
ISTRO
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Virginia Beach, VA
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Living Roots, Living Soil
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Abstract Proceedings for the:

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Welcome to the **official proceedings** for the 22nd International Soil Tillage Research Organisation (ISTRO) International Conference that was held in Virginia Beach, VA, USA! ISTRO promotes engagement among scientists working with and researching soil tillage, field traffic, and their relationship with soil, environment, land use and crop production. This conference gave attendees the opportunity to meet with other scientists, to share research, and to stimulate new collaborations and ideas for the advancement of soil and crop production sciences.

ISTRO 2024's theme was "***Living Roots, Living Soil***" to focus on regenerative agriculture, soil health, cover crops, residue systems and sustainable crop production as a whole. We aimed to focus on how sustainable practices impact soils.

The conference took place in the United States' renowned and exciting east coast resort city of Virginia Beach, VA. Life there is good because of all the natural beauty that surrounds this resort town perfectly paired with a flourishing local culinary scene, rich history, a variety of arts and entertainment and family-friendly attractions that keeps locals and visitors entertained year-round.

We had 198 scientific abstracts presented that encompassed work from 512 authors and co-authors over our 5-day event. Representatives were registered from 35 countries around the world that represented more than 42 countries when considering attendees hailing from different homelands than their current affiliation (Fig. 1).

ISTRO2024 Local Organizing Committee

This event would not be possible without the work, expertise, and perseverance of the local organizing committee. The local organizing committee consisted of:

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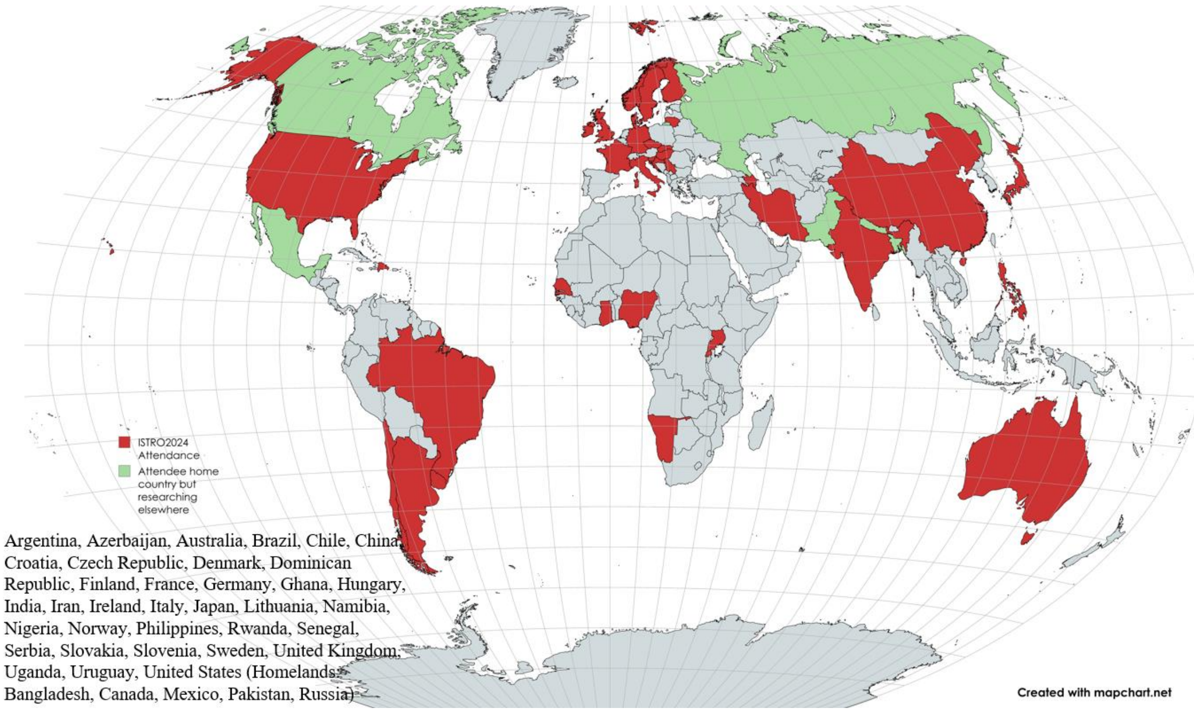

Figure 1. Registered ISTRO2024 countries (red) and attendees representing their homelands (green).

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Kang Xia , Mary Burrows

144. - Keynote Speaker: Root, Soils, Environment, Ag Science, and Farms – How Can We Keep Them Alive?

Ole Wendroth

145. - Revolutionizing Sustainable Agriculture: A Convolutional Neural Network Model and Algorithm-Driven Prototype for Sustainable Tilling and Fertilizer Optimization

Sajeev Magesh

146. - Use of slug shingle refuge traps in no-till fields to establish treatment threshold and slug hatch prediction models in full-season soybeans in Virginia

Helene Doughty , Michael Crossley , Clark Robert

156. - The impact of biofumigation on non-targeted soil arthropods and subsequent host-mediated interactions with aboveground insects

Usha Panta , Arash Rashed

157. - Bed Architecture for Drip-Applied Soil Fumigation in Tomato Production

Emmanuel Torres , Josue Alarcon Mendoza , Lorena Lopez

158. - Application of Electromagnetic Conductivity Technology in Soil Management for Tropical Crops

Emmanuel Torres , Arturo Bisono

159. - Scalable Solutions for Global Agriculture: Integrating Artificial Intelligence and Natural Language Processing in Biosystems Engineering

Emmanuel Torres , Fernando Fuentes-Peñailillo

160. - Asian Jumping Worms and Soil Health: Microbial, Microarthropod, and Plant Impacts in Turf and Agriculture

Jordan Thompson , Tom Kuhar , Alejandro Del-Pozo , Ashley Jernigan

161. - Conserving the Future: Wildlife Refuges and the Next Generation

Nicole Walker

162. - The Nature Conservancy’s Activities within the Virginia Coast Reserve

Susan Bates

163. - The Economics of nutrient cycling at Brandon Farms

Robert Waring , Joseph Haymaker , Mark Reiter

164. - Soil & Water Conservation Districts: What They Can Do for Farms Large or Small

Palmer Smith , Carmie Ross

165. - Conserving Soil for the Future: USDA-Natural Resources Conservation Services, Accomac Field Office

Jenny Templeton , Ben Young

166. - Virginia Department of Agriculture and Consumer Services

Ursula Deitch

167. - Field Tour 1: Eastern Shore of Virginia

Roy Flanagan ·, Ursula Deitch , Helene Doughty , Theresa Pittman , Mark Reiter

168. - Field Tour 2: Southeast Virginia

Roy Flanagan ·, Nathan Sedghi , Helene Doughty , Mark Reiter

169. - Unmanned Aerial Systems bring innovation to agriculture sector

Vijay Singh ·, Akashdeep Brar , Fatemeh Esmaeilbeiki , Rutvij Wamanse , Milos Viric , Robert Cooley , John Mason , Mark Reiter , Daniel Martin

170. - The Spirit of Norfolk Dinner Cruise

Mark Reiter ·, Helene Doughty

171. - Comparative Analysis of Unmanned Aerial Systems for Weed Control in Broccoli (Brassica oleracea var. italica)

Fatemeh Esmaeilbeiki ·, Akashdeep Brar , Rutvij Wamanse , Milos Viric , Vijay Singh

172. - Influence of different Cover Crops and their Termination Timings on Weed Suppression in Edamame (Glycine max) cultivars

Akashdeep Brar ·, Michael Flessner , Bo Zhang , Mark Reiter , Vijay Singh

173. - Confirmation of Multiple Herbicide Resistance in Italian ryegrass in Virginia

Milos Viric ·, Akashdeep Brar , Vipin Kumar , Michael Flessner , Vijay Singh

174. - Energy required for subsoiling long-term no-tillage soil and effect of compaction amelioration on sunflower yield

Magdalena Kaczorowska-Dolowy , Guido Botta ·, Diogenes Antille , Paula Misiewicz

175. - Utilizing cover crops to maximize ROI and achieve farm goals

W. Hunter Frame ·, Bright Ofori , Ryan Stewart , Mark Reiter

176. - Adaptive Subsurface Drip Irrigation Strategies for Enhancing Corn Yield in Eastern Virginia

Unius Arinaitwe ·, W. Hunter Frame

177. - Influence of Biochar-Herbicide Interactions on Weed Control Efficacy in sandy soil in Alabama

Nisith Nishank Purohit , Rakesh Kumar Ghosh , Yucheng Feng , Stephen Prior , Aniruddha Maity

178. - Assessing the Efficacy and Soil Safety of a Reduced Dose Tank-Mix of Pendimethalin and Pyroxasulfone

Nisith Nishank Purohit , Pervinder Kaur , Harshdeep Kaur , Makhan Singh Bhullar , Aniruddha Maity

179. - Effect of crop residues management on soil physio-chemical properties, macrofauna population and crop yield: An Overview

Elijah Aina Alhassan , Joshua Olaoye

180. - Overview of Virginia Cooperative Extension Programs in Virginia’s Top Agricultural Counties

Theresa Pittman

181. - Against the Current: A film focused on the Eastern Shore of Virginia life

Mark Reiter , Theresa Pittman , Helene Doughty

CHARACTERIZATION OF BIOCHAR PELLETS USING DIFFERENT FEEDSTOCK

Arthur Libang Fajardo [1*^]

Submission Type:
Oral presentation

Sub-topics:
Cover crops and residue additions

Abstract Summary :
Agricultural wastes such as rice hull, rice straw, coconut husk and coconut shell are commonly used as biochar. Once the biochar is in the soil, it has an ability to retain nutrients and moisture due to its porous structure. However, it is recommended to convert the biochar into pellets to prevent varied handling and application concerns. Three (3) different feedstocks were used in the study, namely: carbonized rice hull (CRH), carbonized coconut shell (CCS), and carbonized wood chips (CWC). Cassava paste was utilized as the binder in levels of 10%, 15%, and 20%, respectively. The pellets produced in the study were 13 mm long with a range of 6.60 to 7.79% moisture content. Particle and bulk densities were highest with CRH at 764.22 and 343.67 kg-m3, respectively. The hardness and durability were highest with CWC with 1272.75 Pa and 87.48%, respectively. The highest actual capacity was observed with the CRH at 678.22 kg/day. An analysis of variance showed that the mean machine efficiency of 65.59% is independent of feedstock type and binder level. On the other hand, the binder level had a significant effect on the pelleting recovery with the highest recovery of 98.47%. CCS and CWC could hold water up to 101 to 104% of its weight and could resist up to 1189 to 1273 Pa of pressure. The study recommends the testing of pellets with other feedstock materials and other binder type and formulations.

Arthur Libang Fajardo [1*^], UNIVERSITY OF THE PHILIPPINES, Professor

Session Details:

CHARACTERIZATION OF BIOCHAR PELLETS USING DIFFERENT FEEDSTOCK, Cape Henry C, 24 Sep, 2024 02:00 PM

Row cleaner coulter disc performance effects on no-till pneumatic precision direct seeding machines

Metin Kaan Uyguntüzel [1 * ^]

Submission Type:
Poster presentation

Sub-topics:
Tillage implements and other equipment,
Conservation soil tillage

Abstract Summary :
Unnecessary and excessive tillage causes significant damage to agricultural lands. One of the most important problems in the no-till planting operation, which should be applied to avoid this damage, is that the seeding coulter of the planter can not sow at the desired planting depth by being sufficiently immersed in the soil. As the subject of this contribution, it is aimed to increase the sowing performance of the no-till planter by enabling the stubble cutter row cleaner discs, which should be located in front of the seeding coulter of the no-till planter, to be driven hydraulically and in an adjustable manner, to cut the soil covered with stubble more easily and to ensure that the planter's coulter is better sunk into the soil. Within the scope of the study, the effects of the row cleaner discs in two different profiles, "wide profile" (8 Waves) and "narrow profile (13 Waves), on the performance effect of the row cleaner disc's width have been investigated. In addition, with the designed rotation speed adjustable system, the effects of the speed of the cutter discs on the performance of the no-till planter were investigated by operating the disc at 65 – 130 – 180 rpm. The designed system has been applied to pneumatic no-till precise planter. Laboratory and field tests were carried out at the facilities of Ege University Faculity of Agriculture. It was observed that the best results in terms of plant development values were obtained as a result of the field trials are obtained by operating the narrow-formed row cleaner cutter disc at a speed of 130 rpm on the no-till pneumatic precise planter. It was observed that the worst results were obtained with the wide formed row cleaner cutter disc at a speed of 65 rpm on the no-till pneumatic precise planter. As a result, within the scope of this study, a hydraulically driven row cleaner system with adjustable working speed was designed, which could be applied to all pneumatic precise planters and could make all machines capable of no-till planting. The designed system has been successfully produced and applied and it has been seen that the applied system gives satisfactory results with very good performance. In addition, the comprehensive comparative data obtained as a result of this study, is expected to be a reference for researchers who will work on determining the performance criteria of no-till planters.

Metin Kaan Uyguntüzel [1 * ^], Turquagro Group, CEO

Session Details:

Poster Session (Tillage) Displayed, Atlantic Foyer, 23 Sep, 2024 08:00 AM

Fractionation of soil evaporative water losses using hydrogen and oxygen stable isotopes under different mulch covered soil-column

Mohamad Abdul Kader [1*^], Kimihito Nakamura [2], Yumi YOSHIOKA [3]

Submission Type:

Oral presentation

Sub-topics:

Soil physics/water movement

Abstract Summary :

Understanding soil evaporation is crucial for optimizing water management in agriculture, leading to improved ecohydrological modeling and increased crop yields. Soil mulching plays a water retention technology which help to reduce soil evaporation loss. However, the precise mechanisms controlling moisture exchange between topsoil and mulch, particularly vapor exchange, remain unclear. Stable isotope ratios in soil water reflect its phase changes due to equilibrium and kinetic effects which is a valuable tool to investigate the water mixing process under mulched soil. To understand the differences in isotope ratio and evaporation affected by different mulch, isotope-based non-destructive estimation quantifies the soil evaporation and vapor exchange processes. We investigated a soil-column experiment at Kyoto University, Japan to examine the soil evaporative water losses considering isotopic fluctuation (enrichment) processes using oxygen and hydrogen stable isotopes techniques under the three treatments of black plastic mulching (BPM), white plastic mulching (WPM) and no-mulching (NM). Results showed that mulching significantly reduced soil evaporation compared to the no-mulch. Daily evaporation rates were highest in bare soil (2.41 mm d^{-1}), followed by WPM (0.76 mm d^{-1}) and BPM (0.74 mm d^{-1}). The actual evaporation ratio (evaporation to irrigation) was also lower for plastic mulching (BPM: 23.1%, WPM: 23.7%) compared to bare soil (75.1%). Plastic mulching reduced soil water evaporation by 23% and increased soil water storage by 51% compared to bare soil. Furthermore, the heavier isotopes of $\delta^{18}O$ and $\delta^{2}H$ in soil water were less depleted in mulched soil profiles compared to bare soil at 0-60 cm depths, suggesting that mulching reduces evaporation due to water retention effect. The regression slope of $\delta^{18}O$ and $\delta^{2}H$ is lowered in condense water as compared to soil water under the mulching treatments which implies the greater evaporation effects by increasing vapor exchange between soil to plastic film interface. The isotopic estimation of evaporative loss fraction quantified the relative differences between the plastic mulch and bare soil which is higher under bare soil and lower in mulching treatments. Therefore, the stable isotope techniques could be an effective tool for estimating soil evaporation losses under different mulching methods.

Mohamad Abdul Kader [1*^], Kyoto University, Japan, Postdoctoral researcher

Kimihito Nakamura [2], Kyoto University, Japan, Professor

Yumi YOSHIOKA [3], Gifu University, Japan, Associate Professor

Session Details:

Fractionation of soil evaporative water losses using hydrogen and oxygen stable isotopes under different mulch covered soil-column, Mariner Room, 26 Sep, 2024 09:00 AM

Different methods of sample extraction and breakup for the Visual Evaluation of Soil Structure (VESS)

Vacilania Pacheco [1] , Esmailson Moreira Dos Santos [2] , Lucas Salcoski Rossoni [3] , Samienta Charles [4] , Craig David Rogers [5] , Cassio Antonio Tormena [6] , Rachel Muylaert Locks Guimaraes [7 * ^]

Submission Type:
Poster presentation

Sub-topics:
Methodologies for visual, chemical, and physical soil examination

Abstract Summary :

The visual evaluation of soil structure (VESS) method is efficient at distinguishing soil quality under different soil use and management. The method was developed for temperate soils and, although it has been used successfully in very clayey soils, obtaining undisturbed samples from these soils using the original spade extraction method can be difficult. The aim of this work was to test different methods of sample extraction, as well as more objective aggregate break up methods for soil quality (Sq) evaluation with VESS in very clayey tropical soils. The evaluations were carried out in three areas of very clayey Oxisol (77% clay, 17% silt and 6% sand). In each area ten samples were taken using each of the extraction methods: spade; spade + mallet; impact spade (a mallet is used to strike the crown of a bespoke handle); a long narrow bladed spade; pitchfork (12-tooth gravel pitchfork); chainsaw (adapted) and a spade attached to the bucket of a tractor. To test the aggregate break up methods, the following were tested: manual break up (standard method); aggregate break up by hitting the underside of the spade with a mallet, with the soil sample on top; and hitting the spade against the ground, with the soil sample on top, with 10 replications made at each of the three areas. The impact spade and the chainsaw methods were the easiest sample extractions to perform, however, the latter requires operator skill and the use of personal protective equipment. The spade coupled to the tractor caused compaction to the sides and the lower portion of the sample. The use of the spade + mallet caused dislocation of the soil structures in the upper portion of the sample, in addition to requiring three operators (same as the tractor method, compared with one or two for the other methods). The long narrow bladed spade and pitchfork did not allow the sample to be extracted, as they did not allow sufficient force to be applied to extract the sample. The best methods for extracting the sample were the spade, the impact spade and the chainsaw. Breaking up the aggregates using a mallet to hit the spade or hitting the spade against the ground promoted excessive dislocation and uneven break up of aggregates compared with the standard manual method, resulting in the mixing of layers of different Sq, meaning that neither was a suitable replacement.

Vacilania Pacheco [1] , Universidade Tecnológica Federal do Paraná, PhD Student

Esmailson Moreira Dos Santos [2] , Universidade Tecnológica Federal do Paraná, PhD Student

Lucas Salcoski Rossoni [3], Universidade Tecnológica Federal do Paraná, Undergraduate Student

Samienta Charles [4], Universidade Tecnológica Federal do Paraná, Msc. Student

Craig David Rogers [5], Independent Scholar, Scientific Consultant

Cassio Antonio Tormena [6], Universidade Estadual de Maringá, Professor

Rachel Muylaert Locks Guimaraes [7] * ^, Universidade Tecnológica Federal Do Paraná, Associate Professor

Session Details:

Poster Session (Environmental Quality, Regenerative Agriculture) Displayed, Atlantic Foyer, 26 Sep, 2024 08:00 AM

Implementing regenerative organic farming in the Asian monsoon region improves soil health and quality for soybean production

RATIH KEMALA DEWI [1 * ^], Qiliang Huang [2], Rahmatullah Hashimi [3], Masakazu Komatsuzaki [4]

Submission Type: Oral presentation

Sub-topics: Soil health and quality

Abstract Summary :
Regenerative organic agriculture is expected to have a positive impact on soil conservation, serving as a gateway to sustainable agricultural production in the world. However, there has been limited research on the effectiveness of no-tillage and cover crops, which have been recognized in Western countries, in the context of the hot and humid Asian monsoon region. In this study, the author evaluated the soil health and quality resulting from the implementation of environmentally regenerative organic agriculture for soybean production. The study involved long-term different tillage management such as no-tillage (NT), moldboard plowing (MP), and rotary tillage (RT) combined with cover crop practice such as rye (RY), hairy vetch (HV), and fallow (FA). Biochar had been implemented after 18 years of tillage and cover crops management in the recent two years field experiment in the Center for International Field Agriculture Research and Education, Ibaraki University, Japan. The experimental design followed a randomized complete block split-split plot. The result showed that there was no significant difference of soybean yield in biochar (WB) and no biochar (NB) plot in 2020 and 2021. However, the amendment of biochar resulted in an increased in soil organic carbon (SOC) content and sequestration in the 0–30 cm soil depth, suggesting potential changes in the physical and chemical properties of the soil. WB significantly reduced soil bulk density in the surface soil of 0–2.5 cm soil depth compared to NB. In comparison with NB, WB significantly increased SOC content and stock by 7.1% and 9.6% in 2020 and 2021, respectively. Furthermore, a significant interaction between tillage (T) and biochar (B) was observed at the depth of 0–2.5 cm, the addition of biochar resulted in an increase in SOC content of approximately 45.8%, 13.9%, and 11.4% in NT, RT, and MP management in 2020, and 98.7%, 21.9%, and 12.1% in NT, RT, and MP management in 2021, respectively. Moreover, total nitrogen increased, especially at the depth of 0–2.5 cm, under biochar amendment in 2020 and extended to deeper depths of 0–7.5 cm in 2021. Electrical conductivity and nitrate nitrogen also increased with biochar addition in soil depths of 2.5–30 cm. These findings suggest that the addition of biochar may be a wise combination to enhance the performance of both no-tillage and cover crop management. Furthermore, the production technology of environmentally regenerative soybeans through the combination of no-tillage cultivation and cover crops actively contributes to the sustainability of agricultural production in the Asian monsoon region. Keywords: biochar, cover crop, soil organic carbon, soil nutrition, tillage

RATIH KEMALA DEWI [1 * ^], IPB University, Ibaraki University, Researcher

Qiliang Huang [2], Tokyo University of Agriculture and Technology, Student

Rahmatullah Hashimi [3], Tokyo University of Agriculture and Technology, Student

Masakazu Komatsuzaki [4], Ibaraki University, Professor

Session Details:

Implementing regenerative organic farming in the Asian monsoon region improves soil health and quality for soybean production, Cape Henry C, 24 Sep, 2024 01:00 PM

Cultivation of soil health quality in coastal saline soil: based on soil structure and microbial indicators

Shenggao Lu [1*^]

Submission Type:
Oral presentation

Sub-topics:
Nutrient cycling

Abstract Summary :

There is a large area of coastal saline soil in China's coastal areas. The soil had very low productivity due to obstacles such as high salt content, nutrient deficiency, and poor structure. In order to quickly improve the coastal saline soil, a long-term experiment was performed in Zhejiang Provinces of China. The soil improvement technique included the once-time application of 150 tons/ha of cow organic fertilizer at the begin of grape plantation and 6 t/ha bioorganic fertilizer, 900 kg/ha calcium magnesium phosphorus fertilizer, and 900 kg/ha mineral fertilizer each year. In 2022, a chronosequence soil of grape plantation (0, 8, 18, and 36 years) in the coastal soil were selected. A space-for-time substitution method was used to assess soil health quality evolution with soil cultivation. Pore structure, microbes and enzyme activities of macroaggregate were analyzed by CT scanning coupled with synchrotron radiation (SR-μCT), high-throughput sequencing and microplate fluorimetry method, respectively. Soil cultivation significantly increased the content of organic matter, available nitrogen and phosphorus, and decreased soil pH and salt content of coastal saline soil. The long-term cultivation practice significantly increased the volume of macropores (>75 μm) and connectivity of macroaggregates. Long-term cultivation remarkably ($p< 0.05$) increased equant pores of macroaggregates while decreasing oblate, triaxial, and prolate pores, indicating that the soil pore structure was homogenized. The abundance of bacteria showed a growing tendency with long-term grape cultivation while abundance of fungi did not change. The cultivation practice would result in a decrease in the compositions of proteobacteria and chloroflexi and an increase in the compositions of acidobacteria, actinobacteria, thaumarchaeota, and planctomycetes based on the phylum at the relative level of 0.01%. The cultivation practice drastically reduced the composition of rozellomycota and increased ascomycota and mortierellomycota in the fungi community. This study provided the detailed information about the effect of cultivation practice on pore structure and microbial community in the coastal soil. The improvement technique quickly eliminated soil salt and compaction issues, improved soil health quality, and provide favorable growth conditions for grapes.

Shenggao Lu [1*^], Zhejiang University, Professor

Session Details:

Cultivation of soil health quality in coastal saline soil: based on soil structure and microbial indicators, Cape Charles A , 24 Sep, 2024 02:00 PM

LIVESTOCK INTEGRATION AND THE ROLE OF ROOTS ON SOIL PHYSICAL QUALITY UNDER CONSERVATION AGRICULTURE

Karina Cavalieri-Polizeli [1 * ^], Vanessa S Romanoski [2], Leandro B Oliveira [3]

Submission Type: Oral presentation

Sub-topics: Conservation agriculture

Abstract Summary :

Conservation practices in pastures can enhance the roots' growth and development, improving the soil physical quality. Currently, Brazil has an estimated 17.95 million hectares under Integrated Crop Livestock Systems (ICLS) (Polidoro et al. 2021), which indicates that better use of the areas can avoid the exploitation of new agricultural areas to meet the demands for food. Objective: This work aimed to evaluate the remaining effect of root attributes on soil physical properties, under different livestock systems. Methods: The study was performed on a Ferralsol, at the Center of Technological Innovation in Agriculture (NITA) under Cfb climate, in Southern Brazil. The experiment was established in 2012. Four livestock systems were studied: Livestock-L, Crop-Livestock-CL, Livestock-Forestry-LF, and Crop-Livestock-Forestry-CLF. The crops are maize and oats in a no-till planting green, and Aries Guineagrass (Megathyrsus maximus Jacq cv. Aries) for livestock. While eucalyptus (Eucaliptus benthamii) for trees in forestry integrations. Weeds are managed by mowing, and animals were Aberdeen Angus breed (Bos taurus). Roots sampling was performed in the summer of 2019/20, while undisturbed soil samples in 2020/21, being 144 samples each time. It used WinRhizo software® for roots data, and soil water retention curve for physical attributes. ANOVA was performed for each soil layer, 0-0.05, 0.05-0.15, and 0.15-0.30 m, in a randomized block model, then Tukey test was used ($p < 0.05$), plus regressions analysis, using SAS software. Key results: All physical attributes kept adequate values. The higher root length and volume were followed by the increased diameter, in the 0-0.05 m layer, which affected the pores size distribution between treatments. In general, positive correlations for length, volume, diameters of 0-0.5 mm, and 0.5-1.0 mm, and dry matter, with mesoporosity were found. Soil carbon content also had positive correlations with soil available water content and microporosity. Implications and potential impact: Besides the root effects on soil pores size distribution being different between treatments, they did not cause great distinctions in soil physical attributes. This indicates that independently of integration or pasture, the use of conservation practices is efficient to maintain the soil physical quality. References Polidoro, J. C., Freitas, P. L., Hernani, L. C., Anjos, L. H. C. dos, Rodrigues, R. de A. R., Cesário, F. V., Andrade, A.G., Ribeiro, J. L. (2021). Potential impact of plans and policies based on the principles of conservation agriculture on the control of soil erosion in Brazil. Land Degradation & Development, 32(12), 3457–3468. doi:10.1002/ldr.3876

Karina Cavalieri-Polizeli [1 * ^], UFPR- Federal University Of Paraná, Professor

Vanessa S Romanoski [2], UFPR, PhD Student

Leandro B Oliveira [3], UFPR, Professor

Session Details:

LIVESTOCK INTEGRATION AND THE ROLE OF ROOTS ON SOIL PHYSICAL QUALITY UNDER CONSERVATION AGRICULTURE, Cape Henry C, 26 Sep, 2024 11:00 AM

Development of Agrohydrology in relation to Critical Zone Science

Ying Zhao [1 * ^]

Submission Type:
Oral presentation

Sub-topics:
Soil physics/water movement

Abstract Summary :
The interdisciplinary field of agrohydrology, fundamentally concerned with the water-related processes in agriculture, has evolved significantly with the advancement of Critical Zone (CZ) Science. This review explores the development of agrohydrology within the context of CZ, emphasizing the integration of soil, water, and biotic resources. In particular, our review focuses on an overview of the fast-growing, highly interdisciplinary research area that uses CZ science as a basis to provides new insights from rapid advances in understanding agrohydrolgical research, i.e., CZ Agrohydrology. We identify an effort on contributions that investigate hydrological processes altering agricultural water allocations and efficiency, geophysical techniques to characterize CZ structure, water quantity and quality issues in diversified farm systems, groundwater's roles interacting with farmland ecosystems and climate change, and application of CZ Agrohydrology to advance future agriculture. In this regard, we synthesize the understanding of the increasing agriculture's roles in water, soil, and food security by the four-depths conception of CZ science, address knowledge gaps in managing agroecosystems, and highlight the potential of CZ Agrohydrology in the development of future agriculture. We hope this review has provided vital insights into growing opportunities for synergistically advancing CZ science, hydrology, and agriculture, making a great contribution to global water security.

Ying Zhao [1 * ^], Ludong University, Professor

Session Details:

Development of Agrohydrology in relation to Critical Zone Science , Mariner Room, 26 Sep, 2024 11:00 AM

TOWARDS A METHODOLOGY FOR EVALUATING THE POTENTIAL OF BIO-SUBSOILERS IN SOIL COMPACTION RECOVERY.

Maria Camila Herrera-Coy [1 * ^], Lars J. Munkholm [2], Loraine Ten Damme [3], Sabine Ravnskov [4]

Submission Type: Poster presentation

Sub-topics: Soil compaction

Abstract Summary :

Soil compaction is a significant threat to soil ecosystem functions and environmental quality. Consequently, various strategies have been implemented to recover soil functionality and create stable and continuous pores in compacted soils. Using roots as bio-subsoilers has recently gained more relevance because it offers several advantages over traditional tillage methods. However, it is essential to increase our knowledge of the potential of roots from single species and selected mixtures in mitigating long-term subsoil compaction. A field experiment using intact soil columns (Ø=20 cm, height=50 cm) obtained from severely compacted subsoil is carried out to investigate the role of plants in soil compaction recovery via root growth patterns and symbiosis with arbuscular mycorrhizal fungi. The evaluated species are grown in the undisturbed and compacted soil columns. Bare soil columns are used as the control. The methodology aims to evaluate the soil structure recovery effect of selected mixtures of plant roots and single species roots on soil mechanical and structural parameters following compaction by linking root traits to soil physical and morphological patterns. The measurements have a root phenotyping approach and point to characterising the expression of roots under a compacted environment and better understanding the correlation between arbuscular mycorrhizal fungi, roots, and soil structure. This study uses non-invasive (X-ray CT scanning) techniques to measure soil root interactions and their effects on soil structure. We use a micro CT scanner that enables the visualisation of roots and the soil pore network in 2D and 3D simultaneously. CT-derived parameters are quantified by image analysis that allows the segmentation and characterisation of roots and soil matrix. All parameters are evaluated before and after the field experiment. Destructive techniques are also used to quantify root system architecture, soil structural properties, and measure the biomass of arbuscular mycorrhizal fungi and glomalin-related soil protein. Assessing soil structure and root traits using both destructive and non-destructive methods provides numerous benefits for this study and further investigations. It allows a better understanding of the relationship between CT soil pore measurements and soil hydraulic functions, solute transport, and preferential flow. Additionally, it can visualise the interactions between roots and soil, making it easier to observe the processes occurring in the vicinity of the root. The CT images of soil structure and the integration of CT-derived parameters with easily accessible measures (destructive techniques) of hydraulic, mechanical, and inherent soil properties provide valuable insights into the structural patterns of soils not analysed with a micro CT scanner. The findings from this study quantify the soil recovery effect of potential bio-subsoiler species and mixtures and contribute to gaining a deeper comprehension of the soil structure-arbuscular mycorrhizal fungi-root

interaction.

Maria Camila Herrera-Coy [1 * ^], Aarhus University, PhD student

Lars J. Munkholm [2], Aarhus University, Professor

Loraine Ten Damme [3], Aarhus University, Department of Agroecology, Postdoctoral Researcher

Sabine Ravnskov [4], Aarhus University, Associate Professor

Session Details:

Poster Session (Tillage) Displayed, Atlantic Foyer, 23 Sep, 2024 08:00 AM

THE “DASHBOARD” AS A TOOL FOR MONITORING THE IMPROVEMENT OF SOIL FERTILITY AND SUPPORT AGROECOLOGICAL TRANSITION

Anne-Sophie Perrin [1 *], Jospéhine Peigné [2], Matthieu Abella [3], Léo Bilheran [4], Alain Brauman [5], Bertrand Deloste [6], Annie Duparque [7], Jim Félix-Faure [8], Bernard Garric [9], Michael Geloen [10], Domitille JAMET [11], Nicolas Latraye [12], Matthieu Loos [13], Patrice Mahieu [14], Lorène Prost [15], Aicha Ronceux [16], Clemence De Saintignon [17], Vincent Tomis [18], Romain Tscheiller [19], Stéphane Cadoux [20 ^]

Submission Type:

Oral presentation

Sub-topics:

Working with growers

Abstract Summary :

Cropping systems based on agroecology involve locally adapting strategies combining levers, some of which are well known (cover crops, tillage reduction or crop diversification), and others still to be invented. Given the complexity and uncertainties that characterize agricultural design, farmers should be seen as designers of their own production systems. However, they lack operational knowledge and adaptative management tools to support step by step system re design, based on soil fertility improvement, adapted to their own contexts. Also, to benefit from the services expected from soil fertility (e.g. a soil allowing a good nitrogen supply to crops, a soil resistant to water erosion), it is essential to equip farmers and advisors in this regard. In this work, we describe how dashboards help to manage the improvement of soil fertility and present concrete examples that can be used in a variety of contexts. Terres Inovia and its partners from academic and agricultural sectors co developed innovative tools to facilitate the support of farmer networks by advisors, for the step by step re design of strategies favorable to the functioning of soils and their fertility. These tools are based on the “dashboard” approach whose functional properties (centered on farmers' expectations) and educational properties (visual, synthetic presentation) have already been tested (e.g. Reau et al., 2016; Prost et al., 2018, Cadoux et al., 2023). These tools must allow the adaptation of solutions to the farmers expectations and give them the capacity to innovate on their own and advisors to support them in this process. Dashboards are focused on the service expected by farmers from the fertility of their soils. Key soil conditions to be achieved to benefit from them are then linked to it with causal relationships. It is only at the end that the key practices are defined to achieve the different key soil conditions. Several dashboards, each focused on one service, are being adapted and implemented with six networks of farmers accompanied by their advisor facilitator in different soil, climatic and production contexts in France. Indicators (observations, measures adapted for farmers and advisors) are being tested and validated. They must make it possible to qualitatively or quantitatively assess the levels of achievement of key soil conditions. Farmer networks will next be able to test new strategies, evaluate them and continually adapt them so that they meet their expectations regarding soils. The step by step cropping system re design should thus be possible by relying on the analyzes made from these dashboards, and by drawing lessons in order to improve practices the following year. This approach should contribute to

increasing the skills of advisors and farmers and to better integrate soil functioning evolution in the step by step design of cropping systems.

Anne-Sophie Perrin [1] *, Terres Inovia (France), Soil sciences

Jospéhine Peigné [2], ISARA, Professor of soil science

Matthieu Abella [3], Terres Inovia (France), Baziège (31)

Léo Bilheran [4], AGRO D'OC, Ingénieur-conseil

Alain Brauman [5], IRD, Soil ecologist

Bertrand Deloste [6], Agro-Transfert-RT, Ingénieur fertilité des sols - Chef de projet Sol-D'Phy2

Annie Duparque [7], Agro-Transfert Ressources et Territoires, Estrées Mons, France, Manager

Jim Félix-Faure [8], CIRAD, Soil Scientist

Bernard Garric [9], Terres Inovia, Agronomist

Michael Geloen [10], Terres Inovia, Agronomist

Domitille JAMET [11], Terres Inovia (France), Agronomist

Nicolas Latraye [12], Terres Inovia, Agronomist

Matthieu Loos [13], Terres Inovia, Agronomist

Patrice Mahieu [14], Chambre d'agriculture des Pyrénées-Atlantiques, Chargé de mission Agronomie

Lorène Prost [15], INRAE, senior researcher

Aicha Ronceux [16], Agro-Transfert Ressources et Territoires, Estrées Mons, France, Manager

Clemence De Saintignon [17], Terres Inovia (France), Ingénieur

Vincent Tomis [18], Terres Inovia, Agronomist

Romain Tscheiller [19], Arvalis, Soil research engineer

Stéphane Cadoux [20] ^, Terres Inovia, Agronomist

Session Details:

THE “DASHBOARD” AS A TOOL FOR MONITORING THE IMPROVEMENT OF SOIL FERTILITY AND SUPPORT AGROECOLOGICAL TRANSITION, Mariner Room, 23 Sep, 2024 03:00 PM

Impact of strip-till and no-till systems on soil, crop, and environment

Zita Kriauciuniene [1*^], Lina Saldukaite-Sribike [2], ANDRII ZABRODSKYI [3], Aida ADAMAVICIENE [4], Sidona Buragienė [5], Egidijus Šarauskis [6]

Submission Type:

Oral presentation

Sub-topics:

Tillage implements and other equipment,

Conservation soil tillage

Abstract Summary :

Increasing demand for nutritious food to feed a growing world population, while dealing with soil degradation and climate change, are the main challenges agriculture has to address today. Soil health and food, climate change are therefore on the EU and global agenda. Today's food production demands environmentally friendly and economically viable technologies without compromising crop yield and soil health. Soil tillage is the most time, energy and cost consuming technology, therefore the right choice of soil tillage has a high influence on crop cultivation and productivity, soil status and profit. Strip tillage has many advantages that include positive features of conventional ploughing and no tillage technologies, making it an attractive technology for agricultural production. Therefore, the aim of this research was to investigate and evaluate the use of strip tillage and sowing and direct seeding in different soil tillage intensities and to assess the efficiency in terms of productivity, energy and environmental impact. The research was carried out at the Experimental Station of Vytautas Magnus University, Agriculture Academy (Lithuania). Winter wheat (Triticum aestivum L.) and winter rapeseed (Brassica napus L.) were grown using three different tillage technologies: conventional tillage with ploughing (CT), minimal stubble cultivation (MT), no tillage (NT) and two sowing machines: strip tillage and seeding (STS) and direct seeding (DS). The research showed that minimum tillage had a positive effect on winter wheat yield. A higher winter wheat yield (7.3 t ha 1) was obtained with the NT STS technology compared to the conventional tillage CT STS (6.9 t ha 1). The highest winter wheat yield was obtained with NT DS. The STS drilling system gave 10 to 21% higher yields of winter rapeseed. The highest yields of winter rapeseed were obtained with MT STS and the lowest with CT DS, which was about 21% lower than MT STS. A lower CO2 concentration (0.99 ppm) than in NT STS (1.14 ppm) was found in the soil when winter wheat was grown in the NT DS treatment. The analysis showed that no tillage technologies in winter rapeseed production could save about 20% of GHG emissions and thus contribute to a cleaner environment. The highest total fuel consumption and total costs of technological processes were found in the application of CT STS technological operation, while the lowest consumption and costs were found in NT DS. Saving diesel fuel by reducing the number of tillage technological operations and reducing the consumption of chemical fertilizers are the most important factors in increasing energy efficiency and reducing negative impact on the environment. Key words: strip tillage, direct sowing, winter wheat, winter

Zita Kriauciuniene [1*^], Vytautas Magnus University, Agriculture Academy, Professor

Lina Saldukaite-Sribike [2], Vytautas Magnus University, Agriculture Academy, Junior Researcher

ANDRII ZABRODSKYI [3], Vytautas Magnus University, Agriculture Academy, Junior Researcher

Aida ADAMAVICIENE [4], Vytautas Magnus University, Agriculture Academy, Dean

Sidona Buragienė [5], Vytautas Magnus University, Agriculture Academy, Senior Researcher

Egidijus Šarauskis [6], Vytautas Magnus University, Agriculture Academy, Professor

Session Details:

Impact of strip-till and no-till systems on soil, crop, and environment, Atlantic Ballroom, 24 Sep, 2024 11:00 AM

Development of a 3-dimensional discrete element software for modelling soil-tool-deformable object interactions in tillage processes

László Pásthy [1 * ^], Kornél Tamás [2]

Submission Type:

Oral presentation

Sub-topics:

Technology, Equipment, Artificial intelligence

Abstract Summary :

The discrete element method (DEM) is an effective numerical tool for modelling soil tillage processes. However in the DEM calculations, the objects in contact with the soil particles are generally considered rigid, thus in the event of contact forces causing a significant deformation in the objects, which already affects the movement of particles, the DEM simulation alone is not sufficient, another calculation procedure is required to model the deformation of the solid body, which can cooperate in parallel with the discrete element calculation. The aim of our research is to develop a 3-dimensional DEM software for soil tillage simulations that integrates the discrete element method, as well as numerical methods that enable the calculation of the deformation and tear of solid bodies and are able to cooperate with the DEM in parallel. Furthermore we aim to develop a user-friendly graphical interface (GUI), which makes the preparations, running and post-processing of simulation possible without any programming knowledge. The development of the solver is being carried out in C++. Simultaneously, for the development of the interactive graphical user interface National Instruments LabView environment is utilized. Among the DEM, the finite element method (FEM) and the mass-spring method (MSM) is also incorporated in the software for the purpose of modeling deformable objects. While the DEM particles can model the soil, the FEM can be used to calculate the passive vibrations of tillage tools, and the MSM is able to simulate the deformations and even tear of plant roots and stems, in other words the macro flora of the soil. Furthermore a moving earthworm model is also being developed with the utilization of the MSM, which will enable the modelling of macro fauna in soil.

László Pásthy [1 * ^], Budapest University of Technology, PhD student

Kornél Tamás [2], Budapest University Of Technology And Economics Faculty Of Mechanical Engineering: Budapesti Muszaki Es Gazdasagtudomanyi Egyetem Gepeszmernoki Kar, Associate Professor

Session Details:

Development of a 3-dimensional discrete element software for modelling soil-tool-deformable object interactions in tillage processes, Mariner Room, 24 Sep, 2024 09:00 AM

Development of a two-way coupled DEM-FEM simulation procedure and software for modelling soil-passive vibration tool interaction

László Pásthy [1 * ^], Kornél Tamás [2]

Submission Type: Oral presentation

Sub-topics: Technology, Equipment, Artificial intelligence

Abstract Summary :

One promising approach in energy-efficient soil tillage involves utilizing passive vibration-based tools e.g., passively vibrating sweep tools, harrows and subsoilers. When appropriate tillage parameters are employed, these tools, driven by vibration, have the potential to reduce the force and energy needed for tillage while improving its overall quality. Our research primarily focused on developing a coupled discrete-finite element procedure to examine the interactions between soil and tools employing passive vibration. To validate this approach, a soil bin system was constructed to study the performance of both a highly rigid tool and a flexible tool at three different working depths. For simulations involving the rigid tool, the discrete element method (DEM) was used along with the developed coupled discrete-finite element (DEM-FEM) procedure. Meanwhile, simulations for the flexible tool utilized the coupled DEM-FEM procedure. The DEM simulations were carried out with Altair EDEM, and for the coupled DEM-FEM simulations a new FEM software was developed, which could be coupled with EDEM. In the DEM calculations hysteretic spring and linear cohesion contact models were applied, while FEM calculations used a transient, linear elastic model with Rayleigh damping. Recognizing that soil properties vary with depth during parameter calibration, a multi-layered soil model was developed. Following calibration, the simulated mean force and deformation values closely matched the measured values. Additionally, the simulation results supported the assumption that passively vibrating tillage tools effectively loosen and mix the soil. Based on these results, it can be concluded that the developed coupled DEM-FEM procedure enabled the accurate modelling of passively vibrating tillage tools. A future aim is to make the developed method an effective tool for engineers in the design process of tillage tools. For this purpose a simulation software for coupled DEM simulations (BMEDEM3D) is under development, which is capable of multi-way coupled DEM-FEM simulations, and has an easy-to-use graphical interface. Furthermore for the calibration of contact parameters, which is currently a time-consuming, rigorous manual process, artificial intelligence methods are also planned to be implemented in the developed software. This could significantly reduce the number of necessary manual interventions in the modelling process, thus enabling engineers to design and optimize the tillage tools in a shorter amount of time.

László Pásthy [1 * ^], Budapest University of Technology, PhD student

Kornél Tamás [2], Budapest University Of Technology And Economics Faculty Of Mechanical Engineering: Budapesti Muszaki Es Gazdasagtudomanyi Egyetem Gepeszmernoki Kar, Associate Professor

Session Details:

Development of a two-way coupled DEM-FEM simulation procedure and software for modelling soil-passive vibration tool interaction, Mariner Room, 24 Sep, 2024 09:00 AM

Functionality of the soil pore system in a micro-watershed formed by wet meadows (Vegas) in the southernmost Chilean Patagonia.

Jorge Ivelic-Sáez [1 * ^], Paulina Cisternas [2], John Clunes [3], José Dörner [4], José Luis Arumí [5], Susana Valle [6], Enrique Muñoz [7], Dorota Dec [8], Rainer Horn [9]

Submission Type:

Oral presentation

Sub-topics:

Soil physics/water movement

Abstract Summary :

The Patagonian Vegas are wetlands that provide the main source of food for livestock in this region. They also play an important ecosystemic role associated with water and carbon storage in the soil profile. Such functions are related to soil structure, which is formed by shrinkage and swelling, as well as freeze-thaw cycles and biological activity. This work aims to analyze soil physical capacity and intensity parameters and their relationship with the shrinkage properties of soils associated with a micro-watershed formed by meadows located in the Magallanes region in southern Patagonia, Chile. Seven soil pits (from C1 to C7) were evaluated along a north-south transect. Using the shrinkage curve (COLE and PSI), morphological parameters (depth and textural class), capacity parameters (bulk density, organic carbon, pore size distribution and air-filled porosity), intensity parameters (air permeability) and the shrinkage capacity were evaluated. The sites were classified as mineral (C1, C2, C5, C6 and C7) or organic (C3 and C4) soils. The latter had lower bulk density values (< 0.15 Mg m-3) and higher organic carbon content (> 24% in surface) than the former. Likewise, C4 (organic soil) demonstrated different characteristics from the rest of the evaluated soils, with a greater shrinkage capacity, absence of a structural shrinkage phase and a discontinuous porous system down to depth (< 80 cm). Such results evidence that the porous system of the summits and footslopes conduct water, while the center of the Vega (i.e., the valley of the Vega) favors water storage. When all the evaluated sectors are considered, it is important to note that the shrinkage capacity directly influences the functionality of the porous system.

Jorge Ivelic-Sáez [1 * ^], Universidad Austral De Chile, PhD Candidate

Paulina Cisternas [2], Universidad Austral de Chile, Magister

John Clunes [3], Universidad Austral de Chile, Professor

José Dörner [4], Universidad Austral de Chile, Professor

José Luis Arumí [5], Universidad de Concepción, Professor

Susana Valle [6], Universidad Austral de Chile, Professor

Enrique Muñoz [7], Universidad Católica de la Santísima Concepción, Professor

Dorota Dec [8], Universidad Austral De Chile, Professor

Rainer Horn [9], Universität Christian Albrecht, Professor

Session Details:

Functionality of the soil pore system in a micro-watershed formed by wet meadows (Vegas) in the southernmost Chilean Patagonia., Mariner Room, 26 Sep, 2024 09:00 AM

Irrigated sugarbeet yield, water use and water use efficiency responses to tillage practices

Jay Jabro [1 * ^], William Stevens [2], William Iversen [3], Upendra Sainju [4], Brett Allen [5], Sadikshya Dangi [6]

Submission Type:

Poster presentation

Sub-topics:

Water scarcity

Abstract Summary :

Better management practices have been used to increase soil water storage and reduce evaporation from the soil surface to optimize crop water use efficiency (WUE) in irrigated agriculture. A field study was conducted to evaluate the effect of conventional tillage (CT), No-till (NT) and strip tillage (ST) practices on yield, water use (WU) and WUE of sugarbeet (Beta vulgaris L.) on a clay loam soil under over-head sprinkler irrigation system in the northern Great Plains. Tillage treatments were replicated five times in a randomized block design. Seasonal WU and WUE for sugarbeet root and sucrose yield were determined for the 2018, 2019, and 2020 growing seasons according to the water balance and WUE equations under three tillage practices. Results showed that no significant differences due to tillage treatment were found for crop WU, root yield, sucrose yield, and WUE for sugarbeet root and sucrose in 2018, 2019, and 2020 growing seasons. In 2019, the average value of WU across three tillage systems (616 mm) was significantly greater relative to 2018 (469 mm) and 2020 (494 mm) due to atypical large rainfalls (218mm) occurred in September of 2019. In 2020, root and sucrose yields were significantly lower than those in 2018 and 2019 due weather conditions and insufficient amounts of soil nitrogen. Consequently, WUE values for both root and sucrose yield in 2019 under CT, NT, and ST were significantly lower than those in 2018. While NT and ST practices are promising alternative to CT for agricultural production in this region, further research is needed prior to making any recommendation.

Jay Jabro [1 * ^], ARS-USDA, Research Soil Scientist

William Stevens [2], ARS-USDA, Research Agronomist

William Iversen [3], NPARL, Physical Scientist

Upendra Sainju [4], ARS-USDA, Research Soil Scientist

Brett Allen [5], ARS_USDA, Research Agronomist

Sadikshya Dangi [6], ARS_USDA, Research Soil Scientist

Session Details:

Poster Session (SOIL AND WATER MANAGEMENT, SOIL FERTILITY, PRECISION AG, ON-FARM RESEARCH, CROP

PROTECTION) Displayed, Atlantic Foyer, 24 Sep, 2024 08:00 AM

Litter decomposition rate in an acrisol seven years after rice straw biochar amendment using the teabag approach

Peter Bilson Obour [1 * ^], Eric Oppong Danso [2], Billey Jaafar [3], Daniel Selorm Kpodo [4], Yuting Fu [5], John Bright Amoah Nyasapoh [6], Emmanuel Arthur [7]

Submission Type:

Oral presentation

Sub-topics:

Soil health and quality

Abstract Summary :

Plant litter is a major source of soil organic matter in natural and managed ecosystems, and its decomposition is an essential pathway for the return of nutrients to the soil. The decomposition rate of plant material can be quantified using the teabag protocol proposed by Keuskamp et al. (2013). Despite the wide use of the teabag protocol, only a few studies have been done on tropical soils to add to the global database on litter decomposition. To that end, a field experiment was conducted to examine the effect of the application of rice straw biochar and crop type on litter (tea bag) decomposition rate in a highly weathered tropical sandy clay loam.Two different teabag experiments (Exp) were conducted. Firstly, a time series experiment (Exp 1) where Green (G) and Rooibos (R) teabags were buried in six rows of 12 pairs and retrieved at intervals from 14 days to 90 days to ascertain the optimal burial period. Subsequently, 240 paired teabags were buried on an experimental field (Exp 2) that was amended with rice straw biochar (0, 15, and 30 Mg ha−1) seven years ago. Maize (Zea mays L.) and okra (Abelmoschus esculentus L.) were utilized as test crops. The teabags in Exp 2 were retrieved after 90 days of burial for processing and analysis. The relative mass of tea remaining (RMR) was computed as the difference between the mass of tea before and after burial. Results showed that, as expected, the decomposition was faster for the G-bags compared to the R-bags. Ninety days after burial, the G- and R-teabags had lost about 77% and 34%, respectively of the tea weight. In Exp 2, the decomposition of the G-teabags was significantly (p=0.035) affected by crop type, higher in the maize plots (RMR =0.30) than the okra plots (RMR =0.33). Neither the individual effect of biochar rate, crop type nor their interaction significantly (p >0.05) affected the decomposition of the R-teabag. Findings will be relevant for identifying and prioritizing soil management practices such as cropping systems and litter mineralization that could enhance or mitigate climate change.

Peter Bilson Obour [1 * ^], University Of Ghana (UG), Senior Lecturer

Eric Oppong Danso [2], University of Ghana (UG), Senior Research Fellow

Billey Jaafar [3], University of Ghana (UG), Student

Daniel Selorm Kpodo [4], University of Ghana (UG), Student

Yuting Fu [5], Aarhus University, Aarhus University

John Bright Amoah Nyasapoh [6] , University of Ghana (UG), Student

Emmanuel Arthur [7] , Aarhus University, Senior Scientist

Session Details:

Litter decomposition rate in an acrisol seven years after rice straw biochar amendment using the teabag approach, Cape Henry C, 24 Sep, 2024 01:00 PM

Greenhouse gas emissions in response to tillage and crops in sugarbeet-spring wheat-pea rotation.

Upendra Sainju [1]^, William Stevens [2]*, Jay Jabro [3], Brett Allen [4], William Iversen [5]

Submission Type:

Oral presentation

Sub-topics:

Gaseous losses of nutrients

Abstract Summary :

Information is needed on greenhouse gas (GHG) emissions due to tillage and crops on sugarbeet-based crop rotations. We measured CO2, N2O, and CH4 emissions as affected by tillage systems under sugarbeet and spring wheat phases of a 3-yr sugarbeet-spring wheat-pea rotation from 2018 to 2021 to determine how tillage and crops affect GHG emissions. Tillage systems were conventional till (CT), no-till (NT), and strip till (ST). Greenhouse gases were measured using a static chamber at 3-28 d intervals, depending on plant growth and environmental condition, throughout the year. The CO2 flux peaked for 2-4 mo immediately after tillage, planting, fertilization, intense precipitation, and irrigation. The N2O flux peaked for 8 mo after these events and also during the winter when soil water content was high. The CH4 flux varied little with day of sampling, except for some peaks in the first year. Cumulative annual CO2 flux was greater for CT than NT in 2 out of 3 yr and greater for CT than ST in 1 out of 3 yr under sugarbeet. Cumulative N2O flux was also greater for CT than ST 2 out of 3 yr under sugarbeet, but lower for sugarbeet than spring wheat in all years. Cumulative CH4 flux was lower for CT than NT and lower for sugarbeet than spring wheat in 1 out of 3 yr. The GHG balance was greater for CT than NT and ST in 2 out of 3 yr and greater under sugarbeet than spring wheat in 1 out of 3 yr. Although sugarbeet reduced N2O emissions compared to spring wheat, no-till can reduce GHG emissions compared to tillage systems in both sugarbeet and spring wheat.

Upendra Sainju [1]^, USDA, Agricultural Research Service, Research Soil Scientist

William Stevens [2]*, ARS-USDA, Research Agronomist

Jay Jabro [3], ARS-USDA, Research Soil Scientist

Brett Allen [4], ARS_USDA, Research Agronomist

William Iversen [5], NPARL, Physical Scientist

Session Details:

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Greenhouse gas emissions in response to tillage and crops in sugarbeet-spring wheat-pea rotation.

