[Plenary session]

[CHAIRMEN]

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Agrotechnical measures for reducing the risk of extreme soil moisture events

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Abstract

The most important elements of sustainable development in the Carpathian Basin are the rational use and conservation of soil and water resources, maintaining their favourable "quality" and desirable multifunctionality. In spite of the fact that agro-ecological conditions are generally favourable for multipurpose rainfed biomass production and soil is the largest **potential** natural water reservoir, the risk, probability, frequency, duration and "seriousness" of **extreme moisture events** (flood, waterlogging, over-moistening or drought) are increasing and they often happen in the same year at the same place. The two main reasons of this contradiction are the limitations of water infiltration to the soil and the storage of infiltrated water in plant available form. Consequently, the main goal of an efficient **soil moisture control** is: to help infiltration and useful storage of water in the soil profile; the establishment or maintenance of good agronomic soil structure, prevention or reduction of soil compaction with **site-specific** tillage operations; adequate land use and cropping pattern; recycling of plant residues; increasing of S.O.M. These measures reduce the risk and decrease the unfavourable consequences of extreme hydrological/soil moisture events.

Keywords: risks, waterlogging hazard, drought sensitivity, hydrophysical properties of soils, soil moisture control

Step-by-step adoption of environmentally-sound soil tillage in three Central European countries

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Abstract

In the last centuries, the need for tillage was to provide suitable soil conditions for plant growth (crop-focusing tillage). During the last decades, traditional goals of soil tillage have really been improved considering environmental consequences (environment-focusing tillage). In the next decade a new task is stressed, that is mitigating the climate induced losses (climate-focusing tillage). New challenges for the future is to reduce climate induced damages by the use of environmentally-sound adaptable tillage. The relationship between soil quality factors and climate effects have been studied in parallel in Croatia, in Czech Republic and in Hungary in long term tillage experiments and by field monitoring.

In the environmentally-sound tillage challenge ten important steps are suggested for this region, namely: 1) Awareness of the state of the soil to draw conclusions concerning the likely damage. 2) Preventing the development of compact layers impeding water transport. 3) Eliminating the compact layer in the soil with the aid of a suitable tillage technique. 4) Creating small surface at any time of the season, without compaction stress. 5) Covering the surface with crushed stubble residues to protect soil and moisture. 6) Preserving the soil organic C is crucial at any type of tillage. 7) Protecting the soil structure. 8) Adapting the primary tillage to the soil state improvement. 9) Causing smaller stress in over wet or dry soils. 10) Maintaining the soil's capacity to take in and to store water in irrigated soils.

Keywords: environment, conservation, tillage, water, stubble residues, carbon

Framework of climate change - and soil type - oriented tillage and land management in Croatia

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> All ethic rests upon a single premise that individual is a member of a community of interdependent parts. We are member of the land community. Therefore: we need to exercise the same constraints on our relations to the other members of the land community - soils, waters, plants and animals - as we do in our relations to people…. The oldest task in human history is to live on a piece of land without spoiling.
>
> *Leopold, A., 1991.*

Abstract

For a long time in the past research of soil tillage was one-side, exclusive soil biomass production (crop yield) – oriented, and generally not holistic but specialized, which means collecting more and more knowledge about less and less. Environmental problems, especially climate change and soil degradation as doubtless interconnected emergences are driving forces for re-orientation to respect the other, non-productive soil functions; soil as reactor, transformer and integrator of material and energy from other resources, storage, filter and buffer system, gen reservoir and medium of past and present human activities. Premise of soil tillage as component of (crop) land management will be to understand and improve efficiency of internal recycling and storage of water, carbon and plant nutrients. Creating of framework for soil-type- and climate change-oriented soil tillage, we take in account the forthcoming accession of Croatia to EU, acceptance of CAP as European model of agriculture which is at the same time market oriented, environment friendly, multifunctional and respond to all the demands which society places upon it. There are the three main policy instruments for establishment and practical realization of proposed system on farm level; mandatory measures, (EU directives and national legislation), incentive-based measures, awareness raising and possible private initiatives. Extremely important role in implementation all changes would have Croatian Agricultural Advisory Service (CAAS) in partnership relation with research institutions and Croatian Agricultural Chamber (CAC). It is necessary to clear define of set of minimum standards for to keep the land in Good Agricultural and Environmental Condition (GAES) as precondition for an efficient use of cross compliance for incentives in agriculture.

