Welcome to the 7th SoilCare newsletter.

Whilst the last few months have been a challenging time for the SoilCare project due to the on-going COVID-19 situation, some exciting findings from our SICS experiments are starting to emerge which we look forward to sharing with you in the next newsletter. In the meantime, we are able to report on a number of fact sheets and policy briefs that have been produced recently and some activities from the Study Sites.

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www.soilcare-project.eu
An online SoilCare plenary meeting was held on 7th December 2020. The agenda included updates from the thematic clusters (alleviation of compaction, fertilisers/amendments, soil-improving crops). Each cluster provided an overview of their progress and explained their forthcoming plans. The partners are currently preparing publications, some of which will be submitted to SoilCare's special issue.

Each work package also provided updates on their status' and explained how they plan to achieve their deliverables by the new deadline for the end of the project (August 2021).

The emergence of COVID-19 has led to unprecedented change on global scale. It is, therefore, unsurprising that SoilCare, a European-wide project, was impacted by the pandemic. Labwork was forced to slow down due to lockdown restrictions and several deliverables were inevitably delayed.

As a result, the EU Commission have agreed to extend the deadline for SoilCare. The project will now finish at the end of August 2021.
On 4th August 2020, the extension service in Solør Odal, Norway (Norsk Landbruk-srådgivning Øst) arranged a field day and gathered a group of around 40 advisors and farmers. The aim of the day was to present the field trials and discuss the latest research results and experiences from the 2020 season.

Till Seehusen (NIBIO Apelsvoll) presented the ongoing SoilCare trial in Solør (Title: Soil compaction and possibilities for soil loosening by plant roots). The presentation consisted of three different parts: (a) soil compaction, causes and consequences, results from the presented field trial; (b) SoilCare, plant production and soil improving cropping systems and (c) a presentation of the field trial, plant roots and soil structure (including pictures for illustration) as well as the preliminary results from the trial.

Many questions and comments from the audience led to some good discussions about soil structure, plant roots and agronomics to establish cover crops and succeed with crop rotations and improved soil structure. This presentation was part 2 of a series of presentations about soil compaction and SoilCare. The first one was held in combination with a seminar about cereal production that the extension service arranged in March 2020.
In preparation for the upcoming stakeholder workshops at each study site, experiment fact sheets and policy summaries based on the results of each experiment are being produced. These fact sheets and policy summaries will be available on the SoilCare website once the workshops have been completed.

Conclusions from the compaction alleviation experiment

Overall, when soil compaction forms in a direct drill system traditional methods such as ploughing work well to alleviate compaction and increase yield. However, there are soil health benefits of reduced tillage. These benefits include less greenhouse gas emissions, more worms, and better soil structure.

Conclusions from the grass leys experiment

The aim of this experiment was to see if deep-rooting grass cultivars (festuloliums) could perform better than a rye grass clover mix control for sheep forage, and help alleviate some compaction across the field. We hoped to see improvements in SOC, infiltration and reduced penetration resistance due to the deep-rooting grasses, but we found very little difference. After the SoilCare experiment had finished, we dug deep trenches (70 cm depth) in the soil and found that in an area that was fenced-off so no grazing could occur, the festulolium cultivar (Foijtan) did have more roots at 70cm than the control, but under grazing pressure this difference wasn’t seen, which could explain the lack of differences between the grass cultivars measured in the grazed field for the SoilCare results.
To synchronise the SoilCare project with international frameworks, we have assessed the project’s Soil Improving Cropping Systems against the UN’s Sustainable Development Goals (SDGs). These SDGs refer to soil and land both directly and indirectly and therefore have areas in which SICS can contribute positive progress.

Looking at SDGs 2, 3, 6, 11, 13 -15 (which range from zero hunger, to clean water and life systems), we have highlighted what potential soil threats affect each SDG and how complementary SICS can aid in achieving each one. For example, the threat of soil organic matter (SOM) loss can be tackled through using minimum tillage, returning residue to the soil after harvest, and applying mulch and manure. This feeds into zero hunger and good health and wellbeing (SDG 2 & 3) through building soil health and therefore the ability to produce good and plentiful food, a greater SOM which helps to absorb and filter water (SDG 6), helps store carbon in the ground (SDG 13) and creates a healthier environment for both land and water (through reducing soil erosion) and that on life (providing a rich habitat for below and above ground organisms), (SDGs 14 & 15).