Upendra Sainju [1 * ^]

Submission Type:
Oral presentation

Sub-topics:
Gaseous losses of nutrients

Abstract Summary :

Information is needed on greenhouse gas (GHG) emissions due to tillage and crops on sugarbeet-based crop rotations. We measured CO2, N2O, and CH4 emissions as affected by tillage systems under sugarbeet and spring wheat phases of a 3-yr sugarbeet-spring wheat-pea rotation from 2018 to 2021 to determine how tillage and crops affect GHG emissions. Tillage systems were conventional till (CT), no-till (NT), and strip till (ST). Greenhouse gases were measured using a static chamber at 3-28 d intervals, depending on plant growth and environmental condition, throughout the year. The CO2 flux peaked for 2-4 mo immediately after tillage, planting, fertilization, intense precipitation, and irrigation. The N2O flux peaked for 8 mo after these events and also during the winter when soil water content was high. The CH4 flux varied little with day of sampling, except for some peaks in the first year. Cumulative annual CO2 flux was greater for CT than NT in 2 out of 3 yr and greater for CT than ST in 1 out of 3 yr under sugarbeet. Cumulative N2O flux was also greater for CT than ST 2 out of 3 yr under sugarbeet, but lower for sugarbeet than spring wheat in all years. Cumulative CH4 flux was lower for CT than NT and lower for sugarbeet than spring wheat in 1 out of 3 yr. The GHG balance was greater for CT than NT and ST in 2 out of 3 yr and greater under sugarbeet than spring wheat in 1 out of 3 yr. Although sugarbeet reduced N2O emissions compared to spring wheat, no-till can reduce GHG emissions compared to tillage systems in both sugarbeet and spring wheat.

Upendra Sainju [1 * ^], USDA, Agricultural Research Service, Research Soil Scientist

Session Details:

Greenhouse gas emissions in response to tillage and crops in sugarbeet-spring wheat-pea rotation. , Cape Henry C, 23 Sep, 2024 03:00 PM

Enhancing Sustainability in Organic Soybean Farming with Reduced Carbon Footprints Through No-Tillage and Rye Cover Crops

Qiliang Huang [1*^], RATIH KEMALA DEWI [2], Rahmatullah Hashimi [3], Masakazu Komatsuzaki [4]

Submission Type:
Oral presentation

Sub-topics:
Cover crops and residue additions, Conservation agriculture, Crop production efficiency

Abstract Summary :
Regenerative organic agriculture has the potential to contribute to environmental conservation and sustainable development, although its impact varies depending on management. To investigate the effect of no tillage and cover crop on carbon footprint (CF) and sustainability in organic soybean production, a field experiment was conducted in Ibaraki, Japan, involving of two tillage methods [Moldboard plow (MP) and NT] and two cover crop managements [fallow (FA) and rye (RY)]. Our results showed that NT decrease the soybean yield by 21.2% compared with MP. Nonetheless, the yield reduction in NT system could be mitigated by RY management, resulting in a 20.4% higher yield for NT-RY compared to NT-FA. With a lower fossil fuel consumption, NT had a lower greenhouse gases emission compared with MP. Meanwhile, both NT and RY effectively improved soil organic carbon stock, offsetting total carbon dioxide (CO2) equivalent emissions. Due to reduce fossil fuel usage and increase soil organic carbon stock, NT-RY exhibited the lowest CF (−1892.99 kg CO2 eq ha−1) among all treatments. Additionally, this study also adopted the emergy analysis to evaluate the farming system sustainability. NT had 38.0% lower unit emergy value (UEV) compared with MP, illustrating the system efficiency was higher with NT. Although RY had the extra input of cover crop seeds, the UEV was higher with RY than with FA. NT was more sustainable than MP, with the emergy sustainability index (ESI) of NT being 5.2% higher than that of MP. Moreover, compared with FA, RY had 1.0% and 0.5% increase in ESI under MP and NT, respectively. These findings reveal adopting NT-RY management in organic soybean system can effectively reduce CF and increase sustainability, which will contribute to achieve the sustainable development of organic agriculture in the Asian monsoon region. Key word: no tillage, cover crop, organic farming, carbon footprint, emergy

Qiliang Huang [1*^], Tokyo University of Agriculture and Technology, Student

RATIH KEMALA DEWI [2], IPB University, Ibaraki University, Researcher

Rahmatullah Hashimi [3], Tokyo University of Agriculture and Technology, Student

Masakazu Komatsuzaki [4], Ibaraki University, Professor

Session Details:

Enhancing Sustainability in Organic Soybean Farming with Reduced Carbon Footprints Through No-Tillage and Rye Cover Crops, Cape Henry C, 24 Sep, 2024 01:00 PM

Tillage practices impact soil structural characteristics related to the prevalence of anoxic conditions along a pedoclimatic gradient

Loraine Ten Damme [1 * ^], Sara Sánchez Moreno [2], Mansonia Alejandra Pulido Moncada [3], Laurent Philippot [4], Mart Ros [5], Luca Bragazza [6], Sara Hallin [7], Dalia Feiziene [8], Munkholm Lars [9], Marta Goberna [10]

Submission Type:

Oral presentation

Sub-topics:

Conservation agriculture

Abstract Summary :

Soil structure is a driving factor of water and gas transports through soil, affecting the prevalence of (an)oxic soil processes. Intensive tillage may harm soil pore characteristics and structural stability. Conservation tillage has been suggested as an effective measure to avoid such adverse effects. Yet, a better knowledge of the effects of tillage strategies on soil structure in different pedoclimatic zones and the consequences for soil carbon sequestration and nitrous oxide emissions is still necessary. We investigated the effects of ploughed and no-till practices on soil structural characteristics in seven long-term agricultural field experiments (running 12 years and longer) located along a pedoclimatic gradient in Europe. Intact soil cores (100-cm3) sampled from 0–10 and 10–20 cm depth, collected after harvest, were used for laboratory measurements at Aarhus University. The soil cores were drained to -30, -60 and -100 hPa matric potential for obtaining the corresponding water-filled pore space (WFPS). At -100 hPa, relative gas diffusivity (Ds/Do) and air permeability (ka) were measured. The soil depth generally had the strongest effect on the assessed characteristics, while the effect of tillage practice and their interaction was smaller or not significant. The WFPS was significantly lowest for the ploughed treatments in the 0–10-cm soil layer, with a WFPS less than 70% – even at -30 hPa. Thus, ploughing caused better aeration of the studied topsoil, which limits the risk of nitrous oxide emissions The ka was higher in the 0–10-cm soil layer compared to the 10–20-cm layer (p-value 0.004), with mean rates classified as moderate and slow, respectively, while no difference between tillage treatments was found (p-value > 0.1). The Ds/Do was higher in the 0–10-cm soil layer compared to the 10–20-cm layer (p-value < 0.001), exceeding the 0.02-threshold for (an)oxic conditions in the 0–10-cm layer (p-value 0.029). The Ds/Do was also higher for the ploughed compared to no-till practices (p-value 0.03), with mean values just above 0.02 in both treatments. We found no interaction between site and tillage treatment for the WFPS and Ds/Do, meaning that the tillage effect on these characteristics was similar across the pedoclimatic gradient. The effects of soil depth could, however, not be generalised to all individual experiments. These results show that site and sampling depth often overshadowed the long-term tillage effects on soil structural characteristics in the topsoil for soil sampled after the growing season. The topsoil structural characteristics of no-till were generally slightly more favourable for nitrous oxide emissions than ploughed soil. Stronger effects of tillage may have occurred if samples had been taken closer to the time of tillage.

Loraine Ten Damme [1 * ^], Aarhus University, Department of Agroecology, Postdoctoral Researcher

Sara Sánchez Moreno [2], Spanish National Institute for Agricultural and Food Research and Technology, Madrid, Spain, Researcher

Mansonia Alejandra Pulido Moncada [3], Aarhus University, Academic employee

Laurent Philippot [4], INRAE, Director of Research

Mart Ros [5], Wageningen Environmental Research, Wageningen University & Research, Researcher

Luca Bragazza [6], Agroscope, Group Leader

Sara Hallin [7], Swedish University of Agricultural Sciences, Professor

Dalia Feiziene [8], Institute of Agriculture, LAMMC, Head of the Department

Munkholm Lars [9], Aarhus University, Professor-Senior Researcher

Marta Goberna [10], Spanish National Institute for Agricultural and Food Research and Technology, Madrid, Spain, Research Scientist

Session Details:

Tillage practices impact soil structural characteristics related to the prevalence of anoxic conditions along a pedoclimatic gradient, Cape Henry C, 26 Sep, 2024 08:00 AM

The impact of precipitation on N2O emissions during the freeze-thaw cycle in a typical grassland in Inner Mongolia

Wangchen Zhang [1 * ^], Ying Zhao [2], Pengfei Xue [3], Jinbo Li [4]

Submission Type:

Poster presentation

Sub-topics:

Soil physics/water movement

Abstract Summary :

Approximately 78% of China's grasslands are located north of 30°N latitude, where these ecosystems frequently experience significant seasonal freeze-thaw processes. Grasslands serve as an important source of nitrous oxide (N2O) emissions, with freeze-thaw cycles playing a crucial role in N2O production. Precipitation during the frozen period regulates nitrogen cycling by directly or indirectly influencing soil hydrothermal dynamics, thereby exerting a substantial impact on N2O fluxes. The experiment was conducted at three typical grassland sites in the Inner Mongolia Grassland Ecosystem Research Station (43.38°N, 116.42°E, altitude 1248 m), where high-frequency N2O flux measurements were taken during freeze-thaw cycles in 2018, 2021, and 2023, under three different grazing conditions: long-term ungrazed since 1979 (UG79), short-term ungrazed since 1999 (UG99), and continuously grazed (CG). The results show that in the typical grasslands of Inner Mongolia, higher pulse N2O emissions during the spring freeze-thaw cycle were only observed when precipitation during the frozen period was relatively low. Structural equation model analysis indicates that cumulative precipitation during the frozen period, N2O concentration in the soil, NH3-N content, and soil moisture together explain approximately 81.5% of the total variation in N2O emissions during the spring freeze-thaw cycle. The results confirm that in the freeze-thaw period of typical Mongolian grasslands, increased precipitation enhances soil moisture, creating favourable conditions for N2O production in the soil while also influencing the physical transport of N2O from the soil to the surface. Precipitation not only directly affects the physical pathways of N2O emissions in the soil but also impacts the accumulation of inorganic ammonium nitrogen by affecting soil temperature, providing a crucial nitrogen source for N2O production. Therefore, focusing on precipitation and soil ammonium nitrogen content is essential for accurately predicting N2O emissions during the thawing period in this region. This newly discovered N2O emission event should contribute to more reliable estimates of soil-atmosphere trace gas fluxes.

Wangchen Zhang [1 * ^], Ludong University, Yantai, Shandong 264025, China

Ying Zhao [2], Ludong University, Professor

Pengfei Xue [3], ,

Jinbo Li [4], ,

Session Details:

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Soils in Space: Soil Water Under Microgravity

M.B. Kirkham [1]*^

Submission Type:
Poster presentation

Sub-topics:
Soil physics/water movement

Abstract Summary :
A former president of ISTRO, Rattan Lal, said that plants may have to be grown in space to provide enough food for the growing population on Earth. Water in the soil is the most important factor that affects plant growth. Therefore, it is important to understand the water relations of soils under zero gravity in space or under reduced gravity of extraterrestrial bodies such as the Moon or Mars. This presentation outlines the problems of moving water in soils under zero gravity or microgravity, as well as growing plants in these soils. Even though most scientists cannot participate in experiments done in space, studies still can be done on Earth to simulate microgravity and to gain information needed for growth in space. Soil physicists have long used horizontal columns to eliminate or reduce the effect of gravity. When columns are on their side, gravity acts only through the diameter-depth of the column. And this is relatively small compared to when the columns are standing upright. If one puts columns on their sides, one can study infiltration into the columns under gravity-free conditions. Horizontal-column experiments could be done on Earth with just soil or with plants in the columns. Results from such experiments could be used to grow plants for food when mankind establishes bases on the Moon and Mars.

M.B. Kirkham [1]*^, Kansas State University, University Distinguished Professor

Session Details:

Poster Session (SOIL AND WATER MANAGEMENT, SOIL FERTILITY, PRECISION AG, ON-FARM RESEARCH, CROP PROTECTION) Displayed, Atlantic Foyer, 24 Sep, 2024 08:00 AM

A preliminary modelling framework for spatialization of soil compaction at the field scale

Alvaro Calleja Huerta [1 * ^], Mathieu Lamandé [2], Munkholm Lars [3]

Submission Type:

Oral presentation

Sub-topics:

Tire size and pressure, Controlled traffic farming, Soil compaction

Abstract Summary :

Current Decision Support Tools (DTS) for soil compaction management evaluate the risk of compaction by comparing the expected stresses from a certain machine with an estimate of soil strength. Recent findings from Schjønning (2023)*, have allowed to assess not only the risk of compaction but to estimate topsoil deformation using pedotransfer functions (PTFs) using easily available parameters like mean ground pressure, soil bulk density, soil water potential (pF), soil organic matter and clay content. Using these new PTFs, we propose a model framework for the spatialization of topsoil compaction in the field for GPS-equipped machinery. The needed inputs for the model are first (i) either a planned or conducted route plan in the field, (ii) machinery specifications (number of axles, axle widths, tire dimensions, tire specifications, wheel loads, and implement weight redistributions) and (iii) initial spatialized field soil properties (soil texture, water potential and bulk density). From these inputs, the model generates the wheel tracks where the machinery will be/has been driven combining the route plan and machinery and tire dimensions. These wheel tracks are then rasterized and given a mean ground pressure value for each pixel based on a log-normal distribution of the dynamic wheel load and the corresponding changes in tire-soil contact area (accounting for differences between the recommended and actual inflation pressures). Then, Schjønning (2023) PTF is applied iteratively on each wheel track pixel as many times as axles have the machine plus the implements, updating the soil bulk density with each wheel pass, and giving a spatialization of the soil compaction in the field. The model framework is still limited and cannot, for example, update soil water content with the increasing compaction which is a crucial aspect of the risk of compaction during repeated wheeling. The model can also estimate the stresses at different depths under the wheel tracks using the FRIDA and Söhne models, however, it is computationally consuming and not practical. Both the changes in water content during repeated wheeling, the estimation of stresses at different depths using PTFs, and a subsoil deformation module are currently being developed. This framework can be used as both a DTS/risk assessment tool to estimate expected compaction (pre-field operations), or to evaluate the impacts of a conducted single or multiple operations (post-field operations). With consecutive uses of the model, field operations can be more precisely planned for example, to avoiding compaction hotspots, or assessing the need for tillage. * Schjønning, P., 2023. An empirical model for prediction of topsoil deformation in field traffic. Soil and Tillage Research 227, 105589. https://doi.org/10.1016/j.still.2022.105589

Alvaro Calleja Huerta [1 * ^], Aarhus University, Postdoc

Mathieu Lamandé [2], Aarhus University, Senior Scientist

Munkholm Lars [3], Aarhus University, Professor-Senior Researcher

Session Details:

A preliminary modelling framework for spatialization of soil compaction at the field scale, Cape Charles A , 26 Sep, 2024 11:00 AM

High strain rate compression test to represent soil deformation during traffic in the field

Mathieu Lamandé [1*^], Kristian Einarson [2], Alvaro Calleja Huerta [3]

Submission Type:
Oral presentation

Sub-topics:
Tire size and pressure, Controlled traffic farming, Soil compaction

Abstract Summary :
Soil compaction due to heavy traffic on the arable land from modern agriculture machinery are a threat that often is unseen, but very critical to plant growth. The objective of this study was to compare and discuss the resulting soil deformation from traffic in the field and compression in the laboratory. We perform uniaxial compression tests representing the level of stress, the number of passes, and the loading time of traffic events in the field. Traffic of four machinery for slurry spreading was simulated on two soil types from Denmark (a sandy loam and a loam). The four different tractor-trailer combinations for slurry application presented wheel loads from 3 to 12 tons, and from 1 to 5 wheels passing in the same track. Nine undisturbed soil cores (100 cm3) were sampled at a depth of 25-28 cm for each soil type × machinery combination, which gives a total of 72 soil cores analyzed. The water content of the soil cores was equilibrated at a matric potential of -100 cm H2O. The soil cores were then subjected to uniaxial confined compression tests at a strain rate of 60 mm min-1 up to maximum load corresponding to the load applied by each wheel of the machinery. Total porosity, bulk density, and air-filled porosity were measured on the soil cores prior and after the compression tests. Physical parameters prior to compression were significantly different between the sandy loam and the loam. The sandy loam presented a lower bulk density and volumetric water content, and a larger air-filled porosity than the loam. The vertical deformation of the soil core after each loading was inverse proportional to the initial bulk density and proportional to the number of loadings. A larger deformation was observed for five loadings (corresponding to five wheels passing after each other in the same track) with a maximum normal load of 6 tons than for one loading with a maximum loading of 12 tons. Similar observations from real traffic experiments in the field with corresponding number of wheels and wheel loads have been reported. However, they were discrepancies between the deformations observed in the laboratory and in the field for similar soil types. In conclusion, laboratory uniaxial confined compression tests at high strain rate seemed to represent well the trends in soil stress-strain behavior observed in the field considering wheel loads and number of passes, while the extend of soil deformation might be overestimated. Discrepancies between the controlled conditions and the field were expected due to the rather different stress state in soil during loadings.

Mathieu Lamandé [1*^], Aarhus University, Senior Scientist

Kristian Einarson [2], Aarhus University, Undergraduate student

Alvaro Calleja Huerta [3], Aarhus University, Postdoc

Session Details:

High strain rate compression test to represent soil deformation during traffic in the field, Mariner Room, 26 Sep, 2024 01:00 PM

Spatio-temporal dynamics of soil penetration resistance depending on different conservation tillage systems

Danijel JUG [1 * ^], Irena JUG [2], Boris Đurđević [3], Edward Wilczewski [4], Bojana Brozović [5], Vesna Vukadinović [6], Monika Marković [7]

Submission Type:

Oral presentation

Sub-topics:

Soil compaction

Abstract Summary :

Penetration resistance is one of the most valuable and applicable indicators for determination of soil tillage compaction. Experimentation with penetration resistance on two different soil types (Gleysol and Stagnosol), with different crops (maize, soybean, winter wheat), and on three tillage treatments, start in 2021 in Croatia. Treatments were as follows: ST (plowing), CTD (conservation tillage deep, up to 30 cm with a minimum of 30% of crop residues on the surface), and CTS (conservation tillage shallow, up to 10 cm with a minimum 50% of crop residues on the surface). Crops were grown in same sequence on both sites as follows: maize (2021), soybean (2022), winter wheat (2022/2023), and soybean as a second crop after winter wheat (2023). Before the start of the experiment, there was a permanent pasture on Gleysol, and on Stagnosol was carried out for several years very intensive conventional tillage. The goal was to determine the intensity and time required for soil compaction changes depending on the "starting position" on both soil types. Penetration resistance was measured three times per vegetation year/crop (beginning, middle, end of vegetation). The penetration resistance was measured according to geolocated square grid design. High variation of penetration resistance values was found between soil types, vegetation seasons of measuring, crops and also between tillage treatments. These variations were very high, especially in the first year of the experiment (in range from 1.0 up to 10.0 MPa) but also in the third year (ranging from 3.5 up to 8.5 MPa). As general conclusions can be stated: spatio-temporal dynamics of soil penetration resistance depends on different "start position" (different previous cropping technique on sites), penetration resistance increased with the tillage depth and penetration resistance is inversely proportional to conservation level. Keywords: conservation soil tillage, soil compaction, soil penetration resistance This work has been fully supported by Croatian Science Foundation under the project "Assessment of conservation soil tillage as advanced methods for crop production and prevention of soil degradation – ACTIVEsoil" (IP-2020-02-2647).

Danijel JUG [1 * ^], University Of J.J.Strossmayer, Faculty of Agrobiotechnical Sciences, Full professor with tenure

Irena JUG [2], University Of J.J.Strossmayer, Faculty of Agrobiotechnical Sciences, Full professor with tenure

Boris Đurđević [3], Faculty of Agrobiotechnical Sciences Osijek, University of Josip Juraj Strossmayer in Osijek, Vladimira Preloga 1, Osijek, Croatia, Prof. dr. sc.

Edward Wilczewski [4] , Faculty of Agriculture and Biotechnology, Bydgoszcz University of Science and Technology, Prof. S. Kaliskiego 7, 85-796 Bydgoszcz, Poland, Prof. dr. sc.

Bojana Brozović [5] , Faculty of Agrobiotechnical Sciences Osijek, University of Josip Juraj Strossmayer in Osijek, Vladimira Preloga 1, Osijek, Croatia, Prof. dr. sc.

Vesna Vukadinović [6] , Faculty of Agrobiotechnical Sciences Osijek, University of Josip Juraj Strossmayer in Osijek, Vladimira Preloga 1, Osijek, Croatia, Prof. dr. sc.

Monika Marković [7] , Faculty of Agrobiotechnical Sciences Osijek, University of Josip Juraj Strossmayer in Osijek, Vladimira Preloga 1, Osijek, Croatia, Prof. dr. sc.

Session Details:

Spatio-temporal dynamics of soil penetration resistance depending on different conservation tillage systems, Cape Charles A , 26 Sep, 2024 09:00 AM

Effects of conservation tillage on soil properties and soybean yields on Stagnosol, Eastern Croatia

Irena JUG [1 * ^], Danijel JUG [2], Boris Đurđević [3], Bojana Brozović [4], VLADIMIR ZEBEC [5], Vesna Vukadinović [6], Monika Marković [7], Antonija Strilić [8]

Submission Type:

Poster presentation

Sub-topics:

Conservation soil tillage

Abstract Summary :

Proper land management practices are crucial for improving the productivity of Stagnosols. The productivity of Stagnosols is influenced by their poor drainage, nutrient dynamics, soil aeration, organic matter decomposition rates, and the types of vegetation and crops that are best suited to these conditions. The production capacity of natural, unmodified, Stagnosol is low. They are usually used as such in agricultural production, but they give very variable yields, which depend greatly on the amount of rainfall distribution and applied agricultural technology. Conservation tillage protect soil from degradation processes and ensures more moisture storage, reduces erosion, benefits the crop in arid and semiarid areas by reducing drought risk and increasing grain yield. During 2022 the effects of different tillage systems, fertilization treatment and liming on soil properties and soybean yields were investigated on Stagnosol in Eastern Croatia. Cultivated crop was soybean and the treatments were: ST-standard tillage (deep moldboard plowing, up to 30 cm), CTD-Conservation Tillage Deep (chiseling up to 30 cm and minimum 30% of surface covered with plant residues), CTS-Conservation Tillage Shallow (tillage up to 10 cm and minimum 50% of surface covered with plant residues). Liming was applied with two different variants: CY-treatment with liming (according to recommendation for neutralization soil pH) and CN-treatment without liming. Fertilization treatments include: FR-according recommendation (NPK), FD-fertilization decreased by 50% compared to recommendation, GFR-fertilization according recommendation + 300 kg ha-1 Geo2 (biophysiological soil activator), GFD-fertilization decreased by 50% + 300 kg ha-1 Geo2. The results showed that Soil Organic Carbon (SOC), water content and soil bulk density were significantly influenced by the tillage, liming and fertilization treatments. The highest content of SOC (1.64%) and the lowest soil bulk density (1.26 g cm-3) were recorded on CTD/CY/GFD while highest value of soil bulk density (1.59 g cm-3) and water content (39.23%) were recorded on ST/CY/FD respectively ST/CN/FD. The highest grain yields (4.84 t ha-1), biological yield (11.24 t ha-1) and harvest index (46.34%) were achieved on conservation tillage systems (CTD/CY/GFR and CTS/CY/GFR). Properly selected sustainable land management practices are essential for maintaining long-term soil productivity and reducing soil degradation caused by agricultural activities, especially on soils with poorer productive capabilities. Effective management practices, like conservation soil tillage, liming and optimal doses of fertilizers with the use of biophysiological soil activators are essential to mitigate the challenges posed by Stagnosols and improve their productivity. Keywords: conservation soil tillage, Stagnosol, soil properties, soybean yield This work has been fully supported by

Croatian Science Foundation under the project "Assessment of conservation soil tillage as advanced methods for crop production and prevention of soil degradation – ACTIVEsoil" (IP-2020-02-2647).

Irena JUG [1 * ^], University Of J.J.Strossmayer, Faculty of Agrobiotechnical Sciences, Full professor with tenure

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Bojana Brozović [4], Faculty of Agrobiotechnical Sciences Osijek, University of Josip Juraj Strossmayer in Osijek, Vladimira Preloga 1, Osijek, Croatia, Prof. dr. sc.

VLADIMIR ZEBEC [5], A3C Conference, Prof. dr. sc.

Vesna Vukadinović [6], Faculty of Agrobiotechnical Sciences Osijek, University of Josip Juraj Strossmayer in Osijek, Vladimira Preloga 1, Osijek, Croatia, Prof. dr. sc.

Monika Marković [7], Faculty of Agrobiotechnical Sciences Osijek, University of Josip Juraj Strossmayer in Osijek, Vladimira Preloga 1, Osijek, Croatia, Prof. dr. sc.

Antonija Strilić [8], Faculty of Agrobiotechnical Sciences Osijek, University of Josip Juraj Strossmayer in Osijek, Vladimira Preloga 1, Osijek, Croatia, PhD student

Session Details:

Poster Session (Tillage) Displayed, Atlantic Foyer, 23 Sep, 2024 08:00 AM

Root growth of perennial green fallow crops in macropores of fine-textured soils

Laura Alakukku [1 * ^], Pirjo Mäkelä [2], Merja Myllys [3]

Submission Type:

Oral presentation

Sub-topics:

Conservation agriculture

Abstract Summary :

Plant roots grow in soil macropores and the macropore structure affects the distribution of roots in soil profile. On the other hand, actively growing plant root system modifies the macroporosity of soil (biological tillage). Perennial green fallow in crop sequence provides possibility to use plant roots for enhancing macropore formation. However, the number, size, and growth of roots of these plants in macropores has been seldom studied. In the present work, the distribution of three perennial green fallow crop roots in earthworm burrows, root channels, cracks, and in other macropores was investigated at two fine texture soils. The aim was to identify the number and where to grow of fine roots (diameter < 1 mm) and coarse roots (≥ 1 mm) in top and subsoil. Lucerne (Medigaco sativa L.), red clover (Trifolium pratense L.), and oriental goat’s rue (Galega orientalis Lam.) were grown as green fallow crops (no fertilizer, cutting once a year) on a clay soil (42% clay (< 0.002 mm) in 0 20 cm and 59% in 20 60 cm) in Jokioinen and on a silty clay loam (29% and 36% clay) in Mouhijärvi, southwestern Finland. After three years, undisturbed soil samples (PVC pipe inside Ø 15 cm at Jokioinen and 20 cm at Mouhijärvi were taken from the layer of 0 50 cm during the flowering stage. Three (Jokioinen) and two (Mouhijärvi) replicate samples per crop, with the auger centered over the plant, were taken. The samples were cut into subsamples in 5 cm increments. To obtain an intrinsic soil surface, all smeared or damaged soil was removed from the subsample surfaces with a knife and brush. The number of roots at the cut soil surface were counted, and the macropore where the root grow was visually classified as earthworm burrow (cylindrical pore diameter ≥ 2mm), root channel (cylindrical pore diameter < 2mm), crack, and other (mainly between aggregates). The diameter of roots over 1 mm was determined with a slide caliper. The number and cross sectional area of all cylindrical pores ≥ 2 mm (earthworm burrows) were also determined from the subsample surfaces. Below 30 cm depth, the number of roots ≥ 1mm from the total number of roots was mainly 1 8%. Relative root number (number of roots at 30 cm depth/number of roots at 10 cm depth) of red clover (clay 0.46, loam 0.36) and oriental goat’s rue (0.16 and 0.21) was clearly less than that of lucerne (0.77 and 1.05) indicating lucerne’s ability to have deep root system compared to two other crops. Below 35 cm (clay) and 30 cm (load) depth, 50% or more of roots grew in biopores (root channels and earthworm burrows) indicating the importance of biopores to root

Laura Alakukku [1 * ^], University Of Helsinki, professor

Pirjo Mäkelä [2], Unversity of Helsinki, professor

Merja Myllys [3], Natural Resources Institute Finland (Luke), Research Scientist

Session Details:

Root growth of perennial green fallow crops in macropores of fine-textured soils, Cape Henry C, 26 Sep, 2024 09:00 AM

Possibilities to use plant roots to loosen up subsoil compaction on a silt soil in South-East Norway

Till Seehusen [1 * ^]

Submission Type:
Oral presentation

Sub-topics:
Soil compaction

Abstract Summary :

In the Nordic region, climate change will lead to wetter conditions and a reduction in days workable. This increases the risk for severe (subsoil) compaction. Mechanical subsoiling is costly and seldom successful in the long term, which increases interest in strategies using deeply penetrating plant roots to loosen up compacted subsoil. In a former compaction study, a Stagnosol derived from silty alluvial deposits was compacted by multiple wheeling (10x) with 2.8 Mg wheel load. This led to severe subsoil compaction (40 cm) as shown e.g. by a significant increase of bulk density (BD) with 1.69 g cm−3 (exceeding the suggested threshold value for root growth) on the compacted (C) as compared to 1.59 g cm−3 in the uncompacted reference plots (R). Compaction also decreased total pore volume (TPV) by 6% compared to the R plot. Thereafter, four different crop rotation treatments were applied during a 4-year period, (a) oilseed (Brassica rapa L. ssp. Oleifera) and barley (Hordeum vulgare L.) rotation (treatment 1 and 2), (b) barley monoculture (3) and (c) alfalfa (Medicago sativa L.) (4) growing for 4 years to investigate possibilities to loosen subsoil compaction by plant roots. The results show that after these 4 years, the BD was still significantly higher in the compacted than in the uncompacted reference plots. In the uncompacted R plot, the BD was significantly decreased from 1.59 to 1.45 g cm−3 for all treatments compared to the beginning of the study. On contrary, on the C plot, the BD was significantly reduced after 5 years only for treatment 4 (1.45 g cm−3), reaching the same BD as treatment 4 in the R plot (1.44 g cm−3). Both treatment 1 and 4 led to a significant increase in the TPV (+5.1% respectively +7.0%) on the C plots over the 4-year period. The results on other soil parameters as saturated hydraulic conductivity or air permeability were less determined and varied between treatments. Oilseed established only poorly mostly due to a short growing season in this part of Norway. Although oilseed is known to have deep-growing roots, oil seed was therefore not effective to loosen the subsoil in this study. Further, the results show that crop rotation including deep rooting plants have a potential to loosen up soil compaction over time but that it is crucial to choose the right crop and production strategi to get as good establishment as possible. Anyhow, biological soil loosening takes time and is often not economical reasonable so that avoidance of compaction is still the greatest priority.

Till Seehusen [1 * ^], Norwegian Institute Of Bioeconomy Research (NIBIO), Research Scientist (phD)

Session Details:

Possibilities to use plant roots to loosen up subsoil compaction on a silt soil in South-East Norway, Cape

Charles A , 26 Sep, 2024 11:00 AM

Analysis of Soil Pore Anisotropy Induced by Bio-Subsoiler Roots

Mansonia Alejandra Pulido Moncada [1 * ^], Sheela Katuwal [2], Lars J. Munkholm [3]

Submission Type:
Oral presentation

Sub-topics:
Soil health and quality

Abstract Summary :
Subsoil compaction threatens soil health in Northern Europe, affecting 40-50% of the agricultural area by disrupting essential pore functions. Bio-subsoilers (deep-rooting crops) are suggested to create lasting pores that can restore pore functionality in compacted subsoils. Characterising soil pore directionality is important for studying preferred pore connectivity and its impact on fluid (water and gases) transport. However, there has been limited focus on the impact of bio-subsoilers on the pore anisotropy of compacted subsoils. The objective of this study was to evaluate the impact of different bio-subsoiler species on the anisotropy of the soil pore characteristics of a compacted sandy loam subsoil. Four experimental treatments consisting of spring barley (Hordeum vulgare L.) as the reference, and chicory (Cichorium intybus), lucerne (Medicago sativa L.) and tall fescue (Festuca arundinacea L.) as potential bio-subsoilers were established in a field (55°19'42'' N, 11°24'28'' E) previously subjected to a four-year compaction trial with heavy traffic. Persistent subsoil compaction was identified at depths of 0.30–0.50 meters. After two years of crop growth, intact soil samples (579 cm3) were collected both vertically and horizontally at 0.3-0.4 m depth. Air-filled porosity (εa) and air permeability (ka) were quantified at matric potentials of -10, -30, -50, -100, and -300 hPa, and X-ray computed tomography (CT) scans were obtained on samples drained at -100 hPa. Results showed a significant ($p < 0.05$) anisotropic behaviour of εa and ka at different matric potentials for chicory and lucerne, indicating the creation of more vertically oriented pores than horizontally oriented ones. CT-derived macroporosity exhibited a more complex network in the vertical direction, consisting of tubelike, branched and blocked/isolated pores, while horizontally, the pore network was primarily dominated by blocked/isolated pores. A significantly larger proportion of CT-derived macroporosity (~50%) was comprised of vertically connected pores in lucerne as compared to spring barley (~20%). This study suggests that the impact of bio-subsoilers on the soil pore anisotropy in compacted subsoil layers is species-dependent. Among the four bio-subsoilers evaluated in this study, lucerne seems to have greater potential for creating functional pathways for fluid flow through compacted subsoil layers. This knowledge is crucial for soil health enhancement of compacted subsoils.

Mansonia Alejandra Pulido Moncada [1 * ^], Aarhus University, Academic employee

Sheela Katuwal [2], USDA-Agricultural Research Service National Laboratory for Agriculture and the Environment, ORISE Postdoc

Lars J. Munkholm [3], Aarhus University, Professor

Session Details:

Analysis of Soil Pore Anisotropy Induced by Bio-Subsoiler Roots, Cape Henry C, 24 Sep, 2024 11:00 AM

Cover crop - reduced tillage systems without herbicides and chemical fertilizers in onion cultivation: promising but challenges remain

Mariana Scarlato [1 * ^], Magdalena Rieppi [2], Florencia Alliaume [3], Gabriela Illarze [4], Natalia Bajsa [5], Paloma Bertoni [6], Felix. J.J.A. Bianchi [7], Gimena Echeverriborda [8], Guillermo Galván [9], Margarita Garcia De Souza [10], Juan Carlos Gilsanz [11], Pablo González Barrios [12], José Pedro Dieste [13], Tania Trasante [14], Walter A.H. Rossing [15], Santiago Dogliotti [16]

Submission Type: Oral presentation

Sub-topics: Conservation agriculture

Abstract Summary :

Cover crops with reduced tillage technology (CCRT) can foster soil health and functioning, a crucial agroecological principle in any transition strategy to more sustainable agricultural systems. However, CCRT management often results in variable and low crop yields and commonly relies strongly on herbicides and synthetic fertilizers. We assessed the effects of two tillage systems (RT and conventional tillage, CT) and the application of native effective microorganisms (NEM) on onion crop growth and development, yield, N status, weed pressure, and soil physico-chemical and biological quality after a summer CC, without using herbicides or synthetic fertilizers. The study comprised a two-year experiment at an experimental station and one-year simplified experiments on an organic and a conventional commercial farm in the south of Uruguay. The soil type in the three locations was a Mollic Vertisol (Hypereutric), and the species used in the CC were Setaria italica and Vigna unguiculata. We used an interdisciplinary and participatory approach where a group of farmers, technical advisers, and researchers, participated from the beginning of the study to define, monitor, and assess the operational and tactical management of the experiments. Onion yields were generally low (between 10 and 16 Mg ha-1) and lower in 2019 than in 2020, and lower in RT than in CT in 2020. The relatively low yields in 2019 and RT were associated with poor crop growth and development and leaf N concentrations below the critical threshold in the early stages of crop development. Soil bulk density was not limiting crop growth in any treatment. Soil mineral N was lower in 2019 than in 2020 and did not significantly differ between treatments. Soil biological activity was higher in RT than in CT. Although the soil covered by CC residue in the early stages of the onion crop in RT was more than 50%, RT had a higher weed pressure than CT, which was reversed later in the growing season. The NEM application did not significantly affect most crop, weed, and soil variables. In conclusion, the CCRT without fertilizers and herbicides in onion cultivation reduced soil erosion risk, increased biological activity, and did not pose soil physical restrictions for the crop. However, it resulted in N limitation that reduced onion yield and in high weed pressure that increased labour demand. Thus, CCRT systems in vegetable production are within reach, but further research targeting effective ways to suppress weeds and increase soil N availability at the start of the growing season is needed to make them feasible under organic management. The participatory setting improved the experimental design and management. It promoted the learning processes of all actors involved, which is essential for developing long-term research platforms for agroecological farming.

Mariana Scarlato [1 * ^], Faculty Of Agronomy, Universidad De La República Del Uruguay / Farming Systems Ecology, Wageningen University And Research, Research assistant

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Gimena Echeverriborda [8], Cooperativa Entrebichitos, Uruguay., Technical advisor

Guillermo Galván [9], Faculty of Agronomy, Universidad de la República del Uruguay, Professor

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Juan Carlos Gilsanz [11], Instituto de Investigaciones Biológicas Clemente Estable, Researcher

Pablo González Barrios [12], Agronomy College - Universidad De La Republica, Assistant Professor

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Walter A.H. Rossing [15], Farming Systems Ecology, Wageningen University and Research, The Netherlands, Professor

Santiago Dogliotti [16], Faculty of Agronomy, Universidad de la República del Uruguay, Professor

Session Details:

Cover crop - reduced tillage systems without herbicides and chemical fertilizers in onion cultivation: promising but challenges remain, Atlantic Ballroom, 24 Sep, 2024 09:00 AM

Strategies of crop diversification, cover crop implementation and flexible tillage to improve soil fertility and the multi-performance of cropping systems

Domitille JAMET [1 * ^], Stéphane Cadoux [2], Louis Hincelin [3], Anne-Sophie Perrin [4], Matthieu Loos [5], Nicolas Latraye [6], Edouard Baranger [7], Cyril Hannon [8], Yohan Debeauvais [9], Damian Martin [10], Michael Geloen [11]

Submission Type:

Oral presentation

Sub-topics:

Cover crops and residue additions, Soil health and quality, Crop production efficiency

Abstract Summary :

Improving soil fertility is crucial to build agroecological cropping systems that reconcile productivity, profitability, environmental protection and robustness against climatic and price fluctuations. It requires to design innovative strategies at the cropping system scale and adapted to the local context. To meet this challenge and support farmers in the transition of their cropping system, the French technical institutes for arable crops Arvalis, Terres Inovia and ITB, launched the collaborative project Syppre in 2015 (Toqué et al., 2015). The project includes experimental sites in five contrasted production situations in France, hosting long-term cropping system experiments comparing innovative systems co-designed with local experts and regularly fine-tuned to control systems, in real farming conditions. They aim to reach both global and local issues. Improving soil fertility is a shared ambition in all the sites, whether to increase crop robustness and productivity, to decrease fertilizer dependency or to increase resilience against climatic hazards. Therefore, innovative systems implement agronomic levers such as crop diversification, cover crops and flexible tillage. This work focus on 2 experimental sites with different contexts and issues. In the deep silt loam of Picardie with productive cropping systems including industrial crops, the low organic matter content and the use of heavy machinery may jeopardize performances in the long term (risk of compaction and crusting). In the shallow clay-limestone soils with low nitrogen mineralization potential in Berry, the goal was to increase crop robustness through soil fertility improvement, to enhance competitiveness against pests . This work presents how we combined diversification, cover crops and flexible tillage to improve soil fertility and thus cropping system performances and robustness. Different indicators of soil fertility were measured according to the site issues (physical fertility in Picardie, nitrogen supply in Berry), and cropping systems performances were evaluated every year. After 8 years of experimentation, improvements in soil parameters have been observed, improving the performance of certain crops such as winter oilseed rape and potatoes. The assessment of performances showed that productivity and profitability were generally lower in the innovative system compared to the control system, but the environmental performances were better and input use was reduced (Longis et al, 2024). References: Toqué C, et al., SYPPRE: A project to promote innovations in arable crop production mobilizing farmers and stakeholders and including co-design, ex-ante evaluation and experimentation of multi- service farming systems matching with regional challenges. In: 5th International Symposium for Farming Systems Design. Agro2015, Montpellier, France, 2015. Longis S, et al, 2024. Performance of innovative cropping systems diversified with oilseeds and protein crops: identification and resolution of methodological issues, using the Syppre experimental network as a case study. Oilseeds & fats Crops and Lipids 31: 2

Domitille JAMET [1 * ^], Terres Inovia (France), Agronomist

Stéphane Cadoux [2], Terres Inovia, Agronomist

Louis Hincelin [3], Terres Inovia, Agronomist

Anne-Sophie Perrin [4], Terres Inovia (France), Soil sciences

Matthieu Loos [5], Terres Inovia, Agronomist

Nicolas Latraye [6], Terres Inovia, Agronomist

Edouard Baranger [7], Arvalis, Agronomist

Cyril Hannon [8], Arvalis, Agronomist

Yohan Debeauvais [9], ITB, Agronomist

Damian Martin [10], AgroTransfert, Agronomist

Michael Geloen [11], Terres Inovia, Agronomist

Session Details:

Strategies of crop diversification, cover crop implementation and flexible tillage to improve soil fertility and the multi-performance of cropping systems, Cape Henry C, 26 Sep, 2024 08:00 AM

EFFECTS REDUCED TILLAGE AND AGRONOMY PRACTICES ON PHYSICAL AND CHEMICAL PROPERTIES OF SANDY LOAM SOIL AND GROWTH COMPONENT OF SOYBEAN (Glycin max L)

Joshua Olaoye [1], Ezekiel Olanrewaju Ariyo [2 * ^], Mary Olaoye [3]

Submission Type:
Oral presentation

Sub-topics:
Legumes, grasses, brassica, forbes nutrient availability

Abstract Summary :

Crop management technique is to develop soil-conserving tillage practices for soil protection which is crucial for sustainable crop productivity. Over-estimation of tillage requirements can result in soil degradation and high energy consumption. This study investigated the influence of Tillage System (TS), Nutrient Applications (NA) and Weed Management (WM) on soil physicochemical properties (PCPS) and yield of soybean in the derived Guinea savannah ecotones of Nigeria. The physical and chemical properties were determined using the United States Department of Agricultural Laboratory Standards. Field experiments were conducted in 2018 and 2019 sowing seasons. The treatments considered were: Reduced tillage depths (TD) of 10, 15, 20, 25 cm; Nutrient Application Rates were applied at 0 kg/ha, Compost Poultry Manure (CPM) at 0.5 ton/ha + 50 kg/ha of superphosphate (SSP), CPM at 1 ton/ha + 75 kg/ha of SSP and Weed Management were applied as No weeding, 3 l/ha of Pre-emergence (PE) at planting + 2.5 l/ha of post emergence (POE) at 3 weeks after sowing (WAS), 3 l/ha of PE + 3 l/ha of POE at 5 WAS, 3 l/ha of PE + 4 l/ha of POE at 7 WAS). A 4×3×4 factorial experiment in a Randomized Complete Block Design was used. Standard agronomic procedures were followed to obtain GY. Analysis of Variance was conducted on data obtained at $p \leq 0.05$. The findings of the study were that TS and NA were significant ($p \leq 0.05$) on PCPS. TS with depths of cut 10 and 15cm aided availability and retention of soil nutrients. The soil Mg^{2+}, N, P and K contents increased by 24.37, 10.81, 5.05 and 9.09% respectively for NA at CPM of 1 ton/ha +75 kg/ha of SSP while WM had no significant effect on PCPS. Also reduced tillage options influenced growth component of soybean such as number of noodles, root length, plant height and stem girth. TD of 15 cm, NA of CPM at 0.5 ton/ha + 50 kg/ha of SSP and early weed control at 3-5 WAP performed best ($p \leq 0.05$) with a mean GY of 2.62 ton/ha. The study concluded that the investigated input variables can improve yield of soybean. The developed model equation adequately predicted grain yield. The study recommended that tillage depth at 15 cm with CPM of 0.5 ton/ha + 50 kg/ha of SSP and weed control at 3-5 WAP be used for soybean cultivation.

Joshua Olaoye [1], University Of Ilorin, Ilorin, Professor

Ezekiel Olanrewaju Ariyo [2 * ^], Kwara State Ministry of Agriculture and Rural Development, Ilorin, Nigeria, Director

Mary Olaoye [3], Department of Computer Science, University of Ilorin, Ilorin, Nigeria, Principal Technologist

Session Details:

EFFECTS REDUCED TILLAGE AND AGRONOMY PRACTICES ON PHYSICAL AND CHEMICAL PROPERTIES OF SANDY LOAM SOIL AND GROWTH COMPONENT OF SOYBEAN (Glycin max L), Cape Charles A , 24 Sep, 2024 02:00 PM

Development of a Computer Model to Predict the Performance and Cost of Use of an Acha Harvesting Machine in Nigeria

Joshua Olaoye [1 *], Utunji Isaac Tanam [2], Mary Olaoye [3 ^]

Submission Type:

Poster presentation

Sub-topics:

Tillage implements and other equipment

Abstract Summary :

Large scale production of acha (Digitaria specie) has been hampered for non-availability of machines for various aspects of its production. Lack of design data is responsible for lack of development of appropriate harvesters for acha crop. Previous research identified pertinent parameters that affect acha harvesting and the functional relationships between these parameters were developed. These functions required labourious computations to determine an acha harvester Material Capacity, Energy requirements and Cost of the harvest operation. The aim of this paper was to develop a computer model that will simplify the computation of these factors of operation performance. A dynamic programming algorithm was used and a flowchart describing the process was developed, from which a programming code in the Java programing language was adopted. The output from the programme showed that the programme was able to adequately compute the harvester Material Capacity, Energy Required to achieve the observed material capacity as well as the cost of the operation. The paper therefore concluded that the model was able to predict the outcome of acha harvesting operation, and recommends its use by acha farmers and adaptation to similar crops.

Joshua Olaoye [1 *], University Of Ilorin, Ilorin, Professor

Utunji Isaac Tanam [2], Bingham University, Lecturer

Mary Olaoye [3 ^], Department of Computer Science, University of Ilorin, Ilorin, Nigeria, Principal Technologist

Session Details:

Poster Session (Tillage) Displayed, Atlantic Foyer, 23 Sep, 2024 08:00 AM

Present state of soil structure: A Comparison of cropland and grassland soils in North Germany

Conrad Wiermann [1 * ^], Malin Hanne Bockwoldt [2], Daniel Uteau [3], Stephan Peth [4], Anneka Mordhorst [5], Heiner Fleige [6]

Submission Type:

Oral presentation

Sub-topics:

Soil compaction

Abstract Summary :

Climate change is rapidly progressing and land use management must be adapted. In order to develop resilient land use systems, the functionality of soil structure is of central importance: both heavy rain events as well as dry periods should be compensated. The soil structure of cropland and grassland sites were mostly investigated on experimental stations rather than on a wide and representative range of soils within a complete region. Thus, the aim of the presented study is to analyse the actual conditions, in means of functionality, of soil structure as influenced by different land use systems in North Germany. Material and Methods: The soil structure of 45 representative cropland and nearly 50 grassland soils in Schleswig-Holstein were investigated in top- and subsoil using soil physical methods: water retention curve, saturated hydraulic conductivity, aggregate stability (wet sieving and crushing test) and shear strength. Beside the separate interpretation of each applied parameter, the soil compaction status was examined using the concept of the compaction verification tool (CVT) published by Zink et al. (2011). Furthermore, the yield of selected cropland and grassland sites were determined over three years. Results: Within the cropland sites a high degree of harmful top- and subsoil compaction was detected. In contrast, nearly no indications of severe structure degradation could be identified on grassland sites. However, a noticeable number of grassland soils show values for the air capacity < 5 Vol. %, hence indicating a restricted functionality of the soil structure. A clear correlation between soil quality (Muencheberg Soil Quality Rating by Mueller et al., 2013) and crop yield could be shown on arable soils. The yield of grassland sites in contrast is less influenced by soil physical properties than by fluctuating groundwater levels. Conclusions: Degradation of soil structure is widespread within the cropland soils of Schleswig-Holstein, resulting in yield and economic losses. Less soil degradation was identified on grassland soils due to the dense sward with a complex root system, compensating mechanical induced stresses to a significant degree. Literature: Zink, A., Fleige, H., Horn, R. (2011): Verification of harmful subsoil compaction in loess soils; Soil & Tillage Research 114, S. 127 – 134. Mueller, L., Shepherd, G., Schindler, U., Ball, B.C., Munkholm, L.J., Hennings, V., Smolentseva, E., Rukhovic, O., Lukin, S., Hu, C. (2013): Evaluation of soil structure in the framework of an overall soil quality rating. Soil & Tillage Research, 127, 74 – 84.

Conrad Wiermann [1 * ^], University Of Applied Science Kiel, Professor

Malin Hanne Bockwoldt [2], Chamber of Agriculture Schleswig-Holstein, Researcher

Daniel Uteau [3], University of Kassel, Researcher

Stephan Peth [4], Leibnitz University of Hannover, Lecturer and Researcher

Anneka Mordhorst [5], Christian-Albrechts-University of Kiel, Researcher

Heiner Fleige [6], Christian-Albrechts-University of Kiel, Researcher

Session Details:

Present state of soil structure: A Comparison of cropland and grassland soils in North Germany, Cape Charles A , 26 Sep, 2024 11:00 AM

EFFECT OF IMPLEMENT WEIGHT ON THE PERFROMANCE OF THE DISC PLOUGH

Utunji Isaac Tanam [1 * ^]

Submission Type: Oral presentation

Sub-topics: Tillage implements and other equipment

Abstract Summary :

Crop production is the business of maximising profit in growing crops for food, feed and fibre, while ensuring environmental sustainability. Profit maximisation implies reduction in the cost of field operation while environmental sustainability requires that the soil be left in state in which it serves the next generation optimally. Unfortunately, tillage that is meant to prepare the soil for improved crop production has been described as the single most expensive factor in crop production, and yet leaves the soil in an undesirable condition of compaction in the long run owing to the heavy machineries used, thereby negating the principle of sustainability. A lot of research has gone into proffering solutions to these problems but most have not considered the contribution of implement weight to the problem. It is generally believed that higher implement weight aids tool soil penetration. This work therefore aims at studying the actual effect of implement weight on the depth of cut of the disc plough in a gravelly sandy soil. A two factor Latin Square with repeated treatment of weight was used to study the effects of weight on depth of cut using ANOVA. Factors considered were tilt angle ($\alpha 1=16°$, $\alpha 2=22°$, $\alpha 3=26°$,), disc angle ($\beta 1=37°$, $\beta 2=40°$, $\beta 3=43°$) and weight ($\lambda 1=253.1$kg, $\lambda 2=327.7$kg, $\lambda 3=370.4$kg). The implement was powered by a 47.7kW (64 hp) tractor, weighing 2757 kg. Results obtained showed that there was insufficient evidence to prove that implement weight had significant effect on the depth and width of cut of the disc plough. Disc angle was significant on width of cut at 5% only while tilt angle was significant on both depth and width of cut, even at 1%. It may be concluded therefore that varying the weight of the disc plough may not significantly affect its depth and width of cut, and that depth and width of cut are affected by tilt angle while disc angle only affected the width of cut. It is recommended from this result, that ploughs with lighter weight be designed so as to be pulled by smaller tractors to reduce energy requirement and soil compaction.

Utunji Isaac Tanam [1 * ^], Bingham University, Lecturer

Session Details:

EFFECT OF IMPLEMENT WEIGHT ON THE PERFROMANCE OF THE DISC PLOUGH, Atlantic Ballroom, 24 Sep, 2024 10:00 AM

Evaluating Varying Seeding Methods of Cover Crops on Soil Nitrogen Uptake and Biomass Production

Mary Michael Lipford Zahed [1 * ^], Mark Reiter [2], Joseph Haymaker [3], John Mason [4], Ozzie Abbay [5], Kristen Hughes Evans [6], Joshua Mott [7]

Submission Type:
Oral presentation

Sub-topics:
Legumes, grasses, brassica, forbes nutrient availability

Abstract Summary :
A wide-reaching concern of cover crop planting for many farmers is the lack of time after cash crop harvest to get an adequate stand before winter. Many Virginia farmers do not plant as many acres of cover crops as they would like. Nitrogen (N) mineralization is shown to continue after corn uptake ceases, making it possible for sizable amounts of N to leach after harvest and before cover crop planting. This project simulates a combine mounted seeder, which allows for application of cover crop seeds at harvest. We seek to determine if planting cover crops at corn harvest instead of a 4-week delay will increase the ability for cover crops to scavenge more soil N, and to determine which seeding method has the greatest soil N uptake and biomass production. Four seeding methods were used: 1) aerial seeding with incorporation at harvest, 2) aerial seeding without incorporation at harvest, 3) aerial seeding with incorporation 4 weeks after harvest, 4) drilling 4 weeks after harvest, and a no cover crop control. Each seeding method was repeated with rye, hairy vetch, rapeseed, and a mix of all three. This project was conducted from fall 2022 to spring 2024. Preliminary data shows planting cover crops at corn harvest can increase fall biomass production by up to 8 times, when compared to planting 4 weeks after harvest (113.5 kg ha-1 late drilled vetch vs. 919 kg ha-1 early incorporated vetch). More N was accumulated in the aboveground biomass of hairy vetch and the mix, especially when planted early or drilled, compared to the other treatments (23 to 208 kg ha-1 N).

Mary Michael Lipford Zahed [1 * ^], Virginia Tech ESAREC, Graduate Research Assistant

Mark Reiter [2], Virginia Tech, Professor of Soils and Nutrient Management

Joseph Haymaker [3], Virginia Tech, Graduate Research Assistant

John Mason [4], Virginia Polytechnic Institute And State University, Eastern Shore AREC, Research Specialist Sr.

