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BOOK OF ABSTRACTS

Block C

Session C3

Sustianable soil management

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Session Description

Involved projects: SoilCompaC, SCALE, SoilX

Conveners: Lisbeth Johannsen (BAW), Lorena Chagas (SLU), Loraine ten Damme (SoilX)

Sustainable soil management requires consideration of the multifunctionality of agricultural landscapes, in which the management of natural resources may be in conflict with environmental and socio-economic demands. The need for efficient, climate-smart and environmentally-friendly production of safe, high-quality agricultural products that benefit the social and economic conditions of the farmers and local communities, places high demands on soil functions and soil management. Furthermore, the challenges presented by climate change with projected increases in the occurrence and severity of extreme events, add complexity to achieving sustainable soil management. The multiple land uses and involvement of multiple stakeholders require an integrated approach between policy and practice to maintain or improve sustainable soil management. Strategies for sustainable soil management aim at, among others, the prevention and mitigation of soil compaction, minimisation of soil erosion and improvement of soil water retention and infiltration capacity. While measures to achieve these strategic goals are generally known, a deeper understanding is needed on extents of sustainability gains as well as possible trade-offs with different sustainability targets in regional European contexts. The already acute threat of soil compaction is expected to worsen in the future due to the continued trend towards heavier machinery and effects of climate change. Despite the well-documented negative consequences of compaction on key soil functions, there is limited data of the spatial extent, distribution and severity of soil compaction. Moreover, detailed information on the risk of soil compaction, as well as its impacts on key soil functions such as productivity, climate regulation and water cycling in a context of climate change is lacking. Therefore, obtaining a better knowledge of these questions is crucial for a better guidance of sustainable soil management and alleviation of soil compaction today and in future climate. In the context of soil erosion, on-site soil management of agricultural fields also has potential off-site impacts. Water and sediment transport from agricultural fields to other landscape elements such as water courses or infrastructure depends both on soil management and the connectivity within the landscape. Additional knowledge of surface processes at multiple scales and across landscape elements is needed. Through modelling of soil erosion processes and the implementation of mitigation measures, the effects of soil erosion by water can be mitigated by increasing the focus on water and sediment connectivity in the landscape. Measures such as cover cropping, organic amendments and reduced tillage are expected to benefit soil water retention and thus mitigate drought stress in cropping systems. Evidence of these benefits however is very limited. Furthermore, it is largely unknown to what extent such measures could mitigate future drought and precipitation extremes. Even when some measures may be more effective than others, they may not be equally acceptable for farmers. To enable transitions towards more sustainable soil management, possible inhibitors need to be identified and addressed through adjustments in governance. In this session, we focus on sustainable soil management, especially in regard to these three themes and we kindly invite interested parties to submit an abstract with results of their novel research.

Abstracts of Oral Presentations

SCALE – Managing Sediment Connectivity in Agricultural Landscapes for reducing water Erosion impacts

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In the SCALE project we intend to improve the knowledge of sediment connectivity and how to model it at different scales and locations, to enhance our understanding of soil erosion by water, sediment transport and landscape connectivity. This will help to advance the efficient implementation of mitigation measures, which account for regional differences in erosion damages supported by erosion modelling at different scales. We present the current state and results of the project, which contribute to an enhanced knowledge on soil erosion processes, modelling, the implementation of mitigation measures and policy adaptation across landscapes in Europe. These include a survey on soil erosion modelling approaches across Europe, which revealed the use of a wide range of different models, datasets and parameters to produce soil erosion maps and a lack of focus on connectivity for the implementation of mitigation measures. Further, we collected information on mitigation measures, with the purpose of building a comprehensive inventory of the measures in use to mitigate runoff induced erosion across Europe. A dataset of 14 agricultural catchments from 8 European countries, which have different types of erosion problems, was gathered to investigate the implementation of mitigation measures against on-site and off-site impacts of water erosion. The local costs of implementing erosion mitigation measures have also been investigated, as well as local stakeholders' perception of soil erosion and the implementation of mitigation measures aided by modelled risk assessment. Guidelines on the current and improved implementation of erosion measures and connectivity elements depending on scale and modelling approach are being developed through modelling scenarios in several of the described catchments. This so far resulted in two scientific papers analysing the use of the model RUSLE for country-wide erosion prediction and the first large-scale sediment connectivity analysis in the agricultural lands of Finland.

