weed-weed relationships in maize fields in terms of nutrient supplies could help to understand better the competition processes for water, space and nutrient, contributing the development for a more effective weed control technology. For harvesting an appropriate quality and quantity of yield production; the evaluation of competition is important, especially during the early phenological stages of plant growth. The effect of different nutrient supplies on weed infestation to maize was studied in a long-term fertilization experiment set up in 2003 on a FAO Calcaric Phaeosem soil at Nagyhöröcsök, Hungary. The survey was carried out in three consecutive years, at 2-4 leaf stage (BBCH 13) of maize. At the time of sampling, weeds were collected by species from 1 m² herbicide-free plots. The composition of weed flora was described by the presence, the density, the frequency and the order of dominance of weed species. The investigated nutrient treatments were as follows: Control (without fertilization) and NPK (150 kg ha⁻¹ N, 100 kg ha⁻¹ P₂O₅, 100 kg ha⁻¹ K₂O). 17 weed species occurred on the studied plots during the three sampling times. A strong correlation was determined between the nutrient supply and the presence of weed species. Many agreements were pointed out between the experimental years, such as the *Ambrosia artemisiifolia* L. and the *Sorghum halepense* (L.) Pers were the dominant species in Control conditions, whilst *Chenopodium album* L. and *Datura stramonium* L. in nutrient rich circumstances. The diversity of each weed species changed significantly, responding to the applied treatment. Total weed density was higher in NPK treatment in all three years. Considering the density and order of dominance of weed species an interspecific competition had been observed at both treatments.

The present study has been supported by the Hungarian Scientific Research Fund (Project No. OTKA K105789).



SOIL MOISTURE CHANGES IN A LONG-TERM FERTILIZATION EXPERIMENT UNDER MAIZE AND MAIZE-WEED VEGETATION

Éva Lehoczky^{1,2*}, Nikolett Mazsu¹, Renáta Sándor³

¹*Institute for Soil Sciences and Agricultural Chemistry, Centre for Agricultural Research, Hungarian Academy of Sciences, Herman O. út 15., 1022 Budapest, Hungary*

²*Faculty of Agricultural Sciences and Rural Development, Eszterházy Károly University, 3200 Gyöngyös, Mátrai út 36., Hungary*

³*Agricultural Institute, Centre for Agricultural Research, Hungarian Academy of Sciences, Brunszvik u. 2., 2462 Martonvásár, Hungary*

Corresponding author: lehoczky.eva@agr.ar.mta.hu

A long-term fertilization trial has been established on loam soil at Nagyhörcsök in 2003 for investigating the different effects of maize (*Zea Mays L.*) crop and nutrient supplies on yield among other variables. Soil moisture is often used as an indicator of water limitation in dryland agro-ecosystems, as it controls several important chemical and biological processes. Therefore, the questions of water availability and weed-crop interactions were addressed to the field experiment for predicting the impacts of changes in soil moisture and nutrient supply. Soil moisture was observed along the 0–80 cm depth soil profile with 10 cm resolution and harvested aboveground biomass was measured during the vegetation period between 2013 and 2015. Competition for soil water stocks was increased in arid years (2013 and 2015) when the water stress periods reduced both crop and weed biomass production. However, Control treatments showed less sensitivity to heat waves than NPK fertilized plots, owing to lower transpiration of its biomass production. The water intake by weeds reduces the amount of available soil moisture for maize, while the cultivated plants also decrease the water content of the fertile zone. The outcome of competition for water resources depends on the relative abilities of weed and crop vegetation to tolerate soil water deficit conditions. There was no significant difference in soil moisture content under maize and maize-weed vegetation in a semiarid year (2014). According to the De Martonne-Gottmann aridity index analyses using 50 years' meteorological dataset, the experimental site showed arid circumstances in 60%, semiarid, sub-humid and humid in 19%, 19% and 2%, respectively. However, the frequency of arid years was 80% in the last decade compare with 20% chance of semi-arid year. These findings of the long-term fertilization experiment suggest, the availability of water resources is the main limiting factor of plant growth and maize production is facing with a pressing and increasing need for water resources.

The present study has been supported by the Hungarian Scientific Research Fund (Project No. OTKA K105789).



LOTEx 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



COMPOST TREATMENT FOR A SUSTAINABLE GROWTH IN NATURAL GRASSLAND IN KARCAG

Daniel Díaz Fernández¹, István Csízi², Géza Nagy³

¹*University of Debrecen, Doctoral School of Animal Husbandry, 4032 Debrecen, Böszörményi Street 138., Hungary*

²*Research Institute of Karcag, 5300 Karcag, Kisújszállási út 166.*

³*University of Debrecen, Department of Rural Development and Regional Economics, 4032 Debrecen, Böszörményi Street 138., Hungary*

Corresponding author: danieldf@agr.unideb.hu

Grassland ecosystems can be found on every continent, except Antarctica thanks to their high tolerance and adaptability. Moreover the grassland based animal husbandry is an ancient and easy way for food production even in regions where other agricultural sectors cannot be effective. On the other hand these ecosystems are not only valuable because of their role in food production. Grasslands take their share in carbon sequestration, erosion controlling and the conservation of biodiversity and that is why the European Union made strict rules about grassland management. In our experiment we tested two different types of compost - what are officially allowed in organic farming - on natural grassland in Hungary. Three rates of composts (10 t ha⁻¹, 20 t ha⁻¹, 30 t ha⁻¹) were tested on 3m * 10m experimental plots in four replication. Both type had four control plots too, this way we had 32 experimental plots. We measured the botanical composition in May and September, what was followed by harvesting and the measurement of the yield. Samples for laboratory analysis were also taken. Dry matter yield of the pasture showed positive responses to the rates of compost but the protein yield per unit area only grows until a certain point and then it drops down. Our results indicate that the application of these composts is a sustainable method of increasing the productivity of natural grasslands.



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



EFFECT OF MOLYBDENUM TREATMENT ON THE ELEMENT CONTENT OF MAIZE AND GREEN PEA IN A LONG-TERM FIELD EXPERIMENT

Éva Bódi, Szilvia Várallyay, Áron Soós, Emőke Papp-Topa, Béla Kovács
University of Debrecen, Faculty of Agricultural and Food Sciences and Environmental Management,
Institute of Food Science
4032 Debrecen, Böszörményi str. 138. Hungary,
Corresponding author: bodieva@agr.unideb.hu

Molybdenum (Mo) is one of the seven microelements which is essential for the plants. Its relevance of plant physiology primarily lies in the fact that it is a necessary metal component of enzymes participating in nitrogen-metabolism. On the one hand, it has a decisive role in the nitrogen supply of *Fabaceae* as the co-factor of the nitrogenase enzyme, on the other hand, it has an essential role in the process of nitrate reduction, since the presence of Mo is essential in order that the nitrate reductase could function optimally.