Ozzie Abbay [5], VTSPES, Professor

Kristen Hughes Evans [6], Sustainable Chesapeake, CEO

Joshua Mott [7], USDA-ARS, Researcher

Session Details:

Evaluating Varying Seeding Methods of Cover Crops on Soil Nitrogen Uptake and Biomass Production, Cape Charles A , 24 Sep, 2024 01:00 PM

Monitoring the state of subsoil compaction in Swedish arable soils

Ararso Etana [1*^], Thomas Keller [2]

Submission Type:

Oral presentation

Sub-topics:

Soil physics/water movement

Abstract Summary :

Experimental investigations in Sweden and elsewhere have shown that the capacity of natural regeneration of compacted subsoil is very low, and sustainable amelioration is doubtful. However, our knowledge about the level of subsoil compaction at farm level is limited. A program to monitor the spatial pattern and temporal evolution of soil structural properties on Swedish arable lands started in 2003 including 30 farms in six major Swedish cropping area. Each year, we investigated five fields, and each field was sampled ever six years. The soil properties included in the study are soil dry bulk density, saturated hydraulic conductivity, penetration resistance, and water retention at field capacity. Until now, three rounds of sampling and measurements have been completed, i.e. each field has been sampled three times. When we started the monitoring, farm machinery had already reached axle loads that could cause severe subsoil compaction. Therefore, we used dry bulk density and saturated hydraulic conductivity data collected in the 1950s and 1960s as a reference. In 19 out of the 30 fields, dry soil bulk density was greater than the reference values at the start of monitoring, and compaction levels continued to increase in 10 of them. In four fields, bulk density was similar to reference values at the start of the monitoring but significantly increased during the last two decades. Only seven fields seem to have “normal” bulk density values that do not indicate compaction. Saturated hydraulic conductivity is very low compared to reference values in almost all fields. Restriction of water movement in the profile of arable soils may have detrimental effects on leaching through preferential flow and on flooding due to the limited drainage potential. These effects are likely to aggravate in the future in a climate with more extreme precipitation events.

Ararso Etana [1*^], SLU, Associate professor

Thomas Keller [2], SLU, Professor

Session Details:

Monitoring the state of subsoil compaction in Swedish arable soils, Mariner Room, 26 Sep, 2024 08:00 AM

Honeybee pollination efficiency for conventional and twin-row seeded sunflower

Bojan Stipesevic [1*^], Bojana Brozović [2], Zlatko Puškadija [3], Marin Kovačić [4], Đuro Banaj [5], Anamarija Banaj [6], Dominik Mikolčević [7]

Submission Type:

Oral presentation

Sub-topics:

Biodiversity and ecosystem services

Abstract Summary :

The importance of pollination service of insects, especially honey bees, has been very important topic recently, due to disturbance of pollinators via global climate changes, extreme weather patterns and human impact through environmentally unfavorable agriculture practices, such as agri-chemical application. In order to investigate importance of honeybee pollination service on sunflower, the most important oil plant in continental climate, an experiment has been conducted in Experimental station of the Faculty of Agrobitechnical Sciences Osijek, Croatia, on three different sunflower hybrids, seeded as conventional (CT) and twin-row (TR) layout for the same crop density, during seasons 2022 and 2023. The observed honeybee efficiency has been monitored for three treatments: a) open honeybee pollination setup - uncovered sunflower heads, freely available for honeybee visits; b) denied access for honeybees - net with mash for honeybee approach to sunflower heads during whole flowering stage, and c) limited access for pollinators - mounted net was removed for 2 x 10 minutes visits (2 hours before and after noon) in two flowering stages for honeybee access and pollination. For each basic experimental plot there were 5 marked and observed sunflowers, in order to record pollinators' count and behaviour in given timeframe. Sunflower heads were collected in full seed maturity stage. Sunflower head diameter, number of fertile and sterile grains, mass of fertile grains, grains moisture and oil content were determined for each head, and grain yield has been recalculated from plant's density and each head grain's mass. Result showed that the most observed pollinator was honeybee (more than 97%), regardless of sunflower's layout. Twin-row layout showed trend of more frequent honeybee visits than conventional layout, probably due to better soil coverage. Open pollination treatment (a) yielded for both layouts the highest head diameter, total number of fertile grains, mass of grains and oil content, followed by treatment of limited access (c), whereas denied access treatment (b) recorded up to 18% smaller head diameter, 32% less fertilized grains, 35-39% smaller grain mass and 3-7% less oil content. Grain yield achieved by open pollination treatment had 5,7 t/ha, whereas denying pollinators visit to sunflower caused grain yield reduction of 35% for TR layout and even 39% for CT layout, probably due to more succesfull wind pollination for TR layout.

Bojan Stipesevic [1*^], Faculty Of Agrobiotechnical Sciences Osijek, University Of Josip Juraj Strossmayer In Osijek, Vladimira Preloga 1, Osijek, Croatia, Full professor, permanent tenure

Bojana Brozović [2], Faculty of Agrobiotechnical Sciences Osijek, Croatia, Associate Professor

Zlatko Puškadija [3] , Faculty of Agrobiotechnical Sciences Osijek, Croatia, Full professor, permanent tenure

Marin Kovačić [4] , Faculty of Agrobiotechnical Sciences Osijek, Croatia, Assistant professor

Đuro Banaj [5] , Faculty of Agrobiotechnical Sciences Osijek, Croatia, Full professor, permanent tenure

Anamarija Banaj [6] , Faculty of Agrobiotechnical Sciences Osijek, Croatia, Senior assistant

Dominik Mikolčević [7] , KWS sjeme doo, Osijek, Croatia, PhD candidate

Session Details:

Honeybee pollination efficiency for conventional and twin-row seeded sunflower, Cape Henry C, 26 Sep, 2024 08:00 AM

Research of changes in soil physical properties using conventional and autonomous robotic inter-row cultivation methods

Indrė Bručienė [1 * ^], Sidona Buragienė [2], Egidijus Šarauskis [3]

Submission Type:
Oral presentation

Sub-topics:
Weed science

Abstract Summary :

Mechanical weed control is an essential and decisive technological process in organic farming systems and plays an important role in improving the overall quality and quantity of crop yields. On the other hand, this technological operation has an adverse effect on the soil, altering its physical properties and, consequently, adjusting the dynamics of the carbon content of the soil, which is essential for plant development. In addition, mechanical weed control is a more labour-intensive, time-consuming and precise method of weed control than conventional chemical weed control, in order to ensure that crop yields are not compromised. The use of automated autonomous agricultural machines – robots – has therefore recently gained popularity, which not only ensure process efficiency but also contribute to environmental sustainability. In this context, the aim of this study was to experimentally investigate and compare the short-term effects of conventional mechanical machine (CMM) and autonomous agricultural robot (AAR) used in crop maintenance processes on soil properties, such as soil bulk density, porosity, and moisture content, in organic sugar beet production. The results showed that the inter-row cultivation (IRC) process, although carried out by a relatively lightweight solar-powered robot in the AAR variant, has an impact on soil physical properties, but this effect is much smaller than that of the conventional machinery. Soil bulk density at 0–10 cm depth after IRC process in the AAR variant remained unchanged at different stages of sugar beet growth, but increased slightly by up to 3% at 11–20 cm depth. In contrast, in the CMM variant, soil bulk density increased (up to 6%) mainly at 0–10 cm depth, with significant differences. Comparing the effects of AAR and CMM on soil moisture content, it was found that after IRC the moisture content remained similar in both layers in both variants. Soil aeration and total porosity remained similar in AAR at 0–10 cm depth and decreased insignificantly at 11–20 cm depth to 20 and 9%, respectively. In the CMM, soil aeration and total porosity decreased at both 0–10 and 11–20 cm depths, but the decrease was more pronounced in the top layer and differed significantly by up to 21 and 7%, respectively. Thus, low-weight autonomous field robots have the potential to reduce the structural damage to soil, but more research is needed to include different robot designs and to compare the effects in different soil types and crops.

Indrė Bručienė [1 * ^], Vytautas Magnus University, Agriculture Academy, PhD student

Sidona Buragienė [2], Vytautas Magnus University, Agriculture Academy, Senior Researcher

Egidijus Šarauskis [3], Vytautas Magnus University, Agriculture Academy, Professor

Session Details:

Research of changes in soil physical properties using conventional and autonomous robotic inter-row cultivation methods, Cape Charles A , 26 Sep, 2024 01:00 PM

Comparative Analysis of Energy Consumption and Soil Compaction between Tracked and Wheeled Tractors

Kornél Tamás [1]^, Zoltán Hudoba [2]*

Submission Type:

Poster presentation

Sub-topics:

Soil compaction

Abstract Summary :

This study compared tractors equipped with different traction systems for tillage work. Field tests were conducted at three locations, using three types of tractors and various implements. The pulling power requirements of the machines, working speeds, changes in the soil surface, and soil compaction before and after the tillage process were measured. Pulling power, traction efficiency, wheel slip, self-rolling power, area power, and the average compaction effect of the traction systems were calculated. The results indicated that tracked tractors exhibited nearly 20% higher traction force in heavy-duty operations than their wheeled ones. Traction efficiency showed a similar increase. Wheel slip was reduced by approximately one-fifth during heavy-duty work and by about one-third during light-duty work when utilizing tracked drives. Area production saw a 16-20% improvement during heavy-duty operations. Soil compaction attributed to the traction system was reduced by approximately 30% using belted tracks. In summary, based on the conducted field tests, it can be concluded that employing tracked belt drive mechanisms on tractors is advantageous for heavier soil work (e.g., soil loosening), while lighter tasks (e.g., cultivation) approach the performance parameters of wheeled tractors. Additionally, soil compaction damage can be significantly reduced by implementing belted traction systems.

Kornél Tamás [1]^, Budapest University Of Technology And Economics Faculty Of Mechanical Engineering: Budapesti Muszaki Es Gazdasagtudomanyi Egyetem Gepeszmernoki Kar, Associate Professor

Zoltán Hudoba [2]*, Budapest University of Technology and Economics Faculty of Mechanical Engineering: Budapesti Muszaki es Gazdasagtudomanyi Egyetem Gepeszmernoki Kar, Senior Instructor

Session Details:

Poster Session (Tillage) Displayed, Atlantic Foyer, 23 Sep, 2024 08:00 AM

Application of site-specific seeding methods to winter wheat using proximal soil sensing data

Egidijus Šarauskis [1]*^

Submission Type:

Poster presentation

Sub-topics:

Technology

Abstract Summary :

Field zones with different soil productivity may be produce different numbers of winter wheat (WW) stalks and ears. This depends on the soil properties in each soil management zone (MZ). The use of proximal soil sensor data for site specific seeding (SSS) can better exploit the soil's potential to increase yield and quality parameters for energy, environmental and economic (EEE) benefits. The aim of this study was to determine the influence of winter wheat SSS method, based on electrical conductivity measurements on agronomic and EEE parameters. The experiment was conducted in 2021–2022 in a farm field (22.4 ha) in the northern part of Lithuania, whose coordinates are 55°67'45.5 "N 24°14'59.6 "E. The soil type in the field ranged from loam to sandy loam. The apparent electrical conductivity (ECa) of the soil was determined in the field with a scanner EM 38 MK 2. Based on this indicator, the study field was divided into 5 soil MZ and a WW seeding map was created accordingly. 4 different seeding methods were evaluated: URS – uniform rate seeding, VRS – variable rate seeding, VRDS – variable rate and depth seeding, and VRDSF – variable rate and depth seeding and variable rate fertilization. In the URS, a uniform seeding rate (162 kg/ha) was applied, while in the other variants, a variable rate from 131 to 192 kg/ha was used. Direct seeding of WW with the Horsch Avatar 6.16 SD seed drill was performed. After harvesting WW, qualitative yield and EEE indicators were determined. The differences of field soil in terms of ECa using a proximal sensor were obtained from 28.6 mS/m (MZ1) to 22.6 mS/m (MZ5). The summarized research results showed that, compared to URS, the VRDS method showed better WW productivity results. Grain yield was 6.5% (2022) to 20.3% (2023) higher compared to the URS. When evaluating field soil variability, it was found that WW grain yield using the VRDS was better in four out of five field soil MZ compared to the URS. The lowest energy consumption of WW production (14325 MJ/ha) was in URS, but thanks to the higher yield, the energy efficiency ratio in VRSD was the highest (8.81). The energy productivity and specific energy values of VRDS were also the best at 0.61 kg/MJ and 1.64 MJ/kg, respectively. The best indicators of GHG emission efficiency ratio and GHG emission per ton of WW grain were demonstrated by the VRSD, 10.31 and 56.24 kg CO_2eq/t, respectively. The analysis of the economic evaluation showed that, compared to URS, SSS methods also gave economic benefits, i.e. increased income up to 8.3%, which corresponds to an average advantage of EUR 138.6 per ha in favor of precision seeding.

Egidijus Šarauskis [1]*^, Vytautas Magnus University, Agriculture Academy, Professor

Session Details:

Poster Session (SOIL AND WATER MANAGEMENT, SOIL FERTILITY, PRECISION AG, ON-FARM RESEARCH, CROP PROTECTION) Displayed, Atlantic Foyer, 24 Sep, 2024 08:00 AM

Optimization of a Sweep Geometry and Working Parameters Using Discrete Element Method and Genetic Algorithm

Bence Szabó [1 * ^], Kornél Tamás [2]

Submission Type: Oral presentation

Sub-topics: Equipment, Artificial intelligence

Abstract Summary :
Cultivation is an essential part of soil tillage techniques. This operation is highly energy-intensive and covers vast areas, so even small increases in efficiency can result in significant energy savings. For these reasons, the soil-sweep tool interaction is intensively researched. Researchers use physical measurements and numerical simulations to determine the optimal geometry for specific soil tillage tasks and tillage parameters. One commonly used numerical method for modeling soil-sweep tool interaction is the discrete element method (DEM). Increasingly accurate DEM soil models can simulate the draught force acting on the tool simultaneously with the movement of the soil. This model enables more reliable optimization of tillage tool geometries and tillage parameters. There is limited literature on how DEM can be more effectively applied in the design practice of soil tillage tools. Therefore, the aim of this research is to develop a method for the automatic optimization of a sweep tool geometry and cultivation parameters using DEM and a genetic algorithm (GA). The optimization aim is to achieve the soil cultivation objective with minimal energy input, considering the movement and interaction of soil and crop residues. The research results demonstrate that by employing a properly calibrated DEM soil model, the genetic algorithm can provide suggestions for tool geometries and corresponding cultivation depths that meet the specified objective functions at a given tool speed.

Bence Szabó [1 * ^], Budapest University Of Technology And Economics Faculty Of Mechanical Engineering: Budapesti Muszaki Es Gazdasagtudomanyi Egyetem Gepeszmernoki Kar, Msc Student

Kornél Tamás [2], Budapest University Of Technology And Economics Faculty Of Mechanical Engineering: Budapesti Muszaki Es Gazdasagtudomanyi Egyetem Gepeszmernoki Kar, Associate Professor

Session Details:

Optimization of a Sweep Geometry and Working Parameters Using Discrete Element Method and Genetic Algorithm, Mariner Room, 24 Sep, 2024 09:00 AM

Efficiency of the biomethod for reducing carbon dioxide from the soil

Kristina Lekavičienė [1 * ^], Vilma Naujokienė [2], Egidijus Šarauskis [3]

Submission Type:
Oral presentation

Sub-topics:
Cover crops and residue additions, Crop production efficiency

Abstract Summary :
The impacts of mechanization result in higher greenhouse gas emissions from soil. Therefore, it is useful to carefully manage a number of important factors in relation to the established relationship between soil tillage systems and various performance indicators by taking into account the optimization of soil management. Therefore, this study aims to evaluate the biomethod effect on reducing CO2 from soil. The research was carried out under meteorological conditions in central Lithuania. The area of the experimental field was divided into 8 experimental treatments. In spring, after the resumption of plant vegetation, winter wheat “Famulus” (first year) and winter rapeseed “Cult” (second year) were sprayed with 4 different biopreparations (SC2, SC4, SC6, SC8) and their mixtures (SC3 (SC2+SC4), SC5 (SC2+SC6), SC7 (SC2+SC8)) using “Amazone” sprayer (model UF-901). The rate ranged from 1.0 to 4.0 l ha−1. Biopreparations were mixed with water at 200 l ha−1. Technological operations: seeding of eight plots; fertilizing; seven experimental plots spraying different biopreparations; fertilizing, spraying; harvesting; deep tillage and CO2 measurement from the soil. The soil emissions were measured using a Portable Gas Emission Analyser (ADC LCPro Plus). Experimental studies have shown that the most effective microbiological activity in the soil is influenced by the complex bio-solution of the non–membrane, nitrogen–fixing bacteria (Azotobacter chroococcum, Azospirillum brasilense), phosphorus, potassium, and seaweed. This complex bio-solution was used in scenario SC8 where the best effectiveness for CO2 from soil reducing was achieved.

Kristina Lekavičienė [1 * ^], Vytautas Magnus University, Agriculture Academy, Dr.

Vilma Naujokienė [2], Vytautas Magnus University, Senior Researcher

Egidijus Šarauskis [3], Vytautas Magnus University, Agriculture Academy, Professor

Session Details:

Efficiency of the biomethod for reducing carbon dioxide from the soil, Cape Henry C, 24 Sep, 2024 09:00 AM

Fog water harvesting potential using passive harvesters in the Namib desert

Hupenyu Allan Mupambwa [1 * ^]

Submission Type:
Oral presentation

Sub-topics:
Water scarcity

Abstract Summary :
The unique coastal areas of the world's oldest desert, the Namib Desert, see it receiving most of its water as advective fog rather than normal precipitation, a very peculiar characteristic of this desert. Most of the animal and plant species that are found within this desert have thus adopted mechanisms of harvesting this fog for survival. However, there is limited research over the past 20 years to monitor and determine the potential of this fog in creating water for agronomic uses within this hyper arid environment. Our research monitored the quantity and quality of fog water harvested in two locations i.e. Henties Bay and Gobabeb; using a 1 m2 fog harvester. Furthermore, the efficiency of a solar still in desalinating the fog water was also evaluated across the two sites. At the Henties Bay site, the highest amount of water was recorded between May and June, with monthly quantities that reached between 15 and 20 L of water per harvester. In the Gobabeb site, about 90km from the coast, the fog water was only recorded in July and August with quantities ranging from 2730 mL to 5590 mL. Across all the months for Henties Bay, the pH was ranged from 7.4 to as high as 9.6, with electrical conductivity ranging from 5.07 mS/cm to 50mS/cm. However, for pH at Gobabeb ranged from 7.71 to 8.29 with an EC of 0.88 mS/cm to 2.96 mS/cm. The saline water that was deionized using a solar still yielded water with very low salt contents as indicated by the electrical conductivity ranging from 1458µS/cm to 128.6µS/cm. The initial analysis of the trace metal content of the fog water indicated the presence of very low concentrations of Cr, Cd and Ni, whilst Zn and Pb which were mainly at below detectable levels. The preliminary results of this study indicate that the water quality from passive harvesters in the Namibian coast is quite saline close to the coast and may not be suitable for direct agronomic use. This salinity greatly decreases with the distance from the coast as witnessed at Gobabeb site. However, the use of a solar still can create a cheap solution to continuously desalinate this fog water to generate fresh water that can be used for irrigating trees in the Namib desert.

Hupenyu Allan Mupambwa [1 * ^], University Of Namibia, Senior Researcher and Head of Sam Nujoma Marine and Coastal Resources Research Center (SANUMARC)

Session Details:

Fog water harvesting potential using passive harvesters in the Namib desert, Mariner Room, 26 Sep, 2024 09:00 AM

Economic and Yield Benefits of Using Cover Crops to Reduce Nitrogen Fertilizer Inputs in Corn Production on U.S. Coastal Plain Soils

Joseph Haymaker [1 * ^], Mark Reiter [2], John Mason [3], Ryan Stewart [4], Kurt Stephenson [5], Kipling Balkcom [6]

Submission Type:

Oral presentation

Sub-topics:

Legumes, grasses, brassica, forbes nutrient availability

Abstract Summary :

Sandy loam soils on the U.S. Coastal Plain are prone to nitrogen (N) leaching, and fluctuations in fertilizer prices have further affected corn (Zea mays) production profitability. In fall 2014, we initiated a long-term study to evaluate the impact of 12 different crop rotations on soil health and cash crop yields. Rotations included four no-cover crop (NCC) controls, seven cover crop (CC) treatments, and a perennial mix treatment where corn was planted every third year. In fall 2022, CCs were planted after corn harvest on October 12 (five treatments) and soybean harvest on November 9 (two treatments). Biomass and N accumulation from CCs and weeds were assessed before chemical termination on April 24, 2023. Corn was planted across all 12 treatments the following day, with 56 kg N ha-1 of starter fertilizer applied. At the V6 growth stage, each main plot was split into four 3.7m × 12.2m subplots and sidedressed at 0, 56, 112, and 168 kg N ha-1 rates. Corn yields were measured at harvest and adjusted to 155 g H2O kg-1. Total CC and weed biomass production ranged from 1,383 to 5,405 kg ha-1 ($p < 0.001$, LSD0.05 = 1208 kg ha-1), and N accumulation ranged from 24 to 186 kg N ha-1 ($p < 0.001$, LSD0.05 = 28 kg N ha-1). Among CC treatments, cereal rye (Secale cereale) had the lowest total biomass production (2,623 kg ha-1) and N accumulation (34 kg N ha-1), which were similar to NCC controls. Early-planted hairy vetch (Vicia villosa) accumulated significantly more biomass (4,578 vs. 3,440 kg ha-1) and N (186 vs. 134 kg ha-1) than late-planted vetch. However, late-planted vetch accumulated similar N as the early-planted CC mixes (121 to 160 kg N ha-1). At the zero N sidedress rate, N accumulation from total biomass positively correlated with corn yield (R2 = 0.68), while total biomass C:N ratio negatively correlated with corn yield (R2 = 0.60). Monoculture and hairy vetch-dominant mix treatments exhibited the lowest C:N ratio (≤12:1) and highest N accumulation (>134 kg N ha-1), resulting in the highest corn yields and lowest yield response to increased N fertilizer. In contrast, NCC controls and cereal rye treatment had the lowest corn yields at each N-sidedressing rate. Although all treatments experienced yield increases with higher N rates, economic returns were minimal for hairy vetch treatments, with partial net profits ranging from US$1,733 to US$1,758 ha-1 for early-planted vetch and US$1,588 to US$1,740 ha-1 for late-planted vetch across N rates. However, cereal rye treatment yielded negative net returns, earning US$73 to US$174 less than the NCC control across N rates. This study highlights that legume CCs and mixes can improve corn yields, reduce N fertilizer inputs, and enhance profit potential.

Joseph Haymaker [1 * ^], Virginia Tech, Graduate Research Assistant

Mark Reiter [2], Virginia Tech, Professor of Soils and Nutrient Management

John Mason [3], Virginia Polytechnic Institute And State University, Eastern Shore AREC, Research Specialist Sr.

Ryan Stewart [4], Virginia Polytechnic Institute and State University, Associate Professor

Kurt Stephenson [5], Virginia Tech, Professor

Kipling Balkcom [6], USDA-ARS, Research Agronomist

Session Details:

Economic and Yield Benefits of Using Cover Crops to Reduce Nitrogen Fertilizer Inputs in Corn Production on U.S. Coastal Plain Soils, Cape Charles A , 24 Sep, 2024 01:00 PM

Measuring and mapping soil moisture in agricultural fields by neutron-gamma analysis

Galina Yakubova [1 * ^], Aleksandr Kavetskiy [2], Stephen Prior [3], H. Allen Torbert [4], Sidharth Gautam [5]

Submission Type:

Oral presentation

Sub-topics:

Technology

Abstract Summary :

Knowledge of subsurface soil water content distribution over agricultural fields is important for optimizing modern agricultural practices and enhancing soil science knowledge. It is important in selecting appropriate tillage, land use, and irrigation management practices. Collecting and processing representative field soil cores for traditional laboratory analysis or measuring soil field moisture by portable devices is labor intensive, time consuming and represent “point” soil moisture content. There are other methods that measure soil characteristics using remote sensors (from aircraft and satellites), but their estimates cover large spatial areas with relatively large associated errors. Pulsed fast thermal neutron analysis (PFTNA) technology for measuring and mapping soil moisture is a good alternative to the previous mentioned methods. PFTNA is based on detecting gamma lines that appear due to neutron nuclei interactions. Each neutron-nucleus interaction give a gamma line of particular energy for that interaction. Soil water content is correlated with the 2.22 MeV gamma signal from hydrogen in soil. State-of-the-art nuclear physics methodologies and instrumentation, combined with commercial availability of portable pulse neutron generators, high-efficiency gamma detectors, reliable electronics, and measurement and data processing software, have currently made the application of neutron-gamma analysis possible for routine measurements in various fields of study. Our mobile PFTNA system (paired with GPS) was used for moisture measurements by determining hydrogen peak areas in the thermal neutron capture gamma spectra acquired when scanning agricultural fields. A calibration dependency was used for converting hydrogen peak area to soil moisture content by comparing PFTNA hydrogen peak area to other soil moisture determination methods (gravimetric, time domain reflectometry, and nuclear moisture/density gauge). Long-range (100-300 m) trends of changing water content are of interest when mapping soil water distribution for agricultural purposes. This distribution can be represented as isolines overlaying a geographical map of a studied field. Data suitable for mapping are prepared as datasets of geographical coordinates and corresponding hydrogen content. Isolines across the field can be created from such dataset by different methods. Examples of the water content maps of real agricultural fields suitable for use in agricultural practices will be presented. While data acquired by gravimetric or instrument methods can be labor intensive and time consuming, PFTNA scanning of a 10-ha field can acquire needed mapping data in ~1 h. Thus, PFTNA scanning can be recommended as a more efficient method for measuring and mapping soil moisture in agricultural fields.

Galina Yakubova [1 * ^], USDA-ARS National Soil Dynamics Laboratory, research scientist

Aleksandr Kavetskiy [2], USDA-ARS NSDL, research physical scientist

Stephen Prior [3], USDA-ARS NSDL, Plant Physiologist

H. Allen Torbert [4], USDA-ARS NSDL, research leader

Sidharth Gautam [5], USDA-ARS NSDL, programmer

Session Details:

Measuring and mapping soil moisture in agricultural fields by neutron-gamma analysis, Mariner Room, 24 Sep, 2024 08:00 AM

Soil Mapping for Carbon Sequestration and Regenerative Agriculture Using Gamma Analysis Technology

H. Allen Torbert [1 * ^], Aleksandr Kavetskiy [2], Galina Yakubova [3], Stephen Prior [4]

Submission Type:
Oral presentation

Sub-topics:
Technology, Equipment

Abstract Summary :

A new methodology has been developed that can provide soil elemental content distribution mapping across a field with no soil disturbance. The technology uses a mobile inelastic neutron scattering (MINS) system to measure elemental content in the soil at the atomic level. With this system, a neutron generator radiates the soil with neutrons and gamma detectors measure the resulting gamma rays produced from the excited nucleus of the atoms in soil. Elements such as C can be distinguished and the content determined. The methodology has been developed to allow the system to be mounted on a mobile platform with a GPS and moved across a field. With this system, the elemental content of elements such as soil C can be mapped across large areas. This patented methodology (United States Patent US 11,397,277 B2, Jul. 26, 2022) was licensed by Carbon Asset Solutions, is the basis of their MRV soil credit methodology, and has been ISO validated (June 30, 2023) as “comprehensive and transparent approach to calculating carbon sequestration” compliant with ISO 14064-2:2019 and 14064-3:2019. The details of this system and the resulting mapping will be discussed.

H. Allen Torbert [1 * ^], USDA-ARS NSDL, research leader

Aleksandr Kavetskiy [2], USDA-ARS NSDL, research physical scientist

Galina Yakubova [3], USDA-ARS National Soil Dynamics Laboratory, research scientist

Stephen Prior [4], USDA-ARS NSDL, Plant Physiologist

Session Details:

Soil Mapping for Carbon Sequestration and Regenerative Agriculture Using Gamma Analysis Technology, Mariner Room, 24 Sep, 2024 08:00 AM

TRACTOR FORWARD SPEED, WHEEL DESIGN AND SLIPPAGE OF A CASSAVA PLANTER IN A SANDY CLAY LOAM SOIL

Monday Ale [1 * ^], Olawale Olukunle [2]

Submission Type: Poster presentation

Sub-topics: Tillage implements and other equipment

Abstract Summary :

A study to determine the effect of tractor forward speed on slippage as well as wheel design on slippage of a cassava planter in a sandy clay loam soil was carried out. Five varying speeds of 1.5, 1.8, 2.1, 2.3 and 2.6 km/h were used at a constant soil depth of 100 mm in the speed-slippage experiment. Pneumatic wheel, rigid wheel with pegs and rigid wheel with lugs were used in the wheel design- slippage experiment. Circumferential angles of 0˚, 45˚ and 60˚ were used for the wheel with lugs at a constant speed of 1.5 km/h. A linear relationship was observed between forward speed and wheel slippage in the pneumatic and rigid wheel experiments with higher values of slippage in the pneumatic experiment. It was also observed that intra-row spacing increased with an increase in wheel slippage in the rigid and pneumatic wheel experiments. The intra-row spacing varied between 1.05 and 1.15 m in the rigid wheel experiment and 1.09 and 1.31 in the pneumatic experiment. The highest performance in terms of wheel slippage was recorded in the rigid wheel with pegs having the least value of wheel slippage of 2.6% at forward speed of 1.5 km/h. It was found that rigid wheels with 0˚ circumferential lug arrangement angle showed the highest performance with wheel slippage of 3.11% at the optimum forward speed of 1.5 km/h. The results suggest that the planter should be used with the rigid wheels with pegs or rigid wheels with lugs at 0˚ circumferential angle and optimum forward speed of 1.5 km/h.

Monday Ale [1 * ^], Rufus Giwa Polytechnic Owo, Principal Lecturer

Olawale Olukunle [2], Federal University of Technology Akure, Professor

Session Details:

Poster Session (Tillage) Displayed, Atlantic Foyer, 23 Sep, 2024 08:00 AM

A simple spade method for a scaled-up assessment of soil structure by advisors and farmers

Stéphane Cadoux [1 * ^], Anne-Sophie Perrin [2], Bernard Garric [3], Michael Geloen [4], Domitille JAMET [5], Vincent Tomis [6], Jospéhine Peigné [7]

Submission Type:

Oral presentation

Sub-topics:

Methodologies for visual, chemical, and physical soil examination

Abstract Summary :

Soil structure is a key element of soil fertility and many methods exist for assessing it. The "profil cultural" method (Boizard et al., 2017) is considered to provide one of the most detailed description of soil structure but is also one of the most time-consuming and complex to implement (Boizard et al., 2005). A spade method derived from it, was developed by Peigné et al. (2019), but did not incorporate the latest developments in the method (Boizard et al., 2017) and the description still required a fairly high level of expertise. To encourage widespread use of soil structure assessment by advisors and farmers, we developed a new simple spade method called “Terres Inovia-test” (TI-test), simplified from that of Peigné et al. (2019), and integrating the latest developments in the "profil cultural" method. In this work we describe the implementation of the method and detail the way in which the soil structure is described. In short, the description is done in two stages, first noting the structural organisation of the entire trench and then the internal state of the clods. Combining the two results in a score. An equivalence with the soil structure quality (Sq) score of the VESS method (Ball et al., 2007) is proposed in order to make the link with this other widely deployed method. This new simplified spade test has already proved its worth in helping to choose the optimum tillage for winter oilseed rape establishment (Cadoux et al., 2018). It also allows to propose several methods based on the same soil structure description method, offering a gradient of ease of implementation and diagnostic accuracy: "profil cultural" (Boizard et al., 2017), “mini 3D soil profile” (Tomis et al., 2019), ISARA method (Peigné et al., 2019), and “Terres Inovia-test” (this paper). References: Ball, B. C. et al. 2007. Field assessment of soil structural quality–a development of the Peerlkamp test. Soil use and Management, 23(4), 329-337. Boizard, H. et al. 2005. Field meeting visual soil structure assessment held at the INRA, Research Station, Estrées-Mons, France, 642 25–27 May 2005. Boizard, H. et al. 2017. Developments in the “profil cultural” method for an improved assessment of soil structure under no-till. Soil and Tillage Research, 173, 92-103. Cadoux S. et al. 2018. Tillage strategies to optimize rapeseed establishment: a method to support decision making. 21th International ISTRO conference, 24-27 September 2018, Paris, France. Peigné, J. et al. 2019. Des méthodes bêches dérivées de la méthode du profil cultural. Agronomie, Environnement et Sociétés, 9(2), 87-93. Tomis, V. et al. 2019. Development of the “mini 3D soil profile”–A visual method derived from the “profil cultural”. Soil and Tillage Research, 194, 104285.

Stéphane Cadoux [1] * ^, Terres Inovia, Agronomist

Anne-Sophie Perrin [2], Terres Inovia (France), Soil sciences

Bernard Garric [3], Terres Inovia, Agronomist

Michael Geloen [4], Terres Inovia, Agronomist

Domitille JAMET [5], Terres Inovia (France), Agronomist

Vincent Tomis [6], Terres Inovia, Agronomist

Jospéhine Peigné [7], ISARA, Professor of soil science

Session Details:

A simple spade method for a scaled-up assessment of soil structure by advisors and farmers, Cape Henry C, 24 Sep, 2024 11:00 AM

The alleviation effects of different soybean genotypes to soil compaction

Lidong Ren [1 * ^]

Submission Type:
Oral presentation

Sub-topics:
Soil compaction

Abstract Summary :
As the development of agricultural mechanization, agricultural machinery stress is increasing, making soil compaction become one of the key constraints to sustainable development in the agricultural modernization process. In China, agricultural mechanization has developed rapidly in recent years; however, there is still lacking studies on the effects and alleviation of soil compaction, especially on the biological mitigation benefits. This study explores the response of different soybean genotypes to soil compaction and the alleviation mechanism of compacted soil. The specific objectives of the study are: 1) to compare the different response of five different genotype soybeans by using aboveground biological indicators and to understand the mechanism of biological root system adaptation to soil compaction by analyzing the indicators of soybean root system architecture; 2) to quantitatively soil alleviation ability of different genotype soybeans and the main indicators of soil structure change by combining soil water retention curves, soil moisture, soybean root system structure and X-ray CT extracted soil structure properties under different cropping years. The results have important implications for promoting soybean breeding, increasing soybean production under intensive regulation, and mitigating the effects of agricultural mechanization on soil quality. Keywords: soil compaction; soybean genotypes; root system architecture; soil structure; X-ray CT

Lidong Ren [1 * ^], Institute Of Geographic Sciences And Natural Resources Research, Chinese Academy Of Sciences (CAS), Assistance professor

Session Details:

The alleviation effects of different soybean genotypes to soil compaction, Mariner Room, 26 Sep, 2024 02:00 PM

Improving the analysis of in-season effects of cover crops, crop rotation and tillage on nitrate leaching using a generalized additive model approach for time-series data

Jorge Federico Miranda-Vélez [1 * ^], Gavin Leslie Simpson [2]

Submission Type:
Oral presentation

Sub-topics:
Agricultural runoff, leaching, and other loss mechanisms

Abstract Summary :

Nitrate leaching is one of agriculture’s most significant environmental impacts, and reducing it is a priority goal in many regions and countries around the world. Studies in this field typically compute cumulative fluxes (often yearly) and analyze the effects of experimental treatments via linear or linear mixed models. This approach is useful but offers limited insights on the temporal dynamics of soil nitrate under different management and environmental conditions. Generalized additive models (GAMs) are a novel statistical tool that allows for the analysis of trends and variations in non-linear and non-cyclical experimental time-series data, which makes them ideally suited for analyzing soil nitrate concentrations over time. This study analyzed the effects of cover crops and conservation tillage on soil nitrate concentrations at -1 m depth as measured from suction cup samples over 4 years in the CENTS long-term crop rotation and reduced tillage experiment at Aarhus University. The results of this study will contribute to assessing both the effectiveness of cover cropping and conservation tillage in reducing nitrate leaching as well as the temporality of their effects.

Jorge Federico Miranda-Vélez [1 * ^], Aarhus University Department Of Agroecology, Postdoctoral Researcher

Gavin Leslie Simpson [2], Aarhus University Department of Agroecology, Assistant Professor

Session Details:

Improving the analysis of in-season effects of cover crops, crop rotation and tillage on nitrate leaching using a generalized additive model approach for time-series data, Cape Henry C, 23 Sep, 2024 02:00 PM

The integration of cover crops and soil tillage to improve crop production efficiency in a long running UK field experiment

Nathan Morris [1 * ^], David Clarke [2], Douglas Warner [3], Elizabeth Stockdale [4], Stéphanie Swarbreck [5]

Submission Type:

Oral presentation

Sub-topics:

Crop production efficiency

Abstract Summary :

The NFS (New Farming Systems) project is a long-term study at Morley Farm, Morley, Norfolk, UK on an Ashley Series, sandy loam soil. Research is managed by NIAB and supported by The Morley Agricultural Foundation (TMAF) and the JC Mann Trust. The aim of this long running experiment is to explore the interaction between cultivation and cover /companion crop use for sustainable arable production. This research uses a single rotation – based on winter cereals with winter and spring sown break crops – in a fully replicated experiment; as described by Stobart and Morris, 2013. This paper presents findings on the impact of soil tillage and rotational cover crop use over 12 years (2009-2020) and considers the impact on crop yield, financial returns and the implications of energy use efficiency for producing combinable crop grains. Energy use per hectare (highest to lowest) was: plough > deep non-inversion > shallow non-inversion. When considered in combination with lower energy input per hectare, energy efficiency increased relative to the plough-only control. Greenhouse gas (GHG) emissions from fertiliser, N2O emissions and field operations; together account for more than 70% of the total GHG intensity from the Cereal Yield Enhancement Network entries. In order to address the challenge of producing high-quality grain yield while limiting the negative effect on our environment through the next phase of support (2023-2028); we are evaluating new genetic pre-breeding lines under farming practises that may be more sustainable. Our vision is to develop new varieties with low N requirement and low GHG emissions, with an understanding of the associated best agronomic practises to limit the environmental impact while maintaining high-quality grain yield production. Provisional findings from this new phase of work will also be presented here.

Nathan Morris [1 * ^], NIAB, Senior Specialist - Farming Systems and Soils

David Clarke [2], NIAB, NIAB Soils and Farming Systems Specialist

Douglas Warner [3], University of Hertfordshire, Associate Professor in Research

Elizabeth Stockdale [4], NIAB, Head of Farming Systems and Agronomy Research

Stéphanie Swarbreck [5], NIAB, Group Leader Molecular Physiology

Session Details:

The integration of cover crops and soil tillage to improve crop production efficiency in a long running UK field experiment, Cape Henry C, 24 Sep, 2024 11:00 AM

Enhancing Organic Rice Production in Central Japan through No-Till and Cover Crop Management

Masakazu Komatsuzaki [1 * ^], Koichi Shoji [2], Naomi Asagi [3], Yoshinori Watanabe [4], Jun Sugai Sugai [5], Yudai Koike [6], Khoki Muto [7], Takatoki Kaku [8], Chaki Matsubayasi [9], Honoka Honoka Nakayama [10]

Submission Type:

Oral presentation

Sub-topics:

Cover crops and residue additions, Conservation agriculture

Abstract Summary :

Organic farming has garnered increased attention within the agricultural sector, particularly in Japan. However, Japanese organic farming practices are often characterized by labor-intensive methods and lower yields when compared to conventional rice (Oryza sativa L.) cultivation systems. This study investigates the impact of two key factors, namely tillage methods (rotary tillage vs. No-till) and cover crops (Italian Ryegrass and hairy vetch mixture vs. winter fallow), on organic rice production in central Japan. The experimental research was conducted under organic management in a paddy field situated at the Center for International Field Agriculture Research & Education, Ibaraki University, during the year 2023, utilizing a split-plot design with four replications. Our findings reveal that the No-till transplanting method exhibited superior performance, as evidenced by a vacant hill ratio of 15%, in contrast to the tilled field, which showed a 10% vacant hill ratio. Moreover, rice yields demonstrated significant improvements, with increases of 8.5% and 42.6% when utilizing Italian ryegrass and hairy vetch mixture as a cover crop under conventional tilled and No-till field conditions, respectively. Particularly noteworthy is the significant interaction observed between the cover crop and the tillage system, with the No-till approach coupled with a cover crop yielding the highest results. Notably, no significant differences were detected in weed biomass during the rice cultivation period among the various treatments. These results collectively suggest the potential for implementing no-tillage combined with cover crop management strategies in paddy fields to foster the development of regenerative organic rice production. This research contributes to addressing the challenges associated with organic farming in Japan and offers valuable insights into sustainable agricultural practices in the region.

Masakazu Komatsuzaki [1 * ^], Ibaraki University, Professor

Koichi Shoji [2], Kobe University, Associate Professor

Naomi Asagi [3], Ibaraki University, Associate Professor

Yoshinori Watanabe [4], Fukushima University, Associate Professor

Jun Sugai Sugai [5], Ibaraki University, Master Student

Yudai Koike [6], Ibaraki University, Student

Khoki Muto [7], Ibaraki University, Master Student

Takatoki Kaku [8], Ibaraki University, Master Student

Chaki Matsubayasi [9], Ibaraki University, Student

Honoka Honoka Nakayama [10], Ibaraki University, Student

Session Details:

Enhancing Organic Rice Production in Central Japan through No-Till and Cover Crop Management, Cape Henry C, 26 Sep, 2024 09:00 AM

Model to simulate fuel consumption and sowing performance based on adjustable settings on tractor-tire-tool system for barley on loamy soil

Hamza Mohieddinne [1 * ^], Hamilton Araujo [2], Andrii Yatskul [3], Carolina Ugarte [4]

Submission Type:

Oral presentation

Sub-topics:

Technology

Abstract Summary :

The agriculture machinery use faces a serious challenge to reduce soil compaction effect on crop production, while also reducing the ecological and economical cost of energy. Amidst the ongoing digital and agroecological transitions, the present study aims at proposing models to simulate the fuel consumption, plant emergence and crop yield based on the variation of adjustable settings on tractor-tire-tool system by the operator, optimizing energetic and agronomic performances concurrently. The studied adjustable settings were tractor speed, axel load distribution, inflation pressure and soil working depth. To establish prediction models of crop yield, plant emergence and fuel consumption, a dataset was established based on the outcomes of three barley sowing performed on three silty loam soils and over three seasons of sowing in northern France. After a feature engineering phase and a cross-validation (by grid search) to find the best model parameters, with a Random Forest approach, the targeted simulation was modeled using clay content and the adjustable settings as explanatory variables for fuel consumption, then soil bulk density and air permeability were added for crop yield. As results, fuel consumption could be predicted by the established model at 94.13% of accuracy, 0.39 of mean absolute error and an R^2 score of 0.55. Barley yield could be predicted by the established model at 99.45% of accuracy, 0.44 of mean absolute error and an R^2 score of 0.98. As a conclusion, a simulation of fuel consumption and crop yield could be obtained for a silty loam soil and thereby adjust the adjustable settings on tractor-tire-tool system to reduce fuel consumption and increase crop yield. The findings of this study are promising to develop an operator-friendly application as decision-making help, enabling the farmers to optimize their sowing operation.

Hamza Mohieddinne [1 * ^], Aghyle Research Unit SFR Condorcet FR CNRS 3417, Polytechnic Institute UniLaSalle, 19, Rue Pierre Waguet, 60000 Beauvais, France, Research Scientist

Hamilton Araujo [2], B2R Research unit, Geosciences Department, Polytechnic Institute UniLaSalle, 19, rue Pierre Waguet, 60000 Beauvais, France, Associate Professor

Andrii Yatskul [3], Aghyle research unit SFR Condorcet FR CNRS 3417, Polytechnic Institute UniLaSalle, 19, rue Pierre Waguet, 60000 Beauvais, France, Associate Professor

Carolina Ugarte [4], Aghyle Research Unit SFR Condorcet FR CNRS 3417, Polytechnic Institute UniLaSalle, 19, Rue Pierre Waguet, 60000 Beauvais, France, Associate Professor in soil science

Session Details:

Model to simulate fuel consumption and sowing performance based on adjustable settings on tractor-tire-tool system for barley on loamy soil, Mariner Room, 24 Sep, 2024 11:00 AM

Soil structure conservation and its relevance for pasture productivity in grazing systems on Andosols of southern Chile

José Dörner [1 *], Dorota Dec [2], Felipe Zúñiga [3], Jorge Ivelic-Sáez [4 ^], Iván Ordóñez [5], Rainer Horn [6], Sebastián Bravo-Peña [7]

Submission Type:

Oral presentation

Sub-topics:

Soil physics/water movement

Abstract Summary :

In southern Chile, there are over 1.3 million ha of pastures on volcanic ash soils. Climate change scenarios and the need of increasing yields while reducing environmental impacts are forcing farmers to improve pasture managements. This implies developing an intensified soil use that must prevent soil degradation. The aim of this work is to highlight the relevance of the soil structure conservation of a volcanic ash soil for pasture productivity in grazing systems. Two experiments were carried out at the Estación Experimental Agropecuaria Austral (EEAA-UACh) (39◦46′ S, 73◦13′ W, 12 m.a.s.l.) in Valdivia, Chile. The average annual temperature is 12 °C with a yearly mean rainfall of 2,440 mm between 1901 and 2005. The soil is derived from volcanic ashes (Petroduri-Silandic Andosol). “Soil Compaction (SC)” experiment was conducted to reach three compaction levels, which correspond to bulk density (Bd) defined as T0: 0.65, T1: 0.75 and T2: 0.85 Mgm-3 (not compacted, compacted, and highly compacted, respectively). After conventional soil tillage and homogenization, the soil was compacted by controlling the number of rollers passes (“Cultivated Land Roller Güttler Mediana 600 A”; working width: 6 m; weight: 1.37 Mg). A diverse pasture was sown. The “Pasture Improvement Managements (PIMs)” experiment considered an initial situation (non-fertilized naturalized pasture without tillage treatment; NFNP), a fertilized naturalized pasture without tillage treatment (FNP), cultivated pasture with conventional tillage (CP), direct drill pasture (DP), and diverse direct drill pasture (DDP). All pastures were grazed by sheep. In both experiments undisturbed soil samples were collected at 10, 20, and 60 cm depth in order to measure water retention curve, air conductivity and precompression stress. At the same depths, sensors were installed to register soil water content (SWC). Soil penetration resistance (PR), field air conductivity, and pasture yield were measured in both trials. The increase in Bd after compaction increased the mechanical strength and decreased the volume of macropores, inducing an increase in field volumetric water content in the upper 10 cm of the soil, which in turn decreased the field air conductivity. The initial differences in PR values assessed between treatments at the soil surface dissipated a few months later because of soil drying and animal trampling. Conversely, the implementation of PIMs without altering structure dependent properties (FNP) conserves the continuity of the pore system in the soil profile improving the water accessibility to plants. Consequently, it encourages the multi-species contribution within the pasture, increasing the biomass production during water-restrictive periods, and improves the resilience against mechanical and hydraulic stresses.

José Dörner [1] *, Universidad Austral de Chile, Professor

Dorota Dec [2], Universidad Austral De Chile, Professor

Felipe Zúñiga [3], Universidad Austral de Chile, Professor

Jorge Ivelic-Sáez [4] ^, Universidad Austral De Chile, PhD Candidate

Iván Ordóñez [5], INIA, Researcher

Rainer Horn [6], Universität Christian Albrecht, Professor

Sebastián Bravo-Peña [7], Wageningen University Research, PhD candidate

Session Details:

Soil structure conservation and its relevance for pasture productivity in grazing systems on Andosols of southern Chile, Cape Charles A , 24 Sep, 2024 02:00 PM

Integrated use of organic amendments increased mungbean (Vigna radiata (L.) Wilczek) yield and its components compared to inorganic fertilizers

Andre Diatta [1*^], Cesar Bassene [2], Anicet Manga [3], Ozzie Abbay [4], Wade Thomason [5]

Submission Type: Oral presentation

Sub-topics: Country/region specific issues and reports

Abstract Summary :

Rainfall variability, low soil organic matter content, and costly inorganic fertilizers are the major agricultural constraints in Sub-Saharan Africa. Integrated use of compost and manure is essential for sustaining soil fertility and increasing crop productivity. This study was conducted to evaluate the combined effects of compost and animal manure on mungbean growth and yield. The 12 treatments consisted of control, recommended dose of nitrogen, phosphorus, and potassium (NPK), 5 ton ha−1 of compost, 10 ton ha−1 of poultry, 10 ton ha−1 of cattle, and 10 ton ha−1 of sheep manure, and six combinations of organic amendments with 50% of their applied rate alone. These treatments were laid out in a randomized complete block design with six replications. Application of cattle manure at 10 ton ha−1 significantly increased mungbean seed yield by 66% and 84% compared to the recommended rate of NPK and control treatments, respectively. Similar observations were made on stem diameter, total pod weight, and number of seeds per pod. Plants amended with compost had the highest number of ramifications and number of pods than NPK fertilized plants, which recorded (9±) ramifications and (27±) pods per plant. On average, integrated use of 5 ton ha−1 of poultry manure + 5 ton ha−1 of cattle manure had the highest soil plant analysis development values, though not significantly different from NPK fertilizers. These results suggest that application of organic amendments could be an alternative to costly and inaccessible inorganic fertilizers for improving mungbean productivity under low-input agriculture systems.

Andre Diatta [1*^], Université Gaston Berger, Assistant Professor/Soil fertility and Cropping systems

Cesar Bassene [2], Université Gaston Berger, Associate Professor

Anicet Manga [3], Université Gaston Berger, Associate Professor

Ozzie Abbay [4], VTSPES, Professor

Wade Thomason [5], Oklahoma State University, Professor and Department Head Plant & Soil Sciences

Session Details:

Integrated use of organic amendments increased mungbean (Vigna radiata (L.) Wilczek) yield and its components compared to inorganic fertilizers, Cape Charles A , 24 Sep, 2024 08:00 AM

Long-term response of bahaigrass pastures to elevated atmospheric CO2 and fertility management: Forage quality

Stephen Prior [1 * ^], Brett Runion [2], H. Allen Torbert [3]

Submission Type:

Poster presentation

Sub-topics:

Country/region specific issues and reports

Abstract Summary :

Southeastern US pasture systems remain understudied agro-ecosystems as affected by elevated atmospheric CO2 concentration. A long-term study of bahiagrass (Paspalum notatum Flüggé) assessed responses to elevated CO2 on a Blanton loamy sand (loamy siliceous, thermic, Grossarenic Paleudults) For 10 years, both managed and unmanaged systems were assessed for impacts on forage quality. Pastures were exposed to ambient or elevated (ambient plus 200 ppm) CO2 using open top field chambers. Based on extension and soil test recommendations, an N treatment was applied where half of all plots received N [(NH4)2SO4] at 90 kg ha-1 three times yearly, while remaining plots received no N; these two treatments represent managed and unmanaged pastures, which are common in the Southeast. Forage samples from yearly summer harvests were sent to Auburn University Soil, Forage & Water Testing Laboratory. This is the same conduit that producers use to assess forage and feed samples. These routine analyses included percent moisture, crude protein, acid detergent fiber, neutral detergent fiber, Lignin, total digestible nutrient, relative forage quality, NO3-N and elemental content (Ca, K, Mg, P, B, Cu, Fe, Mn, Na, and Zn), digestible protein, crude fiber, Net energy L, Net Energy M, Net energy G, and metabolizable energy. Findings based on these analyses will be discussed.

Stephen Prior [1 * ^], USDA-ARS NSDL, Plant Physiologist

Brett Runion [2], USDA-ARS NSDL, Plant Pathologist

H. Allen Torbert [3], USDA-ARS NSDL, research leader

Session Details:

Poster Session (Environmental Quality, Regenerative Agriculture) Displayed, Atlantic Foyer, 26 Sep, 2024 08:00 AM

Soil chemistry determinations using neutron-gamma analysis

Galina Yakubova [1] , Aleksandr Kavetskiy [2 * ^], Sidharth Gautam [3] , Stephen Prior [4] , H. Allen Torbert [5]

Submission Type:

Oral presentation

Sub-topics:

Soil chemistry

Abstract Summary :

Knowledge of primary subsurface soil components (e.g., SiO_2, Al_2O_3, Fe_2O_3, C, H_2O, and CaO) in agricultural fields can be important for assessing modern agricultural practices and for soil science research. Field soil core sampling and subsequent laboratory chemical analysis is labor intensive and time consuming. Neutron-stimulated gamma analysis is a good alternative to traditional soil analysis methods. One modification of this alternative analysis, the Tagged Neutron Method (TNM) or associated particle imaging technique, can determine main soil components practically in-situ with a required field measurement time of no more than 1 h. This method is based on measuring the inelastic neutron gamma spectra in the tagged neutron mode and the subsequent deconvolution of this spectra based on reference spectra. The deconvolution procedure yields the soil component content in average weight percent for the upper soil layer (~20-30 cm). A mobile field measurement system was developed and constructed. This system included a neutron generator with a built-in alpha detector, LaBr gamma detectors, control electronics, an autonomous power system, and a control computer; GPS was also included for determining geographical positions. Algorithm and computer code were developed for spectra deconvolution and determining contents of each primary component. This presentation will discuss TNM, construction of the mobile field cart, and determination of primary soil chemical components for different agricultural fields in Alabama, USA. Possible correlations between soil component contents determined by TNM and soil texture will also be discussed.