Keywords: soil erosion, sediment connectivity, mitigation measures, sustainable soil management

Mapping and alleviating soil compaction in a climate change context (SoilCompaC)

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Soil compaction is a major threat to soil productivity and ecological and hydrological soil functioning. Although adverse impacts of compaction on soil properties and functions are relatively well documented, there is little data of the spatial extent, distribution and severity of soil compaction. Furthermore, our understanding of how compaction affects the carbon cycle is limited, and we lack information on the compaction risks for different pedo-climatic zones and cropping systems in Europe, as well as how these risks may evolve due to climate change. The SoilCompaC project directly addresses these knowledge gaps. SoilCompaC will quantify interactions between soil compaction and climate, and present information on how to assess, detect, recover and minimize soil compaction, thereby providing a basis for sustainable soil management in Europe. SoilCompaC will realize this by: exploring novel technologies such as remote sensing and data-driven, reciprocal modelling to quantify the extent and severity of the soil compaction for different pedo-climatic conditions in Europe; conducting an extensive literature review on the recovery of compacted soils; using modelling approaches to predict current and future compaction risks; and applying a modelling framework combining a compaction, root growth and soil-crop model in combination with field measurements to quantify impacts of soil compaction on soil key functions, focusing on carbon storage but considering also crop productivity and water balance. The activities in SoilCompaC will improve our understanding of compaction impacts on key soil functions and how this is affected by climate change, to synthesize information and identify novel methods for detection and alleviation of compaction, as well as to provide a solid basis for estimation of compaction risks to guide sustainable soil management today and under future climate.

Keywords: soil compaction; recovery; soil carbon; sustainable soil management

Soil management to mitigate climate change-related precipitation eXtremes (SoilX)

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With climate change, both drought and heavy precipitation are becoming more frequent. SoilX investigates the possibilities to mitigate impacts of such extremes on crop productivity and other ecosystem services (i.e. soil protection, nutrient cycling, carbon sequestration) through improved soil management practices. We are conducting a harmonized field sampling campaign across Europe to measure the impacts of soil management improvements on soil hydraulic characteristics. Based on existing and new measurements from this project, we will evaluate possible benefits and drawbacks of soil management changes with regard to productivity gains and other ecosystem services under current and future climate conditions. This work involves the use of several biophysical models to evaluate the robustness of impact estimates towards structural model uncertainties. Socio-economic factors that hinder or enable the adoption of improved soil management practices are identified through farmer interviews. The synthesis of the project findings will ultimately improve the knowledge base for advising farmers and policy makers at the European and regional levels and thus contribute to the successful implementation of soil structural improvement measures in Europe.

Start date: 1 November 2022 (24 Months)

Keywords: Climate adaptation; Farmer behaviour; Soil hydrology; Soil management; Soil/crop systems modelling

Effect of soil tillage, cover crop and wheel load on track depth, soil penetration resistance and maize yield in the Pannonian basin in 2022

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In the context of the SoilCompaC project (EJP SOIL), a three-factorial field experiment at the Experimental Farm Groß-Enzersdorf (AT) was established to investigate the effect of the load of a tractor slurry tanker combination (high, medium, low), soil tillage for cover crop (ploughing, cultivating, no-tillage) and cover crop mixture (deep rooted, shallow rooted, without cover crop) on soil physical and agronomic parameters.

The soil (0–30 cm) is a silty loam with 19.9% clay, 44.1% silt, and 36.1% sand with soil organic carbon of 16.3 g kg^{-1} and is classified as Calcaric Chernozem. The year 2022 was very dry with a mean annual precipitation of 392 mm and temperature of 11.9 °C. In the three-factorial design, cover crop mixture and load were nested in tillage of the cover crop. The plot size for a tillage treatment was 30 m x 27 m and for cover crop within tillage of the cover crop 30 m x 9 m. The total field trial size was 7290 m^2, with three replicates for each factor.