Our research is based on the long-term field experiments of Nagyhörscök, where different levels of soil contamination conditions are represented. Mo was supplemented to the soil as $(\text{NH}_4)_6\text{Mo}_7\text{O}_{24}\cdot 4\text{H}_2\text{O}$ in three different concentrations as follows: 90, 270, 810 kg ha⁻¹ and control for our reference. The treatments were arranged in a split-plot design with two replications.

In our present work, element content of maize (*Zea mays*) and green pea (*Pisum sativum*) samples was introduced, they were collected from the above-mentioned experiment station. Wet digestion with nitric acid and hydrogen peroxide was applied during sample preparation of these plants. Total element concentration was determined by inductively coupled plasma optical emission spectrometry (ICP-OES) and inductively coupled plasma mass spectrometry (ICP-MS).

Our results show that Mo is present only in small amount in plants naturally, but plants are able to accumulate Mo also in high concentrations, when the soil is contaminated with Mo. Although excessive Mo accumulation does not lead to metabolic problems or phytotoxic effects in plants, the same high Mo concentration can cause molybdenosis in animals.

The results also demonstrate that Mo was predominantly in the vegetative parts of the plants and maize and pea seeds (generative parts) contained only a small fraction of the accumulated Mo, which has important human health aspects.



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



CARBON-DIOXIDE EMISSION OF THE SOIL IN THE LONG-TERM SOIL CULTIVATION EXPERIMENT AT KARCAG

József Zsembeli¹, Lúcia Sinka², Györgyi Kovács¹, Géza Tuba¹, Krisztina Czeller¹, Csaba Juhász²
¹Research Institute of Karcag Institutes for Agricultural Research and Educational Farm University of Debrecen

H-5300 Karcag, Kisújszállási út 166.

²Faculty of Agricultural and Food Sciences and Environmental Management University of Debrecen
Corresponding author: zsembeli@agr.unideb.hu

CO₂-emission from soils is one of the most important elements of the global carbon cycle, thus it has crucial role in climate change. Each soil cultivation operation intervenes in soil microbiological life hence tillage is a factor through that the processes taking place in soil can be controlled. During the last decades the organic material content of agricultural soils decreased to the half due to the intensive management resulting in the degradation of natural soil fertility. While intensive, plough-based tillage can cause soil degradation and erosion, the physical, chemical and biological status of the soil can be significantly improved by the application of conservation tillage methods. The results of long-term experiments prove that soil protective tillage enhances the enrichment of organic matter in the top layer of the soil. In order to reveal the role of tillage systems in CO₂-emission from the soil, regular measurements were carried out in the plots with conventional and reduced tillage of the soil cultivation experiment of Karcag Research Institute. Anagas CD 98 and Gas Alert Micro 5w infrared gas analysers were used to measure CO₂-concentrations, and a specially developed method (consisting of a frame and a bowl) was applied to delimitate the measuring area. Most of the measurements were done on stubbles after harvest in order to exclude root respiration. Weather conditions of the examined 10 years were very changeable providing a good chance to compare them. We found the tillage operations resulting in higher emission values in both tillage systems. On stubbles higher and more even emission was characteristic to reduced tillage due to the lower degree of soil disturbance and higher soil moisture content.



LOTEx 2017

**INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY**



COMPARISON OF THE DIFFERENT LAND USE MANAGEMENT AT MARTONVÁSÁR BY SOIL METABOLIC ACTIVITY PROFILES

*Orsolya Gazdag, Tünde Takács, László Ködöböcz, Márton Mucsi, Ilona Villányi, Tibor Szili-Kovács
Institute for Soil Sciences and Agricultural Chemistry, Centre for Agricultural Research, Hungarian
Academy of Sciences, H-1022 Budapest, Herman Ottó út 15.
Corresponding author: gazdag.orsolya@agrar.mta.hu*

Nowadays, growing attention has been paid to understand the key role of the relationship between different land management methods and soil biological processes in order to support functionality of biological and ecological cycles. Soil-microbiota have a fundamental role in organic farming systems and can develop self-sustainable land managements. Catabolic activity of the soil microorganisms can be measured on the basis of CO₂ production by MicroResp method and therefore gives a more detailed characterization of the functional diversity of the soil microbial communities than the earlier approaches.

The aim of this study was to compare the metabolic profile of soil microbial communities if they differ between organic and traditional land management in a long-term experiment.

Respiratory activity of the soil microbial community was compared at Martonvásár (Hungary), from clay loam soil with organic and conventional land use history and two different sampling time. MicroResp method were used with 23 different substrates to characterize the respiration pattern of soils. The multivariate statistical analysis revealed a significant difference between the metabolic profiles of the soil microbial communities of the two management systems. The soil salinity, humus content, pH and the vegetation could be established affecting the rate of CO₂ evolution and the metabolic profiles. The catabolic respiration response approach is useful to classify microbial communities, even on a large scale.

This research was financially supported by OTKA (K108572) and Research Institute of Organic Agriculture and by János Bolyai Research Scholarship (BO/00948/15/4).



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



RESPONSE OF MICROBIAL BIOMASS AND IT'S ACTIVITY TO SEASONAL CHANGES IN SALT AFFECTED SOILS OF INDIA

Ravi Kumar Gangwar¹, Jaspal Singh², Marianna Makádi³ and Tamás Szegi¹

¹*Department of Soil Science and Agricultural Chemistry, Szent István University, Gödöllő, Hungary*

²*Department of Environmental Science, Bareilly College, Bareilly, U.P. India*

³*Research Institute of Nyíregyháza, University of Debrecen, Nyíregyháza, Hungary*

Corresponding author: ravi25388@gmail.com

The aim of the study was to investigate the responses of soil microbial biomass and its activity in salt affected soils of Kittauna village of Aonla, (Bareilly) Uttar Pradesh, India. The study area is characterized as Solonetz soils. Soil samples were collected from arable land from the upper 15 cm layer during Summer (April, 2016) and Winter (Nov, 2016). Soil microbiological properties viz. phosphatase and dehydrogenase activities of the samples were measured, as well as soil microbial biomass carbon (MBC) and soil microbiological respiration. Besides soil microbiological properties, soil physical and chemical properties (SOM, pH, EC, available macro, meso and micro nutrients and moisture content) were also investigated. The results of this study were statistically compared based on the seasonal changes and different soil microbial activity and showed great variation in soil chemical and microbiological properties.



LOTEx 2017

**INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY**



STUDIES ON PHOTOCHEMICAL ACTIVITY CHANGES IN MAIZE

Szilvia Veres, Attila Simkó

*Department of Agricultural Botany, Crop Physiology and Biotechnology, Institute of Crop Sciences,
University of Debrecen, Böszörményi 138, Debrecen, Hungary*

Corresponding author: szveres@agr.unideb.hu

The decrease in photosystem two (PSII) electron transport efficiency induced by different stresses should be accompanied by some alterations in the primary photochemical processes of PSII, which would be reflected by measurements of *in vivo* chlorophyll fluorescence on leaves. Among environmental stresses the nutrient deficiency can control by producers, mainly if they are able to detect the nutrient deficiency before appearance of any visual symptom. The fast fluorescence induction kinetics can allow us to evaluate the changes in PSII photochemistry such as energy absorption, the utilization and dissipation of excess excitation energy by PSII using a non-invasive, powerful and reliable method.