Galina Yakubova [1] , USDA-ARS National Soil Dynamics Laboratory, research scientist

Aleksandr Kavetskiy [2 * ^], USDA-ARS NSDL, research physical scientist

Sidharth Gautam [3] , USDA-ARS NSDL, programmer

Stephen Prior [4] , USDA-ARS NSDL, Plant Physiologist

H. Allen Torbert [5] , USDA-ARS NSDL, research leader

Session Details:

Soil chemistry determinations using neutron-gamma analysis, Cape Charles A , 24 Sep, 2024 01:00 PM

Evaluation of the accuracy of Terranimo® in predicting the risk of soil compaction for agricultural operations carried out under the pedoclimatic conditions of northern France

Carolina Ugarte [1 * ^], Marine Lacoste [2], Damian Martin [3], Annie Duparque [4], Mathieu Lamandé [5], Pascale Métais [6]

Submission Type:

Oral presentation

Sub-topics:

Soil compaction

Abstract Summary :

Soil compaction during agricultural operations is a well-known process that impacts soil health and crop production, affecting the hole agroecosystem. The resultant reduction in soil porosity and soil connectivity can affect the water cycle by reducing infiltration and increasing runoff, reduce biodiversity and impact greenhouse gas emissions. Prevention of soil compaction requires, on the one hand, reducing the mechanical stress applied to the soil by adjusting machinery characteristics, such as tire dimensions, tire inflation pressure, machinery power, or implement type, and on the other hand, scheduling field operations when the soil is strong enough to support traffic. Accurate evaluation of the soil compaction risk helps in planning sustainable agricultural practices. The present study evaluated the ability of the decision support tool Terranimo® to assess the soil compaction risk for a range of pedoclimatic conditions in the North of France. This evaluation was a part of the J-DISTAS project (2019-2023), which aimed at developing an interoperable tool to predict the number of available days for a given agricultural operation. The J-DISTAS tool assesses soil readiness, which is the combination of soil trafficability (soil capacity to support traffic without deformation) and workability (soil suitability for tillage), and agricultural operations performance. We compared soil physical properties measured on undisturbed soil cores sampled at two depths (20 cm and 40 cm) (air permeability, air-filled porosity, dry bulk density) before and after operations in the field for 23 agricultural operations (46 modalities in total). Soil deformation is considered when soil physical properties mean values were significantly different after than before the agricultural operation. Discrepancies between field measurements and risk assessment were identified for 24 out of 46 modalities: no soil deformation was observed when a risk of compaction was calculated. Either Terranimo gave an overestimation of the risks of soil compaction, or the measured parameters could not detect soil deformation after traffic. The chosen parameters may not be sensitive enough to test for soil deformation, or there may be too few soil cores to test for statistical differences. A working hypothesis is the inaccuracy, for the soils studied in the J-DISTAS project, of the pedotransfert function used for calculating soil strength in Terranimo. As precompression stress values were measured before each operation, the next step will be to compare this measure with the soil strength estimated by Terranimo®. At present, Terranimo® prediction of soil compaction risk may decrease the available days calculated by J-DISTAS. The goal is now to identify and implement improvements in Terranimo® to enhance its accuracy in predicting soil compaction risk, and therefore improve J-DISTAS

accuracy in estimating soil readiness.

Carolina Ugarte [1 * ^], Aghyle Research Unit SFR Condorcet FR CNRS 3417, Polytechnic Institute UniLaSalle, 19, Rue Pierre Waguet, 60000 Beauvais, France, Associate Professor in soil science

Marine Lacoste [2], INRAE, URSOLS, 45075, Orléans, France, Associate Professor

Damian Martin [3], AgroTransfert, Agronomist

Annie Duparque [4], Agro-Transfert Ressources et Territoires, Estrées Mons, France, Manager

Mathieu Lamandé [5], Aarhus University, Senior Scientist

Pascale Métais [6], Arvalis, biopôle Clermont Limagne, 2 Rue Henri Mondor 63360 Sain Beauzire, France, Engineer

Session Details:

Evaluation of the accuracy of Terranimo® in predicting the risk of soil compaction for agricultural operations carried out under the pedoclimatic conditions of northern France, Cape Charles A , 26 Sep, 2024 08:00 AM

Supporting farmers towards on regenerative agriculture

Michael Geloen [1 * ^], Stéphane Cadoux [2], Domitille JAMET [3], Anne-Sophie Perrin [4], Bernard Garric [5]

Submission Type:

Oral presentation

Sub-topics:

Working with growers

Abstract Summary :

The MAGELLAN Group, a collective of farmers in Nièvre, France, is dedicated to enhancing soil fertility through the adoption of various agronomic techniques, including no-till farming, organic inputs, the incorporation of annual and perennial cover crops, and the application of biofertilizers. To aid farmers in achieving their objectives, the group has established a tailored support system specifically focused on the transition to regenerative agriculture. This comprehensive approach includes: 1. Initial Diagnosis: A thorough assessment to identify the strengths and weaknesses of each farm. 2. Agronomic Project: Each farmer develops a detailed agronomic project outlining expected outcomes, necessary steps, selected indicators, and the tools to be utilized. 3. Co-design Workshops: These collaborative sessions bring farmers together to share experiences and collectively devise innovative cultivation systems aimed at fostering more fertile soils. 4. Field Tours: Specialized excursions emphasize peer-to-peer knowledge sharing. Participants gain a deeper understanding of soil observation and functioning. The group provides feedback on farmers' implemented systems following co-design workshops. 5. Field Experiments: Micro-plot experiments contribute to establishing new benchmarks, facilitating a better understanding of regenerative practices, and enriching discussions during co-design workshops. 6. Soil Fertility Monitoring Sheet: Each parcel is tracked using a comprehensive sheet that compiles physical, chemical, and biological indicators. This aids in managing soil fertility parameters effectively. Simultaneously, the group has developed specific tools to facilitate the transition to regenerative agriculture: • Cover Crop Mixes: The group has formulated two cover crop mixes—one for intercrops and another for associations with rapeseed. • ACACIA Software: A dedicated software assists farmers in constructing optimal cover crop blends. • SYCAS Software: This tool aids group farmers in mastering soil analyses and steering interventions related to chemical fertility. • VIBER Mobile App: An application has been created for maintaining communication between collective meetings. It serves to answer questions, share experiences, and provide updates on experiments. • Facebook Page: The group utilizes a Facebook page to communicate its activities to other farmers, advisors, or students. Currently boasting over 5000 followers, it serves as a platform to disseminate valuable references. In summary, the MAGELLAN Group's approach to regenerative agriculture involves a holistic support system encompassing diagnostics, collaborative workshops, field tours, experiments, and the development of specialized tools. This multifaceted strategy aims to empower farmers in their transition toward more sustainable and regenerative agricultural practices.

Michael Geloen [1 * ^], Terres Inovia, Agronomist

Stéphane Cadoux [2], Terres Inovia, Agronomist

Domitille JAMET [3], Terres Inovia (France), Agronomist

Anne-Sophie Perrin [4], Terres Inovia (France), Soil sciences

Bernard Garric [5], Terres Inovia, Agronomist

Session Details:

Supporting farmers towards on regenerative agriculture, Mariner Room, 23 Sep, 2024 03:00 PM

Regenerative agriculture – Seeking sustainable farming systems through integrated management approaches.

Nathan Morris [1*^], Belinda Bailey [2], Max Newbert [3], Jenny Bussell [4], Joe Stanley [5]

Submission Type:

Oral presentation

Sub-topics:

Conservation agriculture

Abstract Summary :

The Syngenta Conservation Agriculture & Sustainable Farming Systems project initiative has evaluated the economic and ecological sustainability of different systems over a five-year farm rotation on two farms in the UK between 2017 and 2022. The purpose of the project is to develop sustainable farming solutions by creating agronomic advice to support high, profitable food production whilst improving soil health, carbon capture and the wider biodiversity through the optimisation of inputs to create a net positive agricultural system. The first farm is a heavy-land (clay) site at The Allerton Trust, and associated Game and Wildlife Conservation Trust (GWCT) at Loddington, Leics. A further light-land (sandy loam) site, on a commercial farm at East Lenham, Kent (managed by NIAB). The trial has taken a series of commercial fields through a complete five-year rotation, including winter wheat; oilseed rape; hybrid barley (heavy land site only) and a green cover ahead of a spring crop (barley or pulse). Furthermore, each field is split into three establishment systems, to compare effects of a conventional plough-based system (CONV), with non-inversion tillage (MT) and a light tillage, direct drill (LT) based approaches. A value assessment model was used to report and analyse economical (i.e. crop revenue), social (i.e. productivity) and ecological measures (i.e. earthworm numbers). Findings presented in this paper have revealed an average 15% increase in net profit across the farms under a direct drill system, compared to full cultivation establishment, primarily with plough and drill. At the same time, all the indicators for ecological and environmental enhancement were more positive with the direct drill system.

Nathan Morris [1*^], NIAB, Senior Specialist - Farming Systems and Soils

Belinda Bailey [2], Syngenta UK, Sustainable Farming Manager UK & Eire

Max Newbert [3], Syngenta UK, Soil Health & Carbon Farming Technical Lead EAME

Jenny Bussell [4], The Allerton Project, Soil Scientist

Joe Stanley [5], The Allerton Project, Head of Training & Partnerships

Session Details:

Regenerative agriculture – Seeking sustainable farming systems through integrated management approaches., Cape Henry C, 24 Sep, 2024 09:00 AM

Direct Seeding with living mulch of Permanent Leguminous Cover: Practices and Benefits

Michael Geloen [1 * ^], Stéphane Cadoux [2], Domitille JAMET [3], Anne-Sophie Perrin [4], Bernard Garric [5]

Submission Type:
Poster presentation

Sub-topics:
Cover crops and residue additions, Conservation agriculture

Abstract Summary :
Direct seeding with living mulch of permanent cover of forage legumes (such as alfalfa, birdsfoot trefoil, and clover) involves establishing a leguminous cover with a crop and maintaining it for several years (typically 3) by directly seeding subsequent crops (mainly cereals) into the cover. This technique is less suitable for spring crops. Farmers implementing this method must pay particular attention to the success of leguminous cover establishment and the control of leguminous biomass within cereals. The establishment of forage legumes is carried out using crops with compatible vegetative cycles and herbicides suitable for legumes. Commonly used crops for establishing forage legumes include rapeseed, sunflower, or mixed fodder for livestock. These crops aim to ensure the successful establishment of leguminous covers so that they are well-established during the intercrop period before the subsequent cereal. In the following cereals, leguminous biomass must be regulated to avoid penalizing the photosynthetic efficiency of the cash crop. The legume should not exceed 15 cm in height. In case of poor legume control, yield losses range from 5 to 15q/ha (source: Magellan Group). To manage legumes effectively, 1 to 2 applications of hormone-based herbicides at reduced doses (30 to 40% of the approved dose) are applied to the cereal during spring. If the forage legume is well-managed, the impact on yield is reduced, and there are numerous agronomic benefits: • Forage Production: Between two cereal crops, forage production during the intercrop period ranges from 1 to 5 t DM/ha. If not exported, this biomass can contribute to soil health. • Weed Control: Once the forage legume covers 85% of the soil, weed germination is nearly eliminated during the intercrop period. • Soil Structure Maintenance: Seeding at 3 kg of white clover per m² results in a density of 500 to 600 plants per m², contributing to soil porosity maintenance. • Temperature Regulation: Measurements by the Magellan Group revealed temperature differences of 7 to 15°C between bare soil and a cover crop of birdsfoot trefoil in August. • Securing No-Till Implantations: Ensures a favorable surface structure for direct seeding, facilitating seed placement and the passage of the seeder. • Nitrogen Savings in Crop Rotation: Nitrogen release from the decomposition of legume roots and above-ground parts provides between 15 to 50 kg of nitrogen per year, depending on the type and age of the leguminous cover. In conclusion, direct seeding under a permanent leguminous cover offers a range of benefits, including forage production, weed control, soil structure maintenance, temperature regulation, nitrogen savings, and enhanced conditions for successful direct seeding. These practices contribute to sustainable and resilient agricultural systems.

Michael Geloen [1 * ^], Terres Inovia, Agronomist

Stéphane Cadoux [2], Terres Inovia, Agronomist

Domitille JAMET [3], Terres Inovia (France), Agronomist

Anne-Sophie Perrin [4], Terres Inovia (France), Soil sciences

Bernard Garric [5], Terres Inovia, Agronomist

Session Details:

Poster Session (Environmental Quality, Regenerative Agriculture) Displayed, Atlantic Foyer, 26 Sep, 2024 08:00 AM

Evaluation of the effect of agroecological practices on soil health with Biofunctool®, an in-field integrative approach

Alain Brauman [1 *] , Jim Félix-Faure [2] , Bernard Garric [3] , Alexis Thoumazeau [4] , Stéphane Cadoux [5] , Domitille JAMET [6 ^], Anne-Sophie Perrin [7]

Submission Type:

Poster presentation

Sub-topics:

Soil health and quality

Abstract Summary :

Most approaches assessing soil health focus on stock indicators such as carbon, nitrogen, microbial biomass, etc. The question on how to include the role of soil biota that drives soil processes is in the spotlight of current soil assessment approaches. Biofunctool® follows an integrative approach based on the measurement of soil dynamic functions driven by soil biota rather than stocks (Thoumazeau et al., 2019). It takes into account the relationship between physicochemical and biological properties. It includes nine inexpensive field indicators that assess three main soil functions: carbon dynamics, nutrient cycling and structure maintenance. Biofunctool® is particularly useful for assessing the impact of agricultural practices on soil health. The Biofunctool® methodology has been applied in a variety of soil contexts, including tropical soils in Asia and Africa, and in different agronomic situations, such as conservation agriculture, agroforestry, conventional agriculture, etc. (e.g. Pheap et al., 2019). The results prove the relevance and robustness of the method for understanding the impacts of agricultural practices on the multifunctionality of soils. The French technical center Terres Inovia has implemented and evaluated Biofunctool® in agricultural plots and in experimental sites, in a synchronic comparative approach of various practices in the same pedoclimatic context and in a diachronic approach. The method appears relevant for evaluating transitions in cropping systems, because it makes it possible to monitor the functional aggradation of the soil subjected to changes in practices. The robustness of the Biofunctool® tool allowed to clarify the direct beneficial effects of intercropping covers on assessed soils functions. Biofunctool® can be useful in guiding land managers (advisors, farmers) in the implementation of practices favourable to the preservation or improvement of soil health. This presentation will make it possible to draw up an initial assessment of the advantages and limits of this low-tech field method in order to clarify its interest for the evaluation of the agroecological transition in progress. References Thoumazeau A. et al. "Biofunctool®: a new framework to assess the impact of land management on soil quality. Part A: concept and validation of the set of indicators." Ecological Indicators 97 (2019): 100-110. Pheap S. et al. "Multi-functional assessment of soil health under Conservation Agriculture in Cambodia." Soil and Tillage Research 194 (2019): 104349.

Alain Brauman [1 *] , IRD, Soil ecologist

Jim Félix-Faure [2] , CIRAD, Soil Scientist

Bernard Garric [3], Terres Inovia, Agronomist

Alexis Thoumazeau [4], CIRAD, Soil Scientist

Stéphane Cadoux [5], Terres Inovia, Agronomist

Domitille JAMET [6] ^, Terres Inovia (France), Agronomist

Anne-Sophie Perrin [7], Terres Inovia (France), Soil sciences

Session Details:

Poster Session (Environmental Quality, Regenerative Agriculture) Displayed, Atlantic Foyer, 26 Sep, 2024 08:00 AM

What is the best application method for reducing P loss with gypsum from fields receiving poultry litter

Dexter Watts [1 * ^], Javier Gonzalez [2], H. Allen Torbert [3]

Submission Type:

Poster presentation

Sub-topics:

Soil health and quality

Abstract Summary :

Previous research has shown that gypsum can be used as an amendment to reduce dissolved P losses from soils receiving manure applications. Presently, the recommended practice for reducing P loss with gypsum is to apply it after manure application in a separate operation (i.e. applying gypsum on top of manure). However, the question has been raised, is this the most effective application approach for reducing P loss. Thus, a rainfall simulation study was conducted to evaluate the different application methods. Treatments consisted of applying FGD gypsum on top of poultry litter (PL), PL on top of gypsum, gypsum mixed with PL, applying PL on top of gypsum after creating a 250 mm rainfall event, PL only, gypsum only, and a control. Applying PL increased total and dissolved P losses from the agricultural field. The addition of gypsum to PL reduced P loss regardless of the application method employed. There were P reduction benefits to applying gypsum on top of PL. However, the most effective approach was mixing the gypsum with PL.

Dexter Watts [1 * ^], USDA - ARS,

Javier Gonzalez [2], USDA-ARS National Soil Erosion Research Laboratory, Research Soil Scientist

H. Allen Torbert [3], National Soil Dynamics Laboratory, Supervisory Soil Scientist

Session Details:

Poster Session (Environmental Quality, Regenerative Agriculture) Displayed, Atlantic Foyer, 26 Sep, 2024 08:00 AM

Elements of Sustainable Intensified Agricultural Systems with Cover Crop Inclusion

Shalamar Armstrong [1 * ^]

Submission Type:
Oral presentation

Sub-topics:
Biodiversity and ecosystem services, Cover crops and residue additions, Conservation agriculture

Abstract Summary :
Sustainably intensified agriculture (SIA) fosters the principle of maximum profit, while minimizing environmental losses of nutrients. Cover crops have been identified as a highly effective practice to foster SIA in row crop agricultural systems of the Midwest USA. However, adoption barriers of economics associated with adoption cost and crop yield loss exist at the farm scale and scalability of the cover crop ecosystem services at the watershed scale. Thus, the goal of this presentation is to share findings from long-term on-farm and watershed scale cover crop research in Central IL and Southern IN in nutrient loss reduction and yield protection. Over a 9-year period on the field scale, we have observed a 40-49% reduction in total nitrate load and flow weighted NO3-N concentration. Furthermore, we observed a 50% reduction in environmental cost as it relates to losses of NO3-N and N2O. Similarly at the watershed scale, inclusion of cover crops on 50% of the row crop area resulted in 33-48% reduction in nitrate loss via sub-surface drainage and a 38% reduction in NO3-N loss via surface drainage. As it pertains to yield protection, the inclusion of overwintering legumes generated an average of 118 kg ha-1 of N in the above ground biomass, which resulted in a 100 and 50 kg ha-1 less N fertilizer needed to achieve optimal corn yield, respectively, relative to the no cover crop and cereal rye treatments. Results from these studies demonstrated that impact of cover crops to reduce NO3-N via sub-surface drainage is scalable and can occur on the farm and watershed scales. Further, we demonstrated that the utility of biologically fixed N from legume cover crops has the potential to achieve optimal yield with a lower requirement N fertilizer. The implementation of these adaptive management practices has the potential to foster SIA in the midwestern corn belt.

Shalamar Armstrong [1 * ^], Purdue University Agronomy, Associate Professor of Agronomy

Session Details:

Elements of Sustainable Intensified Agricultural Systems with Cover Crop Inclusion, Cape Henry C, 24 Sep, 2024 10:00 AM

Elements of Sustainably Intensified Agriculture with Cover Crop Inclusion

Shalamar Armstrong [1*^], Michael Ruffatti [2]

Submission Type:
Oral presentation

Sub-topics:
Biodiversity and ecosystem services, Cover crops and residue additions, Conservation agriculture

Abstract Summary :
Sustainably intensified agriculture (SIA) fosters the principle of maximum profit, while minimizing environmental losses of nutrients. Cover crops have been identified as a highly effective practice to foster SIA in row crop agricultural systems of the Midwest USA. However, adoption barriers of economics associated with adoption cost and crop yield loss exist at the farm scale and scalability of the cover crop ecosystem services at the watershed scale. Thus, the goal of this presentation is to share findings from long-term on-farm and watershed scale cover crop research in Central IL and Southern IN in nutrient loss reduction and yield protection. Over a 9-year period on the field scale, we have observed a 40-49% reduction in total nitrate load and flow weighted NO3-N concentration. Furthermore, we observed a 50% reduction in environmental cost as it relates to losses of NO3-N and N2O. Similarly at the watershed scale, inclusion of cover crops on 50% of the row crop area resulted in 33-48% reduction in nitrate loss via sub-surface drainage and a 38% reduction in NO3-N loss via surface drainage. As it pertains to yield protection, the inclusion of overwintering legumes generated an average of 118 kg ha-1 of N in the above ground biomass, which resulted in a 100 and 50 kg ha-1 less N fertilizer needed to achieve optimal corn yield, respectively, relative to the no cover crop and cereal rye treatments. Results from these studies demonstrated that impact of cover crops to reduce NO3-N via sub-surface drainage is scalable and can occur on the farm and watershed scales. Further, we demonstrated that the utility of biologically fixed N from legume cover crops has the potential to achieve optimal yield with a lower requirement N fertilizer. The implementation of these adaptive management practices has the potential to foster SIA in the midwestern corn belt.

Shalamar Armstrong [1*^], Purdue University Agronomy, Associate Professor of Agronomy

Michael Ruffatti [2], Purdue University Agronomy, Support Scientist

Session Details:

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Effectiveness of Using FGD Gypsum to Reduce Dissolved P Losses from a Corn Field Receiving Poultry Litter

Dexter Watts [1 * ^], H. Allen Torbert [2]

Submission Type:
Oral presentation

Sub-topics:
Biodiversity and ecosystem services, Cover crops and residue additions, Conservation agriculture

Abstract Summary :
Research has shown that gypsum can be used as best management practice to reduce dissolved P loss from agricultural fields fertilized with poultry litter (PL). Most of this work has been conducted on pastures. There has been limited research evaluating gypsum's influence on P loss under row crops. Also, the effectiveness of gypsum on P loss when applied only to grass buffer strips at the edge of an agricultural field is not well understood. Thus, a study was conducted to evaluate the influence of using FGD gypsum as a soil amendment for reducing P loss from corn plots fertilized with PL and with or without buffer strips. Dissolved P loss was evaluated using rainfall simulations from plots where gypsum was applied to corn plots (no buffer) vs. grass buffer strips only. Phosphorus loss in runoff was evaluated immediately after applying PL and then 6 weeks later. The greatest P loss was observed during rainfall simulations occurring immediately after PL applications. Amending soil with FGD gypsum greatly reduced dissolved P losses occurring immediately and 6 weeks after PL applications regardless of whether the gypsum was applied under corn or to the grass buffer strip. Results of this study show that gypsum may be used as a best management practice to reduce P loss from row cropping systems receiving PL applications.

Dexter Watts [1 * ^], USDA - ARS,

H. Allen Torbert [2], National Soil Dynamics Laboratory, Supervisory Soil Scientist

Session Details:

Effectiveness of Using FGD Gypsum to Reduce Dissolved P Losses from a Corn Field Receiving Poultry Litter, Cape Henry C, 23 Sep, 2024 01:00 PM

Influence of crop diversification in farming systems: effects on soil physical attributes

Vanessa S Romanoski [1*], Leandro B Oliveira [2], Karina Cavalieri-Polizeli [3^]

Submission Type:

Poster presentation

Sub-topics:

Soil physics/water movement

Abstract Summary :

Farming systems can provide good results when managed correctly, and contribute to improving the physical attributes of the soil (Martin et al., 2023). This study aimed to assess whether diversifying single farming systems in integrated crop-livestock systems under no-tillage alters the soil's physical attributes. The study was performed at the Technological Innovation Center in Agriculture (NITA), located at the experimental station of the Federal University of Paraná. The experimental design consisted of three randomized blocks. The treatments were analyzed as follows: (i) Crop (C), Crop Livestock (CL), and Crop Livestock Forest (CLF); (ii) Forest (F), Livestock Forest (LF), and Crop Livestock Forest (CLF); and (iii) Livestock (L), Crop Livestock (CL), Livestock Forest (LF), and Crop Livestock Forest (CLF), at three depths (0 0.05; 0.05 0.15; 0.15 0.30 m). The soils are identified as Ferralsols (Embrapa, 2018), with clayey texture. The analyzed variables included soil bulk density (ρb), total porosity (TP), macroporosity (macro), mesoporosity (meso), and microporosity (micro). Macro, meso, and micro porosities were calculated based on pore size, following the classification by Koorevaar et al. (1983), with pore diameters > 100, 100 30, and 30 µm, respectively, determined by water tension table at 0, 3, and 10 kPa.. Analysis of variance (ANOVA) and Bonferroni's T-test (p-value> 0.05) were performed using R software version 4.1.0. The treatments exhibited ρb values lower than 1.26 Mg m 3, the limit for clayey textured soils associated with the risk of root growth restriction (Pachepsky & Park, 2015). Soil bulk density showed a significant effect at the 0 0.05 depth, with CLF (1.15 Mg m 3) being higher than C (1.04 Mg m 3), while CL (1.08 Mg m 3) did not statistically differ from the two treatments. For the F, LF, and CLF systems, the variables showed a non-significant effect (p-value> 0.05) at the three evaluated depths. The increase in the integration affected positively the macro, in which CLF 0.09 m3 m 3 was higher than L (0.04 m3 m 3), CL (0.07 m3 m 3), and LF (0.08 m3 m 3), only at 0 0.05 m, however, L had the higher microporosity. Changes in mesoporosity were found for C, and L systems, respectively for 0.05, and 0.15 0.30 m of depth. In conclusion, increasing the complexity of integrated farming systems affects the soil's physical attributes, but the suitable management trend to maintain physical attributes similar. Keywords: Integrated crop-livestock systems; soil physical properties; soil porosity. References EMBRAPA (2018). Sistema brasileiro de classificação de solos. Brasília: Embrapa Solos. Available at: www.embrapa.br/busca de publicacoes

Vanessa S Romanoski [1*], UFPR, PhD Student

Leandro B Oliveira [2], UFPR, Professor

Karina Cavalieri-Polizeli [3] ^, UFPR- Federal University Of Paraná, Professor

Session Details:

Poster Session (SOIL AND WATER MANAGEMENT, SOIL FERTILITY, PRECISION AG, ON-FARM RESEARCH, CROP PROTECTION) Displayed, Atlantic Foyer, 24 Sep, 2024 08:00 AM

Geospatial Analysis of Nutrient Transport from Watersheds on the Eastern Shore, Virginia, USA

Thomas Badon [1 * ^], Mark Reiter [2], Richard Snyder [3], Ryan Stewart [4], Matthew Eick [5], Pat Donovan [6]

Submission Type:
Oral presentation

Sub-topics:
Agricultural runoff, leaching, and other loss mechanisms

Abstract Summary :
The Eastern Shore of Virginia has a rich history of vegetable, grain, oilseed, and poultry production. Nutrient losses from row crop agriculture and poultry litter applications create water quality impairments that negatively affect the environment, aquaculture, commercial seafood, and tourism industries. Prior water quality analysis data gathered by the Virginia Institute of Marine Sciences was used to determine the role qualitative and quantitative land use and land coverage types have on the dynamics of nitrogen and phosphorus concentrations in contributing streams. Results showed % row crop land coverage significantly ($\alpha = 0.10$) correlated to higher Total Nitrogen (TN) and Total Phosphorus (TP) concentrations ($p = 0.067$, 0.099), while % forested land coverage significantly correlated to lower TN and TP concentrations ($p = 0.079$, 0.047). There was no significant response with respect to poultry production within a watershed and any nutrient concentration. Findings will guide land managers to implement prescribed conservation practices at the field-scale to have the greatest impact on reducing nutrient transport at the watershed and landscape scale.

Thomas Badon [1 * ^], Virginia Tech ESAREC, Graduate Research

Mark Reiter [2], Virginia Tech, Professor of Soils and Nutrient Management

Richard Snyder [3], ,

Ryan Stewart [4], Virginia Polytechnic Institute and State University, Associate Professor

Matthew Eick [5], VTSPES,

Pat Donovan [6], VTSPES,

Session Details:

Geospatial Analysis of Nutrient Transport from Watersheds on the Eastern Shore, Virginia, USA, Cape Henry C, 23 Sep, 2024 03:00 PM

Evaluating 7 Years of Conservation Management for Soil Health in the Virginia Coastal Plain

Sophie Nicholakos [1 * ^], Ryan Stewart [2], Angela Possinger [3], W. Hunter Frame [4]

Submission Type:
Poster presentation

Sub-topics:
Soil health and quality, Conservation agriculture

Abstract Summary :

In the United States Coastal Plain, conservation practices such as cover cropping and conservation tillage systems (e.g., strip tillage, minimal tillage, or no tillage) are implemented to promote soil organic matter accumulation and improve soil health. However, the temporal effect(s) of specific combinations of conservation tillage and cover cropping systems remains poorly quantified in the U.S. Coastal Plain, particularly in non-grain (cotton and peanut) cropping systems. Consequently, there is a relatively low adoption rate of conservation practices for cotton or peanut growers in the region. To address this gap, we measured bulk density, depth to a root-restrictive layer, and soil carbon pools repeatedly over a 7-year period to evaluate the soil response to different conservation management types. Four tillage systems – conventional, strip, minimal, and no tillage – and three winter cover rotations – fallow, winter cash crop, and high-biomass cover crop – were tested in a split plot design. There was a temporary improvement in bulk density from the strip tillage and conventional tillage systems; however, these effects disappeared by nine months after tillage. Depth to root-restrictive layer was consistently highest in the deep tillage treatments (i.e., strip and minimal tillage). Treatments that combined conservation tillage with a winter cover (i.e., cash crops and high-biomass cover crops) had greater increases in total carbon compared to conventional. A particulate and mineral-associated carbon fractionation was also performed to better understand the potential turnover time of accumulated soil carbon. Out of the four tillage systems, the strip tillage system appeared to have provided the greatest number of benefits with significantly more accumulation of surface and subsurface carbon, a consistently high depth to root-restrictive layer, and temporary improvement of bulk density. These findings demonstrate that Coastal Plain agricultural soils have the potential to act as a carbon sink when using conservation agriculture practices, and that the integration of practices such as strip tillage and cover cropping provide benefits to overall soil health.

Sophie Nicholakos [1 * ^], Virginia Tech, PhD Student

Ryan Stewart [2], Virginia Polytechnic Institute and State University, Associate Professor

Angela Possinger [3], Virginia Tech, Assistant Professor

W. Hunter Frame [4], Virgnia Tech, Associate Professor

Session Details:

Poster Session (Environmental Quality, Regenerative Agriculture) Displayed, Atlantic Foyer, 26 Sep, 2024 08:00 AM

The effect of maize cultivation with undersown intercrops on soil fertility and reduction of soil erosion

Vladimir Smutny [1 * ^], Pavel Nerušil [2], David Kincl [3], Antonin Kintl [4], Antonin Sedek [5]

Submission Type:

Oral presentation

Sub-topics:

Conservation soil tillage

Abstract Summary :

More than 50% of arable land is threatened by water erosion in the Czech Republic. Concerning soil erosion, maize (Zea mays L.) is one of the most challenging crops. The technology with undersown crops allows maize cultivation on sloping fields, where maize cannot be grown without the use of soil conservation technology (mostly direct sowing in mulch from frozen cover crops). The main disadvantage is the necessity to use glyphosate to terminate the intercrop if it is not killed by frost during the winter. Our innovative technology incorporates all intensification inputs in fertilization and plant protection that are included in standard technology for intensive maize cultivation. Sowing suitable crop species between the rows at the 3-4 leaf growth stage of maize creates the preconditions for covering the soil surface with vegetation cover, which has a sufficient protective function against erosion. The undersown crops showed to positively affect the soil structure and water content of the soil aggregates as well as the susceptibility of soil to water erosion which was measured using a field rainfall simulator (the rainfall simulation area of 21 m2, with a rainfall intensity of 1.2 mm/min). Especially in the second (third decade of June) and third (mid to late July) periods of the simulations, a significant reduction in soil loss (by 40-60%) and surface runoff (by 20-30%) was observed compared to conventional maize cultivation. The improvement in soil biological properties (pH, soil respiration, selected enzymatic activities) and in the process of nutrient mineralization has been also detected in our experiments. The greatest support for the functional diversity of the soil microbiome was achieved using the undersowing of winter rye with crimson clover and Pannonian vetch. The experimental data shows that the anti-erosion effect of undersown crops increases with higher biomass production. From cereals, winter wheat and rye can be recommended, from clovers crimson clove, and grasses, especially ryegrass. A significant soil conservation effect was found for early sowing (about 2 weeks after sowing maize) of Italian ryegrass, which significantly reduced soil loss and surface runoff already in the first term (early June) of the rainfall simulation. Mixtures of these species were also very effective. The technology of growing maize with undersown intercrops demonstrated a very good effect on maintaining good soil structure and microbial activity while reducing the risk of damage from water erosion. Acknowledgement: QK22020053 „Conditions of growing maize on highly erosive threatened soil”.

Vladimir Smutny [1 * ^], Mendel University In Brno, teacher at university

Pavel Nerušil [2], Crop Research Institute, Prague, researcher

David Kincl [3], Research Institute for Soil and Water Conservation, researcher

Antonin Kintl [4], Agricultural Research, Ltd.,, researcher

Antonin Sedek [5], P & L Ltd.,, sales manager

Session Details:

The effect of maize cultivation with undersown intercrops on soil fertility and reduction of soil erosion, Cape Charles A , 26 Sep, 2024 09:00 AM

Soil loss due to crop harvesting (SLCH): insights into an underestimated soil degradation process

Fritjof Busche [1 * ^], Philipp Saggau [2], Rainer Duttmann [3], Michael Kuhwald [4]

Submission Type:
Poster presentation

Sub-topics:
Agricultural runoff, leaching, and other loss mechanisms

Abstract Summary :
Soil loss due to crop harvesting (SLCH) leads to a decrease of soil fertility and soil functions on agricultural land. This erosion process occurs worldwide whenever root and tuber crops are harvested and can reach erosion rates that are as high as those of wind and water erosion. Nevertheless, it receives little attention in scientific research. In Europe, sugar beets and potatoes are the most important crops affected by SLCH. However, there is a lack of research on state-of-the-art harvesting machinery in relation to current SLCH rates. Thus, the objectives of this study are (i) to summarize the state of research on SLCH, and (ii) to quantify the current SLCH rates using the example of sugar beet in mechanized agriculture. To achieve these goals, the first step was to conduct a comprehensive review of peer reviewed studies addressing SLCH rates and their environmental impact to identify research gaps. In a second step, a field study was conducted to analyze the current soil losses from sugar beet harvesting with state-of-the-art harvesters. The sugar beets and soil samples were analyzed over a period of three years at 14 sampling sites in northern Germany. Based on the review, it can be stated that (i) 8.4% of the world's agricultural land was affected by SLCH in 2019 (1.1 million km^2), (ii) erosion rates reached up to 22 Mg ha^{-1} $harvest^{-1}$ and (iii) the most studied crops are potatoes and sugar beets, although groundnuts and cassava are the most important crops in terms of cultivated land area affected by SLCH. In addition, no studies and data of SLCH erosion were available for North America, South America and Oceania. Further, the review revealed that there is an urgent need for new SLCH measurements and new models to calculate the SLCH. The results of the field study show a mean soil loss of 5.7 Mg ha^{-1} $harvest^{-1}$ for sugar beets. The SLCH rates vary within the three years period and among the fields, based on weather and soil conditions. We found that soil moisture and clay content significantly affect SLCH rates. Furthermore, we were able to derive new regression equations for state-of-the-art machinery, which indicate that in addition to soil moisture and clay content, other soil properties can explain the variability of SLCH. The field study and the review show that SLCH leads to a loss of fertile soil and soil nutrients and thus accelerates the process of the ongoing soil degradation. Therefore, it's necessary to collect more data on crops that have not yet been studied and to include SLCH rates in models and estimates of erosion processes such as water, wind and tillage erosion.

Fritjof Busche [1 * ^], Kiel University (Physical Geography), Research Associate

Philipp Saggau [2], Kiel University, Postdoctoral Researcher

Rainer Duttmann [3], Christian-Albrechts-University, Professor

Michael Kuhwald [4], Kiel University (Physical Geography), Aarhus University (Agroecology), Postdoctoral Researcher

Session Details:

Poster Session (Environmental Quality, Regenerative Agriculture) Displayed, Atlantic Foyer, 26 Sep, 2024 08:00 AM

The effect of maize cultivation with undersown intercrops on yield

Pavlína Smutná [1*^], Pavel Nerušil [2], David Kincl [3], Antonin Kintl [4], Antonin Sedek [5], Vladimir Smutny [6]

Submission Type:
Oral presentation

Sub-topics:
Conservation soil tillage

Abstract Summary :

Maize cultivation with undersown intercrops was tested on two locations in the Czech Republic under different soil and climatic conditions in small-plot field trials established in the four following years. A four-row multifunctional machine was developed that enables simultaneous performance of four operations, i.e. the inter-row cultivation, sowing of various species of intercrops, the application of liquid nitrogen fertiliser to the root zone of the maize, and the band herbicide application. This technology shows significant economic and environmental benefits in terms of reduced number of passes over the field, targeted application of nitrogen to the soil and reduced herbicide usage. The money saved on herbicides can be used to purchase seeds of intercrops (costs of 25–35 €.ha-1). Maize plants reaching the growth stage of the 3rd to 4th leaf are the most suitable for performing this complex operation. According to our data, intercrop biomass production increases gradually during the first two months after sowing, with a maximum till the end of July. Thereafter, shading by maize plants results in reduced growth and subsequent dieback of most annual species. Species from the Poaceae family (grasses, especially Italian and perennial ryegrass) as well as winter cereals (rye and wheat), some legume crops as crimson clover and also phacelia proved to be the most suitable. Good results were also obtained with mixtures of several species, such as Italian clover, crimson clover, and Pannonian vetch mixture. While dry biomass production of intercrops exceeded 1 t.ha-1, silage yield and quality were not considerably affected. Observed yield reduction reached from 4 to 9 % compared to control variant. The higher decrease in yield occurred mainly in the variants with the highest biomass production of the undersown crop. Our experience shows that this technology can be considered as an economically viable alternative to the already established soil conservation technology that is based on sowing maize in a mulch of frozen or herbicide-treated previous crop. Consequently, it extends the range of technologies available in agricultural practice that allow maize cultivation on arable land threatened by water erosion in the Czech Republic.

Pavlína Smutná [1*^], Mendel University In Brno, teacher - associate professor

Pavel Nerušil [2], Crop Research Institute, Prague, researcher

David Kincl [3], Research Institute for Soil and Water Conservation, researcher

Antonin Kintl [4], Agricultural Research, Ltd.,, researcher

Antonin Sedek [5], P & L Ltd.,, sales manager

Vladimir Smutny [6], Mendel University In Brno, teacher at university

Session Details:

The effect of maize cultivation with undersown intercrops on yield, Cape Charles A , 26 Sep, 2024 09:00 AM

Improving food and nutrition security and health in Ghana: The impact of the Home Gardening Ghana Facebook Page

Frank Ackah [1 * ^]

Submission Type:
Oral presentation

Sub-topics:
Country/region specific issues and reports

Abstract Summary :

Home gardening, growing crop plants near the living environments of urban and peri-urban dwellers is an emerging tool and strategy for sustainable development. Home gardening addresses a wide array of environmental, economic and social objectives. Some evidence suggests that many people took to home gardening following the advent of the COVID-19 pandemic and its attendant lockdowns. In 2020, during the period of the lockdown due to the COVID-19 pandemic, Dr. Frank Kwekucher Ackah, a Senior Lecturer with the University of Cape Coast, Ghana, started an initiative to promote Home Gardening in Ghana. He created a Facebook Group Page, Home Gardening Ghana (H.G.G) (https://www.facebook.com/groups/264527764852594/) that currently has over 284,000 active members from more than 100 different countries. Members who join the page are exposed to the different gardening methods that people are practicing and are guided to establish their own. They receive free training and advice through regular online forums and sometimes through direct training (face-to-face). Some members also sometimes receive free seeds or seedlings from other members to start their garden. Through the activities of H.G.G, a lot of people are growing their own food in their homes and are having healthy food all year round. They also get extra income by selling the excess food from their gardens. The home gardening activities have a long effect of protecting the environment, biodiversity and also helps to reduce climate change. This report presents the activities of the home Gardening Ghana initiative and how it is contributing to food security, nutrition and health in Ghana.

Frank Ackah [1 * ^], University Of Cape Coast, Senior Lecturer

Session Details:

Improving food and nutrition security and health in Ghana: The impact of the Home Gardening Ghana Facebook Page, Cape Charles A , 24 Sep, 2024 08:00 AM

Dairy Effluent applications to a pasture enhance soil microbial activity and fertility without impacting soil bacterial and fungal communities

Gabriela Illarze [1 * ^], Amabelia Del Pino [2], Pilar Irisarri [3]

Submission Type:
Oral presentation

Sub-topics:
Soil microbiology, Biodiversity

Abstract Summary :

Applying farm dairy effluents (FDE) as soil fertilizers can enhance forage yield and improve soil nutrient status. Nevertheless, the impact of this practice on soil microbiota remains largely unexplored and needs to be better studied before large-scale soil disposal. This study evaluated the effects of applying lagoon-stored dairy effluents (Lagoon) and raw dairy effluents (Raw) at a rate of 50 kg N ha^{-1} in four equal doses, in comparison to urea fertilization and a non-amended control, on soil fertility and the activity, abundance, and community structure of soil microbiota. Microbial activity was assessed as basal respiration, potentially mineralizable N, potential nitrification activity, and enzymatic activities. The catabolic activity of the microbial community was evaluated using Biolog Ecoplates™. Bacterial and fungal community composition and diversity were analyzed through amplicon sequencing of 16S rRNA and ITS2. The application of FDE benefited soil fertility and microbial activity. Lagoon had the strongest effects on soil P, K^+, Na^+, Mg^{2+} and Ca^{2+}. Soil treated with Raw displayed higher microbial activities, such as dehydrogenase, basal respiration, urease, and potentially mineralizable N. Application of FDE did not significantly alter the structure, abundance, or functional diversity of the microbial community. However, N-based treatments (urea or FDE amendments) tended to shift the composition and catabolic activity of the microbial community differently compared to the Control. In conclusion, although FDE applications substantially change the soil's chemical properties and increase microbial activity and catabolic capability, bacterial and fungal community structures were more resilient to change.

Gabriela Illarze [1 * ^], Faculty Of Agronomy, Universidad De La República Del Uruguay, Assistant professor

Amabelia Del Pino [2], Faculty of Agronomy, Professor

Pilar Irisarri [3], Faculty of Agronomy, Professor

Session Details:

Dairy Effluent applications to a pasture enhance soil microbial activity and fertility without impacting soil bacterial and fungal communities, Cape Henry C, 23 Sep, 2024 04:00 PM

Sulfur Rate and Application Timing for Maize Production on Sandy Loam Soils in Virginia, U.S.A.

John Mason [1*^], Mark Reiter [2], Joseph Haymaker [3], Caroline Lancaster [4]

Submission Type:

Poster presentation

Sub-topics:

Nutrient cycling

Abstract Summary :

Objectives To determine the most efficient S rates and optimal application timing to maximize corn yield in Virginia coastal plain systems with sandy loam soils. Evaluate different cover crop species and mixes ability to accumulate S that has leached deeper in the soil profile. Methods The 4 × 2 factorial arrangement included S rates of 0, 11.2, 22.4, 33.6, and 44.8 kg S ha-1 using ammonium sulfate (N-P-K-S; 21-0-0-24S) and 2 application timings with S applied at-planting or split 50-50 between at-planting and sidedress at V6 growth stage. Maize growth was monitored, and tissue samples were collected at V6 and R1. At V6 growth stage, whole plant samples were analyzed for total S and total N, while the corn ear leaf was sampled and analyzed at R1. Yield was calculated at harvest and corrected to 155 g H2O kg-1. Soil samples were taken from 0-15, 15-30, 30-45, and 45-60 cm prior to S application and at harvest. Cover crop biomass was collected prior to spring termination and was analyzed for total C, N, and S. Key Results Whole plant tissue at V6 was significantly impacted by S rate x timing interaction at one site, with split applications resulting in overall higher tissue S concentration. Yields responded in a linear fashion to increasing S application rates ranging from an average of 7300 to 12700 kg ha-1, depending upon site. The linear response in yield increases to S application signified that a rate higher than 44.8 kg S ha-1 may be optimal for maximum corn yields on sandy loam soils. Cover crop S accumulation is directly related to cover crop biomass production. Conclusions Drawn Varied site responses showed that multiple factors affect maize yield response to S application. Further studies are needed to adequately update Virginia S fertility guidelines to ensure that yield losses do not occur on sandy loam soils. Additionally, cover crop ability to scavenge leached S and provide it to the following corn crop throughout the growing season could reduce the amount of S fertilizers farmers would need to apply.

John Mason [1*^], Virginia Polytechnic Institute And State University, Eastern Shore AREC, Research Specialist Sr.

Mark Reiter [2], Virginia Tech, Professor of Soils and Nutrient Management

Joseph Haymaker [3], Virginia Tech, Graduate Research Assistant

Caroline Lancaster [4], ,

Session Details:

Poster Session (SOIL AND WATER MANAGEMENT, SOIL FERTILITY, PRECISION AG, ON-FARM RESEARCH, CROP PROTECTION) Displayed, Atlantic Foyer, 24 Sep, 2024 08:00 AM

Lessons from 10 years of direct seeding under cover crop in organic agriculture

Jospéhine Peigné [1 * ^], Laura Vincent-Caboud [2], Jerome Labreuche [3], Regis Helias [4], Amelie Carriere [5]

Submission Type: Oral presentation

Sub-topics: Conservation soil tillage

Abstract Summary :

Ploughing is a tillage technique still widely used in organic farming to control weeds. This practice is now being questioned in terms of its long-term sustainability. Applying the principles of soil conservation agriculture in organic farming could address these concerns by protecting the soil with cover crop, which is then less subject to climatic uncertainties, and by simplifying the cultivation practices. However, there are many obstacles to overcome, first and foremost weed control without tillage or pesticides (Peigné et al., 2007; Vincent-Caboud et al., 2022). Over the past few years, we have been working to achieve direct seeding of crops into cover crops without tillage or the use of pesticides. Two types of trial have been set up, in which crops are directly established either (1) in a cover crop rolled to create a thick mulch, or (2) directly in permanent leguminous cover crops, managed by an inter-row mowder to avoid competing with the crop. For rolled cover crops, the main results show convincing results for soybeans, particularly when sown under rye/triticale cover. Weed control is possible in the presence of a high cover biomass (>8 t.ha -1). The weed control variability occasionally observed is often the result of differences in the performance of the cover crop, which is highly dependent on the climatic conditions. Cover management by rolling needs to be carried out on a tall, dense and mature cover (at least 50% of grass flowering). Compared with pure species, the use of a rye/triticale mix as a cover crop improves agronomic performance, economic performance (triticale seed is less expensive than rye), and organizational performance (ease of access in our context. Results from trials with corn are more mixed. The choice of cover crop is more complex, since it must both meet the rapid nutrients needs of corn and cover the soil for as long as possible to control weeds. A C/N balance therefore needs to be found between these 2 opposing objectives. One of the main issues with these experiments is that they are carried out on a single crop rather than on a rotational basis. The techniques proposed do not provide permanent soil cover as defined by soil conservation agriculture. Consequently, a number of experiments have been carried out at several French experimental stations to develop a new technique: inter-row mowing system of permanent legume cover with direct planting of winter and spring crops in rotation. The aim of this innovative technique is to eliminate the need for pesticides to manage the cover, while avoiding tillage through permanent cover. The first years of trials have enabled us to define the principles of technical management and to understand the limits to the use of such a technique. References: Peigné, J., Ball, B. C., Roger-Estrade, J., & David, C. (2007). Is conservation tillage suitable for organic farming? A review. Soil use and management, 23(2), 129-144. Vincent-Caboud, L., Casagrande, M., David, C.,

Ryan, M. R., Silva, E. M., & Peigne, J. (2019). Using mulch from cover crops to facilitate organic no-till soybean and maize production. A review. Agronomy for sustainable development, 39(5), 1-15

Jospéhine Peigné [1] * ^, ISARA, Professor of soil science

Laura Vincent-Caboud [2], Bio de Normandie, Farm advisor

Jerome Labreuche [3], Arvalis, R & D engineer

Regis Helias [4], Arvalis, R & D engineer

Amelie Carriere [5], Arvalis, R & D engineer

Session Details:

Lessons from 10 years of direct seeding under cover crop in organic agriculture, Cape Charles A , 26 Sep, 2024 08:00 AM

Improving Soil Quality through Agroecological Practices Incorporation

Jana Marjanović [1*^], Apolka Ujj [2], Sandor Varga [3]

Submission Type:
Oral presentation

Sub-topics:
Soil chemistry, Nutrient cycling

Abstract Summary :
This study investigates the application of agroecological practices to enhance soil quality and crop yield in small-scale agricultural settings, with a particular focus on integrating soil microbes, intensive crop rotation, and reduced tillage methods. Conducted at the SZIA Agroecological Garden MATE in Gödöllő, Hungary, twelve separate plots were allocated to different tillage practices, including soil loosening and no-tillage, with and without soil microbial intervention. Collaborating with Phylazonit Kft., nitrogen-fixing and phosphorus-mobilizing bacteria were applied to six plots. Commencing in April 2023, the study centered on cultivating Solanaceae family potatoes, with subsequent soil and harvested potato samples subjected to extensive chemical and physical analyses. Soil plasticity and pH (KCl) showed significant variations among treatments, while statistical analysis using One-way ANOVA revealed p-values predominantly exceeding 0.05 across most parameters, indicating no significant differences. These findings align with initial predictions and existing research, suggesting that notable distinctions between treatments may necessitate an extended observation period. Variations in soil plasticity and pH (KCl) hint at potential meaningful impacts over time, highlighting the dynamic nature of agroecological interventions. Furthermore, significant correlations between weed abundance, total harvest, and plant height have been noted. These results suggest that employing various agroecological practices shows promise in generating positive impacts. This initial evaluation underscores the necessity for prolonged observation beyond the first year, emphasizing that the positive impacts of integrated agroecological practices require time to manifest. Despite immediate results not indicating major differences, the observed alterations in soil characteristics imply that these practices could yield significant effects over an extended period. These findings lay the groundwork for future research, emphasizing the importance of patience in witnessing genuine enhancements in both soil health and crop quality through innovative agroecological approaches. The study's significance extends to directing sustainable agricultural practices and advocating for a long-term approach to agroecological research and application. Keywords: agroecology, soil microbes, crop rotation, reduced tillage, sustainable agriculture, biofertilizer, bioinoculant, microbial inoculants

Jana Marjanović [1*^], Hungarian University Of Agriculture And Life Sciences (MATE), PhD student

Apolka Ujj [2], Hungarian University of Agriculture and Life Sciences (MATE), Associate Professor

Sandor Varga [3], Agrova Kft./Agrova Ltd. / Hungarian University of Agriculture and Life Sciences (MATE), Researcher and Associate Professor

Session Details:

Improving Soil Quality through Agroecological Practices Incorporation, Cape Charles A , 24 Sep, 2024 11:00 AM

Crop Growth Under-Performance: a theoretical approach for agronomic interpretation of earth observation data through the growing season

Holden Nick [1] ^, Erin Goh [2] *

Submission Type:
Oral presentation

Sub-topics:
Technology

Abstract Summary :

Crop growth monitoring using earth observation tends to focus on predicting final crop yield. However, before harvest, knowing the status of the crop is essential to support husbandry decisions, forecast potential yield, and understand environmental impacts. Crop biophysical properties such as leaf area index, aboveground biomass, crop chlorophyll content, and plant height can provide valuable insight into crop development, nutrient demand, and pesticide requirements. The concept of crop growth under-performance is to estimate current crop conditions, using earth observation data, relative to the state required to achieve a desired target yield by, (1) predicting the most important biophysical property at each particular growth stage, (2) comparing the property to a baseline value derived from Irish and UK agronomic recommendations for a target yield of 10 t/ha, and (3) map intra- and inter-field crop status. The study used 35 winter wheat fields in Ireland and 40 in the UK, with all fields being > 1 ha and located between 51º and 54º North, 0º and 9º West. Crop biophysical reference data (green area index, leaf nitrogen, growth stage, shoots density, plant height, above-ground biomass [fresh and dry]) were collected at four phenological stages (tillering, stem elongation, heading, and fruiting) during field campaigns between 2019 to 2021 for 2 winter wheat production cycles (harvest in 2020 and 2021). Over 1500 samples were collected over 2 years. Earth observation data were collected from Sentinel-2A and Sentinel-2B (optical) and Sentinel-1A and Sentinel-1B (SAR) between 4 days before and 4 days after the field sampling at each location. Models were developed to predict crop biophysical properties by whole season and by phenological stage using (i) optical data, (ii) SAR data and (iii) data fusion. The best-performing model for the diagnostic property for each growth stage was identified. These range from R2=0.98 using fused data to predict green area index to R2=0.78 using fused data to predict leaf nitrogen content. Most models had an R2 >0.90. By categorizing crop performance at the end of each phenological stage into three classes ("below target", "on target" and "exceed target"), it was possible to map intra-and inter-field variation and derive recommendations for nutrition, herbicide, fungicide, insecticide, and plant growth regulation at a sub-field scale. A farmer could decide to take remedial action for an underperforming field, or even to cease inputs based on an estimated return-on-investment. The use of multiple data sources, along with data fusion allowed for a robust system to be developed that could maximize gross margin and reduce polluting losses from winter wheat production.

Holden Nick [1] ^, ,

Erin Goh [2] *, University of Southampton, Research Fellow

Session Details:

Crop Growth Under-Performance: a theoretical approach for agronomic interpretation of earth observation data through the growing season, Mariner Room, 24 Sep, 2024 11:00 AM

Assessment of Physical Properties of Light Mountain Chestnut Arable Soils under Rainfed Conditions in Azerbaijan

Asmar Ahmadova [1 * ^]

Submission Type:

Oral presentation

Sub-topics:

Soil physics/water movement

Abstract Summary :

The results of investigation conducted under arid rainfed condition revealed that the physical properties of light chestnut (Kastonozems) soil undergo dynamical changes depending on tillage methods (no-till, minimal, conventional tillage), predecessors (barley, winter wheat, black fallow, pea), climatic conditions, growth stages of crops. Throughout the research period, soil moisture content varies mainly depending on the amount of precipitation, the growth stage of crops, soil depths and the predecessors. Soil bulk density varied within the range of 0.97-1.53 g/cm3 , the higher values were observed under no-tillage and fallow predecessor. In the topsoil volumetric soil moisture content and porosity vary within the range of 10.0-35.4% and 42.9%-63.5%, respectively, and in the subsoil, in the range of 13.5-33.7% and 43.8-53.1%. Satisfactory values of physical properties in the topsoil coincide within the period of intensive growth of the cereal crops, and the impact of mineral fertilizer rates on these properties is relatively weaker than tillage methods and predecessor. During the research period, the values of soil structural indicators can be evaluated as "very good" according to the existing gradations in the topsoil layer. In the topsoil, the soil waterstable aggregates content and mean weight diameter vary in the range of 26.5-57.0% and 0.26- 0.67 mm, respectively, and in the subsoil, in the range of 30.0-62.4% and 0.32-0.59 mm. Soil physical quality index (SPhQI) and normalized physical quality index (NSPhQI) changes in the range of 0.64-0.73 and 0.46-0.49, respectively, indicates that light chestnut soil has "weak" and "moderate" physical quality.