Wheeling with a tractor-slurry tanker combination (10 m^3, pendulum tandem axle) was done on 21st April 2022 in three load levels: high load: 19540 kg total weight, 30 kN max. wheel load; medium load: 14825 kg total weight, 22 kN max. wheel load, low load: 10030 kg total weight, 22 kN max. wheel load. Tire inflation pressure was fixed for the tractor wheels with 300 kPa and for the slurry tanker wheels with 400 kPa. The average soil moisture content was 24.4%. After passing the plots, the track depth as a vertical distance between the middle tire print and the horizontal rigid slat was measured with a ruler. Maize (cv. P9610, FAO 370) was seeded (without tillage before!) directly on 2nd May 2022 in tracks (generated by the tractor slurry tanker combination) and on the area with no tracks using a precision seeder in a row distance of 75 cm. Maize harvest was done on 21st September 2022 in each plot by cutting the maize plants of 2 m rows manually.

Soil penetration resistance was measured three times (spring – 21th April, summer – 1st June, autumn – 18th October) in the tracks generated by wheeling of the tractor-slurry combination and in the unwheeled area with a a cone penetrometer (Eijkelkamp, The Netherlands; 60° cone and 1 cm^2) to a depth of 40 cm. For each plot, five/seven cone penetrations were recorded. The mean track depth was highest at 5.69 cm in the total-filled slurry tanker followed by the half-filled slurry tanker (4.79 cm) and empty slurry tanker (4.07 cm.). Soil penetration resistance was significant affected by tillage, cover crop and load in all three dates. Results for the 1st soil penetration measurement for tillage: ploughing>no-tillage>cultivating; for cover crop: without cover crop = shallow cover crop > deep rooted cover crop; for wheel load: high load > medium load > low load > un-wheeled. Overall the mean grain of maize yield was reduced by 37% through soil compaction generated by high wheel load.

Keywords: cover crop, wheel load, track depth, soil penetration resistance, crop yield

Acknowledgement: The field trial is part of the EJP SoilCompaC project. The research is also Danish-funded DFF RESCUE.

Policies for sustainable soil management – ambitions, knowledge gaps and incoherencies

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In the EU Soil Strategy, sustainable soil management is emphasized as the way to prevent degradation and restore unhealthy soils. Sustainable soil management encompass a set of practices that is able to maintain the soil in, or restore it to, a healthy condition yielding multiple benefits, including for water and air. These practices increase soil biodiversity, fertility and resilience which are needed for the vitality of rural areas. However, soil management is complex, since a series of soil physical, biological and chemical processes have to be taken into account. Furthermore, soil management is connected with a range of aspects like different land-uses, multiple public policies and socio-cultural values. Based on research carried out in the context of several EJP SOIL projects (EJP SOIL WP2, Scale, and Road4Schemes), this presentation will discuss the ambitions, knowledge gaps and policy incoherencies of sustainable soil management. Focusing on case studies regarding certification of carbon removals and erosion mitigation, particular attention will be given to the way in which institutional arrangements can be used to enable a transition to sustainable soil management. We argue that achieving sustainable soil management requires a systemic reorganization of the agri-food system and the support mechanisms under the CAP.

Keywords: EU soil strategy; Systemic intervention, policy incoherencies, sustainable soil management

The Importance of Data Resolution in Regional Scale Modelling for Erosion Prediction and Soil Indicators

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Erosion is a significant environmental issue in Europe, with over 20% of the continent's land area affected by soil erosion. The impacts of erosion on European ecosystems include soil degradation, loss of biodiversity, and water pollution, among other environmental problems. Erosion models have been developed to simulate erosion processes and evaluate the impacts of erosion on European ecosystems. However, the spatial resolution of the data used in these models is an important factor that needs to be investigated to improve the accuracy of the models and provide more effective erosion control and mitigation strategies.