Potential (Fv/Fm) and actual photochemical activity (Yield) was measured by PAM-2001 chlorophyll fluorometer on a maize (*Zea mays L.*) genotype at two different levels of nutrient supply in a field experiment. The investigation was set up early in the morning and at noon and in case of younger (last fully developed) and older (leaf of the main cob) leaves.

The values of Fv/Fm were around the optimal in case of both treatment and leaf ages at early morning. Potential photochemical activity for most dicot plants grown without stress is close to 0.83, lower values suggest that plants are growing under stress and that PSII reaction centers are damaged which, in turn, is connected with reduced effectiveness of electron transport such as when plants are grown under excess light. The differences of the measured parameters between the treatments were more pronounced at noon. The actual photochemical activity values were more sensitive for treatments, leaf ages and environmental factors.

This work was supported by a grant from "Establishing a scale-independent complex precision consultancy system" (GINOP-2.2.1-15-2016-00001) project.



INVESTIGATION OF NDVI INDEX AND SPAD VALUE IN RELATION TO CHLOROPHYLL CONTENT IN MAIZE

Attila Simkó¹, Karina Bodnár², Szilvia Veres¹

¹*DE, MÉK, Institute of Plant Sciences, Department of Agriculture, Botany Plant Physiology and Biotechnology*

²*DE, MÉK, Institute of Land Use, Technology and Regional Development, Department of Land Utilisation*

Corresponding author: simkoattila90@gmail.com

In our days one of the most important objectives of the Hungarian agriculture is to produce, and keep the principles of sustainability. The integration of precision technologies gives an excellent opportunity for this. This is especially true about the fertilization techniques which are one of the most expensive interventions furthermore it includes a large environmental risk. The base of applicability of precision technologies is the validation of the used methods. The *in situ* determination of the chlorophyll content is an important part of the technology, because it is fast, cheap and provides good information about the nitrogen supply and the photosynthetic capability of the plants. During our work we compared the absolute and relative methods of the phytochemical chlorophyll content determination and making recommendations for the precision farming. A maize (*Zea mays L.*) genotype was examined at two different levels of nutrient supply in a field experiment. The weather factors were the same during the investigation. SPAD-502 (Minolta, Japan) and a handheld Greenseeker (Trimble, USA) device were used for the determination of relative chlorophyll content. We also determined the absolute chlorophyll content. For the survey of the different parameters we choose the plants randomly. Four leaves per plant with different ages were involved in our measurements. According to our results we can conclude that the two devices are suitable for detection of the effects of nutrient deficiencies obviously. However, there are differences in the accuracy of the devices. The synchronizing of the values measured by the two devices and the investigation of the results reliability can help the farmers and the scientists to making the best decision about the purchase.

This work was supported by a grant from "Establishing a scale-independent complex precision consultancy system" (GINOP-2.2.1-15-2016-00001) project.



EFFECT OF NITROGEN NUTRITION ON SOME PHYSIOLOGICAL PARAMETERS OF DIFFERENT MEDICINAL PUMPKIN GENOTYPES

Soma Gáspár¹, László Zsombik², Szilvia Veres¹

¹Department of Agricultural Botany, Crop Physiology and Biotechnology, Institute of Crop Sciences, University of Debrecen, Böszörményi str. 138, Debrecen, Hungary

²Research Institute of Nyíregyháza, Institutes for Agricultural Research and Educational Farm, University of Debrecen, Westsik Vilmos str. 4-6, Nyíregyháza, Hungary

Corresponding author: szveres@agr.unideb.hu

Cucurbita pepo var. *styriaca* is known as a medicinal crop among other cucurbits. The benefits of cucurbits fruits are very important in terms of human health especially for purifying blood, stopping constipation and it's also good for digestion and supplying energy. The mutant styrian seed pumpkin (*Cucurbita pepo* L. convar. *Pepo* var. *styriaca* Greb.) exposes a complete lack of lignification of the seed tests, thus this kind of naked pumpkin seed is more consumable as a snack than other seeds. The vegetative growth of plants is crucial for fruit production. Nitrogen is the most imperative element for proper vegetative growth and the development of plants which significantly increases and enhances the yield and its quality by playing a vital role in biochemical and physiological functions of the plant. Field studies were conducted to study the effect of nitrogen nutrition on relative chlorophyll content of styrian oil pumpkin. The small block experiment was carried out based on factorial experiment with randomized blocks design by four replications at the Research Institute of Nyíregyháza in the summer period of 2017. Nitrogen fertilizer was applied at sowing in three different concentrations. SPAD-502 (Minolta, Japan) and handheld Greenseeker (Trimble, USA) devices were used for the determination of relative chlorophyll content. For the survey of the different parameters we chose the plants of two different genotypes (Gleisdorfi Classic and GL Rustical) randomly. According to our results SPAD values and NDVI index measurements are really useful parameters for detecting nitrogen supply in styrian oil pumpkin as well as in other crops. Significant differences were found among treatments and genotype reactions as well but further investigation is needed to have evidence of our statement.

This work was supported by a grant from “Research of complex rural economic and sustainable development, elaboration of its service networks in the Carpathian basin” (EFOP-3.6.2-16-2017-00001) project.



CHANGES OF RELATIVE CHLOROPHYLL CONTENT IN CORN SMUT INFECTED SWEET CORN

Dóra Frommer¹, László Radócz², Szilvia Veres¹

¹*Department of Agricultural Botany, Crop Physiology and Biotechnology, Institute of Crop Sciences,
University of Debrecen, Böszörményi 138, Debrecen, Hungary*

²*Institute of Plant Protection, University of Debrecen, Böszörményi 138, Debrecen, Hungary*
Corresponding author: dorafrommer@gmail.com

Leaf chlorophyll content analysis is important for several reasons. The most common symptom of a plant disease is the larger and smaller chlorosis. There are multiple reasons of chlorosis such as reduction of chlorophyll content, unfavorable change of the total chlorophyll content, occurring disorder with regard to functioning of chloroplasts or ultimately the destruction of the chloroplast. Such chlorosis already means significant loss with regards to the photosynthesis; however the underperformance of the sick plant's photosynthesis is the result of a more complex process than the previously mentioned one.

As we unambiguously experienced in the course of the carried out investigation that the infected sweet corn most common symptom was chlorosis on the leaves, it is especially important to examine, how the infection influenced the leaves chlorophyll content by the hybrids. Five different sweet corn hybrids were investigated in the randomized small block field experiments. Inoculation of five sweet corn hybrids using 2 ml of sporicidal suspension were injected in the stem for inducing a high incidence of common smut of corn caused by *Ustilagomaydis*. Two weeks after the inoculation the relative chlorophyll content was measured in 7 leaves/hybrids by SPAD-502 meter which device is widely used for the rapid, accurate and non-destructive measurement of leaf relative chlorophyll content. Because of the infection the relative chlorophyll content of younger leaves were decreased in comparison to control leaves. The disease systematically spread in the plants causing chlorosis on younger leaves.