Keywords: soil-type-oriented tillage, enhancement SOC management policy, SOCSI

Status and perspectives of soil tillage in South-East Europe

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"Application of reduced / conservation soil tillage will make a good farmer is better, and the poor even poorer".

Abstract

Conservation or reduced soil tillage in different European Countries are mainly specific. This specific arise from different ecological conditions and from possibilities of acceptance a new scientific approaches and technological innovation, and partially of course from different conceptions in soil tillage approaches. However, in most countries conservation tillage are not accepted in proportions which are expected according their natural conditions and possibilities. It should not be forgotten subjective difficulties that require a higher level of education and greater sense of scientific approach to conservation tillage. The aim of this study was to determine the state of soil tillage in Croatia, Hungary and Serbia, and to determine the development prospects of conservation / reduced tillage systems.

Keywords: Soil tillage, Croatia, Hungary, Serbia, South-East Europe

[Session:]

[1. Soil tillage in function of environmental protection]
[2. Soil biotic and abiotic degradations – causes and consequences]

[CHAIRMEN]
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Soil tillage and crop management and their impact on sustainability and soil physical characteristics

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Abstract

There is the strong decline of mouldboard ploughing during transition period from 90% to 60% of arable land in Slovakia due to economic, marketing and environmental reasons. For adoption of environmental sound tillage systems the research and dissemination is needed. The aim of research was to evaluate the influence of conventional and reduced tillage, FYM and residue management on soil bulk density (SBD) and porosity. The field trial was carried out over the period 2004-2006 at the experimental farm PD Kalná nad Hronom in south-western Slovakia. The sugar beet-spring barley-sunflower crop sequence was evaluated. The soil tillage treatments as follows: T1 conventional mould board ploughing with farm yard manure (FYM) application to sugar beet and incorporation of aboveground biomass of growing crops; T2 conventional mould board ploughing without organic fertilization; T3 no-till Horsch CONCORD CO 9. During June the soil samples were taken from 0.05-0.10m, 0.1-0.20m, 0.2-0.3m. The SBD and total porosity was highly significantly influenced by growing crops and weather conditions of evaluated years and SBD was also significantly influenced by tillage system. The positive effect of FYM on total porosity was noted in 2004 during sugar beet phase which is in relationship with SBD 1.266 t m^3-1.279 t m^3 in topsoil layers 0.5-0.20m. In subsequent evaluated years 2005-2006 the topsoil layers 0.5-0.20 m were more compacted with comparison to 2004 after first year of FYM application. In three year average, the conventional mould board ploughing with farm yard manure and incorporation of aboveground biomass form the most suitable soil environment (SBD 1.395 m^3, total porosity 43.65%) but we also recommended the no-till (SBD 1.455 m^3, total porosity 42.31%) for Haplic Chernozems in this specific area of Slovak region.

Keywords: soil bulk density, straw management, tillage systems, total porosity

Effect of nitrogen fertilization under reduced soil tillage on chloroplast pigments concentration in leaves of winter wheat

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Abstract

The scope of this research was to determine concentration of chloroplast pigments in the winter wheat leaves influenced nitrogen fertilization under reduced soil tillage. The research for winter-wheat has been conducted at the Virovitica-Podravina County in 2008/2009 , with six different nitrogen rate (controla-0 kg N ha^{-1}, 30 kg N ha^{-1}, 60 kg N ha^{-1}, 90 kg N ha^{-1}, 120 kg N ha^{-1}, 150 kg N ha^{-1}, respectively) with following continuous soil tillage treatments: CT – conventional soil tillage, based on mouldboard ploughing; DH – multiple pass diskharrowing; and NT – No-tillage. The chloroplast pigments have been measured in stem extension (after Feekes: 6.0). This research showed that chlorophylls are very sensitive to changes in nitrogen content: concentration of chlorophyll a, chlorophyll b, chlorophyll (a+b) and carotenoids increased with higher fertilization rate. Tillage did not significantly effect on concentration of chloroplast pigments.