Asmar Ahmadova [1 * ^], Research İnstitute Of Crop Husbandry, Ph.D student

Session Details:

Assessment of Physical Properties of Light Mountain Chestnut Arable Soils under Rainfed Conditions in Azerbaijan, Mariner Room, 26 Sep, 2024 11:00 AM

Reducing phosphorus leaching in a clay soil through slaked lime amendment: A Swedish field trial

Ararso Etana [1 * ^]

Submission Type: Poster presentation

Sub-topics: Water quality

Abstract Summary :

In Sweden, a significant portion of arable soil is characterized by a high concentration of phosphorus (P) as a legacy of intensive fertilization practices during the 1970s and 1980s. Approximately 125,000 ha is identified as posing a high risk for P leaching, requiring effective mitigation strategies. This study presents the results of a long-term field trial initiated in 2019 on representative clay soil in east-central Sweden (59°43ʹ0ʺ N; 17°41ʹ21ʺE) to evaluate the potential of slaked lime (Ca(OH)2) amendment for reducing P leaching. The trial comprises twelve separately drained plots organized into six blocks. In each block, one plot was treated with Ca(OH)2 and the other left as control. The lime was applied in August 2019 followed by thorough mixing with the soil using a chisel plow. Drainage water is automatically sampled in a flow-proportional sampling station. The samples are analyzed for turbidity, total P, dissolved reactive P, and total carbon. Initial results from 2019 to 2021 indicated a significant reduction in total P and dissolved reactive P leaching by 75% and 25%, respectively. However, subsequent observation revealed a diminishing effect of the slaked lime amendment, probably due to soil disturbance by tillage practices. To investigate the impact of soil disturbance, the experimental design was modified to a split-plot arrangement in 2022, when the same amount of slaked lime was applied again. Since then, tillage practices have alerted across the trial; six plots are cultivated to a depth of 15 cm, and the remaining six to a shallower depth of 5 cm to minimize soil disturbance. Preliminary findings indicate a renewed reduction in turbidity and P leaching post-post amendment, but the influence of tillage on these outcomes remains to be fully understood. This study underscores the potential of slaked lime in mitigating P leaching from clay soils, while also highlighting the need for careful consideration of cultivation practices to sustain the benefit of such amendments.

Ararso Etana [1 * ^], SLU, Associate professor

Session Details:

Poster Session (SOIL AND WATER MANAGEMENT, SOIL FERTILITY, PRECISION AG, ON-FARM RESEARCH, CROP PROTECTION) Displayed, Atlantic Foyer, 24 Sep, 2024 08:00 AM

Assessing machinery-induced compaction during land use change: A laboratory evaluation study

Shoaib Ahmed [1 * ^]

Submission Type: Oral presentation

Sub-topics: Soil compaction

Abstract Summary :

The scarcity of productive arable land, exacerbated by climatic, topographic, and geological constraints, presents a pressing global challenge. In the case of Norway, a mere 4% of the total land area is arable, with one-third of this fraction deemed suitable for cultivating cereals for human consumption. This makes Norway particularly vulnerable to any losses of agricultural land and agricultural ecosystems, especially given the government's objective to increase domestic agricultural output and strengthen food security. Therefore, there is an urgent need to explore the possibilities of moving and re-establishing agricultural soil in an alternative location to mitigate losses in agricultural production due to construction activities i.e. as in the case of road construction projects. However, the process of soil relocation entails an inherent risk of "compaction" which is a determinant for productive plant growth encompassing root growth, water infiltration, drainage, nutrient availability, soil aeration, susceptibility to erosion, and soil biological activity. This leads to the formulation of a research question for this study: How does the type of Machinery and equipment affect soil compaction in newly established agricultural land? Within this context, this study assesses the effects of soil compaction on the topsoil and subsoil resulting from the use of heavy machinery in a newly established agricultural land here in Norway. The methodology includes collecting soil samples before and after re-establishing the newly established agricultural land. As a result, soil's physical properties, i.e., bulk density, moisture content, and porosity, are evaluated to assess the effects of soil compaction resulting from heavy machinery in the field experiment. These results provide insight into soil compaction and would help establish the optimal sets of techniques and practices for moving and re-establishing agricultural soils.

Shoaib Ahmed [1 * ^], Norwegian University Of Science And Technology, PhD Candidate

Session Details:

Assessing machinery-induced compaction during land use change: A laboratory evaluation study, Cape Charles A , 26 Sep, 2024 08:00 AM

New insights into overcoming soil water repellency; a major tillage problem

Naveeda Majid [1 * ^], Richard Harper [2], Ravi Naidu [3], Md Mezbaul Bahar [4]

Submission Type:
Oral presentation

Sub-topics:
Soil physics/water movement

Abstract Summary :

Soil water repellency (SWR) is a major problem in many dryland cropping systems; in Australia alone, it is estimated that 10 million ha is afflicted. SWR reduces infiltration of water into soils and causes uneven wetting. Yield losses occur through the reduction of germination in crops and weeds, the induction of overland flow with a loss of water for grain production and soil erosion. The incidence and severity of SWR is related to soil properties, and generally increases with increasing soil carbon content and decreases with clay content. Approaches to manage SWR include soil profile inversion and addition of detergents or clay. Soil practices that increase soil carbon content (conservation agriculture; carbon sequestration projects) are likely to increase SWR, thus the problem is likely to become worse in coming years. While the general relationships between SWR and soil properties are known, in several large studies anomalies occur, whereby soils that would be expected to be water repellent are not. The cause of this discrepancy is unknown and could relate to differences in organic matter composition, specific soil physical or chemical properties or the soil microbiome. In this paper, we characterized a variety of soils with different degrees of SWR to elucidate the factors contributing to SWR. A strong and positive correlation occurred between total organic carbon and total carbon and SWR. Soil organic matter composition was assessed via Solid-state 13C nuclear magnetic resonance (SSNMR) spectroscopy. Two groups of soils had similar carbon and clay contents but differed markedly in SWR with significant variations in the aromatic carbon content in each group (R2= 0.73). This suggests the potential role of bioremediation, targeting these contributing functional groups. To attain this objective, wax degrading bacteria (Rhodococcus spp) were isolated from high water repellent soils and their capability to degrade waxes including hydrophobic organic compounds and eucalyptus oil were investigated, and marked reductions in SWR were found. Our results suggest that bioremediation techniques may play a role in reducing SWR in agricultural systems.

Naveeda Majid [1 * ^], University Of Newcastle, NSW, Australia , PhD student

Richard Harper [2], Centre for Crop and Food Innovation, Murdoch University, WA 6150, Australia, Professor

Ravi Naidu [3], Founding Director Global Centre for Environmental Remediation (GCER) College of Engineering Science and Environment, university of Newcastle, new south wales, Australia, Laureate Professor Ravi Naidu

Md Mezbaul Bahar [4], Global Centre for Environmental Remediation (GCER) College of Engineering, Science and Environment The University of Newcastle University Drive, Callaghan NSW 2308 Australia, Research

Fellow / Senior Environmental Scientist

Session Details:

New insights into overcoming soil water repellency; a major tillage problem, Mariner Room, 26 Sep, 2024 08:00 AM

Nature–based practices improve soil health and productivity in saline soil of semi–arid region

NIRMALENDU BASAK [1*^], Arvind Kumar Rai [2], Parul Sundha [3], Priyanka Chandra [4], Bhaskar Narjary [5], Gajender Yadav [6], Satyendra Kumar [7], Rajender Kumar Yadav [8]

Submission Type: Oral presentation

Sub-topics: Water quality

Abstract Summary :

Saving land preparation costs and irrigation reduce the salt–load in root zone and improve agricultural sustainability in salt–affected soils of semi–arid regions. Therefore, it is hypothesized that nature–based practices reduce evaporation and inhibit salt accumulation at the surface and improve the biological properties of barren saline soils when converted for intensive cultivation. This field experiment was conducted to test the impact of tillage, deficit saline irrigation (DSI) (in winter) with mulching to improve different chemical and biological properties and increase in yield of rainfed–forage sorghum and irrigated wheat. The experiment had been conducted in split–plot design with three replications with sorghum [Sorghum bicolor (L.)] (monsoon) –wheat (Triticum aestivum) (winter) at CSSRI Experimental Research Station, Nain, Panipat, Haryana for the seven years (2014 to 2021). This station has a semi–arid subtropical monsoonal climate. Three tillage treatments viz. reduced tillage–zero tillage (RT), conventional tillage conventional tillage (CT) and zero tillage–zero tillage (ZT) were taken in main plot and a combination of rice straw mulch (no–mulch and 5 Mg ha–1) and saline irrigation (electrical conductivity 8.0 dS m–1) with 100, 80 and 60% water requirement of wheat (WR) was applied in subplots. Mulching increased moisture content (13%) than no mulch (11%). The soil organic C (SOC) content and soil biological properties improved in fallow and cultivated land after seven years of rotations. Mulching improved the SOC (5.3 g kg–1), and it was significantly greater than no–mulch (4.8 g kg–1). Mulching and deficit irrigation 60WR (6.2 dS m–1) effectively reduced salinity compared to 100WR saline water irrigation (7.4 dS m–1). A decrease in soil salinity was associated with a linear increase in soil pH. In saline irrigated plots, dissolution was coupled with precipitation of the electrolyte added through irrigation water, causing increased calcium carbonate content in 100WR (35 g kg–1) with 100WR. Bacteria, fungi, N–fixers and, phosphate solubilizers and actinobacteria populations respond to change in SOC, salinity and matric stress under different mulching and irrigation strategies adopted in ZT. DSI and mulch favoured increased microbial biomass C (130 µg g–1) than 100WR (107 µg g–1). However, salt–load increased in microbial biomass P, and S. Soil enzymes β–glu and fluorescein diacetate hydrolyzing activities were strongly correlated with SOC. The DSI at 60WR with mulch in reduced tillage produced greater biomass. Therefore, in–situ, soil moisture conservation through mulching can effectively reduce the soil salinity and restore soil fertility by converting barren saline soil for cultivation. The conservation agriculture practices zero–tillage, mulching and deficit saline irrigation also provided a practical approach to achieving the Land Degradation Neutrality and restoration target.

NIRMALENDU BASAK [1*^], ICAR–Central Soil Salinity Research Institute (CSSRI), Karnal 132 001, Haryana, India, Scenior Scientist

Arvind Kumar Rai [2], ICAR–Central Soil Salinity Research Institute (CSSRI), Karnal 132 001, Haryana, India, Principal Scientist and Head

Parul Sundha [3], ICAR–Central Soil Salinity Research Institute (CSSRI), Karnal 132 001, Haryana, India, Scientist

Priyanka Chandra [4], ICAR–Central Soil Salinity Research Institute (CSSRI), Karnal 132 001, Haryana, India, Scientist

Bhaskar Narjary [5], ICAR–Central Soil Salinity Research Institute (CSSRI), Karnal 132 001, Haryana, India, Senior Scientist

Gajender Yadav [6], ICAR–Central Soil Salinity Research Institute (CSSRI), Karnal 132 001, Haryana, India, Senior Scientist

Satyendra Kumar [7], ICAR–Central Soil Salinity Research Institute (CSSRI), Karnal 132 001, Haryana, India, Principal Scientist and Head

Rajender Kumar Yadav [8], ICAR–Central Soil Salinity Research Institute (CSSRI), Karnal 132 001, Haryana, India, Principal Scientist and Director

Session Details:

Nature–based practices improve soil health and productivity in saline soil of semi–arid region , Mariner Room, 26 Sep, 2024 08:00 AM

Long-term trends in soil organic carbon: Insights from comprehensive measurements

Vaida Steponavičienė [1 * ^]

Submission Type:

Poster presentation

Sub-topics:

Conservation soil tillage

Abstract Summary :

The innovative approach to sustainable farming has been developed on the basis of research carried out at the Vytautas Magnus University Experimental Station since 1999, and it is the significant impact of soil health on agricultural productivity over 23 years. Different farming methods have been analyses, with a particular focus on the effects of straw management and different tillage systems, including deep and shallow ploughing, as well as no-till farming. Straw removal or chopping combined with other tillage systems has been observed to lead to significant increases in soil organic carbon. A key objective is to assess how these practices influence the accumulation of soil organic carbon (SOC), an essential component for healthy soil. The experiment aims to demonstrate that strategic management of straw and tillage can lead to substantial increases in SOC. This, in turn, not only contributes to the mitigation of CO2 emissions, addressing a critical aspect of climate change, but also enhances the resilience and fertility of the soil. The expected outcome is a demonstrable improvement in crop growth and yield consistency. As a result, better crop growth and yields are consistently observed. It is recognized that the adoption of these practices is vital to maintaining healthy and productive soils, which is essential in the face of the growing challenges of climate change. Research underlines the importance of sustainable farming practices that priorities soil and environmental health. Acknowledgement The authors dedicate this presentation to the European Joint Programme (EJP) Soil and the Ministry of Agriculture of the Republic of Lithuania-funded project SOMPACS

Vaida Steponavičienė [1 * ^], Vytautas Magnus University, Agriculture Academy, Senior Researcher

Session Details:

Poster Session (Tillage) Displayed, Atlantic Foyer, 23 Sep, 2024 08:00 AM

GIS-BASED ASSESSMENT OF LOWLAND RICE AREAS FOR RICE MACHINERY SUITABILITY IN SELECTED REGIONS OF THE PHILIPPINES

Rossana Marie Amongo [1 * ^], Ronaldo Saludes [2], Ralph Kristoffer Gallegos [3], Patrick Lemuel Relativo [4], Ria Salustia Duminding [5], Adrian Daniel Pantano [6], Julius John Paul Cunan [7], Gherlee Nelle Lalap-Borja [8]

Submission Type:

Oral presentation

Sub-topics:

Tillage implements and other equipment

Abstract Summary :

The use of machinery is essential for improving the overall system of production, harvesting, and processing of agricultural products. To optimize agricultural production, it is crucial to determine suitable areas for specific agricultural mechanization technologies (AMTs), thereby promoting sustainable agricultural mechanization (SAM). This research aimed to develop a land suitability map for agricultural tractors, rice transplanters, rice threshers, rice reapers, and rice combine harvesters using a GIS-based model for lowland rice areas in Region IV-A, Region VI, and Region X in the Philippines. The study considered the technological, socio-economical, and environmental factors affecting the identification of suitable lowland rice areas for the five selected AMTs. An Analytical Hierarchy Process (AHP) was implemented to determine the relative influence of each of the considered factors and the total suitability score (TSS) was obtained by getting the weighted average of the individual suitability scores. The land suitability maps were generated by subsequent reclassification based on TSS using QGIS. The generated maps indicate that both 4W and 2W tractors exhibit high suitability in Region IV-A (81.40%), Region VI (67.08%), and Region X (77.94%). Similarly, rice transplanters, reapers, and threshers demonstrate high suitability in Region IV (80.00%) and Region VI (64.41%). Furthermore, the resulting maps reveal that 18,604.91 hectares (72.84%), 118,955.06 hectares (52.58%), and 26,485.27 hectares (62.18%) of the lowland rice areas in Regions IV-A, VI, and X, respectively, are highly suitable for rice combine harvesters. The generated land suitability maps can be used as a decision tool for enabling enhanced planning, streamlined procurement and distribution processes, and sustained utilization of farm machinery. Through these means, rice production is ultimately enhanced to address food security challenges and uplift the lives of farmers.

Rossana Marie Amongo [1 * ^], University Of The Philippines Los Baños, Professor 9 and Vice Chancellor

Ronaldo Saludes [2], University of the Philippines Los Baños, Professor

Ralph Kristoffer Gallegos [3], University of the Philippines Los Baños, Associate Professor

Patrick Lemuel Relativo [4], University of the Philippines Los Baños, Assistant Professor

Ria Salustia Duminding [5], University of the Philippines Los Baños, Instructor

Adrian Daniel Pantano [6], Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Junior Project and Field Coordinator

Julius John Paul Cunan [7], University of the Philippines Los Baños, University Research Associate

Gherlee Nelle Lalap-Borja [8], University of the Philippines Los Baños, Project Technical Specialist I

Session Details:

GIS-BASED ASSESSMENT OF LOWLAND RICE AREAS FOR RICE MACHINERY SUITABILITY IN SELECTED REGIONS OF THE PHILIPPINES , Mariner Room, 26 Sep, 2024 01:00 PM

ASSESSING SOIL CHEMICAL PROPERTIES FROM CROP SILAGE PASTURE ROTATION INTENSITY

Guillermo Siri [1 * ^], Mauricio Bustamante [2], Oswaldo Ernst [3]

Submission Type: Oral presentation

Sub-topics: Soil health and quality

Abstract Summary :

Sorghum silage a supplemental feed is used in Uruguay farming systems, often producing the crop as a monoculture system. However, little is known about the impact for sorghum silage production within pastures has on soil chemical properties. Sorghum [Sorghum bicolor (L.) Moench] has frequently been suggested as a good option for silage, because of its fast growth rate, early maturity (120-days), and wide agronomic adaptability in Uruguay. However, the main concern is that sorghum silage (SS) could deplete soil properties as soil organic carbon (SOC), total nitrogen (TN). This study was conducted to determine dry matter production (total biomass) and some soil chemical properties as SOC, NT in west Uruguay for 15 years (2005-2019). We evaluated four silage systems: sorghum grown continuously (SSC) with or without cover crops (CC; oat); sorghum rotated with two years pasture (SSP2), and sorghum rotated with four years pasture (SSP4). The total highest biomass sorghum silage systems in these fifteen years evaluated were achieved with pasture rotations (24.98 Mg ha-1 y-1 averaged over SSP2 and SSP4) followed by SSC with CC (23.30 Mg ha-1 y-1) and SSC without CC (21.24 Mg ha-1 y-1). The silage systems affected the SOC concentration at the 0-20 cm depth. Sorghum rotated with pasture (SSP2 and SSP4) or SSC with CC had 20% higher SOC (21.9 mg kg-1) than SS without CC (18.20 mg kg-1)($P \leq 0.03$). We identified a large loss of C in these 15 years on SSC without CC (-209 kg ha-1 y-1), however, SOC stock gain were found using pasture (2 or 4 year) and SSC with CC (+371 kg ha-1 y-1). Comparable resulted were found with TN, where sorghum rotated with pasture (SSP2 and SSP4) had 36% higher SOC (1.63 mg kg-1) than the SSC without CC (1.20 mg kg-1)($P \leq 0.02$). Total N stock gain in these 15 years identified a large loss of N from the SSC without CC (-84 kg ha-1 y-1), while on the other SS systems were less negative (-18 kg ha-1 y-1). The large difference in exported biomass (334.05 Mg ha-1) in these 15 years for SS continuous, coupled to inclusion of perennial pasture that increase SOC (large root productions) could be key factors in better soil properties like SOC and TN between these two SS systems evaluated (rotated or not with pasture). Key words: Sorghum silage, SOC, Sustainability, crop pasture rotation

Guillermo Siri [1 * ^], Faculty Of Agronomy, Universidad De La República Del Uruguay, Prof.

Mauricio Bustamante [2], Faculty of Agronomy, Universidad de la República, Uruguay, Professor and Research Assistant

Oswaldo Ernst [3], faculty of Agronomy, Prof.

Session Details:

ASSESSING SOIL CHEMICAL PROPERTIES FROM CROP SILAGE PASTURE ROTATION INTENSITY, Cape Henry C, 24 Sep, 2024 09:00 AM

Predicting soil strength at the field scale using proximal sensors and pedotransfer function

Ameesh Khatkar [1*^], Amélie Beucher [2], Triven Koganti [3], Munkholm Lars [4], Mathieu Lamandé [5]

Submission Type:
Oral presentation

Sub-topics:
Soil compaction

Abstract Summary :

Mechanization has made a significant contribution to modern agriculture's success. However, the prevailing farm machineries' total weight has now become equal to that of sauropods. Thus, causing serious issues of soil compaction at both top- and sub-soil levels. Sub-soil compaction, being more persistent and cumulative, causes a more permanent negative impact on the soil structure as compared to the topsoil compaction. In the current agricultural system, a variety of machinery is employed randomly in the field, thereby becoming one of the major contributors in compacting around 4% of the total land area worldwide and reducing crop yield by as much as 60%. A range of initiatives are put forward to address this issue. For example, in Europe, the mission 'A Soil Deal for Europe', has been initiated to alleviate soil compaction for improving soil structure as one of the objectives to have healthy soils by 2030. Past research has shown that soil strength acts as the first line of defense against soil compaction. This soil strength is governed by several basic soil properties, such as texture, bulk density, organic matter, and soil water content in a field. In this study, the collection of soil samples and the acquisition of geophysical data were performed for three arable fields to assess these soil properties and soil strength. Bulk soil samples and intact soil cores (100cm3) were sampled from the topsoil (15-cm depth) and the sub-soil (40-cm depth) at 23 sampling points in each field. Geophysical sensors (DUALEM-421H & Gamma-ray spectroscopy) and soil samples were used to predict and validate these soil strength markers. Thereafter, a formerly published pedotransfer function (PTF) was used to translate these basic soil properties into soil strength. These predicted values of soil strength via the PTF were validated against the soil strength values obtained from compression and shear tests on the collected soil cores. This study will boost the use of proximal sensors and basic soil properties for determining soil strength as compared to the existing laborious and expensive assessments. Finally, clustering the field into different zones based on soil strength magnitude will assist us in making efficient pathways for heavy farm machinery.

Ameesh Khatkar [1*^], Aarhus University, PhD Fellow

Amélie Beucher [2], Department of Agroecology, Aarhus University, Blichers Allé 20, 8830 Tjele, Denmark, Assistant Professor

Triven Koganti [3], Department of Agroecology, Aarhus University, Blichers Allé 20, 8830 Tjele, Denmark, Postdoctoral Fellow

Munkholm Lars [4] , Aarhus University, Professor-Senior Researcher

Mathieu Lamandé [5] , Aarhus University, Senior Scientist

Session Details:

Predicting soil strength at the field scale using proximal sensors and pedotransfer function, Cape Charles A , 23 Sep, 2024 03:00 PM

Does No-till Farming Produces Unfavorable Soil Physical Conditions that Impairs Maize Growth in Northeast China?

Shijie Qin [1]*, Chao Wang [2], Li Wang [3]^, Weida Gao [4], Tusheng Ren [5]

Submission Type: Oral presentation

Sub-topics: Conservation soil tillage

Abstract Summary :

No-till (NT) farming practice has been introduced as an effective technology to improve soil quality by reducing wind and water erosion, increasing soil organic carbon (SOC) content, aggregate stability, and water holding capacity, and increasing farming profit. However, there are suspicions that the NT system may produce unfavorable soil physical conditions that impair root growth and eventually lead to yield reduction. In this study, we examined the root traits of maize crop as affected by soil physical properties in the 0-50 profile under a long-term tillage study initiated in 2011. Conversion from a conventional plow-dominant tillage system (CT) to the NT system led to an increase in soil bulk density in the 5-20 cm layer, lower penetrometer resistance (PR > 2.0 MPa) under dry conditions. Compared with that of the CT treatment, the soil under NT showed a uniform macroporosity and improved pore connectivity and as a result, more favorable soil water status and greater water infiltration rate (7 times that of the CT). In addition, maize plants under the NT system had a similar root biomass but a higher total root volume, and a more wide-spread root system in the 0- to 10-cm layer. We conclude that NT produces favorable soil physical conditions that enhance maize growth in Northeast China.

Shijie Qin [1]*, China Agricultural University, PHD candidate

Chao Wang [2], China Agricultural University, Master's degree student

Li Wang [3]^, China Agricultural University, Experimentalist

Weida Gao [4], China Agricultural University, Associate professor

Tusheng Ren [5], China Agricultural University, Professor of Soil Science

Session Details:

Does No-till Farming Produces Unfavorable Soil Physical Conditions that Impairs Maize Growth in Northeast China?, Atlantic Ballroom, 24 Sep, 2024 11:00 AM

Wetting-drying cycle alleviates subsoil compaction of Mollisol in Northeast China

Li Wang [1 * ^], Zhengchao Tian [2], Meng Zhang [3], Tusheng Ren [4]

Submission Type:

Poster presentation

Sub-topics:

Soil physics/water movement

Abstract Summary :

Background: Subsoil compaction is increasingly exacerbated by intensive agriculture production worldwide. Repeated wetting-drying (W-D) cycles, which alters soil hydraulic properties and processes frequently, may modify the structure of compacted subsurface soil layers. Objective: The objective of this study is to examine the influences of W-D cycles on porosity, pore-size distribution, and penetrometer resistance of a Mollisol in Northeast China. Methods: The experimental was a split plot design with two surface covering treatments (bare and residue cover) and three subsoil compaction levels (low, moderate, and high) with bulk densities of 1.2, 1.4 and 1.6 g cm-3 in the 15-25 cm layer. Results: In total, 11 W-D cycles occurred in the summer of 2017. Comparing with the initial states, significant structural changes were observed in the compacted layers at the end of W-D cycles. First, soil available water content responded differently to W-D cycles: it was reduced in the high compacted soil layers, but was increased (by 0.87%-6.87%) in the moderate and low compacted soil layers (except for low under bare). Secondly, for the treatments with low and high compaction levels, the total porosity under residue-cover was increased by 6.02% and 8.34% respectively, and was increased by 8.21% and 3.57% under bare surface conditions. However, no apparent porosity change appeared in the treatment with moderate compaction. Thirdly, the portion of large pores (> 50 μm) was increased significantly under bare treatment, while significant increase in the portion of micro-pores (< 50 μm) occurred under residue cover treatment. Finally, regardless of compaction level and surface cover treatment, W-D cycles led to a decrease of soil penetration resistances, which was less than 2.0 MPa. Conclusion: The process of W-D cycle alleviated subsoil compaction of Mollisol of Northeast China.

Li Wang [1 * ^], China Agricultural University, Lab Master

Zhengchao Tian [2], College of Resources and Environment, Huazhong Agricultural University, Associate professor

Meng Zhang [3], College of Resource and Environment Science, Hebei Agricultural University, Lecturer

Tusheng Ren [4], China Agricultural University, Professor of Soil Science

Session Details:

Poster Session (SOIL AND WATER MANAGEMENT, SOIL FERTILITY, PRECISION AG, ON-FARM RESEARCH, CROP PROTECTION) Displayed, Atlantic Foyer, 24 Sep, 2024 08:00 AM

The influence of crop rotation, monoculture, and intensive farming on phenolic compounds of winter rye (Secale cereale L.) roots

Mindaugas Dorelis [1*^], Jūratė Staveckienė [2], Viktorija Vaštakaitė-Kairienė [3], Vaclovas Bogužas [4]

Submission Type:

Oral presentation

Sub-topics:

Abstract Summary :

Plants synthesize various secondary metabolites, which are crucial in their functioning and relationship to the environment. Phenolic compounds are ubiquitous secondary metabolites in plants. Phenolic acids and flavonoids are essential in forming relationships between the soil and plant vegetation, even at low concentrations. These chemicals exhibit a wide range of functions, including rhizogenesis, allelopathic activity, interactions between plants and microorganisms, symbiotic relationships with arbuscular mycorrhizal fungi, and their ability to act as agents in plant defense against biotic and abiotic stress. A field experiment was established at Vytautas Magnus University Agriculture Academy in Lithuania (54°53′ N, 23°50′ E) to determine the effect of cropping systems on phenolic compound concentrations in winter rye (Secale cereale L.) roots. The four cropping systems were: 1) Intensive (winter rye with winter rapeseed as a catch crop and NPK fertilizers (CRint); 2) Winter rye monoculture without fertilizers and herbicides (MonoF0H0); 3) Winter rye monoculture with fertilizers and herbicides (MonoF1H1); 4) Three-year crop rotation with winter rye, fertilizers, and herbicides (CR3y). The individual phenolic compounds (flavonoids and phenolic acids) in the roots of rye at the head emergency stage (BBCH 57-59) were determined by the high-performance liquid chromatography (HPLC) method. The dominant phenolic compound was epicatechin, followed by caffeic acid > rutin > myricetin > ellagic acid = o-coumaric > apigenin = kaempferol > ferulic acid = chicoric acid > m-coumaric acid. The results demonstrated that the significantly (Tukey HSD test, $P > 0.05$) higher contents of epicatechin, rutin, ellagic, ferulic, and chicoric acids were in rye root grown in CR3y system (an average of 30 %, 24 %, 20 %, 23 %, 35 % higher, respectively) compared to CRint, MonoF0H0, and MonoF1H1 systems. The contents of caffeic acid and myricetin did not significantly differ in CR3y, MonoF0H0, and MonoF1H1systems; however, they were substantially higher (an average of 44 % and 50 %, respectively) compared to the CRint system. About 50 % higher content of o-coumaric was determined in rye roots grown in MonoF1H1 than in other cropping systems. The cropping system did not influence m-coumaric, apigenin, and kaempferol contents in winter rye roots. The data showed that the accumulation of individual phenolic compounds in winter rye roots depends on the cropping system. More detailed studies are needed to understand the multiple biological activities of phenolic compounds related to plant and soil health.

Mindaugas Dorelis [1*^], Vytautas Magnus University, Agriculture Academy, Doctoral (PhD) Student

Jūratė Staveckienė [2], Vytautas Magnus University Agriculture Academy, Senior laboratory assistant, doctoral student

Viktorija Vaštakaitė-Kairienė [3], Lithuanian Research Centre for Agriculture and Forestry, Vytautas Magnus University Agriculture Academy, Assoc Prof, Senior researcher

Vaclovas Bogužas [4], Vytautas Magnus University, Agriculuture Academy, Professor, Chief researcher

Session Details:

The influence of crop rotation, monoculture, and intensive farming on phenolic compounds of winter rye (Secale cereale L.) roots, Cape Henry C, 23 Sep, 2024 01:00 PM

Conservation tillage increased lodging resistance of maize in the black soil region of Northeast China

Hu Zhou [1 * ^], Xiaoqing Wei [2], Xuelong Guo [3], Tusheng Ren [4], Paul Hallett [5], Baoguo Li [6]

Submission Type:
Oral presentation

Sub-topics:
Conservation soil tillage

Abstract Summary :

Abstract Maize root lodging causes crop yield and quality penalty, improving lodging resistance is a great challenge to maize production. Conversion from conventional tillage to conservation tillage might affect root lodging due to the change in soil environment. In this study we compared root lodging resistance in conventional and conservation tillage, and evaluate soil physical properties, the aboveground and belowground trait of maize plants at 13 filed locations. We found conservation tillage significantly enhanced root pushing/pulling resistance. The brace root diameter and brace root angle, especially on node 7, nodal root whorl numbers and stalk width were increased under conservation tillage relative to conventional tillage. However, the tillage practice had slight effects on brace root number in a whorl and plant height. Meanwhile, conservation tillage significantly increased the topsoil (0-20 cm) bulk density, penetration resistance, shear strength and volumetric water content. Soil strength, shear strength and water content had significant correlation with brace root phenotypes, indicating that these soil properties may be the key factors affecting maize brace root growth. Soil physical properties and plant and brace root phenotypes can explain 45.62% and 36.17% of root pushing/pulling resistance, suggesting root lodging were closely related to soil physical properties (soil strength, shear strength and water content) and brace root development. Our results confirmed that conservation tillage is an effective way to increase maize root lodging resistance.

Hu Zhou [1 * ^], China Agricultural University, Professor

Xiaoqing Wei [2], China Agricultural University, PhD student

Xuelong Guo [3], China Agricultural University, Master student

Tusheng Ren [4], China Agricultural University, Professor of Soil Science

Paul Hallett [5], University of Aberdeen, Chair in Soil Physics

Baoguo Li [6], China Agricultural University, Professor

Session Details:

Conservation tillage increased lodging resistance of maize in the black soil region of Northeast China, Atlantic Ballroom, 24 Sep, 2024 11:00 AM

Measurement and estimation of evapotranspiration and infiltration fluxes in a no-till maize field: A long term experiment study

Yili Lu [1 * ^], Yutong Liu [2], Tusheng Ren [3]

Submission Type:

Oral presentation

Sub-topics:

Soil physics/water movement

Abstract Summary :

Quantifying evapotranspiration (ET) in rainfed cropping systems can be challenging due to complicated interactions among site-specific soil, plant, and management factors. In Northeast China, ET and soil water status in no-tilled maize fields often display strong spatial and temporal variations due to the changes in tillage practice, planting pattern, and maize plant density. Previous studies have shown that near-surface soil water content () observations at multiple scales provide the potential to estimate surface soil water fluxes. In this study, we introduced a new method to estimate daily field ET by using a soil water flux model mainly based on the time-series of at a depth of 2.5 cm. The new method required a calibration of soil water diffusivity with maximum net water flux in the near-surface soil layer, which was related to precipitation redistribution below the canopy. Finally, the new method was evaluated using observed ET values over a 2-year period in a maize field, where independent measurements of soil water evaporation (E) and transpiration (T) were made with heat-pulse sensors and sap-flow gauges, respectively. Field observations showed that E dominated water loss during the seedling stage. As the canopy was fully developed, E sharply decreased to a value of 0.4 mm d-1, and T accounted for about 89% of ET since the silking stage. On rain-free days, the ET values estimated with the new method matched well with the measured E+T values, with R2 and RMSE values of 0.85 and 1.93 mm d-1. Therefore, the new approach provides an effective way to quantify maize ET. We also used the new method to estimate the infiltration fluxes during the wet periods, and the long-term infiltration fluxes under residue cover was quantified.

Yili Lu [1 * ^], China Agricultural University, Associate Professor

Yutong Liu [2], College of Land Science and Technology, China Agricultural University, Dr.

Tusheng Ren [3], China Agricultural University, Professor of Soil Science

Session Details:

Measurement and estimation of evapotranspiration and infiltration fluxes in a no-till maize field: A long term experiment study, Cape Charles A , 24 Sep, 2024 09:00 AM

Low inflation pressure tyres reduce the effect of agricultural traffic on soil health and crop yields

Magdalena Kaczorowska-Dolowy [1*^], Przemek Dolowy [2], Md Rayhan Shaheb [3], Richard Godwin [4], David White [5], Edward Dickin [6], Tony Grift [7], Mary Harty [8], Kevin McDonell [9], Minli Yang [10], Xiao Yang [11], Zhen Li [12], Zhenghe Song [13], Paula Misiewicz [14]

Submission Type:

Oral presentation

Sub-topics:

Tire size and pressure, Soil compaction

Abstract Summary :

Soil compaction is a well recognised problem world wide, as it can cause soil degradation and deteriorate conditions for crop growth and yield. One of the mitigation measures is the use of high flexion tyre technologies, with reduced tyre inflation pressures (LTP), which increases tyre soil contact area, and reduces the contact pressure, in comparison to a conventional system, i.e. radial tyres with standard inflation pressure (STP). This paper reports on results from four experiments: a) a long term experiment (started in 2011) on sandy loam soil in West Midlands, UK (“site1”); b) a short term experiment (2019-2021) on clay soil in Cambridgeshire, UK (“site2”); c) a 3 year study (2016 2018) on silty clay loam soil in Illinois, USA (“site3”) and a trial on black soil in Northeast China (2021-2023, “site4”). These experiments compared the effects of LTP and STP on soils cultivated to three tillage depths: zero, shallow (10 cm) and deep (25 cm; 45 cm at site3), on soil properties, crop growth and yields. Additionally, the sites 1, 3 and 4, served as case studies for an economic analysis. The results showed that LTP has a potential to significantly ($p< 0.05$) improve soil health, as well as crop growth and yield, in comparison to STP, it: 1) enhanced soil fauna feeding activity by 17% and 50% (in 2019 and 2020 respectively, at site1); 2) reduced soil penetration resistance by 7% - 16%, depending on soil depths and crop (site3); 3) enhanced porosity by 6% -12% (depending on soil depth, at site4) 4) improved plant establishment (by 0.76% and 0.8%) and the number of plants per hectare of maize and of soybean (site3), as well as plant establishment of winter barley by 59% (site2, 2019), 5) improved crop yields: a) on deeply tilled soil by 5%, during 12 years of observations on site1, with wheat, barley, oats and field beans crop rotation (2012 - 2023); b) of winter barley by 7% on site2, regardless of the tillage; c) of maize by 4.3% and 2.7% in 2017 and 2018, respectively, and soybean by 3.7% in 2018, at site3; d) of maize by 2.65% and soybean by 1.95% on site4; 6) improved the economic performance by an average of \$72/ha at site1, and \$42 and \$45/ha for 200ha and 800ha farms, respectively at site3. The site1 data gives breakeven areas to cover the increased “Ultraflex” tyre costs of: i) 120 ha for larger farms (with 4 tractors, 3 trailers, 1 combine harvester and a sprayer) ii) 16 ha for for smaller arable farms (with 1 tractor, 1 combine harvester). Additionally, LTP reduced fuel consumption by 10.35% and increased operating efficiency by 2.41% (site4).

Magdalena Kaczorowska-Dolowy [1*^], Harper Adams University, Post doctoral research associate

Przemek Dolowy [2] , Soil and Water Research Centre, Harper Adams University, UK, Post-doc researcher

Md Rayhan Shaheb [3] , Department Of Plant And Agroecosystem Sciences, University Of Wisconsin-Madison, USA, Research Associate/Agronomist

Richard Godwin [4] , Agri-Tech Research Centre, Harper Adams University, UK, Professor emeritus

David White [5] , Harper Adams University, Senior lecturer in engineering

Edward Dickin [6] , Harper Adams University, Senior lecturer in agronomy

Tony Grift [7] , Department of Agricultural and Biological Engineering, University of Illinois Urbana-Champaign, USA, Professor

Mary Harty [8] , School of Agriculture & Food Science, University College Dublin, Ireland, Associate professor

Kevin McDonell [9] , School of Agriculture & Food Science, University College Dublin, Ireland, Professor

Minli Yang [10] , Department of Agricultural Engineering, College of Engineering, China Agricultural University, China , Professor

Xiao Yang [11] , Department of Mechanical Engineering, College of Engineering, China Agricultural University, China, Associate professor

Zhen Li [12] , Department of Mechanical Engineering, College of Engineering, China Agricultural University, China, Associate professor

Zhenghe Song [13] , National Key Laboratory of Agricultural Equipment Technology, China, Professor

Paula Misiewicz [14] , Harper Adams University, Senior lecturer in soil and water management

Session Details:

Low inflation pressure tyres reduce the effect of agricultural traffic on soil health and crop yields , Cape Charles A , 23 Sep, 2024 03:00 PM

IMPACT OF CROP ROTATIONS AND CROP RESIDUE ON SOIL ORGANIC FRACTIONS IN TEMPERATE REGIONS

Mauricio Bustamante [1*^], Guillermo Siri [2], Oswaldo Ernst [3]

Submission Type:

Oral presentation

Sub-topics:

Soil health and quality

Abstract Summary :

Crop residues are considered a very important raw material for bioenergy production. However, their removal can impact soil degradation and decrease soil organic carbon (SOC). We aimed to evaluate the impact of different rotations and/or residue removals after 13 years on the SOC content and its fractions. The treatments consisted of different levels of residue removal (0, 33, and 66%) in a two-year Wheat-Sorghum grain-Maize (WSgM) rotation and a Silage Sorghum Monoculture (SSM; the entire sorghum plant is harvested 20d after flowering) with winter cover crop, planted in no tillage. In April 2021, soil sampling was carried out at 0–5, 5–10, 10–20, 20–30, 30–50, and 50–70 cm depth to analyze SOC associated with particulate organic matter (C -POM) and the mineral fraction (C-MAOM). The WSgM rotation without residue removal had 24% more SOC concerning removing crop residue (average of 33 and 66%), explained by a higher content (75%) of the C-POM fraction, presenting no differences in the C-MAOM. SSM treatment presented intermediate values of SOC and its fractions. On the other hand, bulk density (BD), as an indicator of soil quality, increased in the SSM and WSgM treatments with residue removal, 15% higher compared to the WSgM system without removal in the first 10 cm of soil. After 13 years, these results demonstrated that by only removing 1/3 of crop residue, SOC content decreased (mainly C-POM), together with an increase in BD, suggesting a deterioration of the soil resource. Furthermore, the SSM treatment decreased soil quality (SOC and BD) despite presenting a winter cover crop for its sustainability. Keywords: Rotations, crop residue removal, SOC, bulk density.

Mauricio Bustamante [1*^], Faculty of Agronomy, Universidad de la República, Uruguay, Professor and Research Assistant

Guillermo Siri [2], Faculty Of Agronomy, Universidad De La República Del Uruguay, Prof.

Oswaldo Ernst [3], faculty of Agronomy, Prof.

Session Details:

IMPACT OF CROP ROTATIONS AND CROP RESIDUE ON SOIL ORGANIC FRACTIONS IN TEMPERATE REGIONS, Cape Henry C, 24 Sep, 2024 08:00 AM

ALFA™, a gel-formulated soil inoculant improves tolerance to abiotic stress, plant health, and yield

Cassandra Rieser [1*^], John Aigner [2], Drew Wolter [3]

Submission Type:
Oral presentation

Sub-topics:
Extension outreach programming, Working with growers, Applied demonstration data

Abstract Summary :
Microbial communities have been increasingly correlated to soil health and increased crop yields. Specifically, mycorrhizal fungi (MF) and nitrogen-fixing bacteria (NFB) have been shown to increase plant tolerance to abiotic stressors and access to soil nutrients. Revitalized initiatives promoting soil health and demands for sustainable agricultural practices, have led to soil inoculants becoming increasingly popular in commercial agriculture. Obstacles surrounding ease of application, understanding overall crop benefits, and traditional fertilization practices are some of the factors limiting large scale adoption of these products. As a uniquely formulated, 100% soluble gel that contains Rhizophagus irregularis (MF) and Azospirillum brasilense (NFB), ALFA™ (UPL NA) addresses some of these current limitations. Studies show that the gel formulation can be easily applied via fertigation without clogging emitters or sprinkler heads while also resulting in trends of enhanced root mass and increases in marketable yields in both standard and reduced nitrogen fertility programs. Adoption of ALFA may improve conditions to help plants tolerate abiotic stress, improve nutrient availability, and yield.

Cassandra Rieser [1*^], UPL, Technical Service Manager

John Aigner [2], UPL NA, Technical Service Lead, US

Drew Wolter [3], UPL NA, Technical Development, BioSolutions

Session Details:

ALFA™, a gel-formulated soil inoculant improves tolerance to abiotic stress, plant health, and yield, Mariner Room, 23 Sep, 2024 02:00 PM

Assessing the transition to organic farming and soil tillage practices from the perspective of farmers

Apolka Ujj [1 * ^], Jana Marjanović [2], Kinga Pércsi Nagyné [3], Annamária Harkányi [4], Paulina Jancsovszka [5]

Submission Type:

Oral presentation

Sub-topics:

Country/region specific issues and reports

Abstract Summary :

The European Union Green Deal aims to promote sustainable and environmentally friendly agricultural practices, reduce the environmental burden caused by agriculture, and increase rural development and biodiversity. From several points of view, organic farming is considered a key element of the strategy aimed at achieving a climate-neutral Europe. The Green Deal envisages the increase of organic land by at least 25% of the EU's agricultural land by 2030 which is still only around 6% in Hungary. Despite the subsidies, many factors block the farmers from switching to organic farming. During our research, we investigate the topic from the perspective of the farmers, identifying those factors that influence the success of the transition to organic farming. The research methodology was semi-structured in-depth personal interviews with Hungarian organic and conventional farmers (20 farmers), followed by content analysis of the interviews using NVivo12 qualitative data analysis software. After the initial deductive coding of the research questions' responses, we found the inductive coding more effective. The answers of the farmers were organized into topic groups that provided a comprehensive picture of the farmers' current practices and described their experienced (in the case of organic farmers) and supposed (in the case of conventional farmers) challenges during the transitional period. Accordingly, our findings are organized into 10 codes including Soil management with specific subcodes such as crop residue management, tillage method, extra soil amendments. Concerning climate change effect mitigation, farmers highlighted the importance of preserving soil moisture. The majority of responding organic farmers no longer use plowing (although in organic farming it used to be a typical weed control tool), and the majority of them strive for reduced tillage underlying that they only cultivate the soil shallowly. Nevertheless, none of them apply zero tillage. The majority of conventional farmers do not see the solution to climate change in adaptive soil tillage. Only a few of them apply direct sowing and permanent mulching and are not interested in zero tillage. Both organic and conventional farmers believe that the success of the transition to organic farming is not limited to the change of specific production technology elements but requires a complex approach. Based on their suggestion, this holistic approach should include proper crop selection and harvest loss prevention techniques; Added value creation; Marketing assisted by education that would help promote and sell the products; Risk mitigation and sales problem prevention by joint action suggesting cooperation with other farmers; Mentor program assisting farmers to select plants in organic crop rotation and solve technological issues; Transition plan; Education (vocational) for mentors and farmers; Regular farm visits guided by

reliable farmers to see that arable crop production can work without pesticides and also in a no-till system.

Apolka Ujj [1]*^, Hungarian University of Agriculture and Life Sciences (MATE), Associate Professor

Jana Marjanović [2], Hungarian University Of Agriculture And Life Sciences (MATE), PhD student

Kinga Pércsi Nagyné [3], MATE - Hungarian University of Agriculture and Life Sciences, associate professor

Annamária Harkányi [4], MATE - Hungarian University of Agriculture and Life Sciences, MSc student

Paulina Jancsovszka [5], MATE - Hungarian University of Agriculture and Life Sciences, associate professor

Session Details:

Assessing the transition to organic farming and soil tillage practices from the perspective of farmers, Cape Charles A , 24 Sep, 2024 09:00 AM

Dry-wet cycles are more effective than freeze-thaw cycles in compacted soil recovery

Muhammad Mohsin Nawaz [1*^], Emmanuel Arthur [2], Mathieu Lamandé [3]

Submission Type:
Oral presentation

Sub-topics:
Soil compaction

Abstract Summary :

Soil compaction is a serious threat to soil health in arable land. Freezing-thawing (FT) and drying-wetting (DW) are naturally occurring soil processes that alter the soil pore space and thus soil structure. FT and DW are considered important climatic and abiotic mechanisms to ameliorate soil compaction. However, to what extent annual FT and DW can accelerate natural recovery from subsoil compaction is unclear. To investigate and compare the effects of FT and DW on the recovery of soil structure post-compaction, we collected subsoil samples from the headlands of a long-term traffic-induced compaction trial. Samples were first exposed to FT and then DW under controlled conditions. Briefly, a single FT cycle (FTC) consisted of 15 hours of exposure to -18°C followed by 24 hours of exposure to 10°C. Similarly, a single DW cycle (DWC) meant exposing samples to 40°C for 72 hours and then saturating samples in sandboxes with capillary water from beneath for 168 hours. We evaluated air flow, and accessible air-filled porosity (AFP) at soil matric potential of -100 hPa before and after 5 and 15 FTCs and 5 DWCs. Moreover, soil pore morphology was evaluated using X-ray computed tomography (CT). Results showed that air permeability (Ka) and accessible AFP increased after exposure to FT and DW. On average, Ka and accessible AFP increased by 22% and 12%, respectively, after exposure to 15 FTCs. However, the increase in Ka after 5 DWCs was 261% higher than Ka after 15 FTCs. Interestingly, this was coupled with just a 3.63% increase in the corresponding value of accessible AFP. Preliminary results from the X-ray CT image analysis indicated that FT reduced soil pore volume; however, DW exposure after FT helped to recover some of this reduction. Both FT and DW caused an increase in macropore length density and number of macropores (> 0.48mm). Increased, yet lower values of Ka and accessible AFP after FT suggested pore reorganization mainly through fragmentation that was corroborated with the X-ray CT analysis. On the other hand, the sharp increase in Ka after DW points towards better connectivity of the pore network. FT and DW can help structure recovery in compacted subsoil; however, DW appears to be more effective than FT.

Muhammad Mohsin Nawaz [1*^], Department Of Agroecology, Aarhus University, Tjele, Denmark, PhD Fellow

Emmanuel Arthur [2], Aarhus University, Senior Scientist

Mathieu Lamandé [3], Aarhus University, Senior Scientist

Session Details:

Dry-wet cycles are more effective than freeze-thaw cycles in compacted soil recovery, Cape Charles A , 23 Sep, 2024 03:00 PM

Review of techniques for the recovery of compacted soils in Europe

Emmanuel Arthur [1 ^], Guido Bakema [2 *], Derk Van Balen [3]

Submission Type:

Poster presentation

Sub-topics:

Soil compaction

Abstract Summary :

Soil compaction due to agricultural vehicle traffic is recognized as one of the major threats to soil productivity, and soil ecological and hydrological functioning. As part of the EJP SOIL SoilCompaC project, we conducted an extensive literature review on the recovery of compacted soils in combination with data from current recovery field experiments in different European countries. The review included mechanical (tillage), biological (“bio-subsoiling”) and natural (freeze-thaw and wet-dry cycles) methods. We focused on the compacted subsoil below the plough layer (25-50 cm depth) in arable systems. Complete recovery of soil properties to pre-compaction levels was seldom observed in the experiments reviewed. In 80% of the cases, no more than 50% recovery of soil properties was achieved. Overall, soils with a high clay content demonstrated the highest potential for recovery, regardless of whether natural or mechanical approaches were employed. In the past, deep subsoiling of compacted soil layers was a common approach, leading to short-term improvements but often resulting in recompaction a few years later. One major drawback of most mechanical methods is that they often disturb the entire soil structure, significantly reducing mechanical strength and moisture delivery capacity. Subsoiling can be effective for certain soils when conducted with appropriate equipment and under moderately moist conditions. However, its loosening effect will only be sustained if subsequent traffic loads are greatly reduced and cover crops with substantial belowground biomass are implemented. In the past, the choice was often made to perform deep subsoiling of the compacted soil layers. This resulted in short-term improvement but with a high risk of recompaction a few years later. The main disadvantage of most mechanical methods is that often the complete soil structure is disturbed, which strongly reduces the mechanical strength and moisture delivery capacity. The mechanical method of subsoiling is useful for certain soils if executed with the right equipment and under not-too-wet conditions. However, its loosening effect will only be preserved if afterwards traffic loads are strongly reduced and cover crops with high belowground biomass are used. However, to prevent disruption of the natural soil structure and the risk of recompaction, it is better to choose natural recovery methods. Freeze-thaw and wet-dry cycles, particularly for fine-textured soils, can restore the soil structure but the effect on the subsoil (> 25 cm depth) seems generally limited. The most promising technique involves the use of deep-rooting plants, often referred to as bio-subsoilers. These plants can effectively impact the subsoil without significantly compromising the topsoil. However, further research is necessary to determine the most effective deep-rooting crops under various soil conditions and how best to integrate them into cropping systems.

Emmanuel Arthur [1] ^, Aarhus University, Senior Scientist

Guido Bakema [2] *, Wageningen Environmental Research, The Netherlands, Senior researcher

Derk Van Balen [3], Wageningen Plant Research, The Netherlands, Researcher

Session Details:

Poster Session (Tillage) Displayed, Atlantic Foyer, 23 Sep, 2024 08:00 AM

Regeneration of the subsoil pore structure of a compacted silt loam after five years

Emmanuel Arthur [1 * ^], Meisam Nazari [2], Muhammad Mohsin Nawaz [3], Damian Martin [4], Viviane Mandah [5], Remy Duval [6], Vincent Tomis [7], Francis Bazelaire [8], Mathieu Lamandé [9]

Submission Type: Oral presentation

Sub-topics: Soil compaction

Abstract Summary :

Machinery-induced subsoil compaction negatively impacts its structure, potentially rendering it irreparable. However, the combination of specific plants and natural processes like wetting and drying may facilitate subsoil structure recovery post-compaction. This study assessed the regenerative potential of subsoil structure in a silt loam soil (24% clay, 68% silt, 8% sand) five years post-compaction. The experimental site was in Boiry-Sainte-Rictrude (France) and is part of a Tereos experimental farm. The site was harvested in wet soil in 2018 with a three-axle self-propelled sugar beet harvester (ROPA euro-Tiger 6) with a maximum wheel load of 11 Mg. The experiment included three replications each for non-trafficked control (NT) and trafficked (TF) treatments. Post-compaction, the field underwent a beet-cereal rotation until the time of sampling and measurements. In 2023, we conducted field measurements of penetration resistance (0-40 cm), visually evaluated subsoil structure using SubVESS, and measured saturated hydraulic conductivity for 30-40 cm depth. Additionally, we sampled 100 cm3 intact soil cores for laboratory measurements of soil air permeability and gas diffusion across matric potentials ranging from -10 hPa to -1000 hPa. The SubVESS evaluation revealed that the regenerated TF treatment had similar rooting and aggregate structures to the NT treatment, albeit slightly less porous and denser. However, the TF treatment still exhibited higher penetration resistance (6-21% in the 0-30 cm layer and 6% in the 30-40 cm layer) compared to the NT treatment. Additionally, saturated hydraulic conductivity was 31% lower in the TF treatment than in NT. Laboratory analyses indicated that air flow by convection (air permeability) and diffusion were, on average, 80% and 45% lower in the subsoil for the TF treatment compared to NT. These findings suggest that the subsoil pore system, particularly macropore connectivity, has not fully recovered after the compaction event.

Emmanuel Arthur [1 * ^], Aarhus University, Senior Scientist

Meisam Nazari [2], Aarhus University, Postdoc

Muhammad Mohsin Nawaz [3], Department Of Agroecology, Aarhus University, Tjele, Denmark, PhD Fellow

Damian Martin [4], AgroTransfert, Agronomist

Viviane Mandah [5], International Institute of Tropical Agriculture, Cameroon, Researcher

Remy Duval [6], AgroTransfert, Agronomist

Vincent Tomis [7], Terres Inovia, Agronomist

Francis Bazelaire [8], Tereos, Factory based in Chevrières , Agronomist

Mathieu Lamandé [9], Aarhus University, Senior Scientist

Session Details:

Regeneration of the subsoil pore structure of a compacted silt loam after five years, Cape Henry C, 26 Sep, 2024 01:00 PM

The influence of different agricultural production systems on carbon sequestration in the soils of Eastern Croatia

Brigita Popovic [1 * ^], Karolina Vrandečić [2], Jasenka Ćosić [3], Krunoslav Zmaic [4], Ante Bubalo [5]

Submission Type:

Poster presentation

Sub-topics:

Carbon sequestration and management

Abstract Summary :

Carbon dioxide is one of the most important gases that cause the greenhouse effect, and it is anthropogenically emitted more than all other greenhouse gases combined. Due to its size and intensity, agriculture has a major impact on the carbon stored in the soil and its release into the atmosphere. As a measure to mitigate climate change, the possibility of carbon sequestration in agricultural soils is opening up through appropriate management. In accordance with the legal regulations of the European Union, the European Commission adopted a document on sustainable carbon cycles in December 2021. The document sets out short- and medium-term measures to deal with the current challenges of carbon sequestration in agriculture in order to advance that green business model that will result in carbon sequestration and major biodiversity benefits. One example of effective carbon sequestration practices in agriculture is agroforestry and other forms of mixed agricultural production that combine woody vegetation (trees or shrubs) with crop and/or animal farming systems on the same land. Therefore, the goal of our research was to determine the impact of the intercropping system (walnut + wheat) on the level of carbon sequestration in comparison to the control: a wheat field in organic farming and an organic walnut orchard. The experiment was conducted across two distinct areas in Eastern Croatia, EU: Ivankovo and Đakovo, where agricultural production was carried out using three different systems: control, intercropping, and orchard. Carbon sequestration values varied across these systems and localities. In Đakovo and Ivankovo, the lowest levels of carbon sequestration were observed under control conditions. Notably, in Đakovo, a marginal increase of 0.2 was noted, equivalent to a 1.68 mg/ha increase over the 2018-2022 period. Conversely, in Ivankovo, a reduction of 10.92 mg/ha in sequestered carbon was observed under control conditions during the same timeframe. The most substantial increase in carbon sequestration was observed in intercropping systems, with an impressive rise of 26.04 mg/ha recorded in both Đakovo and Ivankovo. Intercropping also demonstrated significant improvements in carbon sequestration compared to control systems. In Đakovo, there was an increase of 15.96 mg/ha, while in Ivankovo, the increase was even more substantial at 20.16 mg/ha. The additional impact of the intercropping system was also reflected in the increase in biodiversity in the soil. Likewise, the EU legislative framework provides various possibilities for additional financing of systems that increase carbon sequestration through government incentive and private initiatives related to carbon markets, so the results of this research will be of great help in promoting new ways of managing agricultural land.