The table below presents further examples of how SICS contribute to SDGs. The more holistic the set of practices (SICS) used on each farm, the greater the potential for contributing to each SDG.

<table>
<thead>
<tr>
<th>SOIL THREATS</th>
<th>SICS TYPE</th>
</tr>
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<tbody>
<tr>
<td>Erosion (wind and water)</td>
<td>Zero-tillage, landscape management, Contour traffic</td>
</tr>
<tr>
<td>Decline in organic matter</td>
<td>Minimum tillage, Residue return, Mulching, Manuring</td>
</tr>
<tr>
<td>Compaction</td>
<td>Controlled traffic, Low wheel load, low tyre pressures</td>
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<tr>
<td>Decline in biodiversity</td>
<td>Minimum tillage, residue return, No pesticides, Minimal fertilizer</td>
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<tr>
<td>Floods and landslides</td>
<td>Drainage, Landscape management</td>
</tr>
<tr>
<td>Local and diffuse contamination</td>
<td>No use of polluted inputs, Trees to scavenge air-born pollution</td>
</tr>
<tr>
<td>Salinisation</td>
<td>Drainage, Targeted Irrigation, Ridging</td>
</tr>
<tr>
<td>Acidification</td>
<td>Liming, manuring</td>
</tr>
<tr>
<td>Desertification</td>
<td>Landscape management</td>
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The SoilCare project is funded by the European Union’s Horizon 2020 research and innovation programme under grant agreement No. 677407.
Some key policy options that came from this assessment included:

- The adoption of SICS is an effective way to contribute to SDGs as they contribute to multiple SDGs.
- Creating a methodology to monitor SICS contribution to SDGs, starting with baseline assessments of soil and land properties (such as SOM). Having a standard approach, whilst maintaining a level of flexibility for farmers, will help in being able to compare changes.
- Member States need to have guidelines and support on how best to undertake SICS, which work towards achieving SDGs.
- Long-term perspectives, suited to different regions, need to be created and fostered for more effective use and uptake of SICS.
- In order to transition to SICS and therefore more sustainable soil management, farmers require strong support from policy through funding, creating and encouraging advice networks and knowledge transfer. It is vital to listen to farmers needs in respect to changing management practices.

The policy brief is available [here](#) and the full report [here](#). The report, ‘Providing support in relation to the implementation of soil and land-related Sustainable Development Goals at EU level’, was written for the EU Commission.
THE SOCIAL FACTORS THAT INFLUENCE FARMER’S UPTAKE OF SUSTAINABLE SOIL-IMPROVING CROPPING SYSTEMS

Despite economic and regulatory incentives to transition to more sustainable soil management, many farmers across Europe have still not tried such practices or been motivated to change behaviour for the long-term. Complex social factors affecting farmers can be a cause for this lack of action. A SoilCare paper led by the University of Newcastle explored how building social capital (the glue that binds us together) can positively affect the uptake of innovative practices in farming.

The research highlighted four main components of social capital which affect the uptake of sustainable soil management:

**TRUST** is key; if a farmer does not trust the person or institution providing information, they will probably think it is not trustworthy either. Farmers trust information from those who they feel are in a similar position e.g., other farmers. This is partly because they feel other farmers know and understand their goals and values more than “outsiders” (e.g., government officials, researchers). Distrust can occur through lack of information or contact consistency, whilst reciprocating trust in farmers can help to build relationships.

**CONNECTEDNESS** affects our behaviour. Having diversity within a network really helps spur innovation. For instance, if farmers are part of a wider community network, such as EU Operational Groups, they learn from other farmers as well as agronomists and environmental advisers. Not being connected with a wider network outside of their immediate locale can stifle innovation.

**NORMS** are shared expectations about how people should act. The norm for innovation – feeling it is OK to try something new – is important for encouraging farmers to try more sustainable soil practices. Studies across several countries have shown that farmers are more willing to change practices if their peers also do so. However, this can also present a barrier if peers have had negative past experiences or perceptions of more sustainable practices, e.g., conventional farmer group views of organic farming.