Keywords: soil tillage, nitrogen fertilization, chloroplast pigments

Soil tillage as the key issue in soil preservation under actual and altered climatic conditions

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Abstract

Changes in climatic conditions in both possible directions - increase or decrease of annual precipitation and mean annual temperature, will actualize the issue of soil conservation by tillage. I order to estimate the effect of the current climatic conditions, soil loss was measured on Stagnic Luvisol of sloping terrain in the Daruvar area in six different tillage treatments and the following crop rotation: maize – soybean - winter wheat - oilseed rape – double crop (barley + soybean). The highest erosion in the 15-year period was recorded in the control treatment. Following was the treatment that involved ploughing and sowing up and down the slope. Lower soil losses were recorded in no-tillage treatments and treatments with ploughing and sowing across the slope. Higher soil losses were recorded in spring row crops growing (Maize and Soybean) than in winter crops (Wheat and Oilseed rape). In the current climatic conditions an average loss of 0.45 cm of the plough layer was recorded in the control treatment, which means that the entire plough layer be completely eroded away in a period of 57 years. In ploughing and sowing up and down the slope treatment average soil loss was 0.08 cm and plough layer would be completely eroded away in a period of approximately 300 years. In all other treatments which we recommend for the area of Stagnic Luvisol the soil could be preserved for the next several thousands of years. The primary goal of this investigation was to define the amount of soil that would be eroded under different tillage treatments in altered climatic conditions.

Keywords: soil tillage, soil loss, climatic change

Soil organic carbon accrual in aggregates of arable soil in wheat based cropping systems

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Abstract

In order to investigate effects of cropping technology on content of soil organic carbon (SOC) and distribution of particle size fractions of soil, different cropping systems of winter wheat were analyzed. Arable soil samples were collected from the long-term experiments carried out at the Rimski Sancevi experimental station, Novi Sad. Soils from nine different cropping systems were analyzed and adjacent land (control) in depths: 0-20, 20-40 and 40-60cm. Particle size fractions (<2000 μm, 2000-250 μm, 250-53 μm and < 53 μm) were obtained by dispersion in water with series of sieves. Organic carbon content was determined by CHNS analyzer. Differences in SOC content among treatments were associated with the below-ground biomass quantity of crops in rotation and fertilization. The results indicate that the addition of manure without crop residue was not sufficient for soil structure preservation. The content of aggregates among fertilized treatments, in 0-20 and 20-40 cm soil layer showed similar distribution, whereas 40-60 cm depth have had higher proportion of the macroaggregates as clay fraction predominates. SOC increase with increased particle size, accordingly, macroaggregates turnover was found to be important in the processes of soil organic matter stabilization.

Keywords: soil organic carbon, particle size fractions, cropping systems

Measures for increase of degraded soil biogenity

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Abstract

The intensive agricultural production comes to contamination and degradation of land, and urban land degradation activity was greatest in the mining surface. One of the main problems to be solved in the future is how to maintain, increase the level of organic matter in soil. Tracking biogenity of land as the first prerequisite of productive properties are used to certain physiological and systematic groups of microorganisms and enzyme activity. The aim of this study was to determine the types of fertilizers and technology of growing plants influenced the increase of soil elements biogenity. Research was conducted on soil type deposol. Fertilization was done with organic manure fertilizers, celuflorom, microbial fertilizer and mineral fertilizer as a control. Experiment was performed with sowing maize and sorghum as monocrops crop and in a joint with soya bean. It was found to increase the number of microorganisms using organic fertilizers, in a joint crop. Also within the larger crops biogenity was established in joint of maize and soybeans.