Brigita Popovic [1 * ^], Faculty Of Agrobiotehnical Sciences Osijek, full professor

Karolina Vrandečić [2], Faculty of agrobiotehnical sciences Osijek, full professor

Jasenka Ćosić [3], Faculty of agrobiotehnical sciences Osijek, full professor

Krunoslav Zmaic [4], Faculty Of Agrobiotehnical Sciences Osijek, full professor

Ante Bubalo [5], Faculty of agrobiotehnical sciences Osijek, Ph.D. student

Session Details:

Poster Session (Environmental Quality, Regenerative Agriculture) Displayed, Atlantic Foyer, 26 Sep, 2024

08:00 AM

Persistent soil compaction remains evident in the subsoil of a silt loam even after 28 years

Maliheh Fouladidorhani [1 * ^], Muhammad Mohsin Nawaz [2], Mathieu Lamandé [3], Nataliya Bilyera [4], Antonios Apostolakis [5], Emmanuel Arthur [6]

Submission Type:	**Sub-topics**:
Oral presentation	Soil compaction

Abstract Summary :

Soil compaction by agricultural machinery affects the topsoil and subsoil differently, with topsoil recovering faster than the subsoil. Previous work has reported that subsoil compaction persists even after several decades. In this work, we evaluated the soil structure and gas and water flow properties of the subsoil of a silt loam 28 years after the compaction event. In April 1995, the experimental field was compacted at field capacity moisture content with six passes and a wheel load of 5 Mg. The experiment was distributed in four replications and included a non-compacted control. Field measurements and soil sampling (100 cm3 intact cores) were conducted at a depth of 30-40 cm in May 2023. In the field, we measured penetration resistance and saturated hydraulic conductivity and evaluated the soil structure using the SubVESS methodology and the abundance of earthworms. In the laboratory, we measured air permeability, effective air-filled porosity, and relative gas diffusivity on the intact 100 cm3 soil cores at -100 hPa. Visual evaluation by Sub-VESS revealed that the compacted treatment still exhibited a denser structure, lower porosity, poorer aggregate friability, and less rooting. The average soil structural quality (Ssq) scores were 1.2 and 2.8 for the control and compacted treatments, respectively. The denser soil structure in the compacted treatment was reflected in an average of 80% higher penetration resistance compared to the control. Surprisingly, there was higher saturated hydraulic conductivity (26.7 cm/h) in the compacted treatment compared to the control (20.0 cm/h), whereas the air permeability was similar between the treatments. A higher conductivity and permeability in the compacted treatment was likely due to a higher abundance of earthworm holes in the compacted plots. Soil gas flow by diffusion, which considers the entire air-filled pores, was 30% lower for the compacted treatment relative to the control. This was consistent with a 20% decrease in effective air-filled porosity. Further analyses of the soil pore system revealed higher tortuosity for the compacted plots. It can be concluded that while the effects of compaction were no longer reflected in the water flow and gas flow by convection, there was still a persistent effect on other soil structure indicators and the entire soil pore system reflected in lowered gas diffusion in the subsoil of a silt loam.

Maliheh Fouladidorhani [1 * ^], Aarhus University, postdoc

Muhammad Mohsin Nawaz [2], Department Of Agroecology, Aarhus University, Tjele, Denmark, PhD Fellow

Mathieu Lamandé [3], Aarhus University, Senior Scientist

Nataliya Bilyera [4], University of Tuebingen, Postdoc

Antonios Apostolakis [5], Georg-August-Universität Göttingen, postdoc

Emmanuel Arthur [6], Aarhus University, Senior Scientist

Session Details:

Persistent soil compaction remains evident in the subsoil of a silt loam even after 28 years, Mariner Room, 26 Sep, 2024 01:00 PM

Potato-LITE project: Low Intensity Tillage Enhancements for Sustainable Potato Production in Regenerative Agricultural Systems

Paula Misiewicz [1*^], Magdalena Kaczorowska-Dolowy [2], Jim Monaghan [3], Edward Dickin [4], David White [5], Jane Rickson [6], Wilfred Otten [7], Shaunagh Slack [8]

Submission Type:

Poster presentation

Sub-topics:

Conservation soil tillage

Abstract Summary :

Conventional potato growing practices – tillage, bed-forming, destoning, planting and harvesting – are perceived to be disruptive to soil structure, for example due to compaction associated with heavy machinery use. Due to the need for a significant break between potato crops, a large proportion of UK potato crops are grown on short-term rented land, but landowners are increasingly likely to resist renting land for potatoes (and other root crops) due to concerns about the potential impact on soil health. Access to land presents a threat to the UK potato industry which is worth £824M (2020 value), employs >16,000 people and delivers a large amount of carbohydrate for UK consumers, making it a significant market. Creating deep, destoned seedbeds, free from stones and clods, is currently deemed necessary within the potato and root crop industries to reduce tuber/root damage and misshapen produce, and to improve harvesting speed. However, this process involves intensively sieving large soil volumes (>3k m3/ha). The intensity and frequency of these tillage operations is generally deemed to be unfavourable to soil health and does not fit in with the current drive towards regenerative agriculture and Net Zero. Rapid innovation is necessary to preserve and enhance UK potato/root crop production and maintain food security/supply-chain stability. The Potato-LITE project (https://potato-lite.farm/) aims to deliver novel, sustainable cultivation approaches to minimise tillage intensity in potato production. This four-year project aims to develop novel machinery and cultivation practices for UK-based potato farms to minimise tillage intensity, improve soil health and reduce greenhouse gas emissions (GHG). The consortium is co-funded by Innovate UK and comprises PepsiCo, McCain Foods, GRIMME UK, forward thinking potato farmers and leading research organisations (Harper Adams University, Cranfield University and Crop Health and Protection) with input from private-sector expert consultants. Potato-LITE began in spring 2023, where experimental, commercial-scale field trials were established at three UK sites to validate the performance and commercial viability of three alternative lower intensity cultivation strategies.

Paula Misiewicz [1*^], Harper Adams University, Senior lecturer in soil and water management

Magdalena Kaczorowska-Dolowy [2], Harper Adams University, Post doctoral research associate

Jim Monaghan [3], Ha, Professor

Edward Dickin [4], Harper Adams University, Senior lecturer in agronomy

David White [5], Harper Adams University, Senior lecturer in engineering

Jane Rickson [6], Cranfield University, Professor

Wilfred Otten [7], Cranfield University, Professor

Shaunagh Slack [8], PepsiCo International, Senior crop physiologist

Session Details:

Poster Session (Tillage) Displayed, Atlantic Foyer, 23 Sep, 2024 08:00 AM

Biochar application enhances tolerance to boron toxicity in rice (Oryza sativa) seedlings

Muhammad Riaz [1 * ^]

Submission Type: Poster presentation

Sub-topics: Soil chemistry, Nutrient cycling

Abstract Summary :

Boron (B) is an essential micronutrient required for plant growth and development. Plants exhibit a narrow concentration range for boron that is optimal, with high sensitivity outside this window where deficiency or toxicity occurs. Boron toxicity poses a more serious limitation to agriculture compared to deficiencies, which can be addressed with boron-rich fertilizers. It has been reported that the use of biochar can alleviate heavy metal toxicities, however, it is not clear how biochar can mitigate boron toxicity in rice.The primary objectives of this study involved the exploration of how biochar influences B uptake, transport, and tolerance in rice seedlings subjected to B toxicity.The investigation involved a pot experiment with distinct treatments: a control treatment (CK), biochar only, B toxicity treatment, and biochar combined with B toxicity treatment. The results showed that application of biochar improve rice root and shoot growth and effectively decreased boron accumulation in rice leaves under boron toxicity conditions. Biochar application was found to increase boron tolerance in leaves, as evidenced by the reduction in hydrogen peroxide and malondialdehyde accumulation. Additionally, biochar elevated the activities of antioxidant enzymes and proline levels in leaves, suggesting it enhanced the rice plant's antioxidant capacity to cope with toxicity-induced oxidative stress. Biochar regulated boron transport from roots to leaves, reducing boron translocation. At the cellular level, biochar enhanced boron fixation in cell walls and decreased boron entry into leaf organelles compared to the control. Collectively, these findings demonstrate biochar confers boron tolerance through multiple mechanisms involving reduced boron accumulation, transportation and antioxidative defense enhancement in rice leaves. Biochar addition was found to increase the levels of osmoprotectants like proline and glycine-betaine, which help plants adapt to stress conditions. Overall, the results demonstrate that biochar enhances rice's ability to withstand boron toxicity by modulating anti-oxidative defense mechanisms and boron homeostasis within the plant. The findings provide evidence that biochar application could support phytoremediation of boron-contaminated soils and boost crop productivity on such lands by mitigating the impacts of boron toxicity.

Muhammad Riaz [1 * ^], 1College Of Resources And Environment, Zhongkai University Of Agriculture And Engineering, Guangzhou 510225, P.R. China, Associate Professor

Session Details:

Poster Session (SOIL AND WATER MANAGEMENT, SOIL FERTILITY, PRECISION AG, ON-FARM RESEARCH, CROP

PROTECTION) Displayed, Atlantic Foyer, 24 Sep, 2024 08:00 AM

Process-based modeling insights into annual weather variability effects on corn yields in a long-term experiment

Kathryn White [1 * ^], Michel Cavigelli [2], Harry Schomberg [3], David Fleisher [4], Dennis Timlin [5]

Submission Type:

Oral presentation

Sub-topics:

Soil chemistry, Nutrient cycling

Abstract Summary :

Process-based crop models simulate the physical, chemical, and biological processes underlying crop growth and yield. Simulation studies using legacy data can be used to expand LTAR (Long-Term Agricultural Research); enabling exploration of factors that would otherwise be difficult to measure in the field. In addition, improved management strategies to reduce yield variability can be readily evaluated. MAIZSIM is a coupled crop and soil simulation model that outputs crop and soil data at an hourly time-step, allowing for detailed assessment of crop genetic x environment x management interactions. The crop model simulates leaf initiation and expansion, photosynthesis, water and nitrogen (N) uptake, carbon and N partitioning, root growth, and phenological development. The coupled soil model simulates root, water, N, heat, and gas distribution, movement, and loss in the soil profile. The model was evaluated using 24 years of management and yield data from the ARS Farming Systems Project (FSP) in Beltsville, MD. We also compared model performance relative to measured relationships between growing season weather and FSP yield. The model was evaluated using a limited set of input data (generic cultivar, assumed preharvest plant population) to assess model sensitivity to cultivar parameters. The overall model fit was relatively good (Index of Agreement = 0.92, Mean Bias Error = 51 kg ha-1), but low yields were overpredicted and high yields were underpredicted. The effect of interannual variability in growing season weather was comparable between measured and modeled yields, revealing that the model simulated the long-term agronomic trends associated with annual weather patterns at the FSP. Commonality analysis revealed that cumulative precipitation from 9 to 13 weeks and heat stress from 8 to 13 weeks after planting were critical periods that accounted for 62% of the explained (R2 = 0.84) annual modeled yield variation. Results indicate that adapting management strategies (cultivar selection, planting rate, planting date) to avoid critical period water and heat stress could help to minimize yield losses, particularly under future climate scenarios with more variable precipitation patterns and greater growing season temperatures.

Kathryn White [1 * ^], USDA-Agricultural Research Service-Beltsville Agricultural Research Center, Soil Scientist

Michel Cavigelli [2], USDA-Agricultural Research Service, Research Soil Scientist

Harry Schomberg [3], USDA-Agricultural Research Service-Beltsville Agricultural Research Center, Research Ecologist

David Fleisher [4], USDA-Agricultural Research Service, Research Agricultural Engineer

Dennis Timlin [5] , USDA-Agricultural Research Service, Research Soil Scientist

Session Details:

Process-based modeling insights into annual weather variability effects on corn yields in a long-term experiment, Mariner Room, 24 Sep, 2024 08:00 AM

Saturated hydraulic conductivity can be affected by limes and phophogypsum reapplications on no-tillage? Residual and initial effects.

André Auler [1 ^], Lucas Aguiar [2 *], Horácio Mazero [3], Eryka Okuda [4], Letícia Schulze [5], Roberta Mendes [6], Rafaela Araújo [7], Gabriel Barth [8]

Submission Type: Oral presentation

Sub-topics: Soil physics/water movement

Abstract Summary :

Saturated hydraulic conductivity (Ksat) is a crucial soil physical property indicating changes in soil structure due to tillage, soil use and management, and variations over time and space. To investigate these dynamics, we conducted a field experiment in Ponta Grossa, Brazil, on a sandy clay loam Oxisol, assessing the impact of reapplying acidity correctives and phosphogypsum (PG) on Ksat over three years. The study began in 2015 with the application of 3.8; 4.2; and 2.7 Mg ha 1 of limestone (L), rock silicate powder (RSP), and calcined limestone (CL), respectively, with or without 2.4 Mg ha 1 of PG. All amendments were broadcasted, and a control treatment was included. In 2020, treatments were reapplied with doses of 4.5; 15.4; 3.4; and 3.0 Mg ha 1 of L, RSP, CL, and PG. Following the reapplication (April 2020) and subsequent samplings after 12 (April 2021) and 24 (April 2022) months, soil samples were collected at 0 0.05, 0.05 0.10, 0.10 0.20, 0.20 0.40 and 0.40 0.60 m layers using steel rings. Ksat was measured using a constant head permeameter. Statistical analyses, based on a randomized block design with factorial arrangement. After 5 years from the initial application, the residual effects of applying soil amendments and PG are slightly pronounced on Ksat. A reduction in Ksat between 0.10 0.20 m, from 31 to 16 mm h 1, was observed with the application of PG, regardless of acidity correction. At 0.40 0.60 m, there was interaction between treatments, with surface acidity correction resulting in increased Ksat at depth, particularly with the use of L with PG compared to control; isolated application of CL compared to SRP; and sole application of PG reducing Ksat from 39 to 18 mm h 1. However, after reaplication, Ksat underwent changes between 0 0.60 m, both at 12 and 24 months. Isolated treatment effects were observed between 0 0.05 m in 2021 and 0 to 0.20 m in 2022. In the surface layer, SRP provided the highest Ksat values. However, from 0.05 m onwards, more reactive amendments, such as CL, resulted in increased Ksat, especially when applied together with PG. Regarding PG application, after 12 months, the conditioner reduced Ksat from 31 to 21 mm h 1 at 0 0.05 m. Whereas, after 24 months, it led to a 60 mm h 1 increase in Ksat in this soil layer. Meanwhile, in layers between 0.05 to 0.60 m, PG elevated Ksat, particularly when applied with less reactive amendments (SRP and L) compared to control. In conclusion, alterarion on Ksat are dependent on soil corrective used and time and depth of reaction after applications. In general, results show that PG promotes positive effects on Ksat, mainly when associatet with

André Auler [1 ^], Universidade Federal Do Paraná, Professor

Lucas Aguiar [2 *], Universidade Federal do Paraná, Master student

Horácio Mazero [3], Universidade Federal do Paraná, Ph.D Stutent

Eryka Okuda [4], Universidade Federal do Paraná, Graduation student

Letícia Schulze [5], Universidade Federal do Paraná, Graduation student

Roberta Mendes [6], Universidade Federal do Paraná, Graduation Student

Rafaela Araújo [7], Universidade Federal Do Paraná, Ph.D. Student

Gabriel Barth [8], Fundação ABC, Researcher

Session Details:

Saturated hydraulic conductivity can be affected by limes and phophogypsum reapplications on no-tillage? Residual and initial effects., Cape Charles A , 24 Sep, 2024 11:00 AM

Impact of utility-scale solar field development on surface infiltration and ponding.

Emilia Hyland [1 * ^], Ryan Stewart [2], John Hoben [3], John Ignosh [4]

Submission Type:

Poster presentation

Sub-topics:

Soil physics/water movement

Abstract Summary :

Balancing the benefits and drawbacks of utility-scale solar energy is crucial as solar energy continues to grow in usage across the world. Development of solar sites often leads to cut-and-filled, compacted, and poorly vegetated soils with increased rates of erosion and stormwater runoff. These effects have primarily been studied through simulations and models, which lack real-world verification. Field data is necessary for better understanding, and therefore management, of stormwater on these sites. The aim of this study is to quantify the impact that solar field development has on infiltration and ponding (i.e., water that collects on the soil surface during precipitation) using field data. Single ring infiltrometers and ponding gauges were used to measure surface infiltration and ponding in pre- and post- construction catchments of a utility-scale solar facility in the coastal plain physiographic region of Virginia. Post-construction areas are expected to show higher ponding values and lower infiltration rates in comparison to the pre-construction areas. The results from this study can be used to refine stormwater models and improve site development practices in the future.

Emilia Hyland [1 * ^], Virginia Polytechnic Institute And State University, Graduate Student

Ryan Stewart [2], Virginia Polytechnic Institute and State University, Associate Professor

John Hoben [3], Virginia Polytechnic Institute and State University, Research Scientist

John Ignosh [4], Virginia Tech Extension Northern District, Advanced Specialist

Session Details:

Poster Session (SOIL AND WATER MANAGEMENT, SOIL FERTILITY, PRECISION AG, ON-FARM RESEARCH, CROP PROTECTION) Displayed, Atlantic Foyer, 24 Sep, 2024 08:00 AM

Long-term organic and conventional cropping systems management influences soil strength.

Harry Schomberg [1 * ^], Michel Cavigelli [2], Kipling Balkcom [3], Kathryn White [4], Alondra Thompson [5]

Submission Type:

Oral presentation

Sub-topics:

Soil compaction

Abstract Summary :

We evaluated soil strength before and following subsoiling for five crop management systems common in the Mid-Atlantic Region, USA. The research was conducted in the long-term Farming Systems Project (FSP) at the Beltsville Agricultural Research Center in Beltsville, MD (39.0°N, 76.9°W) from 2017 through 2020. The two conventional systems were 3-yr rotations of corn/rye cover crop–soybean/wheat/soybean managed with No-till (NT) or Chisel Till (CT). The three organic systems represented increasing rotation length and complexity: a 2-yr hairy vetch cover crop–corn/rye cover crop–soybean rotation (Org2); a 3-yr hairy vetch cover crop–corn/rye cover crop–soybean/wheat rotation (Org3); and a 6-yr corn/rye cover crop–soybean/wheat/alfalfa–alfalfa–alfalfa rotation (Org6). The organic systems utilized tillage of varying intensities and timing for weed control. Plots were split in half (6 rows each) and subsoiled in 2017 and 2019 after corn harvest when soils were at optimum moisture conditions. Soil strength was measured using a tractor-mounted hydraulic five probe penetrometer from nine locations in each subplot. Measurements were centered in subplots to capture both trafficked and non-trafficked mid-rows of subsoiled and non-subsoiled subplots. Initial measurements collected in spring 2017 prior to corn planting and prior to subsoiling indicated soil strength was greater in the CT compared to the NT soil profile. The Org systems had soil strength values more similar to CT compared to NT. The pattern of soil strength for the Org systems reflected traffic intensity with slightly greater soil strength in Org 6 compared to the other two systems. Org 6 measurements were made following 3 years of repeated perennial forage harvests. The effects of fall subsoiling on soil strength were obvious the following spring for all treatments and were greatly reduced after one year, but still distinguishable. A more detailed analysis of soil strength measurements will be presented for individual years in relation to management effects.

Harry Schomberg [1 * ^], USDA-Agricultural Research Service-Beltsville Agricultural Research Center, Research Ecologist

Michel Cavigelli [2], USDA-Agricultural Research Service, Research Soil Scientist

Kipling Balkcom [3], USDA-ARS, Research Agronomist

Kathryn White [4], USDA-Agricultural Research Service-Beltsville Agricultural Research Center, Soil Scientist

Alondra Thompson [5], USDA-Agricultural Research Service, Ag. Engineer

Session Details:

Long-term organic and conventional cropping systems management influences soil strength. , Cape Charles A , 23 Sep, 2024 02:00 PM

In field soil compaction and phosphorus deficiency: effects on cash crops and penetration resistance

André Auler [1 ^], Pedro Fariña [2 *], Kaline Wagner [3], Eryka Okuda [4], Giorgia Ribeiro [5], Jéssica Harmatiuk [6], Júlio Brita [7], Lucas Aguiar [8], Jean Santos [9], Guilherme Sotsek [10]

Submission Type:

Oral presentation

Sub-topics:

Soil compaction

Abstract Summary :

Soil compaction and phosphorus [P] deficiency are two factors that can significantly reduce crop production and soil functionality. To address these issues, we initiated a field experiment in Paraná State, Brazil, in November 2022, focusing on evaluating levels of soil compaction and doses of triple superphosphate under a no tillage system. Our primary objectives were to assess the effects of these treatments on penetration resistance (SPR) and the development of maize wheat succession. The levels of soil compaction were based on the degree of compaction [DC]. We aimed for DC values of 85±2, 90±2, and 95±2%. Achieving these levels involved subjecting the field to tractor traffic [Case 165©]. The natural soil DC was 80±2%, considered the non compacted treatment. The number of wheel passes was controlled until the bulk density equivalent to the DC was reached, resulting in bulk densities of 1.20, 1.28, 1.36, and 1.43 kg dm 3. These treatments were replicated in three blocks, each containing four plots measuring 11×25 m. Once the desired DC was achieved, plots were subdivided [11×6.25 m] in a split plot design. In these split plots, doses of 0, 50, 100, and 150 kg ha 1 of triple superphosphate were applied during each crop sowing season [November 2022 and June 2023], directly in the sowing furrow. Other fertilizers were applied on the soil surface, and pesticide spraying was carried out manually to avoid additional compaction. Throughout the crop seasons, we assessed dry mass accumulation [DM], yield, and phosphorus nutrition. After harvest, we analyzed SPR using a field digital penetrometer (PGL2040, Falker®). The interaction between soil compaction and phosphorus fertilization affected the DM and yield of maize and the DM of wheat. Maize development decreased at all compaction levels and phosphorus fertilization compared to non compacted soil. However, phosphorus fertilization significantly increased the DM and yield of maize in non compacted soil and under low compaction conditions [DC near 85%]. Optimal doses of triple superphosphate were found to be 106, 92, 104, and 90 kg ha 1 in non compacted treatment and DC of 85, 90, and 95%, respectively. At these doses, the maximum yields obtained were 5423, 3275, 5155, and 2782 kg ha 1, for maize, respectively. Additionally, phosphorus nutrition decreased in maize, as indicated by DM and yield. PR was affected only by compaction levels after one year, specifically in the most superficial soil layer [0 0.10 m]. In this case, SPR showed a quadratic adjustment: PR = 74,520.3 1,700.4DC + 9.9DC2 [p< 0.001, R2 = 0.88]. PR values at 0 0.10 m layer were 1679, 1526, 1375, and 2210 kPa for 80, 85, 90, and 95% of DC, respectively. These results underscore that an increase in

André Auler [1] ^, Universidade Federal Do Paraná, Professor

Pedro Fariña [2] *, Universidade Federal do Paraná, Ph.D. Student

Kaline Wagner [3], Universidade Federal do Paraná, Ph. D. Student

Eryka Okuda [4], Universidade Federal do Paraná, Graduation student

Giorgia Ribeiro [5], Universidade Federal do Paraná, Graduation Student

Jéssica Harmatiuk [6], Universidade Federal do Paraná, Graduation Student

Júlio Brita [7], Universidade Federal do Paraná, Master degree student

Lucas Aguiar [8], Universidade Federal do Paraná, Master student

Jean Santos [9], Universidade Federal do Paraná, Master degree student

Guilherme Sotsek [10], Universidade Federal do Paraná, Master Degree student

Session Details:

In field soil compaction and phosphorus deficiency: effects on cash crops and penetration resistance, Cape Charles A , 23 Sep, 2024 04:00 PM

Visual evaluation of soil structure (VESS) and its relationship with soil physical properties

Esmailson Moreira Dos Santos [1] , Vacilania Pacheco [2] , Lucas Salcoski Rossoni [3] , Samienta Charles [4] , Craig David Rogers [5] , Cassio Antonio Tormena [6] , Rachel Muylaert Locks Guimaraes [7] * ^

Submission Type:
Poster presentation

Sub-topics:
Methodologies for visual, chemical, and physical soil examination

Abstract Summary :
The Visual Evaluation of Soil Structure (VESS) method is a complementary tool to quantitative soil measurements, which provides additional information about the soil structural quality. VESS is applied directly in the field, and provides quick and easy-to-interpret results. The objective of the study was to relate the different structural quality scores (Sq), attributed to the soil via the VESS and CoreVESS methodologies, with quantitative indicators of soil physical quality. Two areas were selected, one under agriculture and the other with native forest, both in the municipality of Pato Branco-PR, Brazil. The assessment was carried out using the VESS methodology (Guimarães et al., 2011) at different points on the property, totalling 50 points in the field and 10 in the forest. Undisturbed soil samples were obtained at the same points using metal cylinders. In the laboratory, soil density, total porosity, macroporosity, microporosity, soil resistance to penetration, saturated hydraulic conductivity and soil organic matter were assessed for the undisturbed samples. To assess whether the score sampled in the field was the same as that contained in the undisturbed samples, a methodology similar to the CoreVESS (Joahannes et al., 2017) was applied. VESS and CoreVESS were highly correlated with the evaluated soil physical properties, demonstrating that VESS is a reliable tool that can be used to make management decisions for the evaluated soil. Quantitative soil indicators and visual assessment scores of soil structure are complementary and their inclusion provides a more complete assessment of the structural and physical quality of the soil.

Esmailson Moreira Dos Santos [1] , Universidade Tecnológica Federal do Paraná, PhD Student

Vacilania Pacheco [2] , Universidade Tecnológica Federal do Paraná, PhD Student

Lucas Salcoski Rossoni [3] , Universidade Tecnológica Federal do Paraná, Undergraduate Student

Samienta Charles [4] , Universidade Tecnológica Federal do Paraná, Msc. Student

Craig David Rogers [5] , Independent Scholar, Scientific Consultant

Cassio Antonio Tormena [6] , Universidade Estadual de Maringá, Professor

Rachel Muylaert Locks Guimaraes [7] * ^ , Universidade Tecnológica Federal Do Paraná, Associate Professor

Session Details:

Poster Session (Environmental Quality, Regenerative Agriculture) Displayed, Atlantic Foyer, 26 Sep, 2024 08:00 AM

An On-Farm Test Plot Can Teach You a Lot. Utilizing Legume Cover Crops to Reduce Nitrogen Fertilizer

Jenna Beville [1*^], Michael Flessner [2], Lydia Fitzgerald [3], W. Hunter Frame [4]

Submission Type:

Poster presentation

Sub-topics:

Applied demonstration data

Abstract Summary :

Achieving the agronomic optimum nitrogen (N) rate is important for production efficiency and minimizing negative environmental impacts. Legume cover crops like hairy vetch (Vicia villosa) are known to produce up to 4500 kg/ha of biomass, with an N content of 280 kg/ha. Much of this N will become plant-available in the soil as the cover crop decomposes, potentially allowing reduced N fertilizer inputs in subsequent cash crops such as corn and cotton. To quantify fertilizer reductions, on-farm experiments were conducted in Surry County, Virginia, USA on sandy loam/sand soils with a fall planted cover crop of hairy vetch + crimson clover (Trifolium incarnatum). All sites applied starter N fertilizer at or before planting in the spring at 67 kg/ha and no subsequent N fertilizer. Cover crop biomass samples collected at cotton planting contained 2900 and 3700 kg/ha, which contained 87 and 136 kg N/ha, in 2022 and 2020, respectively. Cotton yield was 1700 and 1300 kg/ha in 2022 and 2020, respectively, which was >400 kg/ha more than the Virginia average yield in both years. Fertilizer savings were 45 kg N/ha or 124 USD/ha compared to local recommendations of 112 kg N/ha. Additionally, the Precision Sustainable Agriculture Cover Crop Nitrogen Calculator, “CC-NCALC” (https://covercrop-ncalc.org/) was used to estimate the cover crop N credit, which was 26 and 53 kg N/ha in 2022 and 2020, respectively. Therefore, legume cover crops can supply N allowing for reduced fertilizer inputs while maintaining or exceeding cotton yields compared to conventional practices. Other agronomic advantages of cover crops such as reduced soil erosion, reduced weed competition, soil moisture conservation, and others were noted by observation from the farmer, which is supported by pervious literature. Future research may examine reductions in potassium or phosphorous fertilizers due to cover crop’s role in nutrient cycling.

Jenna Beville [1*^], Virginia Tech, Graduate Research Assistant

Michael Flessner [2], VTSPES, Associate Professor

Lydia Fitzgerald [3], Virginia Tech, Soil Health Agronomist

W. Hunter Frame [4], Virgnia Tech, Associate Professor

Session Details:

Poster Session (SOIL AND WATER MANAGEMENT, SOIL FERTILITY, PRECISION AG, ON-FARM RESEARCH, CROP PROTECTION) Displayed, Atlantic Foyer, 24 Sep, 2024 08:00 AM

Effect of Cover Crop Lignin: N on the Stabilization of Plant Carbon Inputs

Poulomi Dey [1 * ^], Brian Strahm [2], Brian Badgley [3], Jacob Barney [4], Angela Possinger [5]

Submission Type:
Poster presentation

Sub-topics:
Carbon sequestration and management

Abstract Summary :
Soil organic matter (SOM) formation and retention as stable SOM is crucial towards soil health, crop production and furthermore food security. As mineral-associated organic matter (MAOM) (Islam et al. 2022) has a higher residence time it predominantly forms the more stable OM fraction. Factors like plant type, plant functional traits, microbial community structure, and interaction of plant and soil structure affects decomposition processes to produce SOM. Amongst these, the type of cover crop material (lignin: N ratio) (Taylor et al. 1989) as soil carbon input is studied as an important regulator of MAOM accrual in soil. A wide spectrum of microorganisms participates in the decomposition of complex carbon inputs (OM) (Burton 2003). Microbial decomposition acts as a filter to process the OM input into soil C sink (MAOM formation). The overarching objective of this study is to evaluate the relationship between different types of cover crops (range of lignin: N ratio) and the formation of MAOM in a microcosm study by a mass balance approach. Five species of cover crops are selected according to their Lignin: N ratio (to cover a range of Lignin to Nitrogen) and relevance of regional cropping usage. The biomass of C13 labeled plant species would be incubated in microcosms (replicates in triple) and finally the MAOM formation would be studied by two-step density fractionation of MAOM. Pathway of carbon would be studied by tracking the C13 isotope, and C allocation in soil with the mass balance approach. By evaluating the relationship between C inputs and soil C accrual, this study will aid in the mechanistic understanding of the C cycling in soil as driven by microbial dynamics. Carbon Sequestration is imperative in the long-term global carbon cycle balance and in improving the stable soil carbon stocks for future agronomic production

Poulomi Dey [1 * ^], Virginia Polytechnic Institute And State University, Graduate Research Assistant

Brian Strahm [2], VT, Professor

Brian Badgley [3], VTSPES, Professor

Jacob Barney [4], VTSPES, Professor

Angela Possinger [5], Virginia Tech, Assistant Professor

Session Details:

Poster Session (Environmental Quality, Regenerative Agriculture) Displayed, Atlantic Foyer, 26 Sep, 2024 08:00 AM

Extension Agent Led On-farm Soybean Research in Virginia

Scott Reiter [1*^], Stephanie Romelczyk [2]

Submission Type:
Oral presentation

Sub-topics:
Extension outreach programming, Working with growers

Abstract Summary :
On-farm research and demonstration has been a cornerstone of Extension agent work since 1914. The Virginia on-farm soybean research program was officially established in 1997 to consolidate and publish on-farm research data from agents across Eastern Virginia. The trials are a series of replicated or strip plots established on individual soybean producer farms using their farm equipment and management systems. The plots in these trials are large scale (15-90 feet by 300-1000 feet). Over the years, treatments have included variety trials, fertilizer applications, fungicide programs, nematode management, seed treatments, and numerous other management strategies. The program has also included wide scale surveys such as a nematode sampling program and soybean nutrient-tissue testing. Results have shown that variety selection for specific locations is crucial to obtaining high soybean yields. Nematodes are a more widespread problem than many farmers realize therefore genetic resistance or seed treatments are needed for nematode management. Yield responses to fungicides and additional fertility applications are highly dependent on weather conditions that govern our yield potential. Results from the on-farm research program are distributed to Virginia farmers through local, regional, and statewide production meetings. An annual Extension publication is developed for printing as well as posted to the Virginia Cooperative Extension website.

Scott Reiter [1*^], Virginia Cooperative Extension, Extension Agent

Stephanie Romelczyk [2], Virginia Cooperative Extension, Extension Agent

Session Details:

Extension Agent Led On-farm Soybean Research in Virginia, Mariner Room, 23 Sep, 2024 01:00 PM

Greenhouse Gas Emissions from Agricultural Fields in Virginia

Patrick Bewick [1*^], John Hoben [2], Victorya Carvalho De Azevedo [3], Mike Wilson [4], Ryan Stewart [5], Bo Zhang [6]

Submission Type:

Poster presentation

Sub-topics:

Climate change, Gaseous losses of nutrients

Abstract Summary :

Agriculture is responsible for 10% of all greenhouse gas (GHG) emissions in the United States, and more than half can be attributed to soil management. The objective of this project was to identify relationships between microbial populations, GHG emissions, and agricultural inputs such as fertilizer and crop rotation history for the last three years. A total of 55 soil samples were collected from four major agricultural production areas in Virginia with five replicates per field. DNA was extracted from each sample, and the V4/V5 hypervariable regions of the 16S rRNA gene were sequenced to identify the composition of the microbial community and individual taxa abundance within each sample. Replicates of each soil sample were adjusted to 40%, 60% and 80% water-filled pore space and incubated in jars. GHG emissions were measured at 4 hours, 24 hours, and 48 hours. No significant difference was seen between WFPS treatments for N2O and CO2 emissions until 48 hours or for CH4 at any timepoint. Taxa abundance was correlated with GHG emissions and agricultural inputs. 236 genera had some level of correlation to GHG emissions at some WFPS at some timepoint. Of these taxa, 203 also correlated to at least one agricultural input. More taxa correlated to fields where soybean was grown in 2022 than any other crop in any other year. Of 66 taxa that correlated to 2022 soybean cultivation, 53 were negatively correlated to taxa that correlated to GHG emissions. Interestingly, only 28 taxa were correlated to fields where edamame was grown in 2022, and all these correlations were positive. Six genera commonly correlated to fields where edamame and grain soybean were grown in 2022 but were positively correlated to edamame and negatively correlated to grain soybean. This suggests that soybean genotype might affect the abundance of GHG producing soil microbes.

Patrick Bewick [1*^], Virginia Tech, Graduate Student

John Hoben [2], Virginia Polytechnic Institute and State University, Research Scientist

Victorya Carvalho De Azevedo [3], Federal University of Lavras, Undergraduate

Mike Wilson [4], Virginia Tech, Undergraduate

Ryan Stewart [5], Virginia Polytechnic Institute and State University, Associate Professor

Bo Zhang [6], VTSPES, Associate Professor

Session Details:

Poster Session (Environmental Quality, Regenerative Agriculture) Displayed, Atlantic Foyer, 26 Sep, 2024 08:00 AM

Commercial Wood Biochar Reduces Nutrient Leaching from Inorganic Fertilizers in a Sandy Loam Soil: Effects of Feedstock Types and Nutrient Forms

Huijie Gan [1 * ^]

Submission Type:
Oral presentation

Sub-topics:
Agricultural runoff, leaching, and other loss mechanisms

Abstract Summary :

Nutrient loss from croplands is a persistent problem in modern food production systems that contributes to greenhouse gas emissions and water pollution. Biochar is suggested as a possible solution to mitigate off-farm nutrient loss, due to its high surface area and porous structure for nutrient absorption. In the greenhouse study, we compared biochar types (hardwood vs softwood feedstock) and biochar particle size (fine vs. coarse) in influencing nutrient leaching from synthetic fertilizers. We analyzed the nutrient contents of leachate collected from the bottom of the pots by simulating 2.5 cm of rain events twice a week. Our results reveal that both types of commercial wood biochar reduce NH4+ and PO4- leaching due to direct adsorptions of NH4+ to cation exchange sites on biochar surface and biochar-induced increase in soil pH that reduces PO4- solubility. However, only the hardwood fine biochar showed a substantial reduction (-28%) in nitrate leaching and an increase in plant growth. In the field experiment, we found that mixing the hardwood biochar with leaf compost (4.5 Mg/ha biochar + 20 Mg/ha leaf compost) increased beet yield by 20% as compared to the leaf compost only treatment. However, simply mixing the biochar with leaf compost at the time of application had no impact on plant yield as compared to the biochar only or the compost only treatments.

Huijie Gan [1 * ^], Virginia Tech, Assistant Professor of Soil Health & Nutrient Management

Session Details:

Commercial Wood Biochar Reduces Nutrient Leaching from Inorganic Fertilizers in a Sandy Loam Soil: Effects of Feedstock Types and Nutrient Forms, Cape Henry C, 23 Sep, 2024 01:00 PM

Toward soil nutrient security for improved agronomic performance and increased resilience of taro production systems in Samoa

Diogenes Luis Antille [1 * ^]

Submission Type:
Poster presentation

Sub-topics:
Biodiversity and ecosystem services, Soil health and quality

Abstract Summary :
A progressive decline in soil fertility in taro (Colocasia esculenta L., Schott) production systems has contributed to reduced crop productivity and farm profitability and is recognized to be a threat to soil nutrient and food security in Samoa. Evidence based on three years of field experimentation showed that appropriate nutrient budgeting is required to reduce soil nutrient deficits and mitigate soil organic carbon loss. Balanced crop nutrition coupled with appropriate crop husbandry can significantly improve productivity and narrow yield gaps. A framework to guide nutrient recommendations for taro production systems is presented and discussed. This framework proposes that recommendations for N be derived from the yield-to-N response function (from which the most economic rate of N can be estimated) and that for other nutrients, namely P, K, Ca, and Mg, recommendations be based on replacement. The replacement strategy requires the development of soil nutrient indexes, which can be used to define the long-term nutrient management policy at the field scale. This long-term policy is informed by soil analyses, and it will determine whether existing soil nutrient levels are to be maintained or increased depending on the focus (productivity, profitability, environmental protection). If soil nutrients were already at an agronomically satisfactory level, their application may be omitted in some years to help reduce crop production costs, improve use efficiency, and ensure environmentally safe levels in soil are not exceeded.

Diogenes Luis Antille [1 * ^], CSIRO Agriculture and Food, Canberra, ACT 2601, Australia, Senior Research Scientist of Soil Physics with CSIRO Agriculture and Food and is based in Canberra, Australia

Session Details:

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Fabrication and calibration of an Extended Octagonal Ring (EOR) transducer for measuring tillage forces

Kayode Elegbeleye [1 * ^]

Submission Type:
Poster presentation

Sub-topics:
Conservation soil tillage

Abstract Summary :

For the purpose of determining the magnitude of the three-dimensional force components on a tillage tine, an indigenous Extended Octagonal Ring (EOR) transducer was fabricated and calibrated. The transducer shows some basic dimensional modifications so that it can be customized and different tines can be attached to it for the measurement of the three force components (horizontal, vertical and moment on the third axis) on experimental tillage tines. The transducer was calibrated by applying forces in the three orthogonal directions simultaneously and independently. The sensor exhibited good coefficient of determination and low cross sensitivities. Primary sensitivities during horizontal and vertical loadings were 280.83 and 81.18 µVV^(-1) N^(-1) . Secondary sensitivities in the two directions were 6.45 and 1.09 µVV^(-1) N^(-1). The percentage cross sensitivities were 2.30 and 1.34 when calibrating in horizontal and vertical directions.
Keywords: Extended octagonal ring (EOR), Transducer, Calibration, Cross sensitivity

Kayode Elegbeleye [1 * ^], Department Of Agric. & Bio-Environmental Engineering, The Federal Polytechnic, Ado Ekiti, Ekiti State, Nigeria, Head of Department

Session Details:

Poster Session (Tillage) Displayed, Atlantic Foyer, 23 Sep, 2024 08:00 AM

Short-term Carbon Mineralization: Review on Sampling, Storage, and Incubation

Caroline Wolcott [1 * ^], Huijie Gan [2], Ryan Stewart [3]

Submission Type:

Poster presentation

Sub-topics:

Soil health and quality

Abstract Summary :

The short-term carbon mineralization test is a key indicator of soil biological activity. This measure of activity links to soil nutrient cycling capacity and informs soil biodiversity. However, rates of carbon mineralization vary depending on environmental conditions such as soil temperature, soil water content, and plant growth. In this experiment we varied sampling, storage, and incubation techniques to see how resilient the carbon burst test was over time and sampling conditions. This study took place on Kentland Farms in Montgomery, VA. Soil samples were taken from conventional and rotational tilled plots as well as a forest control. The plots were sampled weekly over two months to a depth of 30 cm and subsampled every 2 cm. Soil temperature and weather conditions were recorded at sampling. Each subsample was processed and then began incubation at one of three-time schedules: immediately after air drying, two weeks of storage, or four weeks of storage. This was to see how carbon mineralization varied after dormancy. Finally, we varied incubation periods from 1 to 7 days. The results have not been compiled and this abstract will be updated when those are available.

Caroline Wolcott [1 * ^], Virginia Tech, Graduate Student

Huijie Gan [2], Virginia Tech, Assistant Professor of Soil Health & Nutrient Management

Ryan Stewart [3], Virginia Polytechnic Institute and State University, Associate Professor

Session Details:

Poster Session (Environmental Quality, Regenerative Agriculture) Displayed, Atlantic Foyer, 26 Sep, 2024 08:00 AM

Effects of the cone size of a cone penetrometer on the measured soil cone indices

Ernest Owusu-Sekyere [1 *], Zhiwei Zeng [2 ^], Kobby Acquah [3], Zach Yarechewski [4], Ying Chen [5]

Submission Type:
Oral presentation

Sub-topics:
Soil compaction

Abstract Summary :

Soil compaction has been considered to be one of the major factors that cause crop yield loss and soil degradation. Accurate measurement of soil cone index is critical to quantify the level of soil compaction. The objective of this study was to investigate effects of the cone size of a cone-penetrometer on the measured soil cone indices under different soil compaction levels. Field experiment was conducted for two years in Manitoba, Canada. The soil was sandy loam. The field was ploughed and harrowed to a depth of 120 mm and allowed soil to settle for a period of 4 weeks. Prior to the field measurements, a tractor was used to compact the field through passing the tractor on the same wheel tracks for 0, 1, 2, and 3 times, creating four different soil compaction levels in the field. Field measurements were performed within the areas of the tractor wheel tracks. A cone penetrologger, developed by Royal Eijkelkamp, was used to measure soil cone index under the different soil compaction levels. The device was equipped with a load cell, a probing rod, communication port, GPS antenna, LCD screen, control panel, depth reference plate and level. The cone penetrometer was also equipped with four different cone sizes with varying areas of cone base of 1, 2, 3.33 and 5 cm2. The four cones all had an angle of inclination of 60 degree. Results showed that soil cone index measured varied from 0.2 to 2.5 kPa. For the effect of soil compaction on the soil cone index, there was an increasing trend of soil cone index from the lowest compaction level to the third compaction level. However, the effect of soil compaction level on the measured soil cone index was not statistically significant. In contrast, the effect of penetrometer cone size on the measured soil cone index was highly significant. As the cone size increased, the soil cone index measured decreased. The smallest cone (with 1 cm2 area of the cone base) produced the highest soil cone index of 1.83 kPa. The soil cone indices resulting from the other cone sizes of 2, 3.33, and 5 cm2 decreased by 30.76%, 57.22% and 62.10% respectively. The interaction between soil compaction level and cone size did not yield a significant effect on the soil cone index. The results from this study can guide the development of the ASABE Standards for cone penetrometers.

Ernest Owusu-Sekyere [1 *], University of Manitoba, Ph.D Student

Zhiwei Zeng [2 ^], University of Wisconsin-River Falls, Assistant professor

Kobby Acquah [3], MacDon Industries, Engineer

Zach Yarechewski [4], University of Manitoba, Student Technician

Ying Chen [5] , University Of Manitoba, Canada, Professor

Session Details:

Effects of the cone size of a cone penetrometer on the measured soil cone indices, Cape Henry C, 26 Sep, 2024 01:00 PM

Near saturation water retention and structural stability of soils: effect of long–term land use and polyacrylamide rate

Amrakh I. Mamedov [1 * ^], Guy Levy [2], Darrell L. Norton [3]

Submission Type:

Oral presentation

Sub-topics:

Conservation agriculture

Abstract Summary :

Improving soil structure, a central feature of soil health, is associated with land use and soil type, and takes long-term period. The objective of this study was to evaluate the water retention or structural condition of soils exploited under different long-term land use (> 20 years) in competition with one-time anionic polyacrylamide (PAM) application. 50 soils samples from US Midwest were used: crop CT (conventional till), NT (no-till), grass, and forest. Three crop-CT soils varying in texture (loam, silty loam, clay loam) were treated with five concentrations (0=non treated, 25, 50, 100 and 200 mgL-1) of polyacrylamide (PAM). Effects of treatments were investigated using the high energy (0-50 hPa) moisture characteristic (HEMC). The water retention curves of the soils were characterized by the VG model parameters (and n), and SI-structure stability. Treatments formed different shapes of the water retention curves (α = 0.052–0.082 hPa-1, n = 7.7–19.5), that occurred at diverse ranges of macropore sizes (> 250, 125–250, 60–125 μm) associated with the large and small macroaggregate stability (SI = 0.005–0.036 hPa-1). Increase in soil organic carbon (SOC = 1–8 %) content (crop CT < crop NT < grass < forest), and PAM rate significantly improved α and SI, and decreased n, but the magnitude was soil texture dependent. The SI correlated with the SOC and SOC/Clay ratio. The crop-CT soil yielded the lowest SI, which were 1.2-4.0 folds less than SI of the other land uses. However, treating crop-CT soil with (i) low PAM rates (25–50 mgL-1) delivered SI (0.009–0.022 hPa-1) comparable with the SI of crop-NT or grass soils (0.009–0.016 hPa-1), and (ii) high PAM rates (100–200 mgL-1) improved SI (0.016–0.026 hPa-1), which were up to two times greater than SI of crop-NT or grass soil, and comparable with the SI of forest soils (0.018–0.036 hPa-1). Impact of long-term NT or grass (SOC ≥ 2 %) and low PAM rate (25 mgL-1) on SI of were comparable, and could be used as a threshold level to evaluate soil structure quality (SI ≥ 0.010–0.020 hPa-1). Exponential relations, existed between SI and α (R2 = 0.81) or n (R2= 0.64), could be used to evaluate the (i) impact of long-term land use and management on soil biophysical indices: SI, SOC, pore or aggregate - size distribution and resistance to slaking, and (ii) rational PAM rate, as a part of the novel conservation agriculture. Such relations can assist in designing the resilient soil structure and faster SOC accruing approach, and developing the site-specific or precision agriculture management practices.

Amrakh I. Mamedov [1 * ^], Tottori University, Professor

Guy Levy [2], Israel ARO Institute of Soil, Water and Environmental Sciences, Research Soil Scientist

Darrell L. Norton [3], Purdue University, Professor

Session Details:

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Effect of controlled traffic farming on crop yield over thirteen cropping seasons in Central Europe

Jana Galambosova [1*], Miroslav Macak [2], Diogenes Luis Antille [3^], Vladimir Rataj [4]

Submission Type:

Poster presentation

Sub-topics:

Controlled traffic farming

Abstract Summary :

Soil compaction caused by machinery wheels affects the crop production role of soil, e.g., soil water and nutrient availability, natural biological activity, and vulnerability to soil erosion. This then turns into loss on yield, need to manage the compaction with tillage practices which are costly and effect the soil health. A Field Scale Long term experiment at a 16 ha field (48°37´17´´ N, 18°20´75´´ E) was introduced in 2010 at loam soil (Haplic Luvisol) respecting the in-field variability of the field resulting from steep slope terrain conditions. The field was converted from random traffic with conventional tillage technologies to CTF together with soil conservation tillage. The CTF system was designed on the basis of a 6 m machinery module to be able to use existing farm machinery, resulting in 55% of the field being a no traffic area, 39% covered by a single pass (combine harvester), and 24% covered by permanent tramlines which are used for cropping as well. Four traffic treatments were monitored during 13 growing seasons, A – non compacted soil, B- one machine pass a year, C- multiple passes (permanent tramline), D – multiple passes – random traffic. Winter as well as spring crops were grown including Maize corn, Pea, Spring barley, Winter barley, Winter wheat and Oil seed rape. Yield as well as soil properties were determined. Standard normalisation procedures were used in order to compare the yield determined at selected areas across the seasons. The overall effect of field variability on yield was significant for all traffic treatments. Areas with no traffic performed significantly better compared to the other monitored locations across all blocks and at the same time block field variability) had significant effect on crop yield except winter wheat crop. The negative effect of traffic was observed to be higher in block with lower yield potential. The main achievement of this study is quantification of the differences in yield obtained at variable conditions showing that the traffic induced compaction enlarges the differences in yield among the blocks. Differences among blocks at non compacted soil reached 15% compared to 22% difference for the most trafficked locations.

Jana Galambosova [1*], Slovak university of Agriculture in Nitra, Slovakia, Associated Professor

Miroslav Macak [2], Slovak University of Agric,ulture in Nitra, Associate professor

Diogenes Luis Antille [3^], CSIRO Agriculture and Food, Canberra, ACT 2601, Australia, Senior Research Scientist of Soil Physics with CSIRO Agriculture and Food and is based in Canberra, Australia

Vladimir Rataj [4], Slovak University of Agric,ulture in Nitra, Emeritus professor

Session Details:

Poster Session (Tillage) Displayed, Atlantic Foyer, 23 Sep, 2024 08:00 AM

Pilot Exchange Program to Address Food Security Challenges in Ghana through Community Gardens

Mary Michael Lipford Zahed [1 * ^], Frank Ackah [2]

Submission Type:
Oral presentation

Sub-topics:
Country/region specific issues and reports

Abstract Summary :

Through a pilot exchange program, Virginia Tech and University of Cape Coast partnered with Garden For All (G4A) to establish inaugural community gardens in Ghana, West Africa. A great need in Ghana's urban settings is access to safe nutritious food. Due to the increase in food and fertilizer prices globally, the contamination of water sources in Ghana, the lack of fresh vegetables in the dry season, and the depreciation of the Ghanian cedi, food insecurity is increasing. The ability to garden can lead to direct access of nutrient dense foods, as well as an increase in income from sales of garden products. The idea of community gardening is novel within Ghana and largely misunderstood. Through this exchange, graduate and undergraduate students, as well as professors from both universities' College of Agriculture worked on a semester long project of planning and implementing a community garden in Kpone Katamanso, a suburb of the capital city of Accra with a low-income population. Prior to establishment, the team worked with a professional landscape architect on community garden design, developed pre-garden surveys for the members, created rules and regulations, obtained hundreds of donated seeds from Virginia Cooperative Extension and local Ghanaians, and established membership agreements. During establishment, the team built 17 raised beds within a wire mesh fence next to a water source, stocked tool shed, herb garden, nursery, training area, and compost area. Trainings were conducted in the local language and will be continued by G4A for one year. 15 of the 17 members were woman, representing large families within the community. A member leadership board was selected and monthly reports by G4A will be submitted, as well as a 6 month and 1 year post survey to tract impact on food security and vegetable intake within each home.

Mary Michael Lipford Zahed [1 * ^], Virginia Tech ESAREC, Graduate Research Assistant

Frank Ackah [2], University Of Cape Coast, Senior Lecturer

Session Details:

Pilot Exchange Program to Address Food Security Challenges in Ghana through Community Gardens, Cape Charles A , 24 Sep, 2024 08:00 AM

Effects of traffic and tillage management systems on soil organic carbon dynamics

Ana B. Prada Barrio [1 *] , Paula Misiewicz [2 ^], Edward Dickin [3] , David White [4] , Simon Jeffery [5] , Diogenes Luis Antille [6] , Richard Godwin [7]

Submission Type:

Poster presentation

Sub-topics:

Carbon sequestration and management

Abstract Summary :

Promoting sustainable management practices to store soil organic carbon (SOC) in cropland is an essential tool to increase soil health and resilience and help mitigate climate change by storing atmospheric carbon dioxide (CO2). Although numerous investigations have focused on the impacts of different tillage management practices on soil organic carbon (SOC) dynamics, the effects of vehicle traffic management have frequently been overlooked. Knowledge gaps still exist on the long-term effects of alternative traffic systems, and their interaction with different tillage systems, on SOC dynamics. A long-term 3 x 3 factorial experiment was established in the United Kingdom in 2011 to determine the effects and interactions of three traffic farming management systems: standard inflation pressure tyres (STP), low tyre inflation pressure (LTP) and controlled traffic farming (CTF) on soils managed with three tillage systems: deep (25 cm), shallow (10 cm) and zero tillage on (i) total soil organic carbon (SOC) stocks (0-30 cm), (ii) SOM fractions (total particulate organic matter-C [POM-C] and mineral-associated organic matter-C [MAOM-C] (0-30 cm) and crop yield over time. Soil carbon dynamics will be next investigated using natural abundance 13C stable isotope approaches to trace the flow of plant C into the SOM fractions, to provide insights into the mechanisms that determine the residence time of C in soils. This will help inform as to best practices for maximising C sequestration into soils thereby improving soil health and helping to mitigate climate change.