This work was supported by a grant from "Research of complex rural economic and sustainable development, elaboration of its service networks in the Carpathian basin" (EFOP-3.6.2-16-2017-00001) project.



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



SOME RELEVANT RESULTS FROM THE ARDS LIVADA LONG-TERM FIELD EXPERIMENTS

Ana Teodora David

*Agricultural Research and Development Station Livada
7th, Baia Mare Street, 447180 Livada, Satu Mare, Romania
Corresponding author: anamoldovant@yahoo.com*

Due to the practical importance of this research for our geographical area, we continue to sustain the long-term field trials, established in 1961 and 1967 at the Livada Agricultural Research Station, with lime and fertilizer application. They have the advantage of providing realistic field-growing conditions and they represent perhaps the best opportunity to quantify fertilization effects and to elucidate the mechanism of crop responses. The Luvisol they are placed on is poorly supplied with humus and mobile phosphorus, medium-well supplied with potassium and it has a slightly acidic pH.

This research aimed to quantify the impact of fertilization on nutritional deficiencies and photosynthetic efficiency of maize.

The determinations were made using chlorophyll fluorescence measurements as a non-invasive methods and direct observations.

Obvious phosphorus deficiency symptoms were revealed in the plots here the phosphorus treatment was less than 40 kg P₂O₅/ha. In these circumstances, the increased dose of nitrogen clearly intensified the phosphorus deficiency symptoms. Analyzing the evolution of the same phenomena experienced with increased doses of farmyard manure applied once every four years, it was found that in the absence of phosphorus fertilization, deficiency symptoms are visible only up to 40 tones/ha/4 years of farmyard manure application .

Knowing the relative increase of fluorescence by using the "Quantum Photosynthetic Yield" protocol allows quantification of photosynthetic plants tissue to undergo photosynthetic processes. Maximum quantum yield (Y) of PSII is reduced under nutrient stress in steady state crops.

The results show clear differences between the photosynthetic efficiency and ability to react to environmental stresses of the maize plants from the liming and fertilization experiment. The plants in the limed plots have higher photosynthetic yield values.



THE DRY MATTER CONTENT OF POTATO TUBER IN WESTSIK'S LONG-TERM CROP ROTATION EXPERIMENT

István Henzsel, Gyuláné Györgyi

*University of Debrecen, IAREF, Research Institute of Nyíregyháza, 4400 Nyíregyháza, Westsik Vilmos
u. 4-6. Hungary*

Corresponding author: henzsel@agr.unideb.hu

The Westsik's long-term crop rotation experiment was established by Vilmos Westsik in Nyíregyháza, Hungary. The experiment consists of 15 crop rotations and based on the following fertilization methods applied: straw-, and farmyard manure, green manure and the combinations of these organic fertilization methods with NPK fertilizer.

In this work the dry matter content of potato tubers were measured and, based on these values, the dry weight based potato yields were calculated. Besides these plant parameters, the humus and available phosphorus content of the soil and the ratio of soil particles under 0.02 mm were measured.

The dry matter content of potato tubers was between 21 and 25%. We measured the least dry matter content in the control plot (I) the unfermented straw manure plot (IV) and the farmyard manure plot (XI). The highest dry matter content was measured in main-, and second crop green manure plots (VIII), lupine green forage plot (IX) and lupine second crop plot without any NPK fertilizer (XV). The potato yield based on dry weight (d.w.) varied between 1.5 and 5.2 t ha⁻¹ in the experiment. This yield parameter reached the lowest value in the control plot (I). Comparing to the control, significantly higher yields based on dry weights of tubers were measured in main-, and second crop green manure plots (VIII), in bigger doses (11.3 and 26.1 t ha⁻¹) straw manure + NPK artificial fertilizers plots (V, VI) and farmyard manure plots (X, XI). As the Pearson correlation showed, the dry matter content of potato tuber was higher if the ratio of soil particles under 0.02 mm was higher ($r=0.663$, $p<0.01$), while the yield based on dry weight was higher if the soil humus content ($r=0.713$, $p<0.01$) and the soil available phosphorus content ($r=0.602$, $p<0.05$) increased.

We concluded that the increased humus and available phosphorus content of the soil resulted in an increase of the potato yield based on dry matter content of tubers independently of the ratio of soil particles under 0.02.



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



MICRIBIOTA OF UPPER SOIL IN A LONG-TERM OPEN-FIELD FERTILIZATION EXPERIMENT WITH ENERGY WILLOW (*SALIX* sp.)

Maryna Kryvtsova¹, Nadija Bobrik¹, Angela Kolesnik¹, László Simon²

¹*Uzhgorod National University, Faculty of Biology, Department of Genetics, Plant Physiology and Microbiology, Uzhgorod, Ukraine*

¹*University of Nyíregyháza Institute of Engineering and Agricultural Sciences, Department of Agricultural Sciences and Environmental Management, Nyíregyháza, Hungary*

Corresponding author: maryna.krivcova@gmail.com

An open-field small plot long-term fertilization experiment was set up during 2011 with willow (*Salix triandra* x *Salix viminalis* 'Inger'), grown as an energy crop. The 0.4 hectare experimental plots with 10 various treatments and 4 replications are located in Nyíregyháza city, at the field of Research Institute in Nyíregyháza, University of Debrecen, Centre of Agricultural Sciences. The brown forest soil was treated during June 2011, May 2013, May 2016 with municipal biocompost (MBC), municipal sewage sludge compost (MSSC), and willow ash (WA), and two times (2011, 2013) with rhyolite tuff (RT). During June of 2016 urea (U), or sulfuric urea (SU) artificial fertilizers were also applied to the soil, as a top-dressings (TD). The soil sampling for study soil microbiota was done during August, 2016. The soil microbial coenosis analysis was conducted with the use of differentially diagnostic nutrient media by the method of serial dilutions of soil suspension. Thus, the most indicative changes in the soil microbiota against the control plot were found in case of the use of MSSC; rise in the number of intestinal bacteria, ammonifiers, micromycetes and actinomycetes, and fall in the number of oligonitrophils and cellulolytic microorganisms was detected. In case of the use of MBC, rise in the levels of intestinal bacteria, microscopic fungi, actinomycetes, pedotrophs and cellulolytic bacteria were found. While calculating the mineralization/immobilization index, it was shown that the most significant deviation from the control plot was found in RT treated soil – a decrease by 6 times, and in case of WA by 2.3 times, which proves the inhibition of mineralization of the organic substances in the soil. Calculation of the pedotrophy index showed growth of humus formation speed in the soils treated with SU top-dressing, and MBC, while in MSSC treated culture the pedotrophy index was found to be decreasing significantly. In all versions of the experiment, the number of free-living nitrogen-fixing microorganisms (*Azotobacter*) was found to be equal to 100%.