Keywords: soil, organic fertilizer, microorganisms, maize

Can we increase available nutrients using bacteria?

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Abstract

The intensive land use, including the artificial N-fertilizers in agriculture causes the acidification of soils due to the harvest or leaching of cations. Soil microbes are of great importance in cycling nutrients such as carbon, nitrogen, phosphorus and sulphur. Beside their effects on the availability of nutrients the bacterial soil life prevents the uptake of several harmful ions. The most important limiting factor for microbial growth in soil is the abundance of available organic carbon sources. To increase microbial activity in a soil one must make the environment optimal, or at least more favourable, in terms of aeration, moisture and pH, and above all provide the organic substrates needed to fuel the population. The main object of our study was to examine the impact of bio fertilizer Phylazonit MC® as the potential tool to reduce the risk of agricultural production.

Keywords: bio fertilizer, plant growth promoting bacteria, soil tillage

[Session:]

[3. Conservation tillage – direct seeding – no-tillage]
[4. Soil tillage – new approach – technologies – perspectives]

[CHAIRMEN]

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The impact of reduced tillage on the morphological and physiological parameters of soybean

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Abstract

The scope of this research was to determine impact of different soil tillage on the morphological parameters (number of branch, pod weight and stem length) and physiological parameters (chlorophyll a, chlorophyll b, chlorophyll a+b and carotenoids) of soybean. The research for soybean has been conducted at the North-eastern Croatia chernozem soil type during the period of 2001/2002–2002/2003, with following continuous soil tillage treatments: CT – conventional soil tillage, based on mouldboard ploughing; DH – multiple pass diskharrowing; and NT – no-tillage. The influence of Year was significant for the production of chlorophyll b and carotenoids, while the soil treatment had significant effect on the concentration of chlorophyll (a + b) and chlorophyll b. The interaction Year x Tillage proved to be significant only for concentration chlorophyll b and carotenoids. Agroclimatic conditions significantly affected all the morphological characteristics of soybean, while the effect of tillage was not statistically significant.

Keywords: reduced tillage, chloroplastic pigments, morphological parameters of soybean, yield

Numerical Approaches in Tillage and Soil Modelling

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Abstract

The discrete element method (DEM) seems to be a promising approach for constructing a highfidelity model to describe the soil–implement interaction. Discrete Element Models were built in correspondence with the field tests. In this paper we will introduce the methods of DEM approach was used in developing a modell for the prediction of draught force on cultivator sweeps. The mechanical behavior of soil is very complex, and depends on factors including confining pressure, density, and drainage condition. Conventional approach to explore the mechanical behavior of soil mainly relies on the experimental tests in laboratory. The implementation of the DEM is carried out by a series of numerical tests on granular assemblies with varying confining pressures. The results demonstrate that such numerical simulations can produce correct responses of the soil behavior in general, including the critical state response, as compared to experimental observations. In the second half of this paper we demonstrated the influences of cultivator sweep geometry was researched by the DEM and compared the results of soil bin tests to validate the sweep shares. And as the result of the methodology we can validate the optimal β angle of the sweep in a 2D model.

Keywords: Soil, Cultivator, DEM, Modeling, Tillage, Soil Bin, Forces, Optimization

Geostatistical model evaluation for soil tillage suitability on Osijek-Baranya County example

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Abstract

This paper presents a computer model to determine land suitability for soil tillage in eastern Croatian based on geostatistical analysis of soil data. As the basis and source of soil types data was used the Croatian soil suitability map in digital form from which used data of soil types and soil chemical analysis data from the interpretative database fertility control of Osijek-Baranja County, a total of 17 341 samples of soil. Presents the model evaluation arable land workability uses a 6 indicators benefits of which three were identified accurately (pH, humus and elevation), and the remaining three are based on Digital Soil Map of Croatian and pedosystemic units whose inherent properties are ranked relative to particular indicators of suitability for soil tillage. Computer simulation using the described models and kriging geostatistical method obtained results showed that 66% of agricultural land belongs to the class of limited suitability for soil tillage (P3), approximately 21% is moderate and very convenient (P2 and P1), and only ~13% belong to the temporary or permanently unsuitable for soil tillage.