Ana B. Prada Barrio [1 *], Harper Adams university, PhD

Paula Misiewicz [2 ^], Harper Adams University, Senior lecturer in soil and water management

Edward Dickin [3] , Harper Adams University, Senior lecturer in agronomy

David White [4] , Harper Adams University, Senior lecturer in engineering

Simon Jeffery [5] , Harper Adams university, Reader

Diogenes Luis Antille [6] , CSIRO Agriculture and Food, Canberra, ACT 2601, Australia, Senior Research Scientist of Soil Physics with CSIRO Agriculture and Food and is based in Canberra, Australia

Richard Godwin [7] , Agri-Tech Research Centre, Harper Adams University, UK, Professor emeritus

Session Details:

Poster Session (Environmental Quality, Regenerative Agriculture) Displayed, Atlantic Foyer, 26 Sep, 2024 08:00 AM

Soil organic carbon, water availability and vegetable crops yields in rotation with in-situ grown cover crops on conventional and reduced tillage systems

Florencia Alliaume [1 * ^], Magdalena Rieppi [2], Walter A.H. Rossing [3], Pablo Tittonell [4], Santiago Dogliotti [5]

Submission Type:

Oral presentation

Sub-topics:

Cover crops and residue additions

Abstract Summary :

Soils in vegetable crop systems are usually subjected to frequent tillage and little or no organic matter inputs, resulting in soil degradation and poor water holding capacity, threatening soil productivity and system sustainability. This study evaluated the effect of reduced tillage, crop residue management and organic matter incorporation on SOC, water availability, and productivity of vegetables planted on raised beds and rotated with cover crops. A field trial was set up from 2010 to 2016 in a temperate climate on fine textured soil for testing four soil management practices: reduced tillage with a cover crop left as mulch and chicken manure incorporation (RT_GMchM), conventional tillage with a green manure and chicken manure incorporation (CT_GMchM), conventional tillage with chicken manure incorporation (CT_chM), and conventional tillage as control (CT). Soil organic carbon in the first 0.20 m was, on average, 13% larger after 6 years of green and animal manure incorporation, representing an accumulation of 5.0 Mg ha 1 of SOC. SOC under RT_GMchM and CT_GMchM did not differed significantly, being 41.6 Mg ha 1 on average, while under CT_Chm it was 39.6 Mg ha 1 ha and under CT it was 36.7 Mg ha 1. Soil moisture in the first 0.2 m under RT was between 4 and 14 mm more than under conventional tillage systems on most measured dates, especially during dry periods. This was explained by 50% reduction of runoff under RT_GMchM, measured on runoff parcels in the field, and a reduction of soil evaporation, estimated to be 38, 32, and 18 mm less under RT_GMchM compared with conventional tillage on average for tomato, sweet maize and onion, respectively. Increased infiltration and reduction of soil evaporation are of special interest in these systems as they may result in the saving of irrigation water, allowing for increasing the area of irrigated crops on a farm, thus building resilience to climate change. Sweet maize and onion yields did not differ between treatments. Tomato yields under CT_ChM were the largest, due to a better synchronization of N availability with crop needs under this treatment, and a poor vegetable crop establishment under the firsts years of treatments that included green manures. These results suggest that when green and animal manures are incorporated annually, together with reduced tillage, it is possible to increase SOC and water availability on these highly intensive soil use systems. In order to increase the adoption of this technology by farmers, further research should be done to facilitate the operational aspects to manage the mulch and crop and to improve the synchronization of N supply and crop demand. Future research should focus on organic systems, where the use of this technology presents a significant challenge.

Florencia Alliaume [1*^], Faculty of Agronomy, Universidad de la República del Uruguay, Professor

Magdalena Rieppi [2], Faculty of Agronomy, Universidad de la República del Uruguay, Researcher

Walter A.H. Rossing [3], Farming Systems Ecology, Wageningen University and Research, The Netherlands, Professor

Pablo Tittonell [4], IFAB-INTA-CONICET, Main Resarcher

Santiago Dogliotti [5], Faculty of Agronomy, Universidad de la República del Uruguay, Professor

Session Details:

Soil organic carbon, water availability and vegetable crops yields in rotation with in-situ grown cover crops on conventional and reduced tillage systems, Cape Henry C, 24 Sep, 2024 08:00 AM

Temporal dynamics of soil aggregating agents and aggregates properties induced by plant roots and crop residues in Argiudolls

Silvia Imhoff [1 * ^]

Submission Type: Poster presentation

Sub-topics: Cover crops and residue additions

Abstract Summary :

The resistance to structural degradation is largely controlled by the maintenance or increase of soil organic carbon content (SOC) in Argiudolls of Argentina. The SOC content increases according to the roots or crop residues contribution. Their influence on soil aggregation depends on the microbial activity and therefore on the production of binding agents. This study investigated the combined effect of plant roots, crop residue addition and location on the temporal dynamic production of aggregating agents and aggregates properties in an Argiudoll of Santa Fe, Argentina. An experiment was carried out in a greenhouse. Samples of a Typic Argiudoll were collected, ground, sieved (2mm) and used to fill pots. Six treatments with three replications were established: (i) plant roots (with or without); (ii) adding crop residues (with or without); (iii) crop residues location (left on the soil surface vs. incorporated). In treatments with plants, 2 wheat plants were grown for 180 days. Total organic carbon (TOC); particulate organic carbon (POC); hot water extractable carbohydrates (HWEC); glomalin-related soil protein (GRSP); aggregates stability (mean weigh diameter: MWD) and aggregates tensile strength (TS) were measured over time. In treatments without plants, the addition of residues on the soil surface increased TOC levels (0.054 g kg-1); in treatments with plants, TOC increased when residues were added to the soil regardless their location (0.154 g kg-1). POC increased over time, reaching a greater value with plants + residues (4.33 g kg-1 day-1) than without residues (3.33 g kg-1 day-1). The maximum concentration of HWEC was reached with plant + incorporated residues followed by plant + on surface residues (155 vs 136 mg kg-1). The maximum value of GRSP was reached in treatments with plants (2.89 mg g-1), followed by the treatments with residues incorporated and on soil surface residues (2.80 and 2.70 mg g-1). The MWD was positively affected by the presence of plants and residues with variation over time, reaching the greater value when residues were incorporated (1.56 mm). TS was positively affected by the combined effect of plant roots and residues regardless their location reaching a maximum value of 54 kPa. MWD was strongly correlated with POC (0.89), HWEC (0.90) and GRSP (0.93). TS had moderate correlation with POC (0.60) and GRSP (0.69). This study revealed that plant roots and/or the addition of crop residues had positive effects on the aggregating agents and therefore on the aggregate properties, and that these effects varied over time. Field experiments are now necessary to confirm our findings.

Silvia Imhoff [1 * ^], ICiAgro Litoral (CONICET-UNL-FCA), Director of ICiAgro Litoral, Associate Professor

Session Details:

Poster Session (Environmental Quality, Regenerative Agriculture) Displayed, Atlantic Foyer, 26 Sep, 2024 08:00 AM

Impact of a calcitic amendment on the compressibility of a Mollisol under direct seeding and controlled traffic

Silvia Imhoff [1 * ^]

Submission Type:

Poster presentation

Sub-topics:

Controlled traffic farming

Abstract Summary :

Silty loam Argiudolls of Argentina are susceptible to soil compaction. Direct seeding (DS) and controlled traffic farming (CT) prevents soil compaction, but the effects of applying calcitic amendments are unknown. We investigate the effects of applying calcium on the compressibility of an Argiudoll under DS and CT. A trial of CT was established 8 years ago. The treatments consisted of 3 levels of compactions with three replicates (n=9) induced at the beginning of the experiment on the permanent traffic line (PTL) with a harvester: T0, without passing with the harvester, T1: passing the harvester until soil reached 2MPa of penetration resistance, T2: passing the harvester until soil reached 4 MPa. The gravimetric water content at that moment was 23%. Three sampling positions were established within each plot: center of the PTL (CPTL), border of the PTL (BPTL) and between the PTL (permanent crop bed: PCB). After 7 years, an amendment of calcium sulfate (1400 kg ha 1) + calcium hydroxide (260 kg ha 1) was applied on the surface in half of the plots. Then, corn was sown. After 6 months and after harvesting the corn, undisturbed soil samples (3x7cm) were collected at 3 depths: 0 10 cm, 10 20 cm and 20 30 cm (n=162) and equilibrated at a matric potential of 10 kPa. Then, compression curves, precompression pressure (σp) and compression index (CI) were determined. The amendment modified the compression curves, especially in T2 in all sampling positions at the depth of 0 10 cm, increasing σp. The main effect was due to treatments and sampling position: in T0 from 0 to10 cm σp values were: PTL (92 kPa) = PCB (88 kPa) > BPCL (58 kPa), from 10 to 20 cm they were: PTL (179 kPa) = BPTL (167 kPa) > PCB (111 kPa), from 20 to 30 cm they were: PTL (236 kPa) = BPTL (204 kPa) > PCB (126 kPa); in T1 from 0 to10 cm σp value were: PTL (101 kPa) > BPCL (65 kPa) = PCB (50 kPa), from 10 to 20 cm and 20 to 30 cm there were no differences between σp values: PTL (169 kPa) = BPTL (174 kPa) > PCB (148 kPa); in T2 from 0 to10 cm σp values were: PTL (218 kPa) > BPCL (65 kPa) = PCB (45 kPa), from 10 to 20 cm and 20 to 30 cm there were no differences between σp values: PTL (217 kPa) = BPTL (194 kPa) > PCB (131 kPa). Neither treatments, sampling position nor amendment affected CI, which had an average value of 0.25. In the short period evaluated the amendment increased the soil support capacity, improving the machinery trafficability in the PTL.

Silvia Imhoff [1 * ^], ICiAgro Litoral (CONICET-UNL-FCA), Director of ICiAgro Litoral, Associate Professor

Session Details:

Poster Session (Tillage) Displayed, Atlantic Foyer, 23 Sep, 2024 08:00 AM

Knowledge, Attitude and Practices of Small Holder Farmers on Conservation Agriculture in Rwanda

Jean Damascene Tuyizere [1 * ^], Kallunde Pilly Sibuga [2], Hamisi Tindwa [3], Mark Reiter [4], Guillaume Nyagatare [5]

Submission Type:

Oral presentation

Sub-topics:

Conservation agriculture

Abstract Summary :

Introduction: In Rwanda, the size of land available for agricultural production continues to decrease dramatically reaching 0.2ha/household (NISR, 2014). This poses a major threat to the country's economy considering that Rwanda is a middle-income country where agriculture remains the main contributing sector to its GDP (Chantal et al., 2018). Land scarcity led to farmers adopting unsustainable farming practices such as continuous cropping with poor soil fertility management and over-application of inorganic fertilizers in order to sustain household food security (Cantore, 2010). This has resulted in an increased nutrients depletion rate in Rwanda reaching more than three times the continental average (Bekunda et al., 2010). Conservation agriculture (CA) is believed to have the potential to preserve soil nutrients and water (Dumanski et al., 2006). Because CA is a knowledge-intensive and complex system to learn and implement, adoption rates have been low among most farming communities especially in Africa where adoption rate is still less than 1% (Li et al., 2011). The practice and wider extension of CA thus require a deeper understanding by farmers and extension workers of its ecological underpinnings in order to manage its various elements (Reiter, 2009). Therefore, the potential of CA to restore soil fertility suggests that this farming method could be a viable solution to soil fertility decline in Rwanda. Methodology: A total of 300 farmers were selected randomly from eight villages of Bugesera and Musanze districts of Rwanda. An open-ended structured questionnaire was used to collect quantitative and qualitative data through face-to-face household interviews. The questionnaire was digitalized into Kobo collect software and pre-tested before use. Statistical analysis was performed using SPSS software (version 24.0). Descriptive statistics (frequencies, means, percentages, and cross-tabulation) were used to generate descriptions from the data collected. Contingency chi-square tests were computed at $P \leq 0.05$ levels of significance to compare the level of differences and similarity between the two sites. Results: Results of the study showed poor access to information on Good Agricultural Practices (GAPs) and Conservation Agriculture (CA) among smallholder farmers in the study area resulting into poor adoption of these practices. The use of organic and mineral fertilizers stands at 80% and roughly 60% respectively. However, farmers do not follow guidelines provided for the use of these fertilizers but rather determine application rates by estimation or by random. Such inappropriate use of fertilizers can be linked to increasing soil degradation in the country which also contributed to the declining crop yield (Cantore, 2010). There is a need to train farmers on practices that are conservational of soil nutrients and water such as GAPs and the CA practices.

Jean Damascene Tuyizere [1 * ^], Sokoine University of Agriculture , PhD student

Kallunde Pilly Sibuga [2], Sokoine University, Professor of Weed Science

Hamisi Tindwa [3], Sokoine University of Agriculture , Senior Lecturer and Director, Directorate of Undergraduate Studies

Mark Reiter [4], Virginia Tech, Professor of Soils and Nutrient Management

Guillaume Nyagatare [5], University of Rwanda, College of Agriculture Animal Sciences and and Veterinary Medicine , College Principal

Session Details:

Knowledge, Attitude and Practices of Small Holder Farmers on Conservation Agriculture in Rwanda, Cape Henry C, 26 Sep, 2024 09:00 AM

A Comparative Assessment of the Effect of Tillage Methods on Growth Parameters and Yield Performance of Maize in Two Contrasting Agroecological Zones of Rwanda: towards efficient and sustainable use of mineral fertilizers

Jean Damascene Tuyizere [1*^], Kallunde Pilly Sibuga [2], Hamisi Tindwa [3], Mark Reiter [4], Guillaume Nyagatare [5]

Submission Type: Oral presentation

Sub-topics: Conservation soil tillage

Abstract Summary :

Rwanda is known for its hilly landscape hence the popular name "land of thousand hills". This makes soil erosion a major problem facing agriculture sector across the country (ACIAR, 2013). Considering that in most cases soil erosion washes away the topsoil (10 20cm) which hosts majority of soil nutrients and microorganisms makes it a major contributor to soil fertility losses. Tillage method is an important consideration in soil fertility management. It affects overall soil health (aeration, infiltration, population and activity of microorganisms, nutrients - nutrients interaction and absorption). Unfortunately, this is mostly forgotten by policymakers. In Rwanda, the focus has been put on mobilizing farmers to use mineral fertilizers and indeed the adoption has been on increase since 2006. However, the higher input expenditures did not reflect an overall increase in agricultural output (Cantore, 2010). This study tested the effect of four tillage methods on maize yield. The study was conducted in two contrasting agroecological zones (AEZs) of Rwanda. The experiment was a 4x4x3 factorial trial arranged in RCBD. The experiment tested four tillage methods: Flat till (FT), Ridge till (RT), Minimum till (MT), and Permanent organic mulch (POM), in combination with four fertilizer levels. Maize was used as the test crop and data were collected on growth and yield parameters. Growth parameters were measured at 30; 60 and 90 days after sowing (DAS), and yield (kg/ha) determined at 12% moisture content. Data were subjected to Analysis of Variance (ANOVA) using R. Statistical software. Means exhibiting significant differences between treatments, between seasons and between treatments within each season were separated using Duncan's Multiple Comparison analysis ($P \leq 0.05$). Generally, POM outperformed other tillage methods (FT, RT, MT). Germination rate (GR) under POM ranged from 82 93% compared to 34 81% under other tillage methods. In the Eastern savannah, at 30DAS, treatments did not significantly affect LA and LAI. While at 60DAS, POM-based treatments outperformed treatments formed based on other tillage methods. In volcanic higher land, treatments significantly affected LA and LAI at 30, 60 and 90DAS. The highest LA and LAI were from two treatments both of POM origin (POM+FYM&POM+N+FYM). Although there was no significant difference among tillage methods except for POM, addition of FYM increased crop LA and LAI at all growth stages. In the Eastern savannah, the highest yield was 7.4t/ha from POM+N and the least 2.3t/ha from Co+RT. In Volcanic higher land, the highest yield was obtained from POM+N+FYM (9.3t/ha) and the least from MT+FYM (3.2t/ha). These results suggest that POM could provide a sustainable solution to soil fertility decline in Rwanda.

Jean Damascene Tuyizere [1 * ^], Sokoine University of Agriculture , PhD student

Kallunde Pilly Sibuga [2], Sokoine University, Professor of Weed Science

Hamisi Tindwa [3], Sokoine University of Agriculture , Senior Lecturer and Director, Directorate of Undergraduate Studies

Mark Reiter [4], Virginia Tech, Professor of Soils and Nutrient Management

Guillaume Nyagatare [5], University of Rwanda, College of Agriculture Animal Sciences and and Veterinary Medicine , College Principal

Session Details:

A Comparative Assessment of the Effect of Tillage Methods on Growth Parameters and Yield Performance of Maize in Two Contrasting Agroecological Zones of Rwanda: towards efficient and sustainable use of mineral fertilizers, Mariner Room, 26 Sep, 2024 03:00 PM

Cover crop biomass, benefits, and the importance of fall versus spring sampling

Nathan Sedghi [1 * ^], Ray Weil [2]

Submission Type:
Oral presentation

Sub-topics:
Cover crops and residue additions

Abstract Summary :

Winter cover crops are commonly grown for the benefits they produce. These benefits may include, but are not limited to: weed suppression, nutrient retention, water quality protection, soil health improvement, moisture retention, microbial community alterations, or just to receive a subsidy. However, many papers published do not include a measure of cover crop biomass, which is known to greatly affect the benefits of cover crops. Other papers that plant a mix may not differentiate the cover crops by species, despite diversity of a cover crop mix being known to affect how many benefits can be received. Other papers may sample cover crop biomass only in the spring, or fall, and then report effects of the cover crops. Some benefits of cover crops occur only at a particular time and are dependent upon the cover crop species diversity, as well as biomass at a particular point in time. This presentation will include some cover crop biomass and benefits data collected at University of Maryland, but it will also examine the literature to determine which cover crop benefits are best determined by fall versus spring cover crop biomass. This work aims to help guide future methodologies when working with cover crops in order to determine the best potential sampling timing.

Nathan Sedghi [1 * ^], Virginia Cooperative Extension, Associate Extension Agent

Ray Weil [2], University of Maryland, Professor

Session Details:

Cover crop biomass, benefits, and the importance of fall versus spring sampling, Cape Henry C, 24 Sep, 2024 08:00 AM

Unlocking a “Good Soil Discount”: Quantifying the Risk Reducing Benefits of Soil Health Practices

Aria McLauchlan [1 * ^], Harley Cross [2]

Submission Type: Oral presentation

Sub-topics: Soil health and quality

Abstract Summary :
Despite the well known agroecological benefits of soil-health practices, adoption continues to remain low, with persistent issues related to funding the transition and maintenance of more resilient agricultural systems being a major barrier. However, a significant opportunity exists for assessing the risk reduction associated with soil-health practice implementation and incorporating it into finance models. This could unlock unprecedented market-based funding mechanisms, and even lead to incentives like a “Good Soil Discount,” to increase practice adoption and help de-risk US agriculture. This presentation will discuss the Soil Health Risk Model project, convened and led by soil health non-profit, Land Core, and funded by FFAR and USDA-NIFA (AFRI). The project is developing an actuarially-sound, predictive model of the risk-mitigating benefits of soil health practices such as crop rotations, cover cropping, and reduced tillage on corn and soybean yields. There will be an opportunity to learn about the promising preliminary research findings, led by partners at UC Berkeley, Rice University, Michigan State University, and University of Arkansas, and also see a live demonstration of the beta-version of the online, interactive risk model tool. The session will include lessons learned from discussions with agricultural lender and insurer Compeer Financial, a farm credit system cooperative with $30 billion in assets, who has helped inform the development of the model. It will also discuss key takeaways from the tool for farmers, conservationists, lenders and policymakers, including the development of appropriate policies, pricing, and meaningful economic incentives for producers, to support the transition to better soil-health management systems.

Aria McLauchlan [1 * ^], Land Core, Executive Director

Harley Cross [2], Land Core, Director of Strategy

Session Details:

Unlocking a “Good Soil Discount”: Quantifying the Risk Reducing Benefits of Soil Health Practices, Cape Henry C, 26 Sep, 2024 10:00 AM

Seed Impact Mills: A Potential Tool to Preserve No- and Reduced-Tillage Systems from Herbicide Resistance

Eli Russell [1*^], Kevin Bamber [2], Michael Flessner [3]

Submission Type: Oral presentation

Sub-topics: Weed science

Abstract Summary :

Herbicides allowed for the broad adoption of no-till and reduced tillage systems. These reduced tillage systems have many benefits; however, with the development of herbicide resistance, some growers in the US are considering tillage to help control these problematic weeds. Additional integrated weed management tactics are needed so that growers do not have to revert to tillage. Harvest Weed Seed Control (HWSC) is a weed control strategy that targets weed seeds at harvest by concentrating, removing, or destroying them as they exit the combine. Seed impact mills, like the Redekop Seed Control Unit (SCU) and the integrated Harrington Seed Destructor (iHSD), are one way to implement HWSC. These mills originated in Australia but have potential in soybean and wheat production in the United States. Initial testing with stationary mills indicated that both the Redekop SCU and iHSD killed >97% of problematic soybean weed seeds tested and >91% of problematic wheat weeds tested. In the field >98% of soybean weed seeds were killed by the Redekop SCU and iHSD, while greater than >90% of wheat weed seeds were killed with the Redekop SCU. When weed seeds entered the combine, less than 5% of the seeds bypassed the mill by exiting the combine in the straw fraction. The data indicates that seed impact mills have the potential to be an additional tool to add to an integrated weed management system and potentially preserve no- and reduced tillage systems.

Eli Russell [1*^], Virginia Tech, Graduate Research Assistant

Kevin Bamber [2], VTSPES, Research Specialist Senior

Michael Flessner [3], VTSPES, Associate Professor

Session Details:

Seed Impact Mills: A Potential Tool to Preserve No- and Reduced-Tillage Systems from Herbicide Resistance, Cape Charles A , 26 Sep, 2024 01:00 PM

Effects of traffic and tillage management systems on crop establishment, growth and yield

Paula Misiewicz [1 * ^], Ana B. Prada Barrio [2], Magdalena Kaczorowska-Dolowy [3], Anthony Millington [4], Edward Dickin [5], David White [6], Diogenes Luis Antille [7], Richard Godwin [8]

Submission Type:

Oral presentation

Sub-topics:

Controlled traffic farming

Abstract Summary :

Soil compaction caused by the use of heavy agricultural equipment adversely affects soil conditions and the performance of crops. It has been estimated that more than 33% of European subsoils are highly susceptible to soil compaction. Soil compaction occurs when soils are subjected to loads and stresses, often from agricultural equipment, that exceed the soils' inherent strength. A long-term 3 x 3 factorial experiment was established at Harper Adams University, United Kingdom, in 2011 to determine the effects and interactions of three traffic farming management systems: standard inflation pressure tyres (STP), low tyre inflation pressure (LTP) and controlled traffic farming (CTF30% / CTF15% trafficked area) on soils managed with three tillage systems: deep (25 cm), shallow (10 cm) and zero tillage on (i) on crop establishment and growth and (ii) crop yield grown in a sandy loam soil in the UK. The results of this continuing long term study have shown that both traffic management and tillage systems have significant effects on the crop establishment, growth and yield. Irrespective of the traffic system, there was no statistically significant difference between the yields of the deep and shallow tillage systems. Initial lower yields of the zero tillage system improved with time, resulting in the same or higher yields as the tillage systems. The main effect of traffic was significant and consistent over the length of the project, with CTF30% producing a 4% higher yield than conventional traffic with standard tyre pressures. The effect of reducing the trafficked area to 15% (CTF15%) produced an estimated further increase in mean crop yield of 3.0%. For deep tilled soils, the use of LTP tyres is cost effective and resulted in an 3.9% increase in crop yield over the STP system.

Paula Misiewicz [1 * ^], Harper Adams University, Senior lecturer in soil and water management

Ana B. Prada Barrio [2], Harper Adams university, PhD

Magdalena Kaczorowska-Dolowy [3], Harper Adams University, Post doctoral research associate

Anthony Millington [4], Harper Adams University, PDRA

Edward Dickin [5], Harper Adams University, Senior lecturer in agronomy

David White [6], Harper Adams University, Senior lecturer in engineering

Diogenes Luis Antille [7], CSIRO Agriculture and Food, Canberra, ACT 2601, Australia, Senior Research Scientist of Soil Physics with CSIRO Agriculture and Food and is based in Canberra, Australia

Richard Godwin [8], Agri-Tech Research Centre, Harper Adams University, UK, Professor emeritus

Session Details:

Effects of traffic and tillage management systems on crop establishment, growth and yield, Cape Charles A , 23 Sep, 2024 01:00 PM

Design considerations of mobility and traffic management systems for improved efficiency and soil sustainability

Diogenes Antille [1 * ^]

Submission Type:

Oral presentation

Sub-topics:

Controlled traffic farming

Abstract Summary :

The cost of soil compaction worldwide both in terms of reduced productivity and environmental impacts is known to be significant, albeit largely unquantified. In the United Kingdom and Australia, the cost of compaction has been estimated at approximately US$1.5 and US$1 billion per year, respectively. The cost of tillage repair treatments is also significant (e.g., US$40-90 per ha), and alleviation of compaction is energy-intensive. Increased machinery size and weight has, to some extent, offset advances made by the industry in developing improved mobility systems such as increased deflection tire and rubber track designs, the use of central tire inflation systems to reduce contact pressures, and controlled traffic farming (CTF) systems. The availability of reliable global navigation satellite systems coupled with improved vehicle designs have contributed to the development of efficient field-traffic management approaches, namely, CTF systems. These systems aim to confine all load-bearing wheels to the least possible area of permanent traffic lanes so that the field-cropped area affected by compaction can be minimized. In well-designed CTF systems, the area of a field affected by compaction may be 12-15% of the field-cropped area (which compares to 40% or greater in no-tillage systems without adoption of CTF). Controlled traffic has fundamental advantages in maintaining all aspects of good soil structure with lower inputs of energy and time compared with conventional field traffic systems. However, the rate of uptake of CTF worldwide is relatively small; an exception being the case of Australia where these systems are used in about 40% of the grains industry. Despite this, CTF adoption is almost non-existent in more complex mechanization systems such as in cotton and sugarcane production. Increased tire deflection technology, and central tire inflation management systems provide benefits in terms of reduce tire-soil contact pressure. By acknowledging that no-single system design of mobility systems or traffic management fits all, this paper will provide a critical review and discussion of established and emerging technology and traffic management systems for mitigating soil compaction, improving the efficiency of field operations, and soil sustainability. Recent advances for design and verification of tire and rubber track designs, central tire inflation systems, controlled traffic farming systems for conventional and newer light-weight autonomous vehicle systems are discussed. The paper synthetizes the current state of knowledge relevant to mobility and traffic management systems and use a series of case-studies to introduce the concept of 'smart tire technology'. The overall framework of integrating soil management for design considerations of mobility systems are explored with reference to precision traffic management systems including tire inflation management, and the feasibility of adopting CTF.

Diogenes Antille [1] * ^, CSIRO Agriculture and Food, Senior Research Scientist (SoilPhysics)

Session Details:

Design considerations of mobility and traffic management systems for improved efficiency and soil sustainability, Cape Charles A , 23 Sep, 2024 04:00 PM

Designing and modeling novel manure land application toolbars through numerical simulations

Zhiwei Zeng [1 * ^], Ying Chen [2], Aj Loefer [3]

Submission Type:

Oral presentation

Sub-topics:

Tillage implements and other equipment

Abstract Summary :

In Wisconsin, America’s Dairyland, optimizing liquid manure application is crucial for sustainable and profitable farming. Traditional application methods pose environmental challenges, including nutrient runoff and odour emission. This study presents an innovative liquid manure toolbar design, underpinned by extensive use of numerical simulations, specifically Finite Element Analysis (FEA) and Discrete Element Method (DEM). These simulations played a pivotal role in every phase of the design process – from initial concept to final validation. They allowed for precise modelling of the structural integrity of toolbars and soil and fluid dynamics, facilitating the development of three distinct and effective designs: a sweep injector, a disk injector, and a vertical tillage incorporation toolbar. Numerical simulations were integral in predicting the performance under various design alternations and operational conditions, ensuring resilience against mechanical stresses, and optimizing the environmental footprint. This comprehensive simulation-led approach was instrumental in developing the toolbar that stands at the intersection of agricultural efficiency and environmental sustainability. By bridging advanced engineering techniques with practical agricultural needs, the project underscores the transformative potential of numerical simulations in modern tillage equipment development.

Zhiwei Zeng [1 * ^], University of Wisconsin-River Falls, Assistant professor

Ying Chen [2], University Of Manitoba, Professor

Aj Loefer [3], University of Wisconsin-River Falls, Student researcher

Session Details:

Designing and modeling novel manure land application toolbars through numerical simulations, Cape Henry C, 26 Sep, 2024 01:00 PM

Herbicide resistance expression in Italian ryegrass in response to edaphic factors

Aniruddha Maity [1]^, Andrew Ahlersmeyer [2]*, Andrew Price [3]

Submission Type:
Oral presentation

Sub-topics:
Weed science

Abstract Summary :
Soil persistence of herbicides greatly depends on soil biogeochemistry in addition to several other factors such as rainfall and soil moisture content. Repeated application of same herbicide chemistry, especially those have soil residual activity, in the same piece of land can create unique soil microclimate that imposes critical, continuous selection pressure on weeds. This may contribute to evolution and expression of resistance to that herbicide over time in otherwise sensitive weeds. The current study aimed to understand the severity of herbicide resistance expression in Italian ryegrass, a problematic weed in wheat and other winter crops, in response to variable soil edaphic factors. The study is currently being conducted in the greenhouse, and results will be presented at the meeting.

Aniruddha Maity [1]^, Auburn University, Assistant Professor

Andrew Ahlersmeyer [2]*, Auburn University, Ph.D. student

Andrew Price [3], USDA- National Soil Dynamics Lab, Plant Physiologist

Session Details:

Herbicide resistance expression in Italian ryegrass in response to edaphic factors, Cape Charles A , 26 Sep, 2024 01:00 PM

Welcome from the College of Agriculture and Life Sciences, Virginia Tech

Alan Grant [1 *], Thomas Thompson [2 ^], Mario Ferruzzi [3]

Submission Type:
Oral presentation

Sub-topics:
Weed science

Abstract Summary :
Virginia Tech is home to one of the nation's premier comprehensive agricultural and life sciences programs. Through its learning, discovery, and engagement missions, the College of Agriculture and Life Sciences creates, integrates, and shares knowledge to enhance life sciences, food, and agricultural systems; the economic prosperity and life quality of the greater community; the stewardship and health of land, water, and air for future generations; and student learning through diverse hands-on experiential opportunities. The college is at the center of the land grant tradition at Virginia Tech, and consequently conducts its research and educational programs at numerous sites on- and off-campus. The college is home to approximately 700 faculty (including 230 tenured or tenure-track faculty and 230 extension agents) and over 400 staff. It offers nearly 70 academic program options with associates, B.S., M.S., and Ph.D. degrees. These degree programs are offered through 9 academic units (seven departments and two schools) and the Agricultural Technology program. The college enrolls nearly 3,000 undergraduate students and 700 graduate students, and it has initiated and nurtured programs for recruitment and retention of under-represented students. The college is home to the Virginia Cooperative Extension and the Virginia Agricultural Experiment Station. The college provides research-based information to the people of the commonwealth through 11 agricultural research and extension centers, 107 county and city Cooperative Extension offices, and six 4-H educational centers, in addition to the academic units and research and education facilities in Blacksburg and Roanoke, VA. Faculty in the college are deeply engaged in basic and applied research with sponsored research funding of nearly $75 million in FY2023. The college has re-focused programs and is actively engaged in research-based solutions to complex problems that will transform agriculture and communities in Virginia and beyond. These interdisciplinary programs embrace and address agricultural profitability and efficiencies and environmental issues; food and health of humans, livestock, poultry, and plants; environmental quality; and renewable energy and bio-based products through translational research; and partnerships that will stimulate economic development in rural and urban areas. CALS Global (the college's international programs office) facilitates global partnerships. The research and extension programs on and off campus (including campus research laboratories, college farms, agricultural research and extension centers, and local extension offices), and our partnerships with numerous community organizations and industry firms around the world offer great opportunities to immerse students in solving complex, real-world problems, to provide them with the transferable skills needed for success in their professions, and to be productive members of society.

Alan Grant [1 *], Virginia Tech, Dean of the College of Agriculture and Life Sciences at Virginia Tech

Thomas Thompson [2] ^, Global Programs, College of Agriculture and Life Sciences, Virginia Tech, Associate Dean and Director of CALS Global

Mario Ferruzzi [3], ,

Session Details:

General Session, Atlantic Ballroom, 23 Sep, 2024 08:00 AM

Welcome To Virginia Beach and Virginia Agricultural Overview

Mark Reiter [1 * ^], Helene Doughty [2], Roy Flanagan [3], Ursula Deitch [4], Theresa Pittman [5], Joseph Haymaker [6]

Submission Type: Oral presentation

Sub-topics: Weed science

Abstract Summary :

The Commonwealth of Virginia boasts a diverse agricultural industry that serves as a major economic driver for our region. According to the Virginia Department of Agriculture (VDACS), the agricultural industry has an economic impact of over $82.3 billion annually, provides more than 381,800 jobs within the Commonwealth, and has a $43.8 billion value-added impact. Overall, Virginia has 41,500 farms in which 97% are family owned and operates on over 3.1 million hectares of land (7.7 million acres). Virginia's top agricultural commodities include (from highest to lowest value in yearly cash receipts): 1. Broiler chickens; 2. Cattle and calves; 3. Turkeys; 4. Milk and dairy products; 5. Soybeans; 6. Miscellaneous crops that includes vegetables like potato, tomato, snap bean, watermelon, broccoli, barley, and sorghum; 7. Maize; 8. Other animal products that includes oysters, clams, crab, sheep, lambs, and goats; 9. Floriculture; 10. Chicken eggs; 11. Hay; 12. Wheat; 13. Hogs; 14. Upland cotton; 15. Tobacco; 16. Apples; 17. Peanuts; 18. Cottonseed; 19. Pumpkins; and 20. Trout.

Mark Reiter [1 * ^], Virginia Tech, Professor of Soils and Nutrient Management

Helene Doughty [2], Virginia Cooperative Extension - Northampton County,

Roy Flanagan [3], Virginia Cooperative Extension, Virginia Beach,

Ursula Deitch [4], Virginia Department Of Agriculture And Consumer Services,

Theresa Pittman [5], Virginia Cooperative Extension - Accomack County,

Joseph Haymaker [6], Virginia Tech, Graduate Research Assistant

Session Details:

General Session, Atlantic Ballroom, 23 Sep, 2024 08:00 AM

Effect of long-term conservation agricultural practices on soil Physical health in Indo-Gangetic Planes of India

Pragati Pramanik Maity [1*^]

Submission Type:
Oral presentation

Sub-topics:
Conservation soil tillage

Abstract Summary :

Soil physical health indicators play an important role in crop production. Soil organic matter can enhance the soil's water storage capacity, promote soil water conservation and gas diffusion and increase crop yields and water use efficiency. Feld experiment was conducted in the experimental field of long-term conservation agricultural practices started in 2010 at Indian Agricultural Research Institute, New Delhi (28°35′ N latitude, 77°12′ E longitude and at an altitude of 228.6 meters above mean sea level) involving contrasting tillage (zero tillage, ZT; and conventional tillage, CT), residue (R), and crop establishment method (permanent broad bed, PBB; narrow broad bed, PNB). In 0-15 cm soil depth highest saturated hydraulic conductivity (HC) of 44.22 cm/day was obtained in PBB+R and lowest value 32.22 cm/day was observed in CT. In 0-15 cm the trend was as follows: - PBB+R>PNB+R>ZT+R>PBB>PNB>ZT>CT. In PBB+R hydraulic conductivity was 37.22% higher than the lowest value recorded in CT (32.22 cm/day) though PNB+R, and ZT+R was 34.91% and 29.11% higher. There is no significant difference between ZT and CT, but CT is significantly lower than all residue treated plot though there is no significance between ZT+R and PNB+R. Initial infiltration rate was highest (25.92 cm/hr) in PBB+R and was lowest (9.68 cm/hr) in CT. Initial infiltration rate and steady state infiltration rate of broad bed with residue was almost three times higher than the CT. Stady state infiltration in PBB+R was higher and the time taken to reach was 2.2 hrs. The lowest steady state infiltration of 1.52cm/hr observed in CT and time taken to reach was 1.52hrs. From the results showed it it can be attributed that all the residue applied plots (PBB+R> PNB+R>ZT+R) had significantly high($p< 0.01$) steady state infiltration rate than CT. Bed Cultivation (PBB=PNB) also reported significantly high infiltration rate than CT. Root morphological parameters followed similar trend across soil layers. At 0-15cm soil depth root length density (RLD) was 67.32% higher in PBB+R than CT (2.02 cm/cm3). Thus, PBB + R is a better environmental protection technology which can be recommended for improved soil hydraulic properties and root growth.

Pragati Pramanik Maity [1*^], ICAR-Indian Agricultural Research Institute, Pusa Campus, New Delhi, India, Senior Scientist

Session Details:

Effect of long-term conservation agricultural practices on soil Physical health in Indo-Gangetic Planes of India, Cape Charles A , 23 Sep, 2024 01:00 PM

Agriculture Exports and The Port of Virginia: Four Centuries of Success and Partnership

Greg Edwards [1] * ^

Submission Type:

Oral presentation

Sub-topics:

Conservation soil tillage

Abstract Summary :

Agriculture Exports and The Port of Virginia: Four Centuries of Success and Partnership

Greg Edwards [1] * ^, ,

Session Details:

General Session, Atlantic Ballroom, 23 Sep, 2024 08:00 AM

Use of Biodegradable Superabsorbent Polymers for Enhancing Agricultural Productivity in Marginal and Stress-prone Areas: Overview and Prospects

Saddam Hussain [1 * ^]

Submission Type:
Oral presentation

Sub-topics:
Water scarcity, Irrigation management

Abstract Summary :

Agriculture is considered as the backbone of Pakistan's economy and millions of people in the country directly rely on this sector for their food and livelihoods. Nevertheless, the rapidly increasing population, shrinkage of land and water resources, climate change, and stagnant agricultural growth are threatening the food security and livelihood of the rural population. In Pakistan, approximately 6 mha area is affected by soil salinity, while 5 mha area is covered by Cholistan and Thal. The crop yields in these areas are quite low, and a big yield gap exists between the potential yields and actual yields attained at the farm level. However, these areas may contribute a significant share towards national agricultural production and the economy of Pakistan, by adopting appropriate and cost-effective technologies that support soil water conservation, reduce direct evaporation losses, enhance stress tolerance, and improve soil water balance. Biodegradable and superabsorbent polymers (BSPs) can be used as an efficient, sustainable, and environment-friendly approach to ensure the profitable cultivation of crops in marginal and stress-prone areas. Application of BSPs may increase the water and nutrient holding capacity, reduce irrigation requirement, ensure uniform water consumption, facilitate rapid root growth, minimize nutrient losses, and enhance soil physical properties. Nevertheless, most of the superabsorbent polymers particularly from synthetic sources are too costly and are difficult to apply on a field-scale by resource-poor farmers. Moreover, synthetic polymers are not easily degraded in soil and may cause environmental pollution. It is, therefore, inevitable to focus on the production of BSPs with plants/microbes, and their hybrids which are environmentally and economically acceptable for the farming community. Dr. Saddam Hussain is the pioneer scientist working on the synthesis of novel plant-based BSPs from agricultural waste. He has successfully tested the efficacy of these polymers under different abiotic stresses including salinity and drought. Here, he will comprehensively discuss the potential use of BSPs for enhancing crop productivity and resource use efficiency in marginal and stress-prone areas. He will highlight the current state of knowledge, new progress made along with future research trends, and major challenges hindering the wide-scale application of BSPs in Pakistan.

Saddam Hussain [1 * ^], University of Agriculture, Faisalabad, Associate Professor

Session Details:

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Global Engagement Strategy for Virginia Tech's College of Agriculture and Life Sciences

Thomas Thompson [1*^]

Submission Type:
Oral presentation

Sub-topics:

Abstract Summary :
The College of Agriculture and Life Sciences (CALS) at Virginia Tech founded its global programs office (CALS Global) in 2017. In concert with Virginia Tech's motto "Ut Prosim", that I may serve, the mission of CALS Global is to build partnerships, create opportunities, and drive thought leadership to serve globally. We do this by creating meaningful international engagement opportunities so that faculty and students can serve globally, enrich communities at home and abroad, and develop partnerships to address the most-challenging issues faced by society. CALS Global also leads the Global Agricultural Productivity Initiative, or GAP Initiative. We drive thought leadership by publishing the annual Global Agricultural Productivity Report-GAP Report- (globalagriculturalproductivity.org), which reports and analyzes global trends in agricultural productivity growth. In addition to publishing the GAP Report, we work with partners around the world to educate, advocate, collaborate, and motivate action and investment to promote sustainable productivity growth in agriculture. CALS Global is implementing the largest grant in Virginia Tech's history, an $80 million award as part of the United States Department of Agriculture's Partnerships for Climate-Smart Commodities program. This project, called the "Alliance to Advance Climate-Smart Agriculture" will enroll more than 4,000 producers in four states across the US, including Virginia. CALS Global also works with international partners to enhance agricultural science communication and literacy.

Thomas Thompson [1*^], Global Programs, College of Agriculture and Life Sciences, Virginia Tech, Associate Dean and Director of CALS Global

Session Details:

General Session, Atlantic Ballroom, 23 Sep, 2024 08:00 AM

Welcome from Virginia Cooperative Extension

Mike Gutter [1 * ^]

Submission Type: Oral presentation

Sub-topics:

Abstract Summary :
Virginia Cooperative Extension (VCE) provides educational programs and services to improve the lives of all Virginians and support local and large-scale industries. Beyond our support of production agriculture, natural resources, and other food systems, VCE also provides programming to address public health issues and support families and communities. We have 107 units across the commonwealth, six 4-H Centers and share 11 Agricultural Research and Extension Centers. Dr. Gutter will share a brief overview of VCE and some of its major initiatives.

Mike Gutter [1 * ^], Virginia Cooperative Extension, Director

Session Details:

General Session, Atlantic Ballroom, 23 Sep, 2024 08:00 AM

Virginia Agricultural Experiment Station, Virginia Tech

Kang Xia [1 * ^], Mary Burrows [2]

Submission Type:
Oral presentation

Sub-topics:

Abstract Summary :
The Virginia Agricultural Experiment Station (VAES) was established in 1886 as the research entity for the College of Agriculture and Life Sciences at Virginia Tech. Today, VAES encompasses a team of over 350 scientists from the College of Agriculture and Life Sciences (CALS), the College of Natural Resources and Environment (CNRE), and the Virginia-Maryland College of Veterinary Medicine (VMCVM). These scientists conduct extensive research and outreach activities that span diverse areas including livestock management, ornamental horticulture, field crops, viticulture, seafood safety, bioeconomy, human nutrition and exercise, and environmental health. Together with the Virginia Cooperative Extension (VCE), VAES forms part of the Commonwealth of Virginia's Agency 229, which provides critical funding and support to these initiatives. As a Land-grant university in Virginia, VAES upholds the mission of conducting both basic and applied research to serve the state's agricultural industries. This includes advancing the conservation of natural resources, benefiting consumers and citizens, fostering economic development, and engaging in both national and international collaborations. VAES's research efforts are bolstered by state-of-the-art laboratories on campus, agricultural facilities, and a network of 11 strategically located Agricultural Research and Extension Centers (ARECs) throughout Virginia, reflecting the state's diverse agricultural landscape. To further drive innovation in agriculture, CALS established the Center for Advanced Innovation in Agriculture (CAIA) in 2021. CAIA aims to spearhead cutting-edge research and technological advancements, ensuring that Virginia remains at the forefront of agricultural innovation and sustainability.

Kang Xia [1 * ^], Virginia Agricultural Experiment Station, Virginia Tech, Associate Director

Mary Burrows [2], ,

Session Details:

General Session, Atlantic Ballroom, 23 Sep, 2024 08:00 AM

Keynote Speaker: Root, Soils, Environment, Ag Science, and Farms – How Can We Keep Them Alive?

Ole Wendroth [1 * ^]

Submission Type: Oral presentation

Sub-topics:

Abstract Summary :

Since ISTRO's foundation in 1976, the pioneering intentions that ISTRO Members had when they founded this international organization have been developed further over the years, because the challenges for soil management and the environment have become bigger. With them, the creativity of scientists has led to new technological developments in tillage and scientific tools, new approaches for measuring and analyzing observations around Soil and Tillage. In the 1970s and 1980s, zero-tillage was the big topic. Since the 1990's, soil and agricultural scientists have been facing an abundance of challenges, and they keep searching for strategies to meet them and to fulfil goals that were defined by well-meaning politicians such as the United Nations' Sustainability Development Goals (SDGs). What have we accomplished with conducting countless agronomic and tillage experiments and writing scientific journal articles? How do tillage systems support soil ecosystem services? How does soil tillage research help foster soil resilience? Despite all efforts, the UN released in a report that worldwide, 33% of soils are degraded. In Europe, the percentage of unhealthy soils reaches 60-70. For the U.S.A., the annual economic loss caused by soil degradation is estimated with $85 Billion. What are effective ways to counteract these alarming trends to degraded, unhealthy soils? What are the main inefficiencies preventing scientists from creating strategies for reaching the SDG, and against soil degradation? To what extent are farmers engaged in assessing soil damage and in developing rationale approaches for soil protection? Do farmers trust their government, their agricultural and environmental policy makers? Do farmers appreciate our scientific approaches to assessing soil quality, improving soil health, and supporting their decisions? Do the ways in which we currently design experiments lead to the answers that farmers expect from scientists and that they can use for their management decisions? Do scientists apply state-of-the-art technologies in experiments, i.e., the technologies that farmers use nowadays? Do we teach students the science that they need to understand concepts of soil health and soil resilience, and do we teach in ways that stimulate their creativity to develop soil management methods that foster soil health and food security? How has ISTRO's journal "Soil & Tillage Research" developed over the years? Does STR serve our members and do publications and underlying research focus on relevant issues and offer solutions for inherent problems? In this presentation, examples for current explorations towards healthy soils, and progress towards the UN SDGs are reviewed. Relevant methods and soil state variables that effectively diagnose soil quality will be discussed. Opportunities for experimental and statistical approaches to understanding and describing field scale processes will be introduced.

Ole Wendroth [1 * ^], University of Kentucky, Professor

Session Details:

General Session, Atlantic Ballroom, 23 Sep, 2024 08:00 AM

Revolutionizing Sustainable Agriculture: A Convolutional Neural Network Model and Algorithm-Driven Prototype for Sustainable Tilling and Fertilizer Optimization

Sajeev Magesh [1 * ^]

Submission Type:

Poster presentation

Sub-topics:

Conservation soil tillage

Abstract Summary :

Tilling is an agricultural practice that has been common across the world for centuries. However, about 2.35 billion tons of soil is eroded from US croplands each year solely due to overtilling. Over-tilling comes with a range of problems that impact the environment negatively such as soil erosion, soil infertility, carbon release, water and nutrient runoff, and increased fertilizer usage. This paper evaluates whether optimizing tillage intensity, timing, and the quantity of fertilizer dispensed concurrently through a fully automated, AI-driven approach will address over tilling thus reducing soil erosion, runoff, and carbon release, compared to conventional methods. A convolutional neural network based machine learning model utilizes a camera captured field image to determine existing tilling intensity on a 7-point scale. A sensor module measures field slope and soil parameters - moisture, nutrient levels, temperature. External forecast data is gathered on rain, temperature, wind speed, and crop type. A multi-parameter intelligent axial algorithm uses these inputs to determine optimal tilling and fertilizer levels. A fully functional tractor prototype administers the determined fertilizer quantity and deploys a tilling system for the target level determined. In addition to algorithm validation, a 30-year simulation was run using the Agricultural Production Systems sIMulator, comparing conventionally-tilled and algorithm-tilled farms. The simulation showed a reduction of carbon emission by 57% per farm, fertilizer usage by 43%, and runoff by 86%. These figures align with benchmarks established in existing studies, underscoring the transformative potential of conservation tillage. Additionally, a stationary prototype was successfully replicated and deployed in 155 farms across Belgium, the Netherlands, France, USA, and India.

Sajeev Magesh [1 * ^], Dublin High School, Student

Session Details:

Poster Session (Tillage) Displayed, Atlantic Foyer, 23 Sep, 2024 08:00 AM

Use of slug shingle refuge traps in no-till fields to establish treatment threshold and slug hatch prediction models in full-season soybeans in Virginia

Helene Doughty [1 * ^], Michael Crossley [2], Clark Robert [3]

Submission Type:
Oral presentation

Sub-topics:
Applied demonstration data

Abstract Summary :

Slugs have become a considerable economic pest of field corn and soybeans in Virginia following increased adoption of no-till practices and cover crops. The debris remaining in the field, following the previous season harvest of corn or soybean, is an ideal refuge for slugs' colonization in late winter, early spring. Cover crops can intensify slugs' presence by providing additional refuge and food for hatching young slugs. In 2024, shingle refuge traps were placed in 21 fields in 6 counties in Virginia for weekly slug counts with subsequent assessments on the soybean crop. Sampling of slug specimens was also conducted for evaluation of entomopathogenic nematodes' presence. Data collection conducted in Virginia is part of a multi-state study funded by the United Soybean Board that includes a total of 100 fields monitored by 25 extension agents and specialists across the United States. This study aims to establish treatment thresholds and slug hatch prediction models for integrated pest management of slugs in soybeans.

Helene Doughty [1 * ^], Virginia Cooperative Extension - Northampton County,

Michael Crossley [2], University Of Delaware,

Clark Robert [3], Virginia Cooperative Extension,

Session Details:

Use of slug shingle refuge traps in no-till fields to establish treatment threshold and slug hatch prediction models in full-season soybeans in Virginia, Mariner Room, 23 Sep, 2024 01:00 PM

Quantifying the effects of repeated wheeling on soil water conditions and maize growth during a growing season in a Mollisol

Xinjun Huang [1 * ^], Hengfei Wang [2], Tusheng Ren [3], Rainer Horn [4]

Submission Type:

Poster presentation

Sub-topics:

Soil compaction

Abstract Summary :

Soil compaction primarily derives from field wheeling processes due to compression and shear stresses). Previous laboratory studies have revealed the different effect of these two stresses on soil structure and pore functions with special focus on pore water pressure, but their consequences on soil properties at field scale during a crop growing season needs to be further quantified. In this study the temporal changes of soil water conditions and maize growth under repeated wheeling (with loading of 10.4 Mg) on a Mollisols at field capacity were revealed. The results showed that field soil deformed gradually with the increase of wheeling frequency. The vertical settlement after wheeling with 1, 3, 5, 21 passes (C1, C3, C5, and C21) were 6.4 cm, 8.0 cm, 9.5 cm, and 13.7 cm, receptively. Wheeling process increased volumetric water content and increased the soil matric potential , and this effect lasted for the whole growing period of maize. Due to the soil homogenization created by highly repeated wheeling, the wet range of the field soil water retention curve became steeper with wheeling frequency especially in the surface 0-10 cm layer, and this trend remained stable throughout the observed period. Besides, highly repeated wheeling passes in C5 and C21 obviously increased the occurrence of new cracks due to proportional shrinkage during redrying of the wheeled soil as well as long-last waterlogging events in dry and wet period, respectively. Compared with maize height, stem cross area, leaf biomass per plant, and 100-grain weight, the wheeling had more obvious effects on the reduction of above-ground biomass per plant and yield. After 1, 3, 5, and 21 passes, the above ground biomass per plant of maize decreased by 14.5%, 36.9%, 37.0%, and 56.4% with yield losses of 9.7%, 30.7%, 38.4%, and 59.7%, respectively. To mitigate the harmful effect of wheeling on soil and maize production, the field traffic and frequency should be strictly controlled, and if necessary, 3 wheeling passes could be regarded as a threshold of field traffic operations in the studied region as the utmost.

Xinjun Huang [1 * ^], Leibnitz University of Hannover, Postdoc

Hengfei Wang [2], China Agricultural University, research assistant

Tusheng Ren [3], China Agricultural University, Professor of Soil Science

Rainer Horn [4], Universität Christian Albrecht, Professor

Session Details:

Poster Session (Tillage) Displayed, Atlantic Foyer, 23 Sep, 2024 08:00 AM

Comparison of Field Performance of Four-wheel Tractor Attached with Rotary Tillers Under Lowland Rice Farming

Arthur Libang Fajardo [1 * ^]

Submission Type: Oral presentation

Sub-topics: Tillage implements and other equipment

Abstract Summary :

The evaluation of the field performance of a four-wheel tractor offers to determine the appropriate tractor-rotary tiller sizes combination. It also aims to maximize the efficiency of the land preparation operation, thus, profitability of rice farming. Two (2) sizes of tractor (29.84, 37.3kW) were attached with different operating widths of rotary tiller (1.93 m, 1.75 m, 1.64 m) were operated at different field shapes (square, rectangular). The performance (field capacity, fuel consumption, puddling index) of the tractor-rotary tiller-field shape combinations were compared and analyzed. Results showed that the 37.3kW tractor with 1.64m rotary tiller width operated at a rectangular field consumed the lowest amount of fuel among all combinations at 7.66 L/h. The 37.3kW-1.93m rotary tiller width-rectangular combination has the highest field capacity at 0.70 ha/h. All tractor-rotary tiller-field shape combinations have no significant difference in the puddling index. The tractor-rotary tiller combinations operated at a rectangular field shape have higher field capacity and lesser fuel consumption than the one operated at a square field shape. Operations using a 37.3kW tractor attached with a 1.93 m rotary tiller at a rectangular field configuration is recommended for lowland rice farming.