At present, many erosion models in Europe use low-resolution data, such as data obtained on European and/or global scale, which may not capture the complex interactions between different environmental factors and erosion processes. High-resolution data, such as local remote sensing data, national soil maps, national geodatabases and high-resolution topographic data, can provide more detailed information on the landscape characteristics, vegetation cover, soil properties, and land use practices, which are critical factors influencing erosion rates.

In Flanders, a lot of high-resolution datasets are available and are being used in regional erosion modelling. However, at European scale, these high-resolution data are not being used which leads to divergent values in both model outputs. These uncertainties could potentially lead to conflicts between the different stakeholders and can often lead to distrust in the use of models for policymaking.

In this study the effect of the difference in resolution of the input data for the model has been evaluated. By upscaling the high-resolution dataset and running the same model, the impact of the resolution on the output has been assessed. Different set-ups were tested, where the data resampling takes place at different moments in the modelling process to better understand how the resolution affects modelled outputs.

Despite the fact that this study was only carried out for erosion modelling, it poses a relevant question for all soil indicators. In many cases, spatial models must rely on interpolations and up- and downscaling techniques in order to create a comprehensive overview of the modelled characteristics for a chosen resolution, and therefore they always deal with large uncertainty and a significant number of errors. By using the highest resolution of available data these errors can be reduced, however, this can possibly increase computing time, or this could lead to the emergence of other types of error.

In conclusion, this study evaluates the importance of considering spatial resolution in erosion models to improve the accuracy of the results and provide effective erosion control and mitigation strategies. By using high-resolution data and comprehensive guidelines for the model, the errors and uncertainties associated with spatial models can be reduced, enabling policymakers to make informed decisions. The impact of the spatial resolution on the model output should be considered in policymaking at regional scale and should always be kept in mind in decision making.

Keywords: Erosion Modelling, Spatial Resolution, High-Resolution Data, Soil Indicators

Assessment of potential compaction risk of arable soils in Switzerland

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It is well known that soil compaction has negative effects on soil productivity and soil functioning. With a continuing trend to larger and heavier agricultural machinery, the risk of soil compaction due to agricultural traffic is likely increasing. Soil compaction risk assessments at national scales could help identify susceptible areas and critical field operations, which could guide towards more sustainable arable cropping. However, such data are currently missing in most countries. The aim of this work is to assess the potential compaction risk of arable soils in Switzerland for different major arable crops and critical field operations such as harvest during autumn.

The overall approach is based on a previously established modelling framework that combines simulations of soil moisture using a soil-crop-atmosphere model with estimates of soil stress and soil strength for different combinations of machinery, soils and weather conditions. We collect typical machinery data (wheel loads, tyres, *etc*.) for each field operation, which is used to calculate soil stress based on analytical equations for stress propagation. Soil strength is calculated by means of pedotransfer functions, using simulated soil moisture and basic soil information.

We performed simulations with climate norm weather data from the last 30 years to quantify compaction risk probabilities for the time windows of typical field operations. We focused on subsoil compactions, and therefore, calculations were made for 40 cm soil depth. Results are visualized as risk maps that indicate which areas of Switzerland are prone to a risk of soil compaction for the different field operations. Additionally, we computed the maximal wheel load carrying capacity (i.e., maximal wheel load where soil stress ≤ soil strength). Comparing the maximal wheel load to typical wheel loads used for different machinery gives some insights about the seasonal dynamics and patterns of soil compaction risks.

At the Annual Science Days, we will present soil compaction risk maps and maximal wheel load carrying capacity dynamics for different crops in Switzerland.