Keywords: Geostatistical computer model, soil suitability, soil tillage, kriging

The yield and quality of bread wheat under different agronomic factors

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Abstract

Winter wheat is the most important crop in the Czech Republic. Regions with a less frequent occurrence of precipitation during the period of ripening are favourable for production of high quality bread wheat. However, a lack of water in earlier growth stages can be a limiting factor of yields. Different agronomic factors (forecrop, soil tillage, straw management) themselves or in action in interaction could influence the water management of crops in the course of growing season. The analysed data are coming from field trials which were established in South Moravia and years 2005 – 2008. Two field trials were established as model concept for farming with or without animal husbandry. The winter wheat was grown after four forecrops (winter wheat, safflower, silage maize and lucerne) and two methods of soil tillage (conventional and minimum tillage). The grain yield of wheat was affected by interaction of soil tillage and forecrop and year. Qualitative parameters for bread wheat were mainly influenced by year or in combination with the effect of forecrop, but the values of bulk density, falling number and Zeleny sedimentation test were in limits for bread wheat.

Keywords: soil tillage, crop rotation, bread wheat

The influence of soil tillage system at germination of buckwheat, millet and sudan grass sown as post-harvest summer crops

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Abstract

Research on the influence of the soil tillage systems (CT - moldboard ploughing, MD – multi discharrowing, SD - single discharrowing) on emergence of buckwheat (*Fagopyrum esculentum L.),* millet (*Panicum miliaceum L.*) and sudan grass (*Sorghum sudanense L.*) crops was done on eutric brown soil at site Široko Polje (Croatia) after winter barley (*Hordeum vulgare L.)* had been harvested in July 2009. The formation of soil surface crust after planting on treatments CT and MD significantly reduced the emergence of all three crops. The soil crust at the CT treatment showed the thickest (2.3 cm) and hardest to break (used crust breaking pressure was 1.9 MPa), the MD's crust was significantly thinner (0.9 cm) and easier to break (1.1 MPa), whereas, due to the large soil surface coverage by harvest residues (>80%), the crust was not even formed at SD treatment.

Keywords: buckwheat, millet, sudan grass, soil tillage, soil crust

Primary production at seed rice

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Abstract

One of the challenges crop protection specialists are trying to contribute is the development of the quality of rice seed (*Oryza sativa* L.). These techniques rely on examining the concentration on organic biomolecules (proteins, carbohydrates-total and soluble sugars and organic acids). Eleven pure lines of rice seed (0015, 0025, 0030, 0035, 0042, 0048, 0061, 0063, 0072, 0074 and 0084) were examined in order to show the valuable nutritional factors. Oxidative stability was confirmed by measuring the activity of oxidoreductase - catalase which has the highest effect in the samples 0015 and 0030.

Keywords: rice, organic biomolecules, oxidative stability

[Poster Session:]

[CHAIRMEN]

Ivica Kisić

Tamás Kornél

Effect of reduction of drought stress using supplementary irrigation of dry farming chickpea (*Cicer arietinum L.)* varieties