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



28. September 2017.
Lectures of invited speakers

AGRONOMIC BENEFITS OF LONG TERM TRIALS

Márton Jolánkai

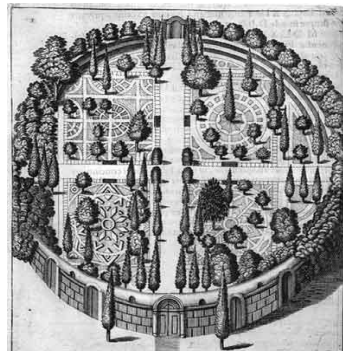
Crop Production Institute, Szent István University, Gödöllő, Páter Károly u 1. e-mail:

Corresponding author: jolankai.marton@mkk.szie.hu

Long term trials have been established in favour of exploring and observing plant and soil interrelations on site. We may determine long term trials as live instruments providing *ceteris paribus* conditions in temporal sequences.

The contribution is dealing with the introduction to major long term trials in the World and in Hungary. Giving a brief summary on plant nutritional research roots beginning with some data from Homer, and the fabulous initial willow tree experiment of van Helmont, as well as the basic inventions of physiological processes by von Liebig, Lawes and Boussingault. The most profound long term trials like Padova's Orto Botanico, the Linné Garden of Uppsala and the Broadbalk of Rothamsted are presented in the lecture.

Agronomic, educational and scientific benefits of the major Hungarian long term trials are also discussed from Westsik 1929 via Maronvásár and the National Plant Nutrition Trials (OMTK) founded in 1963. There is a list of experimental sites giving information on the most important recent long term trial locations and the activities, as well as a short introduction of the major scientific personalities of this field.



The Orto Botanico (1545)



LOTEx 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



APPLICATION OF LYSIMETERS IN SOIL MANAGEMENT

József Zsembeli¹, Krisztina Czeller¹, Lúcia Sinka², Györgyi Kovács¹, Géza Tuba¹

¹Research Institute of Karcag Institutes for Agricultural Research and Educational Farm University of Debrecen

H-5300 Karcag, Kisújszállási út 166.

²Faculty of Agricultural and Food Sciences and Environmental Management University of Debrecen

Corresponding author: zsembeli@agr.unideb.hu

In the Great Hungarian Plain the most important ecological factor determining the development of agricultural production is water. There is long tradition of the efforts focus on saving water in agricultural use of water. Irrigation researches of the last century made it obvious that irrigation can be used only conditionally (strictly taking its environmental impacts as secondary salinization, soil degradation, etc into consideration) on large areas due to the special ecological and soil conditions of the Great Hungarian Plain. Therefore other approaches (water saving soil cultivation, application of crops with high drought tolerance) can be the solution of this problem. Applied crop production technology researches mainly focused on the examination of the water regime of field crops and the microclimate of crop vegetation. In the early phase soil cultivation researches based on simple empirical observations and not on precise measurements, hence even in the case of the well proved and effective soil cultivation methods our knowledge is defective. Researches focus on the control of the water- and salt regime in order to improve the efficiency of water use are of great importance. In accordance with the combat against drought damages and soil degradation the conventional soil cultivation methods are prospectively replaced by conservation tillage, which aims the decrease of the depth of the regularly cultivated soil layer and the formation of a topsoil rich in organic matter. The scientific establishment of the hydrological impacts of these new methods can absolutely be considered actual and needs further efforts. The determination of the effects of technological elements influencing the soil water- and salt regime can contribute to the elaboration of water preserving technologies as the elements of up-to-date and sustainable crop production. The control of soil water regime is an effective environmental protective process at the same time, which is of great importance to prevent soil degradation and to mitigate the pollution of our water funds.



Session 3. Soil-plant interactions II. Soil physics and chemistry

CHANGES OF SOME CHARACTERISTICS OF SOIL BY THE EFFECTS OF CHEMICAL FERTILIZATION AND IRRIGATION IN A LONG TERM FIELD EXPERIMENT

Andrea Balla Kovács¹ - Evelin Juhász¹ - Ida Kincses¹ - Orosz Tóth Mihály¹ - János Kátai¹ - János Nagy² - Tamás Rátónyi²

¹Institute of Agricultural Chemistry and Soil Science, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen

²Institute of Land Utilisation Technology and Regional Development, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen

Corresponding author: kovacs@agr.unideb.hu

The objective of this study was to evaluate the effects of chemical fertilization and irrigation on soil characteristics. In order to achieve the objective we examined the effects in the polyfactorial long-term field experiment (established in 1984) at the trial site of the University of Debrecen (Hajdúság loess plateau, 47° 30' N, 21° 36' E, 121 m elevation). Soil type of the experimental site is chernozem, which is one of the major soil types of the region. The experiment was arranged split-split-plot with different doses of fertilizers and with and without irrigation varieties. Maize hybrids (as monoculture) were planted as a test plant. Basic NPK fertilizers as $\text{NH}_4\text{H}_2\text{PO}_4$, NH_4NO_3 and KCl were applied in fall. The nitrogen application was divided into two parts: half amount of N was applied in fall and the other half was top dressed in spring as NH_4NO_3 after plant emergence. We have chosen some treatments for analyzing the soil samples. The investigated treatments were control, two different doses of chemical fertilizers: medium dose (180kg N ha^{-1} , $184\text{ kg P}_2\text{O}_5\text{ ha}^{-1}$, $216\text{ kg K}_2\text{O ha}^{-1}$) and high dose (300 kg N ha^{-1} , $184\text{ kg P}_2\text{O}_5\text{ ha}^{-1}$, $216\text{ kg K}_2\text{O ha}^{-1}$) with or without irrigation. The soil sampling was in a depth of 0-30 cm in June of 2016. Some chemical parameters (pH, NO_3^- , AL- P_2O_5 , AL- K_2O , AL-Ca and AL-Mg and some microbiological parameters (enzyme activities) of soil were determined and compared due to different treatments. Microbiological parameters have been slightly, while chemical parameters of soil have been significantly influenced by investigated treatments.