Keywords: soil compaction; risk map; wheel load carrying capacity; sustainable arable cropping

Subsoiling and bio-subsoilers to alleviate subsoil compaction in three maize-based cropping systems on a sandy loam soil

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The past few decades have seen an increased strain on the subsoils' capacity to fulfil several ecological and agricultural services. The use of ever heavier farming machinery and the increased frequency of field traffic under wet, and thus weaker soil conditions have seriously increased the risk of compaction of deeper soil layers. These more compacted subsoils constrain water infiltration and storage and increase the mechanical impedance to deeper root growth. While a compacted topsoil can more easily be remediated by natural processes (e.g. swelling-shrinking, freezing-thawing) and by regular tillage operations, compacted subsoils will be much harder to handle. Although deep tillage operations, like subsoiling have been shown to quicky and effectively loosen up compacted subsoil layers in a wide variety of soil types, effects on crop production are variable and the risk of recompaction is high. On the other hand, some deep rooting plant species such as alfalfa have the capacity to penetrate compacted subsoil layers and create stable biopores (bio-susoilers). While the effects of bio-subsoilers are considered to be more sustainable, alleviation of compaction occurs rather slow. Therefore, a multi-year field experiment was set up on a sandy loam soil to assess short and medium term effects of both subsoiling and two deep rooting (cover) crops (i.e. alfalfa and fodder radish) in three maize-based cropping systems. The study site showed the presence of a highly compacted layer at the interface between topsoil and subsoil (30-50 cm; >6 MPa). The combination of both subsoiling and deep rooting (cover) crops was included to evaluate the potential role of the latter in protecting the mechanically loosened subsoil from recompaction. This experiment demonstrated that subsoiling is an effective remediation measure to deal with subsoil compaction (i.e. lowering both bulk density and penetration resistance). The crop response was however highly variable and was only positive (+8%) when root exploration of the newly made accessible subsoil was advantageous (i.e., drought). Besides its inconsistency, the effects also proved to be very short-lived under a standard monoculture of forage maize. Adjusting the crop rotation and including deep rooting (cover) crops, like fodder radish and alfalfa, helped to partially stabilize the disrupted subsoil and reduce recompaction. The difference between both crops was limited. Despite alfalfa's longer growing period and the limit of tillage during its cultivation, the quicker growing fodder radish had a slightly better effect in this respect. While both

fodder radish and alfalfa succeeded in penetrating the compacted subsoil without previous disruption by subsoiling, no significant improvements of the measured soil physical parameters were observed.

Keywords: Deep tillage, bio-subsoiler, maize-based cropping system, subsoil compaction, alleviation

Abstracts of Poster Presentations

Soil physical parameters and winter wheat productivity on headlands: field scale analyses in Lithuania

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Headlands are subjects to greater machinery trafficking than in mid-field area so physical soil degradation occurs in this zone which increases over time. These traffic areas can be compacted and may cause considerable yield loss. The investigations of such areas are very important for the alleviation of soil compaction and sustainable use. The aim of this study was to evaluate soil physical parameters: penetration resistance (PR), bulk density (BD), amount of water stable aggregates (WSA) and productivity of winter wheat (yield and thousand kernel weight (TKW)) in the headlands occurred during long-term intensive agriculture. Two field experiments were initiated at the Lithuanian Research Centre for Agriculture and Forestry in spring of 2022 in soils differing in genesis on two geographical sites. One of them was established on *Endocalcari-Epihypogleyic Cambisol* (55°24'38.4"N 23°51'00.1"E, Central Lithuania) and the other field experiment was set up on *Bathygleyic Dystric Glossic Retisol* (55°43'26.1"N 21°30'15.8"E) (Western Lithuania). The experiments were carried out in winter wheat in two field zones: in the headland and in the mid-field area. Each experiment was performed in 5 replications of 36 m^2 size plots placed in a row. The results obtained in both studied soils showed that the values of the physical parameters describing the soil condition were essentially worse in the headland than in the mid-field. Soil BD (at a depth of 15-30 cm) reached the critical values 1.54-1.70 Mgm^{-3}, at which plant growth is limited or even stopped. Soil PR in headland exceeded critical limit of 2MPa at 10 cm depth in *Cambisol* and at 4 cm depth in *Retisol,* while in the mid-field this limit reached in deeper layers. Lower amount of WSA was also obtained in compacted headlands than in mid-field in both examined soils. Winter wheat grain yield in compacted (headland) soils was by 13.2% and 12.3% lower compared with non-compacted soil. A similar tendency was determined with TKW. These data contribute to the development of sustainable technologies for reducing soil degradation in headlands.