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Abstract

An experiment was carried out in 2007 to investigate the effects of different irrigation regimes, and chickpea cultivars on chickpea production in the Agricultural Research Station, college of Agriculture, Islamic Azad University, Kermanshah Branch .The experiment was split-plot in a randomized complete block design with three replications. Supplementary irrigation at three levels: control treatment (without irrigation),one time irrigation at 50%- flowering stage and one time at pod- filling stage, was allocated to main plots and the varieties (Arman, Hashem and ILC-482) was allotted to sub plots. A significant difference was observed between irrigation treatments in terms of plant height, number of axillary branches, distance to the first pod from soil surface, number of grain per plant, number of pod per plant, grain yield, biological yield, harvest index and100-grain weight; such a difference was observed between test varieties in terms of all trials rather than 100-grain weight. The grain yield mean was significantly higher for Arman than that of Hashem and for Hashem was significantly higher than that of ILC-482. Of course, there was no significant difference between Hashem and ILC-482 in terms of grain yield. The highest values of the number of grain per plant relate to Arman and of pod per plant pertained to Arman and Hashem, respectively. High rate of grain yield in irrigation treatment at pod- filling stage was associated with yield components, especially with the number of pod per plant and 100- grain weight. The grain yield was positively correlated with number of pod per plant ($r = 0.654^{**}$), number of grain per plant ($r = 0.902^{**}$) and 100 grain weight ($r = 0.707^{**}$). This research showed that grain formation and pod- filling stages is the most sensitive one to water-deficit, and under water limitation conditions, we can considerably increase grain yield at this stage by irrigation, especially for Arman.

Keywords: Chickpea, Supplementary irrigation, Drought stress, Grain yield, Yield components

Assessment of conservation tillage effect on Luvisol, loam soil, consequently on cereal production in the Central Bohemia

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Abstract

In fourteen-year field experiment on *Luvisol,* loam soil winter wheat, spring barley and pea (later white mustard) are grown in short crop rotation. The stands of these crops are established by classic, conventional technology, by reduced tillage with chopped straw incorporation and by direct drilling into no-tilled soil with no mulch or covered with mulch from chopped straw of previous crop. Grain yield trends of winter wheat were compared with trends of soil fertility indicators. Until 10-year duration of the experiment no significant yield differences among soil tillage treatment used were found. Approximately from the year 2005 grain production significant increase in conservation soil tillage variants was recorded in comparison with conventional check variant varying about average values. The change was conditioned by soil fertility increase in conservation tillage treatments. It was confirmed by trends of soil fertility indicators that they copied the trends of grain yields in the particular tillage treatments. The best production level was found in the minimum tillage treatment with chopped straw incorporated.

Keywords: conservation tillage, soil fertility, soil microbial activity, crop production

The role of non-chemical plant protection in conservation methods of winter wheat growing

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Abstract

In four-year field experiment (2006-2009) at Prague-Ruzyně site the use of different forms of biofungicide application in combination with different technologies of soil tillage for crop stand establishment were studied. Besides conventional soil cultivation, reduced tillage with chopped straw incorporated and direct drilling into no tilled soil covered with mulch were used. The preparations were applied as follows: Supresivit (*Trichoderma harzianum*), Polyversum (*Pythium oligandrum*) and Trianum P (other strain of *Trichoderma harzianum*). Effect of these preparations, homogenized both with seed (seed treatment before sowing as a dressing) and used as a mixture with mineral fertilizer ANL, on grain production and health state of winter wheat were evaluated. The results obtained showed favourable influence of biofungicides used not only on crop production but especially on health conditions of winter wheat in conservation tillage treatments, where the possibility of infection occurrence is higher comparing with classic technology.

Key words: conservation soil tillage, winter wheat, plant protection, biofungicides, fungi pathogens

Environmental aspect of nitrogen availability under subsoiling and mole drainage

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Abstract

The problem of compactness of heavy soils could be surpassed by mole drainage and subsoiling. The aim of this study was to investigate effects of mole drainage and subsoiling (treatment) on available nitrogen content in the soil profile, as well as, its uptake by maize and sunflower, on calcareous clay chernozem soil, in rainfed cropping during 2009. The total N output by plants, leaching and evaporation in control (without mole drainage and subsoiling) was higher by 15% in sunflower and by 43%, in maize. Moreover, N deprivation by leaching and evaporation during the growing season of sunflower was 338.13 kg N ha^{-1} in control and 287.37 kg N ha^{-1} in the treatment, while it was 475.03 kg N ha^{-1} in maize in control and 268.63 kg N ha^{-1} in treatment. The observed situation affected the plant growth during the growing season – biomass of both, sunflower and maize was higher, but the dry weight was lower in control. The N uptake by crops during the growing season was better in the treatment, resulting in the grain yield increase of 10% in maize and of 9% in sunflower.