LOTEx 2017

**INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY**



SOIL PHYSICAL MEASUREMENTS IN A LONG-TERM SEWAGE SLUDGE COMPOST EXPERIMENT

*József Tibor Aranyos*¹, Attila Tomócsik¹, Lajos Blaskó², József Mészáros³, Marianna Makádi¹*

*¹Research Institute of Nyíregyháza, University of Debrecen, Westsik Vilmos út 4-6., 4400
Nyíregyháza, Hungary*

*²Institute of Water and Environmental Management, University of Debrecen, Böszörményi út 138.
4032 Debrecen, Hungary*

*³Head of Department of Nyírségvíz Closed Shareholder Group, Nyíregyháza, Hungary
Corresponding author: aranyostibi@gmail.com*

Soil constitutes the basic natural resources and one of the most important national treasures. Protection of soil and conservation of its fertility is our common responsibility. In the region of Nyírség there are more than 400.000 hectares of sandy soils. On these soils the crops are hard to grow due to their low fertility and low water retention as determined by the shortage of mineral and organic colloids. The application of organic amendments such as compost is recommended as an effective tool to ameliorate soil structure and fertility. Sewage sludge is the by-product of the wastewater treatment, which is -due to its high organic matter content - a potentially usable material for improving the unfavourable physical properties of sandy soils. The objective of our research was to evaluate the effects of the sewage sludge compost application on the bulk density and air permeability of soil. The soil type of the experiment was Arenosol (Dystric Lamellic Arenosol). The compost contained sewage sludge of 40%, straw of 25%, bentonite of 5% and rhyolite of 30% and was applied in 0, 9, 18 and 27 t ha⁻¹ doses. For measurements undisturbed soil samples of about 100 cm³ in volume were collected from the soil layer of 20-25 cm. According to the results, the soil compaction decreased and the air permeability of soil significantly increased in the first year after compost treatment. However, in the second and third years the beneficial effects of compost application were observed only in the high compost dose treatments because of the rapid mineralization processes.



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



14-YEAR-LONG APPLICATION OF A SEWAGE SLUDGE COMPOST: CHANGES IN SOIL CHEMICAL PROPERTIES AND IN CROP YIELD

Attila Tomócsik¹, József Tibor Aranyos², Viktória Orosz², György Füleky³, József Mészáros⁴,
Marianna Makádi²

¹Research Institutes of Nyíregyháza, University of Debrecen,
Westsik Vilmos u. 4-6., H-4400 Nyíregyháza, Hungary,
Environmental Sciences PhD School, Szent István University, Páter Károly u. 1. H-2100 Gödöllő,
Hungary

²Research Institutes of Nyíregyháza, University of Debrecen,
Westsik Vilmos u. 4-6., H-4400 Nyíregyháza, Hungary

³Department of Soil Science and Agricultural Chemistry, Szent István University, Páter Károly u. 1.
H-2100 Gödöllő, Hungary

⁴Nyírségvíz Closed Shareholder Group, Tó u. 5., H-4400 Nyíregyháza, Hungary
Corresponding author: tomocsik@agr.unideb.hu

A properly treated (stabilized and composted) sludge can be reused in the agriculture. It can provide the necessary nitrogen and phosphorus for the plants through providing valuable nutrients via decomposing the organic matter of compost. In this way, a significant quantity of artificial fertilizer could be replaced in the agriculture. Application of sewage sludge compost in agriculture is very difficult because of the possible high toxic elements content of sludges and the stringent laws of sludge compost utilization.

Sandy soils are poor in organic and mineral colloids and therefore have low fertility. Long-term use of organic fertilizers could improve the above listed problems. For this purpose we use composted sewage sludge in our experiment established in spring, 2003 at the Research Institute of Nyíregyháza, University of Debrecen, in the city of Nyíregyháza, located at NE part of Hungary. Plots were re-treated in 2006, 2009, 2012 and 2015. The compost was applied at 9, 18, 27 t ha⁻¹ doses and ploughed into the soil before sowing. The experimental design is randomized block in five replicates. The test plants are triticale (x *Triticosecale* X *Wittmack*), maize (*Zea mays* L.) and green pea (*Pisum sativum* L.) in a small-plot experiment. Some chemical properties of the soil and the yield of crops were measured. Experimental results showed that composted sewage sludge application produced positive effects on the chemical properties of the soil, such as the increase of pH, humus content and in some cases the magnesium content. Compost treatment had beneficial effect on test plants, the increase of crop yield were found. The results of this research demonstrated that the composted sewage sludge could be used efficiently in crop production.



SUPPORTED BY THE ÚNKP-17-3 NEW NATIONAL EXCELLENCE PROGRAM OF THE MINISTRY OF HUMAN CAPACITIES



LOTEx 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



ROLE OF THE WESTSIK FIELD TRIAL IN GREENING

Veronika Tótok

*University of Debrecen, Institutes of Agricultural Research and Educational Farm, Research
Institute of Nyíregyháza, 4400 Nyíregyháza, Westsik Vilmos Str. 4-6.
Corresponding author: totokveronika@gmail.com*

For the sake of environmentally aware land use, since 2014 the European Union has been directly and indirectly intervening in agricultural production as a regulator. Within this framework, the new EU Member States including Hungary will also have to meet the requirements of the new regulations within the new programming period (2014-2020). Greening is currently a commonly used term by farmers, which is for most of them known to be a set of agricultural practices that are favourable to climate and environment. It includes the maintenance of permanent grassland, crop diversification and ecologically significant areas.

Westsik's long-term field experiment has been introducing the practical utilisation methods of unfavourable sandy soil for 90 years in an unchanged manner. Its purpose is to examine the various possibilities of nutrient supply in the course of which different fertilization methods are used in rye, potato, lupine and vetch cultures. Evaluation of long time series gives an opportunity to examine the efficiency of the cultivation of plants involved in greening and their utilization as green manure. In our analyses, we investigate the effect of crop rotations which are relevant for greening on soil properties, which indirectly affects the strategic and economic efficiency of greening. Analysing of soil resistance values allows the complex examination of the effect of greening on the cost of cultivation. Soil resistance data indirectly determines the economic impact of the effects of change in traction demand, the quantification of the extent of soil compaction, and their effects. In the Westsik's crop rotation experiment, these efficiency indicators can be determined by both the main leguminous crop and the greening component used as green manure. Due to the nature of crop rotation, effectiveness of the combined effects of different nutrient supply and greening methods can be carried out.



LOTEx 2017

**INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY**



**SPATIAL DECISION SUPPORT FOR CROP STRUCTURE
ADJUSTMENT – A CASE STUDY FOR SELECTION OF POTENTIAL
AREAS FOR SORGHUM (*SORGHUM BICOLOR (L.) MOENCH*)
PRODUCTION**

János Jóvér, Elza Kovács, Péter Riczu, János Tamás, Lajos Blaskó
University of Debrecen, Faculty of Agricultural, Food Sciences and Environmental Management,
Institute of Water and Environmental Management, Böszörményi 138, Debrecen, H-4032,
Corresponding author: jover@agr.unideb.hu

An option for climate change adaptation is to widen the assortment of plant species. Sorghum (*Sorghum bicolor (L.) Moench*) is known to tolerate unfavourable environmental conditions, thus, it is reasonable to select preferable areas where extreme conditions still may make its production feasible, replacing other species such as maize. Nowadays, spatial decision supporting systems support primarily the crop production process rather than crop structure adjustment. In this study, potential production sites in the Great Hungarian Plain for sorghum were selected based on soil characteristics including genetic soil type, parent material, physical soil type, clay composition, water management, pH, organic material content, top soil thickness, and fertility; as well as climatic data, particularly precipitation. Extremes were selected for all parameters where maize is more sensitive than sorghum that still may have acceptable yield. Combining map layers of soil characteristics, it can be concluded that soil demand of sorghum is satisfied in the area of 40% of the Great Hungarian Plain; however, maize as a competitive crop is the economically preferable one. On the other hand, 1.63% of this area is still adequate for sorghum where maize would suffer from the unfavourable soil conditions. When precipitation demand of sorghum is evaluated, May is the critical period; precipitation required for germination was recorded only once in the period of 1991-2010 for 700,000 ha, thus, these particular sites are definitely not the target ones for sorghum. As a consequence, to give an alternative crop rotation adjustment planting sorghum competitive with maize, combination of soil and climate conditions and demands should be assessed, since lack of precipitation in the considerable periods significantly decreases the area where maize production cannot be effective, while sorghum still provides a reasonable yield, even though it is a drought resistant species.