Keywords: headland, soil bulk density, water stable aggregates, grain yield.

The effect of different cover crops on soil properties, soil compaction and yields of winter wheat

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The aim of this work is to describe effect of different cover crops sown before winter wheat (W) in dry region of Czech Republic. The selected cover crops were as follow: wheat (WW) (Triticum aestivum L.), pea (PW) (Pisum sativum L.) and rape (RW) (Brasica napus L.). Soil type in study location was determined according to WRB as Pachic Chernozem Clayic (soil with higher amount of soil organic carbon in first 50 cm). The field measurement of unsaturated hydraulic conductivity, soil water repellency and soil compaction was carried out four times in different phenological phases (October 2021, March 2022, May 2022 and July 2022 after the harvest). Soil samples were taken from top soil and also from the subsoil (25 cm). Grab soil samples were used for determination of basic soil properties soil texture, particle density, soil organic matter, active and potential soil reaction, electric conductivity, cation exchange capacity, carbonates and nutrients content. Aggregate stability (WSA index) was also determined. Undisturbed soil samples (100 cm^3) were taken for determination of bulk density, total porosity and soil water retention curves. Next computed tomography (CT) was used for determination of soil microporosity. For description of cover crops effect on yields parameters the thousand-grain weight (TGW) and total yields were determined. It should be noted that the sampling in May was marked by severe drought (associated with a high occurrence of cracks in the soil). The first surprising results came from measured soil organic matter (SOM), where the highest SOM content was obtained in WW than in PW and RW. The nutrient content (P, K) was higher in RW variant. Surprisingly the hypothesis that using pea or rape as cover crop will affect negatively bulk density and enhanced soil porosity due to decay of the root system, was not confirmed. The highest bulk density and the lowest total porosity was observed in RW. These findings correspond with the results of aggregate stability and soil compaction (the highest WSA index and penetration resistance) measured also in RW. Unsaturated hydraulic conductivity determined in October 2021 was higher WW, but in other three sampling (March, May and July) the highest unsaturated hydraulic conductivity was detected in PW. Soil repellency was higher in winter wheat after pea and also after rape. The results of TGW show statistical significantly higher values in winter wheat after rape (42 g) compare to winter wheat after pea (40 g) or wheat (38 g). The same trend occurred also in total yields: RW: 8.64 t/ha, PW 7.83 t/ha and WW 7.64 t/ha. We can conclude that use of rape as a cover crop in drier locality compare to pea or wheat lead to change of almost all measured soil properties both negatively (SOM,

bulk density or porosity) and positively (nutrient content). The highest yields of winter wheat were mainly due to the use of rape as a cover crop.

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Keywords: cover crops, soil compaction, winter wheat, unsaturated hydraulic conductivity

Long-term effects of soil compaction on soil carbon stocks and nitrous oxide emissions

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Soil compaction in agricultural lands results from the usage of heavy machinery, producing soil deformation and changes in soil structure. It impacts soil mechanical and hydraulic properties that control key soil processes such as water flow, plant growth, carbon and nitrogen cycling. By modifying soil structure, soil compaction often creates soil conditions that are linked to reduced productivity, reduction of carbon inputs, and increases in nitrous oxide emissions. Short-term (hours to weeks) changes in soil structure and soil functioning due to compaction are relatively well understood, but long-term (years to decades) effects remain challenging to understand and evaluate. This disparity on the time length of soil processes affected by compaction limits experimental design and data availability for integrative understanding of short and long-term effects of soil compaction on soil functioning. Assessing such impacts is further challenging due to the poor understanding of soil structure dynamics, and soil compaction recovery. In this work, we address this challenge by reviewing empirical evidence of effects of soil compaction on carbon dynamics and nitrous oxide emissions under different climates, soil types and compaction conditions. To complement this, we modelled selected experiments using an agro-ecosystem modelling framework that explicitly considers changes in soil structure dynamics produced by compaction. Using this approach allows to systematically evaluate different management scenarios involving diverse compacting stresses (e.g., by vehicle wheeling or animal trampling), soil types, soil covers and climates. Depending on the compacting stress, the soil compaction model simulates changes in bulk density (increases up to 20%) and hydraulic conductivity (decreases of up to 95%) that are consistent with literature values. These changes led to modelled relative increases in N2O emissions from the compacted soils of up to 200% and a related decrease in yield of up to 15%, and changes in carbon stocks of 13%, which is in agreement with ranges reported in the literature. The proposed framework systematically evaluates the impacts of soil management on soil properties and functions and has the potential for evaluating long-term effects of soil compaction in soil functioning and developing strategies for ameliorating it, and guide experimental design for measuring this.