**POWER** is linked to position and knowledge. Power and trust can be seen in agricultural landlord-tenant relationships, where landlords make overarching farm management decisions. Longer-term contracts and encouraging transparent knowledge exchange are good ways to redistribute power equality and create greater transparency, fairness, and procedural justice.

A policy brief based on this research identified some policy options for increasing the uptake of sustainable soil management:

- Support information providers that farmers respect and trust e.g., farmer influencers or advisers
- Support development of diverse networks which include farmers and non-farmers
- Support farmer networks that are open to trying new things – e.g., innovative farmer networks
- Address power inequalities (e.g., farmer to landowner) through expert facilitation of multi-stakeholder groups and long-term contracts
- Incentivising cooperation and collaborative approaches in a range of contexts can be effective for fostering the four key components of social capital. EU grants are available and some national government programmes and advisory systems facilitate interactive groups. For example, EU Operational Groups on soils provide support to enhance connections between farmers, to advisors and researchers. However, SICS need to become the norm whilst addressing power inequalities for managing soil health. Supporting trusted, unbiased external agencies as facilitators will aid the development of multi-stakeholder soil management groups.

[Read the full paper here](#) and the full policy brief [here](#).
This year’s UN World Soil Day was held on 5th December. This year’s theme was ‘Keep soil alive, protect soil biodiversity’. SoilCare recognises the importance of soil biodiversity and that it is affected by all soil-improving cropping systems (see infographic).

Project co-ordinator Dr Hessel of Wageningen Environmental Research said: “In SoilCare we are working with farmers and scientists to identify the practices that will benefit the soil biodiversity as we know these organisms keep the soil healthy and fertile which in turn benefits the crops. The results of all our trials will be available by the end of the year and we are very excited to be able to identify potential practices that not only improve farm profitability but also benefit the living soil. One of the most important goals of the SoilCare project now is to ensure that farmers and the agricultural industry know about the results of these trials so that there can be a shift to soil-improving cropping systems across Europe.”

To celebrate the occasion, SoilCare released a press release and a new soil biodiversity factsheet, both of which were shared widely across social media. You can read the press release here and access the full biodiversity fact sheet here.
SoilCare has produced several new fact sheets which explore the ability of soil-improving cropping systems (SICS) to improve various aspects of soil health. You can access the full fact sheets by clicking on the images below.
The SoilCare website has now relaunched with a new look and additional resources for farmers, policymakers and researchers. Click on the images below to explore the multitude of informative resources now available on the website.
International initiatives are emphasizing the capture of atmospheric CO2 in soil organic C (SOC) to reduce the climatic footprint from agroecosystems. One approach to quantify the contribution of management practices towards that goal is through analysis of longterm experiments (LTEs). Our objectives were to analyze knowledge gained in literature reviews on SOC changes in LTEs, to evaluate the results regarding interactions with pedo-climatological factors, and to discuss disparities among reviews in data selection criteria. We summarized mean response ratios (RRs) and stock change rate (SCR) effect size indices from twenty reviews using paired comparisons (N). The highest RRs were found with manure applications (30%, N = 418), followed by aboveground crop residue retention and the use of cover crops (9–10%, N = 995 and 129), while the effect of nitrogen fertilization was lowest (6%, N = 846). SCR for nitrogen fertilization exceeded that for aboveground crop residue retention (233 versus 117 kg C ha−1 year−1, N = 183 and 279) and was highest for manure applications and cover crops (409 and 331 kg C ha−1 year−1, N = 217 and 176). When data allows, we recommend calculating both RR and SCR because it improves the interpretation. Our synthesis shows that results are not always consistent among reviews and that interaction with texture and climate remain inconclusive. Selection criteria for study durations are highly variable, resulting in irregular conclusions for the effect of time on changes in SOC. We also discuss the relationships of SOC changes with yield and cropping systems, as well as conceptual problems when scaling-up results obtained from field studies to regional levels.
The SoilCare project has brought together a transdisciplinary team of 28 different organisations to identify, test and promote the adoption of soil-improving cropping systems across Europe.

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