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



Poster session II.

LONG-TERM EFFECT OF DIFFERENT TILLAGE METHODS ON PHYSICAL PROPERTIES OF HEAVY SOILS

Dana Kotorová, Ladislav Kováč, Jana Jakubová, Pavol Balla

NPPC – Agroecology Research Institute, Špitálska 1273, 071 01 Michalovce, Slovak Republic,

Corresponding author: kotorova@minet.sk

Between 2006 and 2015 years impact of different tillage of heavy clay loamy Gleyic Fluvisol were studied. Experiments were carried out at Experimental workplace in Milhostov, in central part of the East Slovak Lowland. Conventional tillage, reduce tillage and no-tillage practises were examined. Soil samples were taken from topsoil in natural conditions without irrigation. Bulk density, total porosity and maximum capillary water capacity were analysed by known methods. Linear trend analysis was used for testing of long-term application of different soil tillage in relation to soil properties. Bulk density was in range of 1,331 – 1,623 kg m⁻³, the lowest average value (1,466 kg m⁻³) was found for reduced tillage. Total porosity was similar to bulk density and its values in average were 38.12 – 49.26%, higher values were at conventional and reduced tillage and lower at no-tillage practise. Maximum capillary water capacity values were in range of 31.65 – 42.03% and reached the level of values typical for heavy soils on the East Slovak Lowland. The trend analysis of 10-year time series indicates decreasing of bulk density at conventional and reduced tillage variants, but it was increased in no-tillage variant. The changes of the total porosity were the opposite of the bulk density. Mainly for no-tillage variant, the decreasing trend of total porosity influence the possibility of air and water regimes changes for clay-loamy soil, which may result in a reduction of the transport function of soil. Changes of maximum capillary water capacity, during observed period, was not significant. Application of soil protective technologies for heavy soils as integrated system, in long-time horizon do not cause deterioration of basic soil physical parameters.

Acknowledgements: This work was supported by the Slovak Research and Development Agency under the contract N. APVV-15-0489.



LOTEx 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



THE ECONOMIC OF MILLET CULTIVATION ON HEAVY SOILS

Ladislav Kováč, Dana Kotorová, Jana Jakubová, Pavol Balla

NPPC – Agroecology Research Institute, Špitálska 1273, 071 01 Michalovce, Slovak Republic,

Corresponding author: kovac@minet.sk

NPPC – Agroecology Research Institute has Experimental workplace in Milhostov, where between years 2013 and 2015 the field treatment with millet variety Biserka was carried out. Two soil tillage technologies (conventional and reduced tillage) and two fertilization variants (control and soil conditioner PRP SOL) were examined. The economic effectiveness of individual variant of millet growing was valued. In experimental years 2013 – 2015 the highest costs (more than 560 € ha⁻¹) were determined for conventional tillage at variant with soil conditioner PRP SOL. The lowest costs, 330 € ha⁻¹, was on control variant without fertilization at reduced tillage. In year 2013 the highest production was ascertained at reduced tillage for variant with PRP sol conditioner (992 € ha⁻¹), gain was 507.09 € ha⁻¹. Despite of lower production per hectare the reduced tillage variant without fertilization was more gain (541.62 € ha⁻¹), profitability per hectare was 163.94 %. In year 2014 higher gain was reached for conventional tillage variants in compare with variants of reduce tillage. More profitable were control variants without fertilization. The highest profit (677.32 € ha⁻¹) was reached in the control variant with conventional tillage. The total production in 2015 from all variants was lower than in 2014. All variants were profitable, with higher gains of control no-fertilized variants. The lowest profit (157.41 € ha⁻¹) was determined for variant with conventional tillage and PRP SOL application. From point of view of experimental year the lowest gains were achieved in 2015. It connected with lower yield in this year and also with unfavourable course of weather factors. The highest profitability was determined for no-fertilized control variants under reduced tillage. Lower gains from variants with application of PRP SOL soil conditioner compensate in next years, when will be exert impact of this conditioner will occur on soil environment and on consecutive crops.



PRODUCTIVITY OF MAIZE IN THREE-FACTOR MONOCULTURE LONG-TERM EXPERIMENT SET UP IN MARTONVÁSÁR

*Tamás Árendás, Péter Bónis, Eszter Sugár, Györgyi Micskei,
Csaba L. Marton, Zoltán Berzsenyi, Nándor Fodor*

*Agricultural Institute, Centre for Agricultural Research, Hungarian Academy of Sciences,
Martonvásár, Brunszvik 2, 2462 Hungary*

Corresponding author: arendas.tamas@agrar.mta.hu

The one-, two-, three- and poly-factor small-plot field experiments to examine the effects of major factors influencing maize production (nutrition, genotype, crop rotation, cultivation, plant density, herbicides, sowing date, etc.) were set up in the late 1950's in Martonvásár. The most recent one (started in 1981) of the ongoing 15 long-term experiments was designed by Béla Györffy and updated by Zoltán Berzsenyi to analyse the effects of nutrient levels (5 doses of nitrogen), sowing time (4 dates) and genotype (5 hybrids), and also the interactions thereof.

According to nitrogen reaction characterised by second degree polynomial functions ($y = -0.0001x^2 + 0.0344x + 6.2944$; $r=0.9793^{**}$), the maximum yield on chernozem soil with forest residues was 9,085 kg ha⁻¹ in the average of 15 years (2001-2015) and of sowing dates, which required an estimated nitrogen fertilizer amount of 162.4 kg ha⁻¹.

Considering the effect of sowing time, productivity was the highest with the sowing date of 22 April (8,541 kg ha⁻¹). Grain yield was 8,350 kg ha⁻¹ in plots sown 10 days earlier, and 8,068 kg ha⁻¹ in plots sown 10 days later. The largest decrease in yield (-968 kg ha⁻¹) as compared to the optimum was observed for the latest sowing date (13 May). As regards the frequency of maximum values, early sowing (A) and late sowing (C) performed best in 2 years each, while very late sowing (D) in one occasion, consequently, sowing at the beginning of the second decade of April proved to have the highest positive effect in two-thirds (10 occasions) of the years examined. The amount of nitrogen fertilizer required for maximum yields reduced with later sowing (A: 177 kg ha⁻¹ → D: 155 kg ha⁻¹). The effect of genotype as a production factor is demonstrated by the correlation found between the number of days to maturity, productivity and optimum sowing date of the hybrids examined (FAO 310: 13 April, 8,161 kg ha⁻¹; FAO 380: 18 April, 8,286 kg ha⁻¹; FAO 470: 19 April, 9,198 kg ha⁻¹).