Keywords: mole drainage and subsoiling, maize, sunflower, nitrogen regime, yield

The impact of different soil tillage on weed infestation in cereals and winter oilseed rape

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Abstract

Soil tillage is one of the important factors which influence weeds. Actual weed infestation was assessed on farm level in crop stand of spring barley, winter wheat and oilseed rape during three years. Minimum tillage increased occurrence of *Equisetum arvense*, *Avena fatua*, *Galium aparine*, *Poa annua* and *Veronica polita* in cereal crop stands, *Apera spica-venti* and *Fallopia convolvulus* in winter crops. In most cases these are species which are difficult to control and which are capable of producing seeds or fruit very quickly. In conclusion it can be said that the areas cultivated using the minimum tillage method show those species in particular which produce seeds and fruit very quickly. Furthermore, these are species which are relatively resistant to chemical control. The occurrence of perennial species of weeds is apparently affected more by the quality and purposefulness of instances of chemical control, which can overlap with the impact of the technology of soil tillage. In addition, it is necessary to realize that the method of soil tillage affects the weed species as merely one of many factors, and also the fact that these act as a multifunctional factor in conjunction with many other factors, which can overlap the impact technology of soil tillage.

Keywords: weeds, cereals, oilseed rape

Evaluation of soil tillage impacts on soil physical condition in different production sites in Hungary

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Abstract

The aim of the study is to evaluate soil tillage effects on soil physical condition in different production sites of Hungary. A multifactorial long-term tillage experiment was carried out on the Látókép Experimental Station of the Centre of Agricultural and Applied Economy Sciences, Debrecen University located in the eastern part of the Great Hungarian Plain (calcareous chernozem soil). Field experiments were carried out on meadow soil, on meadow chernozem soil, on chernozem meadow soil and on brown forest soil. The penetrometer resistance of the soil was measured on the investigate sites on the stubble-field following the harvesting of wheat and rape. Soil compaction caused by improper tillage was detectable in almost every sites involved in the analysis. As a result of tillage carried out on wet soil and in the same depth repeatedly (in multiple years) as well as the lack of deep tillage (deep loosening) 1-2 compacted layers have been formed in the analysed soil profiles. Soil compaction which developed at the investigated sites on the one hand the result of tillage on the other hand it is the result of trampling. It is hard to distinguish these two reasons of degradation, they often emerge together. By applying conventional tillage methods the intensity of factors causing soil degradation exceeded the speed of soil regeneration. Land users must support the regeneration of soil conditions – one of our most important natural resources – by choosing a tillage systems conforming to the soil conditions and reducing factors causing soil degradation.

Keywords: long-term tillage experiment, field experiment, tillage systems, penetration resistance, soil compaction

Influence of different soil tillage treatments on soil compaction and nodulation of soybean root

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Abstract

Stationary research of reduced soil tillage for soybean had been conducted on Northern Baranja chernozem soil type. Research had been conducted during two years (2003/2004 – 2004/2005), as completely randomized block design in four repetitions, with following soil tillage treatments: CT - Conventional tillage based on ploughing; DH - Diskharrowing; CwNs - Ploughing for winter wheat (odd years), in alternation with No-till for soybean as a proceeding crop (even years); and NT - No-tillage. Soil tillage resistance measurements for soybean crop were highest for DH (2.39 MPa) treatment. The anthropogenic compaction was recorded at 10-15 cm and 25-30 cm depths, but soil compaction values were not limiting for normal soybean crops development. Reduced tillage systems had positive trend on nitrogen-fixing bacteria nodulation, since the highest values of number and mass of nodules per plant were recorded. In two-year average period higher yields was recorded for treatments with lower reduction of soil tillage intensity, with following CwNs>CT>DH>NT order. This research was run during two average/wet years, so the research needs continuation.

Keywords: Reduced soil tillage, soil compaction, *Bradyrhizobium japonicum,* nodulation, soybean