Keywords: soil compaction, soil carbon, nitrous oxide, agroecosystem modelling

AGROECOLOGICAL TRANSITION FOR SUISTANABLE AGRICULTURE AND SAFE FOOD PRODUCTION

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In a world with growing population, agriculture is facing two challenges which are apparently contrasting: enhancing safe food production and promoting environmental sustainability. Therefore, one of the most fundamental problems to be solved is the matching of agricultural production and food demand in a condition of decreasing area for agricultural production. The decrease in cropland is due to several causes, desertification and soil degradation in the context of climate change being the major ones. Sustainable agriculture needs to produce healthier food and fibre to feed a growing population in harmony with nature. The development of technology, to satisfy the food needs of the growing human population, has generated commercial competition without ignoring the interest in increasing economic margins. As a result, food security has taken a backseat because of the extreme focus on high yield. Unfortunately, this situation causes the production and consumption of food that is far from maintaining the minimum quality of ecosystems. In this context, Agroecology, a holistic and integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of sustainable agriculture and food systems, seems to be one of the most viable approaches in order to leave a healthy environment, a quality life and a clean world to future generations. A key component of the agroecological perspective is delineating agricultural lands according to their potential characteristics in the scope of sustainable and safe food production. The laws and regulations applied at the state level and the follow-up of the implementation will support rural development. In this context, the Into-DIALOGUE project aims to contribute to rural development along with sustainable and safe food production based on the agroecological approach. The latter will consider field types (in terms of field size, soil type, product pattern, ownership types, etc.). In addition, agroecological systems will help to reduce greenhouse gas emissions from farmland, prevent soil contamination by chemicals, loss of organic matter, soil erosion and decline in soil biodiversity. Finally, the loss of soil biodiversity might also be prevented.

Keywords: Sustainability, Agroecology, Safe food, Environment

Towards a soil quality field test kit guide of soil indicators for end-land users: a litterature approach

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The most important goal of the activities of each agricultural producer is to achieve a sufficiently high yield, of the desired quality for consumption, storage or processing. Among the many factors determining success in achieving such goals, are the physical, chemical and biological properties of the soils on which the production is conducting. These properties, on the one hand, determine the level of soil fertility, i.e. the ability to meet the nutritional needs of plants at an appropriate level throughout the growing season, and, on the other hand, determine its role in shaping the natural environment or climate. The role of soil in shaping the natural environment or climate change is currently not perceived strongly enough by producers. It is therefore justified to carry out activities that will introduce some changes in this respect. Taking this into account, the Into-Dialogue project provides for the development of a soil guide, the aim of which will be, among other things, to make producers aware of the role they can play in shaping soil quality parameters, with particular emphasis on those effects that have not been the object of their special concern so far. The research shows that the treatments that most strongly shape the quality of the soil environment include: proper crop rotation with considering the use of catch crops, proper tillage (in particular not plow), fertilization (especially organic), liming, but also the correct selection of other agrotechnical factors. This is proven by numerous scientific studies determining the role of the above-mentioned agrotechnical factors or their interactions in shaping the quality of the soil. This quality of soil is determined in the research using various indicators that will be included in the guide. One of the most widely described indicator in the soil guide will be the the content of organic carbon, which can even be significantly increased (or maintained at a sufficiently high level), but also, through improper actions, cause its rapid reduction, associated with the release of large amounts of carbon dioxide into the atmosphere.

Keywords: soil, indicators of soil quality, soil guide, farmers