LOTEx 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



EFFECT OF NITROGEN FERTILIZATION ON THE YIELD AND GROWTH OF WINTER WHEAT VARIETIES

Eszter Sugár, Tamás Árendás, Péter Bónis, Zoltán Berzsenyi

*Agricultural Institute, Centre for Agricultural Research, Hungarian Academy of Sciences,
Martonvásár, Brunszvik 2, 2462 Hungary*

Corresponding author: sugar.eszter@agrar.mta.hu

The choice of cultivar is very important in sustainable wheat production. The methods of the growth analysis make it possible to compare the growth dynamics of different cultivars. The effect of N fertilization on the yield, yield components and the growth parameters of winter wheat cultivars was investigated in a long-term experiment in Hungary between 2006/2007 and 2008/2009. In the two-factorial, split-plot experiment, the main plot was nitrogen (N) treatment (0, 80, 160 and 240 kg ha⁻¹) and the sub-plot was three Martonvásár genotypes with different maturity dates (extra early Mv Toborzó, early Mv Palotás and mid-early Mv Verbunkos). The seasonal dynamics and the mean and maximum values of the growth parameters were determined using the functional methods of growth analysis for individual plants and for the plant stand. Maximal grain yield was reached at 80 and 160 kg ha⁻¹ N treatments. The values of growth rate parameters increased up to the N₁₆₀ treatment. A substantial year effect was observed for the yield and yield components. The use of the Hunt-Parsons (HP) program made it possible to characterise the dynamics of dry matter production and leaf area of winter wheat throughout the vegetation period. The diverse maturity dates of the cultivars were clearly reflected in the seasonal dynamics of leaf area and dry matter production and in the dynamics of the growth parameters. The stepwise method of multiple regression analysis demonstrated the significant effect of growth rates and yield components on the yield, with the greatest influence of grain number, crop growth rate (CGR_{mean}) and leaf area index (LAI_{max}). The results showed that understanding the growth of plants is important for optimizing management decisions.



LOTEX 2017

**INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY**



STUDY OF YELLOW RUST INFECTION ON VARIOUS WINTER WHEAT GENOTYPES

László Kiss¹, László Zsombik², Szilvia Veres¹

¹Department of Agricultural Botany, Crop Physiology and Biotechnology, Institute of Crop Sciences,
University of Debrecen, Böszörményi Str. 138, Debrecen, Hungary

²Research Institute of Nyíregyháza, Institutes for Agricultural Research and Educational Farm,
University of Debrecen, Westsik Vilmos Str. 4-6, Nyíregyháza, Hungary

Corresponding author: szveres@agr.unideb.hu

With regard to the production area of winter wheat, some plant pathological problems during the vegetation, in parallel with weather conditions that favour the infection of given pathogens and plant susceptibility enhanced by nitrogen supply have become more and more significant. The right timing of nitrogen supply in winter wheat production is of high importance, because plants can utilize the applied nitrogen amount in the early development stage, but at the same time their resistance against leaf diseases decreases. Furthermore yellow rust may lead to significant yield loss, especially in case flag leaf and husks are infected in the milk kernel development stage.

In the present two-year study differences in the susceptibility of 9 winter wheat genotypes against yellow rust (*Puccinia striiformis* var. *striiformis*) infection was studied on various nitrogen-supply levels. The small plot experiment was carried out based on a factorial experiment with randomized completely blocks design with four replications at the Research Institute of Nyíregyháza. Symptoms were analysed by a microscope before screening and according to the obtained results sensory identification was made. Yellow rust infection rate was detected according to the Cobb-scale and expressed as the percent rate of the total leaf area.

According to our results nitrogen supply treatments did not affect the frequency of yellow rust infection or the extent of leaf infection area significantly. Yellow rust infection proved to be less frequent in case of the genotypes Hystar, Mv. Csárdás, Mv. Magdaléna than in case of genotypes HK1307, 1304KV, Antonius or Hywin. GK Csillag showed the highest susceptibility towards yellow rust pathogen among the studied genotypes.

Hereby we would like to express our acknowledgements for the support of 'Breeding of adaptive winter wheat strains with excellent milling parameters' (AGR_Piac_13-1-2013-0002) project.



LOTEX 2017

INTERNATIONAL CONFERENCE ON LONG-TERM FIELD EXPERIMENTS
27-28. SEPTEMBER, 2017. NYÍREGYHÁZA, HUNGARY



EFFECT OF CLIMATIC FACTORS ON YIELD OF MAIZE IN LONG-TERM FERTILIZATION EXPERIMENT

Ildikó Bélteki, Szilárd Tóth, Sándor Holló, Andrea Ambrus

Eszterházy Károly University, Károly Róbert Campus, 3200 Gyöngyös Mátrai u. 36

Corresponding author: belteki.ildiko@uni-eszterhazy.hu

The yield of field crops has not increased significantly in last decades in Hungary in contrast with surrounding countries, which is also illustrative of maize-growing. The effect of climate change can be seen through the varying yields and decrease of the yield-safety. One of the goals of the long term fertilization experiment set in Kompolt between 1963-1999, was to determine the amount of fertilizer with optimal content and active substance, which fertilizer level can give the most beneficial yield in different crop years. In our study we analysed data obtained in 1981 (droughty), 1985 (rainy), 1988 (optimal), 1991 (optimal), 1994 (droughty) years. Regarding the maize 10 types of nutrient treatments with various contents and rates were carried out. The experiment was set up in five replications with Latin block arrangement on 56 m² gross plots.

According to our results in optimal crop years of the maize double yield-difference can be seen in connection with the precipitation-circumstances of the experimental year. In the examined 5 years of experiment NPK treatment gave the highest yield (7.99 t ha⁻¹), it was followed by the NK treatment (7.93 t ha⁻¹), and the N2PK (7.80 t ha⁻¹). Based on our results we determined that in the agro-ecological conditions of Kompolt the larger amounts of N (N2PK treatment) and P (NP2K treatment) fertilizers were not productive of higher yield in favourable rainy years yet, so their applying are unnecessary. The PK treatment gave the lowest amount of yield (6.48 t ha⁻¹) followed by the P treatment (6.49 t ha⁻¹), the control plots (6.70 t ha⁻¹) and the K treatment (6.75 t ha⁻¹). The effect of P, NP and the K fertilization treatments were not verified in the yield comparing to the control treatment.

The publication was supported by the EFOP 3-6-1-16-2016-00001 „Kutatás kapacitások és szolgáltatások komplex fejlesztése az Eszterházy Károly Egyetemen” project.