Arthur Libang Fajardo [1 * ^], UNIVERSITY OF THE PHILIPPINES, Professor

Session Details:

Comparison of Field Performance of Four-wheel Tractor Attached with Rotary Tillers Under Lowland Rice Farming, Cape Charles A , 23 Sep, 2024 01:00 PM

POTENTIALS OF ARTIFICIAL INTELLIGENCE APPLICATIONS TO SOIL TILLAGE

Akindele Folarin ALONGE [1*^], JOHN AUDU [2]

Submission Type:
Oral presentation

Sub-topics:
Conservation soil tillage

Abstract Summary :
The goal of soil tillage is to create a seedbed that is loose, level, and free of weeds, rocks, and other debris that can interfere with plant growth. This paper presents the need to identify artificial intelligence applications to soil tillage. Artificial Intelligence in soil tillage typically involves the use of machine learning algorithms and other techniques to process and analyze data related to soil health, crop growth, weather patterns, and other factors that impact soil tillage. A review of soil tillage and methods is made. The challenges to effective soil tillage is discussed. Artificial intelligence applications in soil tillage were identified and the impediments to use Artificial intelligence were highlighted.

Akindele Folarin ALONGE [1*^], University of Uyo, Uyo , Akwa Ibom State, Professor and Dean of Engineering

JOHN AUDU [2], university of Agriculture, Makurdi, NIGERIA, senior lecturer

Session Details:

Potentials of Artificial Intelligence Applications to Soil Tillage, Mariner Room, 26 Sep, 2024 03:00 PM

Pyrolysis Degradation Behavior of Oil Palm Woody Biomass and Industrial Wood Chip using Thermogravimetric Analysis

Abubakar Lawal [1 * ^], Mohd Ali Hassan [2], Yoshihito Shirai [3]

Submission Type: Oral presentation

Sub-topics: Carbon sequestration and management

Abstract Summary :

Knowledge of pyrolysis thermal behavior of biomass is a crucial first step towards proper design of thermal conversion systems. In this study, the physicochemical properties and pyrolysis kinetic parameters of oil palm frond, oil palm trunk and industrial woodchips were investigated. The physicochemical properties were determined using proximate analysis, CHNS analyzer and FTIR spectrophotometer, while pyrolysis experiment was carried out using thermogravimetric analyzer (TGA) under inert atmospheric condition at different heating rates. All the biomass materials contained high volatile matter at high organic surface functional groups. Three different models were used to simulate the TGA data and the simulation results showed good prediction capability. The activation energy, frequency exponential factor and reaction order were calculated from the models. The thermal stability of the biomass followed the order of industrial wood chip > oil palm trunk > oil palm frond indicating that oil palm frond is the least thermally stable biomass. The outcome of this study could be useful for a proper design of combustion system and production of carbonaceous products from the biomass materials.

Abubakar Lawal [1 * ^], University of Maiduguri, Senior Lecturer

Mohd Ali Hassan [2], Universiti Putra Malaysia, Professor

Yoshihito Shirai [3], Kyushu Institute of Technology, Professor

Session Details:

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Cover Crop Decision Support Tools: Free, Open-source Resources for U.S. Agriculture Professionals

Elizabeth Seyler [1*], Kayla Driver [2^]

Submission Type: Poster presentation

Sub-topics: Technology

Abstract Summary :

This presentation is on the work of many researchers and technology developers. Why use decision support tools? They bridge the gap between research and the field, accelerating the adoption of new practices to help farmers respond to increasing economic and environmental pressures. The Precision Sustainable Agriculture network has created free, open-source cover crop decision support tools that connect farmers with site-specific knowledge to enable science-based decision-making. Based on more than 350 site-years of on-farm research and expert data validation by the four regional cover crop councils, these tools provide guidance on cover crop species selection, nitrogen release and residue breakdown, seeding rate and mixture options, and economics across the U.S. We explore how these tools work, the science behind them, and their real-world applications. Special emphasis will be on the Cover Crop Nitrogen Calculator, which estimates nitrogen release from cover crop residues and cash crop nitrogen uptake over time.

Elizabeth Seyler [1*], Precision Sustainable Agriculture, Outreach and Communications

Kayla Driver [2^], Precision Sustainable Agriculture | Southern Cover Crops Council, Research Communications

Session Details:

Poster Session (SOIL AND WATER MANAGEMENT, SOIL FERTILITY, PRECISION AG, ON-FARM RESEARCH, CROP PROTECTION) Displayed, Atlantic Foyer, 24 Sep, 2024 08:00 AM

Cover Crop Decision Support Tools: Free, Open-source Resources for U.S. Agriculture Professionals

Elizabeth Seyler [1 *], Kayla Driver [2 ^]

Submission Type: Oral presentation

Sub-topics: Technology

Abstract Summary :

This presentation is on the work of many researchers and technology developers. Why use decision support tools? They bridge the gap between research and the field, accelerating the adoption of new practices to help farmers respond to increasing economic and environmental pressures. The Precision Sustainable Agriculture network has created free, open-source cover crop decision support tools that connect farmers with site-specific knowledge to enable science-based decision-making. Based on more than 350 site-years of on-farm research and expert data validation by the four regional cover crop councils, these tools provide guidance on cover crop species selection, nitrogen release and residue breakdown, seeding rate and mixture options, and economics across the U.S. We explore how these tools work, the science behind them, and their real-world applications. Special emphasis will be on the Cover Crop Nitrogen Calculator, which estimates nitrogen release from cover crop residues and cash crop nitrogen uptake over time.

Elizabeth Seyler [1 *], Precision Sustainable Agriculture, Outreach and Communications

Kayla Driver [2 ^], Precision Sustainable Agriculture | Southern Cover Crops Council, Research Communications

Session Details:

Cover Crop Decision Support Tools: Free, Open-source Resources for U.S. Agriculture Professionals, Mariner Room, 24 Sep, 2024 11:00 AM

Proactive Nutrient Monitoring of Soybean Leaf Potassium Concentrations

Carrie Ortel [1*^], Trenton Roberts [2], Jeremy Ross [3], Kyle Hoegenauer [4]

Submission Type:
Oral presentation

Sub-topics:
Working with growers

Abstract Summary :
Spatial variability of leaf potassium (K) concentrations in soybean (Glycine max (L.) Merr.) must be considered when collecting tissue for nutrient diagnosis. In collaboration with county extension agents and growers, five commercial soybean fields were sampled at a 0.4-ha grid resolution throughout reproductive growth to quantify the trifoliolate tissue-K concentration. The objectives of this study were to identify the potential field variability in soybean leaf tissue-K concentrations in Mid-south irrigated soybean production systems and develop a sampling protocol for in-season tissue monitoring. Across all fields and sample times, no spatial dependencies were indicating that leaf samples should be collected according to the producer's preferred management strategy instead of a specific grid size. One composite sample consisting of at least 18 of the upper-most fully expanded trifoliolate leaves from throughout the delineated management zone are needed to consistently measure within the 95% confidence interval of the area's average leaf tissue-K concentration. This sampling protocol coupled with the newly developed dynamic critical tissue-K concentration curve will provide producers with the ability to effectively monitor soybean for potential hidden hunger and verify K deficiency symptoms in season.

Carrie Ortel [1*^], Virginia Tech Tidewater AREC, Assistant Professor

Trenton Roberts [2], University of Arkansas, Professor

Jeremy Ross [3], University of Arkansas, Professor

Kyle Hoegenauer [4], University of Arkansas, Graduate Assistant

Session Details:

Proactive Nutrient Monitoring of Soybean Leaf Potassium Concentrations, Mariner Room, 23 Sep, 2024 03:00 PM

Impacts of different tillage and cover crop managements on soil physical quality and organic matter stocks

Ekrem Ozlu [1 * ^]

Submission Type:
Oral presentation

Sub-topics:
Tillage implements and other equipment, Conservation soil tillage, Soil compaction

Abstract Summary :
The soils of the North Carolina Coastal Plain pose significant challenges to sustainable farming due to low organic matter and poor soil structure. This study examines how different tillage and cover crop practices can improve soil physical properties and carbon fraction and stocks in the North Carolina. By comparing the long-term impacts of various tillage practices with and without cover cropping implemented, this research aims to provide insights from optimizing field managements. Intact and undisturbed soil samples were collected from each field with four replications. Analyses included measurements of soil particle distribution, bulk density, POM and MOAM carbon fractions. The study's findings seek to inform farmers about the soil quality indicators and offer comparisons between management systems. Preliminary results indicate that surface and subsurface soil compaction dynamics are driven by various factors while soil type, soil organic matter level and soil structure are main soil factors play critical role.

Ekrem Ozlu [1 * ^], North Carolina State University, Assistant Professor and Extension Soil Management Specialist

Session Details:

Impacts of different tillage and cover crop managements on soil physical quality and organic matter stocks, Cape Charles A , 23 Sep, 2024 04:00 PM

Lessons Learnt from Long-term No-till farming Experiments on Carbon Sequestration, Soil health, Climate Change Mitigation and Future Perspectives

Somasundaram Jayaraman [1 * ^], Anandkumar Naorem [2], Ram C Dalal [3], Nishant K Sinha [4], Ch Srinivasa Rao [5], Rattan Lal [6], S Kundu [7], JVNS Prasad [8], Madhu Madegowda [9], Anil Kumar Singh [10]

Submission Type:

Oral presentation

Sub-topics:

Conservation soil tillage

Abstract Summary :

Natural resources such as soil, water and vegetation are under tremendous pressure due to rapid population increase, urbanization, soil degradation and inappropriate management practices. Soil is a fundamental material for farming to achieve food and nutritional security, delivering ecosystem functions and services and attaining Sustainable Developmental Goals (SDGs). Globally declining soil quality owing to soil degradation is of great concern, which directly influences crop production and sustainability. The loss of fertile topsoil from the arable land through sediment losses with runoff is a major concern under conventional farming practices. Worldwide, ~33% soil resource has been adversely degraded by diverse processes. To protect soil resource from further degradation, there is a strong need of sustainable soil management (SSM) practices for enhancing soil organic carbon (SOC), soil health, and crop production in a sustainable manner. ‘No-till farming (NT) /conservation agriculture (CA)’ has been widely practised worldwide on about 210 million ha. The long-term NT experiments play a significant role in improving soil health, SOC sequestration, and in-depth understanding of greenhouse gas (GHG) emission, climate change mitigation and optimizing resource use efficiency, to cater for the needs of the present- and future- generations. According to FAO, NT/CA is a farming system that promotes minimum soil disturbance (i.e., no tillage), maintenance of a permanent soil cover, and diversification of plant species. This system enhances soil biodiversity and natural biological processes in above- and below- ground surface, which helps in enhanced water- and nutrient use -efficiency and sustained crop production. It is evident from the literature that change from traditional/conventional tillage (CT) with residue burning/removal to NT/CA farming has been identified as an important soil management practices for sustaining soil health, reducing soil erosion and reversing soil degradation. The soil quality index (SQI) was significantly highest in NT, followed by RT compared to CT system. CA based practices favoured carbon storage, lowered carbon emission, foot print and soil quality compared to conventional farming. Therefore, long-term adoption of CA practices improved several soil quality indicators, allowing a positive trend for soil preservation. Therefore, location-specific CA technology/machinery generation–dissemination–adoption of CA practices has to be looked into for broader perspective and it has to go in close partnership with farmers.

Somasundaram Jayaraman [1 * ^], ICAR-Indian Institute Of Soil Science, Anandkumar Naorem [2], ICAR–Central Arid Zone Research Institute, Jodhpur, Rajasthan, India, Scientist

Ram C Dalal [3], School of Agriculture and Food Sustainability, The University of Queensland, Professor

Nishant K Sinha [4], ICAR-Indian Institute of Soil Science, Senior Scientist

Ch Srinivasa Rao [5], eICAR–National Academy of Agricultural Research Management, Hyderabad, India, Director

Rattan Lal [6], CFAES Rattan Lal Center for Carbon Management and Sequestration, Director

S Kundu [7], ICAR-Central Research Institute for Dryland Agriculture (CRIDA), Scientist

JVNS Prasad [8], ICAR-Central Research Institute for Dryland Agriculture (CRIDA), , Project Coordinator

Madhu Madegowda [9], ICAR-Indian Institute of Soil & Water Conservation (IISWC), Director

Anil Kumar Singh [10], NASC Complex, Indian Council of Agricultural Research, New Delhi, India, Former Vice-Chancellor

Session Details:

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The impact of biofumigation on non-targeted soil arthropods and subsequent host-mediated interactions with aboveground insects

Usha Panta [1 * ^], Arash Rashed [2]

Submission Type: Oral presentation

Sub-topics: Entomology

Abstract Summary :

Cultural control, a component of integrated pest management, can provide crops with a competitive edge against pests and reduce the need for frequent insecticide applications. However, because cultural practices are assumed to be safer than synthetic pesticides, there has been relatively less focus on their potential negative impacts on non-targeted organisms. One example is soil biofumigation, i.e., the soil incorporation of brassica cover crops or their byproducts, can suppress subterranean pests. However, this practice can negatively impact organisms that are important contributors to soil health and beneficial to our agroecosystem. The present greenhouse study is developed to determine the effect of soil-incorporated brown mustard seed meal on the springtail Folsomia candida (Collembola: Isotomidae), as a non-target organism. Initially, the soil incorporation of brown mustard seed meal significantly reduced springtail populations, however, springtail populations rebounded within 3 weeks of soil incorporation and proceeded to exceed those in non-treated controls. We further examined the potential plant-mediated impacts of soil biofumigation on the bird cherry-oat aphid Rhopalosiphum padi L. (Hem., Aphididae). In our preference bioassays, aphids initially avoided the plants grown in biofumigated soil and visited control plants more frequently; this preference disappeared after 24 hours. Aphids reproduced less on plants grown in biofumigated soil than those grown in untreated soil. The result of this project will help to inform the development of management practices that can simultaneously control soil-borne pests and minimize harmful impacts on soil health and ecosystem function.

Usha Panta [1 * ^], ,

Arash Rashed [2], ,

Session Details:

The impact of biofumigation on non-targeted soil arthropods and subsequent host-mediated interactions with aboveground insects, Cape Charles A , 26 Sep, 2024 03:00 PM

Bed Architecture for Drip-Applied Soil Fumigation in Tomato Production

Emmanuel Torres [1*^], Josue Alarcon Mendoza [2], Lorena Lopez [3]

Submission Type:
Oral presentation

Sub-topics:
Irrigation management

Abstract Summary :
Tomato growers were significantly impacted by the ban on methyl bromide (MBr) in 2005. Currently, many farmers rely on shank (knife injection) applications of 1,3-dichloropropene and chloropicrin (Telone® or Pic-Clor 60®) as alternatives to MBr. However, these products require specialized equipment for proper application, and the effectiveness of various alternatives can be inconsistent in controlling nematodes, diseases, and weeds. This project aims to evaluate the impact of different bed architectures and soil surfactants on the distribution and efficacy of drip-applied fumigants in tomato production. The experiment was conducted at the Horticultural Crops Research Station in Clinton, North Carolina State University. We tested two bed configurations: a standard bed configuration of 24x12 inches and a compact configuration of 16x12 inches. For each configuration, we applied soil fumigants either by shank or drip application, with and without integrated soil surfactants. Measurements were taken on plant performance at 4, 8, and 12 weeks post-transplanting, including volumetric water content, Normalized Difference Vegetation Index (NDVI), and nematode and weed pressure before and after treatment application. All fumigation treatments resulted in a reduction of weed and nematode pressure compared to the control. This research is critical for improving soil fumigation practices in tomato production, helping farmers optimize pest control and maximize crop yields while minimizing environmental impact.

Emmanuel Torres [1*^], NSCU, Assistant professor

Josue Alarcon Mendoza [2], NCSU, Graduate student

Lorena Lopez [3], NSCU, Assistant professor

Session Details:

Bed Architecture for Drip-Applied Soil Fumigation in Tomato Production, Mariner Room, 26 Sep, 2024 04:00 PM

Application of Electromagnetic Conductivity Technology in Soil Management for Tropical Crops

Emmanuel Torres [1] , Arturo Bisono [2*^]

Submission Type:

Oral presentation

Sub-topics:

Irrigation management

Abstract Summary :

The use of Electromagnetic Conductivity (EM) has revolutionized precision agriculture by enabling the creation of highly accurate digital maps that reflect the variability of soil properties. This technology offers sub-meter accuracy in measurements and allows the evaluation of deep soil profiles up to 150 centimeters, which are crucial for root development. Research has confirmed the relationship between EM and soil characteristics such as texture, organic matter, cation exchange capacity, salinity, and moisture, making it a powerful tool for soil management in agriculture. In this conference, studies conducted on tropical crops, such as mango and avocado, will be presented. These studies applied this technology to identify areas with specific soil characteristics that directly impact crop yield. The results demonstrate how the combination of EM technology, field observations, and statistical analysis can improve agronomic decision-making, optimize soil management, increase productivity, and promote sustainability in these agricultural systems.

Emmanuel Torres [1] , NSCU, Assistant professor

Arturo Bisono [2*^], Universidad Tecnologica de Santiago, Director

Session Details:

Application of Electromagnetic Conductivity Technology in Soil Management for Tropical Crops, Cape Henry C, 26 Sep, 2024 03:00 PM

Scalable Solutions for Global Agriculture: Integrating Artificial Intelligence and Natural Language Processing in Biosystems Engineering

Fernando Fuentes-Peñailillo [1 * ^]

Submission Type:
Oral presentation

Sub-topics:
Irrigation management

Abstract Summary :
In the face of increasing global challenges such as climate change and food security, there is a pressing need for scalable technological solutions in agriculture. This presentation explores the transformative role of artificial intelligence (AI) and natural language processing (NLP) within Biosystems Engineering to enhance agricultural productivity and resilience on a global scale. We present a novel approach developed through international collaboration, focusing on integrating advanced AI algorithms and NLP models that convert complex agrometeorological data into intuitive, actionable insights for farmers worldwide. The "SIAC" platform, launched in 2024, demonstrates the potential of these technologies to directly connect users with critical agricultural data, bypassing traditional barriers such as digital literacy. This initiative, supported by a network of interdisciplinary research centers and global partners, exemplifies the importance of international cooperation in developing and deploying cutting-edge solutions in agriculture. By leveraging AI and Biosystems Engineering, we aim to create a new paradigm for smart farming, enhancing decision-making, improving crop management, and ensuring sustainable practices. This presentation will delve into the technological innovations, the collaborative framework behind their development, and the pathways for scaling these solutions across diverse agricultural contexts worldwide.

Fernando Fuentes-Peñailillo [1 * ^], Universidad de Talca, Professor

Session Details:

Scalable Solutions for Global Agriculture: Integrating Artificial Intelligence and Natural Language Processing in Biosystems Engineering, Cape Henry C, 26 Sep, 2024 03:00 PM

Asian Jumping Worms and Soil Health: Microbial, Microarthropod, and Plant Impacts in Turf and Agriculture

Jordan Thompson [1*^], Tom Kuhar [2], Alejandro Del-Pozo [3], Ashley Jernigan [4]

Submission Type:

Oral presentation

Sub-topics:

Irrigation management

Abstract Summary :

Asian jumping worms (AJW, Amynthas spp.) are invasive earthworms that rapidly reproduce and alter soil ecosystems, raising concerns in both turfgrass and agricultural systems. This study investigates the potential impact of AJW on soil and turf health across four residential sites, each featuring infested home vegetable gardens adjacent to turf lawns. By analyzing soil microbial activity, microarthropod abundance, and soil chemical and physical properties along transects from infested gardens into turf, we aim to assess the gradient of AJW influence. Our hypotheses predict that AJW-infested soils will show increased microbial enzyme activity due to accelerated nutrient cycling, reduced microarthropod populations, and decreased soil aggregation. Drawing on previous research, we explore how no-till farming practices, integral to regenerative agriculture, and prominent in our home garden sites, might inadvertently promote AJW populations by minimizing soil disturbance. In fact, anecdotal evidence from current research shows thriving AJW populations in no-till backyard vegetable gardens, which may lead to negative effects on plant physiological processes and soil biodiversity. This research highlights the need for sustainable land management strategies that balance soil health goals with the control of invasive species like AJW.

Jordan Thompson [1*^], Virginia Tech, Master's Student

Tom Kuhar [2], Virginia Tech, Professor

Alejandro Del-Pozo [3], Virginia Tech, Assistant Professor

Ashley Jernigan [4], Virginia Tech, Assistant Professor

Session Details:

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Conserving the Future: Wildlife Refuges and the Next Generation

Nicole Walker [1 * ^]

Submission Type:
Oral presentation

Sub-topics:
Climate change

Abstract Summary :

This is a publication that describes the refuge system/mission and what/how we contribute to conservation efforts nationally.

Nicole Walker [1 * ^], Eastern Shore Of Virginia NWR,

Session Details:

Conserving the Future: Wildlife Refuges and the Next Generation, Cape Charles A , 26 Sep, 2024 03:00 PM

The Nature Conservancy's Activities within the Virginia Coast Reserve

Susan Bates [1*^]

Submission Type: Oral presentation

Sub-topics: Climate change

Abstract Summary :
The Virginia Coast Reserve (VCR) is the longest stretch of coastal wilderness on the East Coast of the US and encompasses a 70-mile stretch of barrier islands and coastal bays. The Nature Conservancy's Volgenau Virginia Coast Reserve programs aim to preserve and protect this wilderness while building community and habitat resilience to the changing climate conditions. These programs include: Marine Habitat Restoration, Migratory and Shorebird Conservation, Coastal Resilience, Education, and Community Outreach. In this talk, you will hear about oyster and eelgrass restoration which provide protection to seaside communities and habitat for wildlife, studies to understand migratory bird movement near offshore wind farms, community resilience planning, and how education and outreach are woven into these activities.

Susan Bates [1*^], The Nature Conservancy,

Session Details:

The Nature Conservancy's Activities within the Virginia Coast Reserve, Cape Henry C, 23 Sep, 2024 03:00 PM

The Economics of nutrient cycling at Brandon Farms

Robert Waring [1 * ^], Joseph Haymaker [2], Mark Reiter [3]

Submission Type: Oral presentation

Sub-topics: Applied demonstration data

Abstract Summary :
Cover Crop diversity and nutrient cycling have become an integral part of a soil health system at Brandon Farms. High biomass cover crops are driving economic decisions, with an emphasis on reduced synthetic nitrogen and potassium. Living roots, no-till and cover crop diversity are becoming the basis for economic and climate tolerance at Brandon Farms, as we learn to mitigate the uncertainties of a changing agricultural climate.

Robert Waring [1 * ^], Brandon Farms,

Joseph Haymaker [2], Virginia Tech, Graduate Research Assistant

Mark Reiter [3], Virginia Tech, Professor of Soils and Nutrient Management

Session Details:

The Economics of nutrient cycling at Brandon Farms, Cape Henry C, 26 Sep, 2024 11:00 AM

Soil & Water Conservation Districts: What They Can Do for Farms Large or Small

Palmer Smith [1*^], Carmie Ross [2]

Submission Type:
Oral presentation

Sub-topics:
Water quality

Abstract Summary :

Across the United States, nearly 3000 conservation districts are helping local people to conserve land, water, forests, wildlife and related natural resources. Known in various parts of the country as “soil and water conservation districts,” “resource conservation districts,” “natural resource districts,” “land conservation committees” or similar names, they share a single mission: to coordinate assistance from all available sources — public and private, local, state and federal — in an effort to develop locally driven solutions to natural resource concerns. Soil and Water Conservation Districts are a political sub-division of the state that are a helpful resource for farmers and farms of all sizes. From livestock fencing to cover crop and no till practices, the districts can offer incentives and agricultural advice. The Eastern Shore Soil and Water Conservation District (SWCD) is dedicated to promoting natural resource conservation on the Eastern Shore of Virginia. Formed in 1945, it serves Accomack and Northampton Counties, focusing on education, cooperative programs, and supporting diverse community needs. Their main roles include administering Virginia’s incentive program for agricultural Best Management Practices and providing environmental education. They offer various programs to both students and adults to raise awareness and encourage conservation efforts.

Palmer Smith [1*^], Eastern Shore Soil And Water Conservation District,

Carmie Ross [2], Eastern Shore Soil And Water Conservation District,

Session Details:

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Conserving Soil for the Future: USDA-Natural Resources Conservation Services, Accomac Field Office

Jenny Templeton [1]*^, Ben Young [2]

Submission Type:

Oral presentation

Sub-topics:

Water quality

Abstract Summary :

The USDA-Natural Resources Conservation Service (NRCS) in Virginia works closely with landowners and agricultural producers to conserve and protect the state’s natural resources. They offer a variety of programs and technical assistance aimed at improving soil health, water quality, and overall sustainability of agricultural operations. The Virginia State Office is located in Richmond, and they have 41 field offices across the state.

Jenny Templeton [1]*^, USDA-Natural Resources Conservation Services,

Ben Young [2], USDA-Natural Resources Conservation Services,

Session Details:

Conserving Soil for the Future: USDA-Natural Resources Conservation Services, Accomac Field Office, Cape Charles A , 24 Sep, 2024 09:00 AM

Virginia Department of Agriculture and Consumer Services

Ursula Deitch [1*^]

Submission Type:

Oral presentation

Sub-topics:

Working with growers

Abstract Summary :

The Virginia Department of Agriculture and Consumer Services (VDACS) is an agency dedicated to promoting the economic growth and development of Virginia's agricultural sector. It also provides consumer protection and encourages environmental stewardship. VDACS offers a wide range of services, including: Food Safety and Consumer Protection: Ensuring the safety and proper labeling of foods, administering laws related to charitable gaming, credit services, and more. Agricultural Development: Supporting new and beginning farmers, providing market news, and promoting Virginia agriculture through various programs. Environmental Protection: Managing pesticide services, plant industry services, and weights and measures to maintain the integrity of transactions3.

Ursula Deitch [1*^], Virginia Department Of Agriculture And Consumer Services,

Session Details:

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Field Tour 1: Eastern Shore of Virginia

Roy Flanagan [1 * ^], Ursula Deitch [2], Helene Doughty [3], Theresa Pittman [4], Mark Reiter [5]

Submission Type:
Oral presentation

Sub-topics:
Working with growers

Abstract Summary :
Eastern Shore of Virginia field tour. Your guide today is Ms. Ursula Deitch, Marketing Specialist with the Virginia Department of Agriculture and Consumer Services.

Roy Flanagan [1 * ^], Virginia Cooperative Extension, Virginia Beach,

Ursula Deitch [2], Virginia Department Of Agriculture And Consumer Services,

Helene Doughty [3], Virginia Cooperative Extension - Northampton County,

Theresa Pittman [4], Virginia Cooperative Extension - Accomack County,

Mark Reiter [5], Virginia Tech, Professor of Soils and Nutrient Management

Session Details:

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Field Tour 2: Southeast Virginia

Roy Flanagan [1*^], Nathan Sedghi [2], Helene Doughty [3], Mark Reiter [4]

Submission Type:
Oral presentation

Sub-topics:
Working with growers

Abstract Summary :
Field Tour 2: Southeast Virginia. Your guide today is Mr. Roy Flanagan, Senior Agricultural and Natural Resources Extension Agent with Virginia Cooperative Extension in Chesapeake, VA.

Roy Flanagan [1*^], Virginia Cooperative Extension, Virginia Beach,

Nathan Sedghi [2], Virginia Cooperative Extension, Associate Extension Agent

Helene Doughty [3], Virginia Cooperative Extension - Northampton County,

Mark Reiter [4], Virginia Tech, Professor of Soils and Nutrient Management

Session Details:

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Unmanned Aerial Systems bring innovation to agriculture sector

Vijay Singh [1 * ^], Akashdeep Brar [2], Fatemeh Esmaeilbeiki [3], Rutvij Wamanse [4], Milos Viric [5], Robert Cooley [6], John Mason [7], Mark Reiter [8], Daniel Martin [9]

Submission Type:
Oral presentation

Sub-topics:
Technology, Artificial intelligence, Unmanned aerial vehicles

Abstract Summary :
Unmanned Aerial System (UAS)-based ag technologies have the potential to revolutionize agriculture sector. UAS-based pesticide and fertilizer applications, and cover crop seeding are beneficial even to small landholders as it is expected to be effective across scales. As this novel spray technology continues to advance, we expect significant improvements in battery life, payload capacity, and application precision. Current research on UAS-based pesticide applications has shown promising results on efficacy, and ease of operations. However, environmental safety, and drift issues are the major concerns. Continuous advancements in UAS/drone products necessitates the testing of these new tools, and evaluate their operational efficiency. These technologies can be utilized for generating large scale pest databases necessary for ground-based real-time pest detection and management operations.

Vijay Singh [1 * ^], Virginia Polytechnic Institute and State University (Virginia Tech), Assistant Professor and Extension Specialist

Akashdeep Brar [2], Virginia Polytechnic Institute and State University (Virginia Tech), PhD Student

Fatemeh Esmaeilbeiki [3], Virginia Polytechnic Institute and State University (Virginia Tech), PhD Student

Rutvij Wamanse [4], Virginia Polytechnic Institute and State University (Virginia Tech), MS Student

Milos Viric [5], Virginia Polytechnic Institute and State University (Virginia Tech), MS Student

Robert Cooley [6], Virginia Polytechnic Institute and State University (Virginia Tech), Research Specialist

John Mason [7], Virginia Polytechnic Institute And State University, Eastern Shore AREC, Research Specialist Sr.

Mark Reiter [8], Virginia Tech, Professor of Soils and Nutrient Management

Daniel Martin [9], United States Department of Agriculture, Research Engineer

Session Details:

Unmanned Aerial Systems bring innovation to agriculture sector, Mariner Room, 24 Sep, 2024 10:00 AM

The Spirit of Norfolk Dinner Cruise

Mark Reiter [1*^], Helene Doughty [2]

Submission Type:

Oral presentation

Sub-topics:

Climate change

Abstract Summary :

The Spirit of Norfolk dinner cruise will include a buffet meal along with a scenic tour of the City of Norfolk. Sites will include: 1. ELIZABETH RIVER: Named by Jamestown colonists in the early 1600s for Princess Elizabeth Stuart, daughter of King James of England, the river is believed to have been first explored by Captain John Smith. Some of America's earliest shipbuilding and repair facilities began here over 350 years ago. 2. NAUTICUS/BATTLESHIP WISCONSIN: This 120,000 foot nature, history and science center was designed to explore the many powers of the sea through hands-on exhibits, movies and ship simulations. The USS Battleship Wisconsin, an iconic WWII ship of the United States Navy was named in honor of the U.S. state of Wisconsin for it's profound war efforts. 3. PORTSMOUTH NAVAL HOSPITAL: The nation's oldest continuously operating hospital: it was constructed in 1827 on the site of an abandoned British defense post called Fort Nelson. Recent expansions have made it the largest military medical facility in the world. 4. NOAA: This facility is the east coast headquarters for the National Oceanic and Atmospheric Administration. NOAA gathers data on oceans, atmosphere, space, and the sun, and produces navigational charts for oceans, rivers, bays and sounds. 5. FORT NORFOLK: Built under orders of George Washington in 1794, this colorful fort stood ready to defend Norfolk in the War of 1812 but was never needed because the British turned back before they reached the city. During the Civil War it was used to house Confederate prisoners of war — you can still read their graffiti on the walls inside the compound. 6. APM TERMINALS: The largest privately owned terminal in North America, APM is currently leased by the Virginia Port Authority. 7. COAST GUARD BASE: Base Portsmouth is home port for 6 out of the 13 Coast Guard' s 270-foot medium endurance cutters. These ships are used for la w enforcement, search and rescue, homeland security and environmental protection duties from Maine, all the way down the coast and even to the Caribbean. 8. NORFOLK SOUTHERN COAL TERMINAL: Home of the world's largest Coal Pier, this terminal's annual throughput capacity is 48 million tons. 9. CRANEY ISLAND LANDFILL: All the mud, known as "spoils," is removed from the Hampton Roads harbor and deposited here. This is a 2,500-acre man made peninsula divided into three cells: one cell is always being pumped into while the other two are drying out. 10. HAMPTON ROADS HARBOR: Featuring the largest port complex in the United States, this majestic harbor was originally called "Earl of Southampton's Roadstead" by the British in the early 1600s. "Roadstead" meant large anchorage, but over the years the name was shortened to just "Hampton Roads." MONITOR/MERRIMAC BATTLE SITE: It was here in March of 1862 that the first two ironclad warships met in the famous Battle of Hampton Roads during the Civil War. While the battle itself was inconclusive, it changed ship designs forever around the world as wooden fleets were converted to the superior ironclad vessels. 12. NORFOLK NAVAL

BASE/ATLANTIC FLEET: Established in 1917, it is the world’s largest naval base and home port for the Atlantic Fleet with over 100 ships including aircraft carriers and nuclear submarines.

Mark Reiter [1*^], Virginia Tech, Professor of Soils and Nutrient Management

Helene Doughty [2], Virginia Cooperative Extension - Northampton County,

Session Details:

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Comparative Analysis of Unmanned Aerial Systems for Weed Control in Broccoli (Brassica oleracea var. italica)

Fatemeh Esmaeilbeiki [1*^], Akashdeep Brar [2], Rutvij Wamanse [3], Milos Viric [4], Vijay Singh [5]

Submission Type:

Poster presentation

Sub-topics:

Technology, Unmanned aerial vehicles

Abstract Summary :

Unmanned Aerial Systems (UAS) have shown promise in enhancing the precision and efficacy of herbicide applications. This study had two primary objectives: (1) to compare herbicide application volumes of 4 GPA and 10 GPA using UAS in comparison with a CO2-pressurized backpack sprayer at 140 L ha^{-1} (BP-15), and (2) to evaluate the performance of two UAS, Precision Vision V35X (PV35X; LeadingEdge Aerial Technologies, FL, USA) and Agras T50 (DJI, China). For the PV 35X, TT11001 nozzles were used, while 250 µm droplet size was selected for the DJI T50. The TT11001 produces a range from fine/medium to coarse droplets with an estimated volume median diameter (VMD) of 250 µm. The experiment was conducted in a completely randomized block design with three replications, using oxyfluorfen (Goal®) as preemergence herbicide and Clethodim (Select Max®) as the postemergence herbicide. Analysis of variance (ANOVA) and Tukey's HSD (α=0.05) were used for statistical analysis. Results indicated no significant difference in the VMD between the 4 GPA and 10 GPA application volumes, and both volumes produced the expected droplet sizes. However, for the DJI T50, results were contrary to expectations, as increasing the spray volume resulted in larger droplets. For PV 35X, application volume had no significant effect on droplet size for either drone, with the difference in average VMD between 4 GPA and 10 GPA being less than 13%. Both drones provided 97% weed control (grass and broadleaved weeds) for preemergence stage, and 99% grass control at postemergence stage.

Fatemeh Esmaeilbeiki [1*^], Virginia Polytechnic Institute and State University (Virginia Tech), PhD Student

Akashdeep Brar [2], Virginia Polytechnic Institute and State University (Virginia Tech), PhD Student

Rutvij Wamanse [3], Virginia Polytechnic Institute and State University (Virginia Tech), MS Student

Milos Viric [4], Virginia Polytechnic Institute and State University (Virginia Tech), MS Student

Vijay Singh [5], Virginia Polytechnic Institute and State University (Virginia Tech), Assistant Professor and Extension Specialist

Session Details:

Poster Session (SOIL AND WATER MANAGEMENT, SOIL FERTILITY, PRECISION AG, ON-FARM RESEARCH, CROP PROTECTION) Displayed, Atlantic Foyer, 24 Sep, 2024 08:00 AM

Influence of different Cover Crops and their Termination Timings on Weed Suppression in Edamame (Glycine max) cultivars

Akashdeep Brar [1 * ^], Michael Flessner [2], Bo Zhang [3], Mark Reiter [4], Vijay Singh [5]

Submission Type:
Poster presentation

Sub-topics:
Weed science

Abstract Summary :

TBD

Akashdeep Brar [1 * ^], Virginia Polytechnic Institute and State University (Virginia Tech), PhD Student

Michael Flessner [2], VTSPES, Associate Professor

Bo Zhang [3], VTSPES, Associate Professor

Mark Reiter [4], Virginia Tech, Professor of Soils and Nutrient Management

Vijay Singh [5], VTSPES, assisstant professor

Session Details:

Poster Session (SOIL AND WATER MANAGEMENT, SOIL FERTILITY, PRECISION AG, ON-FARM RESEARCH, CROP PROTECTION) Displayed, Atlantic Foyer, 24 Sep, 2024 08:00 AM

Confirmation of Multiple Herbicide Resistance in Italian ryegrass in Virginia

Milos Viric [1 * ^], Akashdeep Brar [2], Vipin Kumar [3], Michael Flessner [4], Vijay Singh [5]

Submission Type:
Poster presentation

Sub-topics:
Weed science

Abstract Summary :
Italian ryegrass is considered as one of the most problematic weeds in the wheat production system in Virginia. We conducted field surveys in the summer of 2020 and 2022 in order to get an insight into the distribution of this troublesome weed infesting winter wheat production fields in the region. After collecting a total of 32 samples, they were dried, threshed and screened in a greenhouse for sensitivity to diclofop-methyl (516 g ai ha^{-1}), pinoxaden (59.43 g ai ha^{-1}), mesosulfuron (17.5 g ai ha^{-1}), pyroxsulam (17.94 g ai ha^{-1}), glyphosate (1,032 g ai ha^{-1}), and pyroxasulfone (102.97 g ai ha^{-1}) at 1X field rate. Following the herbicide screenings, dose- response assays were conducted on the most resistant ryegrass population at eight different rates (0.5, 1, 2, 4, 8, 16, 32, and 64X), compared to a susceptible population at six rates (0.0625, 0.125, 0.25, 0.5, 1, and 2X). The experiment was conducted in a completely randomized design with three replications and two experimental runs. Survivors were characterized as highly resistant (0-20% injury) or moderately resistant (21-79%) and susceptible (< 80% injury). Results showed a high level of resistance to individual ALS- and ACCase-inhibitor herbicides and also cross and multiple herbicide resistance in four populations. Ratio of GR_{50} values indicated that most resistant population had 20-, 87-, and 161- fold resistance to pinoxaden, mesosulfuron, and pyroxsulam, respectively. GR_{50} ratio for diclofop-methly-resistant population could not be calculated as none of the doses provided 50% control. These populations showed no resistance to glyphosate and pyroxasulfone. Italian ryegrass is an obligate outcrosser, and this trait increases the risk of spreading of multiple herbicide resistance to neighboring fields via hybridization. In the similar manner, Palmer amaranth populations were collected from soybean, corn and cotton fields and screened for herbicide-resistance. Results from the preliminary screening indicated that 15% of Palmer amaranth populations in Virginia are multiple-resistant to both glyphosate (EPSPS-inhibitor, and ALS-inhibitor). Further investigations are currently underway.. The increasing number of multiple herbicide resistant weeds is a challenge to sustainable crop production in Virginia and presents an obstacle to Integrated Weed Management strategies.

Milos Viric [1 * ^], Virginia Polytechnic Institute and State University (Virginia Tech), MS Student

Akashdeep Brar [2], Virginia Polytechnic Institute and State University (Virginia Tech), PhD Student

Vipin Kumar [3], University of Nebraska-Lincoln, Graduate Reseach Assistant- PhD Student

Michael Flessner [4], VTSPES, Associate Professor

Vijay Singh [5], Virginia Polytechnic Institute and State University (Virginia Tech), Assistant Professor and Extension Specialist

Session Details:

Poster Session (SOIL AND WATER MANAGEMENT, SOIL FERTILITY, PRECISION AG, ON-FARM RESEARCH, CROP PROTECTION) Displayed, Atlantic Foyer, 24 Sep, 2024 08:00 AM

Energy required for subsoiling long-term no-tillage soil and effect of compaction amelioration on sunflower yield

Magdalena Kaczorowska-Dolowy [1^], Guido Botta [2*], Diogenes Antille [3], Paula Misiewicz [4]

Submission Type:
Poster presentation

Sub-topics:
Controlled traffic farming

Abstract Summary :

Strategic (deep) tillage is increasingly being used for remediation of soil compaction in long-term no-tillage soil. This paper reports the results of experimental work that was conducted to quantify the mechanical effort required to perform a one-off subsoiling operation to remove deep (~300-350 mm) compaction from no-tillage soil. The subsoiler was fitted with six curved (rigid) shanks and the soil type was a Typic Argiudoll near Suipacha, northern Buenos Aires (Argentina). The following treatments were performed: (T1) deep tillage after 12 years of no-tillage (control), (T2) deep tillage after 7 years of no-tillage, and (T3) deep tillage after 3 years of no-tillage. The parameters measured were traction effort, work speed, fuel consumption, slippage, soil cone Index before and after traffic, and the power demanded by the subsoiling operation. It was also hypothesized that subsoil compaction due to tractor traffic would occur despite the soils having developed ‘good’ soil bearing capacity after several years under no-tillage, and that the power required to perform the subsoiling operation would increase proportionally with the period of time under no-tillage. Confirmation of these hypotheses would lead to the conclusion that no-tillage alone can be ineffective in preventing (or otherwise reverting) soil compaction, and that controlled traffic would be needed to avoid it in the first place. The main results derived from this work were: (a) the average pull demand, expressed as kN per shank, was 6, 4.7, and 4.4 for T1, T2 and T3, respectively; (b) the power demanded for deep tillage of no-tillage soil increased concurrently with the number of years under no-tillage. As such, the power demanded by T1 was ~22% and 28% greater than that of T2 and T3, respectively. Strategic deep tillage of permanent no-tillage soil may be required to remove traffic-induced soil compaction and improve soil physical conditions, but the afterwards benefits of such operation may be short-lived if controlled traffic is not practiced. Without controlled traffic, no-tillage can lead to widespread soil compaction, reduced infiltration and yield, which therefore may require subsoiling at 3-year intervals to ensure any unwanted effects on crop performance are minimized. However, from an energy-use efficiency perspective, this can be both costly and environmentally unsustainable. Therefore, conversion to controlled traffic (and no-tillage) may be considered as part of the machinery replacement program.

Magdalena Kaczorowska-Dolowy [1^], Harper Adams University, Post doctoral research associate

Guido Botta [2*], Universidad Nacional de Lujan, Argentina, Professor

Diogenes Antille [3], CSIRO Agriculture and Food, Senior Research Scientist (SoilPhysics)

Paula Misiewicz [4], Harper Adams University, Senior lecturer in soil and water management

Session Details:

Poster Session (Tillage) Displayed, Atlantic Foyer, 23 Sep, 2024 08:00 AM

Utilizing cover crops to maximize ROI and achieve farm goals

W. Hunter Frame [1 * ^], Bright Ofori [2], Ryan Stewart [3], Mark Reiter [4]

Submission Type:
Oral presentation

Sub-topics:
Legumes, grasses, brassica, forbes nutrient availability

Abstract Summary :

W. Hunter Frame [1 * ^], Virgnia Tech, Associate Professor

Bright Ofori [2], North Carolina Department Of Agriculture And Consumer Services,

Ryan Stewart [3], VTSPES,

Mark Reiter [4], Virginia Tech, Professor of Soils and Nutrient Management

Session Details:

Utilizing cover crops to maximize ROI and achieve farm goals, Cape Charles A , 24 Sep, 2024 11:00 AM

Adaptive Subsurface Drip Irrigation Strategies for Enhancing Corn Yield in Eastern Virginia

Unius Arinaitwe [1 * ^], W. Hunter Frame [2]

Submission Type:

Oral presentation

Sub-topics:

Irrigation management

Abstract Summary :

To be determined.

Unius Arinaitwe [1 * ^], Tidewater AREC, Virginia Tech,

W. Hunter Frame [2], Virgnia Tech, Associate Professor

Session Details:

Adaptive Subsurface Drip Irrigation Strategies for Enhancing Corn Yield in Eastern Virginia, Cape Charles A , 24 Sep, 2024 10:00 AM

Influence of Biochar-Herbicide Interactions on Weed Control Efficacy in sandy soil in Alabama

Nisith Nishank Purohit [1 * ^], Rakesh Kumar Ghosh [2], Yucheng Feng [3], Stephen Prior [4], Aniruddha Maity [5]

Submission Type:

Poster presentation

Sub-topics:

Weed science

Abstract Summary :

Biochar, a carbon-rich byproduct of pyrolysis, has shown potential to alter pesticide efficacy depending on its physicochemical interactions with soil, microbes, and pesticides. A greenhouse study aimed to evaluate the weed control efficacy (WCE) in biochar-applied sandy soil in response to herbicide on two weed species: Eleusine indica (Goose grass) and Ipomoea lacunosa (pitted morning glory). The experiment was designed as a randomized block with two factors: biochar type and herbicide. We examined the effects of four biochar types (sugarcane, wood, coconut, and pinewood) on the efficacy of two commonly used preemergence herbicides in Alabama row crops, proxasulfone and clomazone. Biochar was applied at 2t/ha, and herbicides were used at recommended field doses. Biochar applied trays with herbicide (treated tray) had a higher survival rate and above-ground biomass of morning glory as compared to control (herbicide application without biochar). Bleaching of pitted morning glory was observed in all clomazone-treated trays; however, as time progressed, treated trays recovered from the bleaching quickly as compared to the control, suggesting enhanced adsorption of clomazone by the biochar. However, the goose grass control efficacy did not change with the application of biochar, with no germination observed in pyroxasulfone-treated trays and complete bleaching in clomazone-treated trays. Biomass production across the different treatment trays significantly differed and was more pronounced in the case of pyroxasulfone than clomazone. The combination of the chemical properties and the mode of action likely governed the extent of biochar-induced reduction in bioavailability of herbicides. Sugarcane biochar demonstrated the greatest reduction in herbicide bioavailability, as indicated by the higher biomass of morning glory in these trays. Although causal mechanisms are under investigation, this work clearly demonstrates the decreased efficacy of herbicides in biochar amended soils. Therefore, understanding herbicide-biochar interactions will be critical for developing sustainable weed management strategies in biochar-amended agricultural systems.

Nisith Nishank Purohit [1 * ^], Auburn University, Graduate Student Assistant

Rakesh Kumar Ghosh [2], Auburn University, post-doctorate

Yucheng Feng [3], Auburn University, Professor

Stephen Prior [4], USDA-ARS NSDL, Plant Physiologist

Aniruddha Maity [5], Auburn University, Assistant Professor

Session Details:

Poster Session (SOIL AND WATER MANAGEMENT, SOIL FERTILITY, PRECISION AG, ON-FARM RESEARCH, CROP PROTECTION) Displayed, Atlantic Foyer, 24 Sep, 2024 08:00 AM

Assessing the Efficacy and Soil Safety of a Reduced Dose Tank-Mix of Pendimethalin and Pyroxasulfone

Nisith Nishank Purohit [1*^], Pervinder Kaur [2], Harshdeep Kaur [3], Makhan Singh Bhullar [4], Aniruddha Maity [5]

Submission Type: Oral presentation

Sub-topics: Weed science

Abstract Summary :

Intensive use of herbicides has resulted in soil health deterioration and evolution of herbicide-resistant weeds, which needs reduction in herbicide usage in the field. The field experiment evaluated the reduced tank-mix doses of pendimethalin and pyroxasulfone on weed control efficacy, soil microbiome health, and its residue in soil and wheat grains. Sixteen treatments comprising sole as well as tank-mix combinations of pendimethalin (four doses: 0, 750, 1125 and 1500 g ha-1) and pyroxasulfone (four doses: 0, 85, 127.5 and 170 g ha-1) as PRE were evaluated in factorial randomized complete block design with three replications. Phalaris minor, Avena ludoviciana, Rumex dentatus and Medicago denticulata were major weed species in the region. Application of pendimethalin at 750 g ha-1 + pyroxasulfone at 85 g a-1 (H1) recorded 63% weed control efficiency which was better than recommended doses of pendimethalin (≥1125 g ha-1) and pyroxasulfone (≥127.5 g ha-1) alone. Unsprayed soils exhibited a continuous increase in soil enzymatic and microbial activities over time, while inhibition in herbicide-treated soils displayed a positive correlation with the dose of sole and tank-mix herbicide. However, the H1 showed lower inhibition of enzymatic and microbial activities than higher doses of both sole and tank-mix combinations, with dehydrogenase activity and bacterial population being more sensitive to tank mix combinations. Moreover, the herbicide residues from H1 soil and wheat grain at harvest were below detectable levels (< 0.01 μg g-1), complying with the regulatory residue limit. The H1 recorded 4.47 t ha-1 wheat grain yield, at par with the highest wheat grain yield (4.95 t ha-1) under tank-mix application of pendimethalin 1500 g ha-1 + pyroxasulfone 85 g ha-1. The results showed that tank-mixing different herbicides at lower doses can achieve better weed control, crop yield, and soil health, promoting sustainable crop production.

Nisith Nishank Purohit [1*^], Auburn University, Graduate Student Assistant

Pervinder Kaur [2], Punjab Agricultural University, Professor

Harshdeep Kaur [3], Punjab Agricultural University, Research Fellow

Makhan Singh Bhullar [4], Punjab Agricultural University, Professor

Aniruddha Maity [5], Auburn University, Assistant Professor

Session Details:

Assessing the Efficacy and Soil Safety of a Reduced Dose Tank-Mix of Pendimethalin and Pyroxasulfone, Cape Charles A , 26 Sep, 2024 02:00 PM

Effect of crop residues management on soil physio-chemical properties, macrofauna population and crop yield: An Overview

Elijah Aina Alhassan [1*], Joshua Olaoye [2^]

Submission Type:
Poster presentation

Sub-topics:
Conservation agriculture

Abstract Summary :
The land resources available for farming activities have over the years reduced due to population growth and urbanization, climate change, fast depletion of soil nutrients resulting from adverse human interference with the eco-system and poor soil management practices. This has hampered efforts at achieving the global food security mostly in the developing economies. Healthy soils are home to millions of microorganisms required to maintain dynamic farming environment, soil health and quality. A buffer that minimizes climate impacts through carbon sink paramount to de-carbonization and carbon neutrality. The exploration of the huge potentials in a soil mass for crop production required it earthen up to loosen the clod for proper crop sowing, germination, establishment, healthy growth and bounty harvest. This mechanism boost crop productivity potential by promoting favourable ambient for healthy plant growth, human nutrition, water filtration and conservation. Tillage as one of the preliminary stages in crop production is vital to healthy plants and robust harvests. The conventional tillage (CT) techniques is an energy intensive operations where huge tractive force is required to pull tillage implement through the soil. The unit operation includes soil cutting, soil turning and soil pulverization which in the process exposes soil to harsh weather conditions as crop residues are often completely bury in the soil. Similarly, machine trafficability decreases soil void spaces (pores) impeding water infiltration, microbial activities, seedling emergency, root growth and the general soil productive capacity. The promotion of conservation farming techniques present smart solutions to halting these negative effects. In conservation agriculture (CA) dynamics, crop residues management (CRM) is primary to achieving it benefits. This has been the focus of many research efforts with remarkable breakthroughs. This review presents a detailed overview of recent advances in crop residues management and impacts on soil properties such as moisture content, bulk density, penetration resistance, hydraulic conductivity, soil temperature, soil fertility and nutrients cycling, soil aeration, microbial growth and populations and the crop yield. The findings from this study presents recent advances in crop residues management, importance in soil properties improvement and impact on crop yield. A vehicle to halt soil degradation and promote sustainability of the farming eco-systems. Keywords: Tillage, Soil degradation, Conservation agriculture (CA), Life on land, Crop residues management (CRM), Crop yield responses, Sustainability

Elijah Aina Alhassan [1*], Landmark University,

Joshua Olaoye [2^], University Of Ilorin, Ilorin, Professor

Session Details:

Effect of crop residues management on soil physio-chemical properties, macrofauna population and crop yield: An Overview, Atlantic Ballroom, 24 Sep, 2024 09:00 AM

Overview of Virginia Cooperative Extension Programs in Virginia's Top Agricultural Counties

Theresa Pittman [1*^]

Submission Type:
Oral presentation

Sub-topics:
Extension outreach programming, Working with growers

Abstract Summary :
The Virginia Cooperative Extension (VCE) plays a pivotal role in enhancing agricultural productivity and sustainability across Virginia's leading agricultural counties. This presentation provides a comprehensive overview of VCE programs, focusing on their impact and contributions to soil health, crop management, and farmer education. Virginia's top agricultural counties, include Accomack and Northampton Counties on the Eastern Shore of Virgnia. Both counties benefit from a diverse array of VCE initiatives. These programs are designed to address the unique challenges faced by local farmers, such as soil erosion, nutrient management, and pest control. Key highlights include: Soil Health Improvement Programs: VCE offers workshops and field demonstrations on cover cropping, no-till farming, and soil testing. These initiatives aim to enhance soil structure, increase organic matter, and reduce erosion. Crop Management Strategies: Through research-based recommendations, VCE assists farmers in optimizing crop yields and quality. This includes guidance on crop rotation, integrated pest management (IPM), and precision agriculture techniques. Farmer Education and Outreach: VCE conducts regular training sessions, webinars, and farm visits to disseminate the latest agricultural research and best practices. These efforts ensure that farmers are well-equipped to implement innovative and sustainable farming methods. Collaborative Research Projects: VCE collaborates with local universities, government agencies, and industry partners to conduct research that addresses pressing agricultural issues. Findings from these projects are shared with the farming community to promote evidence-based practices. This presentation will highlight success stories from Accomack and Northampton counties, showcasing how VCE programs have led to measurable improvements in soil health, crop productivity, and overall farm sustainability. Attendees will gain insights into the strategies and methodologies employed by VCE, which can be adapted and applied to other regions facing similar agricultural challenges.

Theresa Pittman [1*^], Virginia Cooperative Extension - Accomack County,

Session Details:

Overview of Virginia Cooperative Extension Programs in Virginia's Top Agricultural Counties, Mariner Room, 23 Sep, 2024 01:00 PM

Against the Current: A film focused on the Eastern Shore of Virginia life

Mark Reiter [1*^], Theresa Pittman [2], Helene Doughty [3]

Submission Type:	**Sub-topics**:
Oral presentation	Extension outreach programming

Abstract Summary :

“Against the Current” provides a powerful glimpse of how Virginia’s Eastern Shore residents are subject to the challenges of rising water’s effects on their lives and livelihood. Through resilience and perseverance, they learn to co-exist and celebrate their rural home. How can this unique community shed light on the national conversations happening around these climate issues? The film can be viewed at: https://www.pbs.org/video/against-the-current-2adugh/ and will be played during this oral presentation time. "Against the Current" is published and broadcast by the Public Broadcasting Service (PBS) in 2024.

Mark Reiter [1*^], Virginia Tech, Professor of Soils and Nutrient Management

Theresa Pittman [2], Virginia Cooperative Extension - Accomack County,

Helene Doughty [3], Virginia Cooperative Extension - Northampton County,

Session Details:

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