SoilCare
SOILCARE FOR PROFITABLE AND SUSTAINABLE CROP PRODUCTION IN EUROPE

Testing and promoting the adoption of soil-improving cropping systems across Europe

Newsletter 6 May 2020

WELCOME to the sixth newsletter of the SoilCare project.

In this issue:

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Developing future scenarios for policy-making in Europe (Feedback requested!)

European agriculture is confronted with a range of uncertainties regarding its future development. Some of these are linked to changing climatic and environmental conditions, while others are the result of our behaviour. Within the SoilCare project we are exploring different pathways for European agriculture, from now until 2050, as this will help to support the development of policies that are future-proof. The approach we use to develop these pathways is called exploratory scenario development. In this approach we are not looking for the most likely future, nor are we deciding on a best or optimal future. Instead, we are interested in exploring the different uncertainties we might be confronted with, because by better understanding what might happen, we are in a better position to design effective policies. This means that we are aiming for a set of scenarios that help us scope a range of plausible future developments. The scenarios can, therefore, be extreme, but have to remain plausible. In a structured way, we aim to consider unexpected events, whilst avoiding scenarios that would be unrealistic.

Participatory workshop exercise to develop scenarios, June 2019, Brussels

Cont. Pg 2 >

In many scenario studies, scenarios are developed by a limited number of people. To overcome this problem, we organised a participatory workshop in June 2019 in Brussels and a webinar in April 2020 and are collecting further input online, to give all who are interested in the topic the opportunity to provide their input, and by doing so, contribute to an improved set of scenarios.

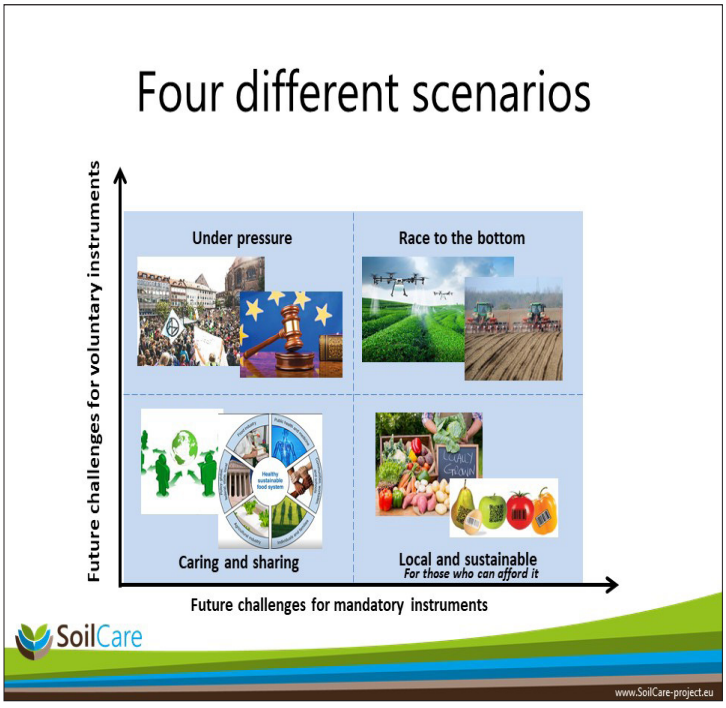
The current draft scenarios feature four different scenarios (see below) and were presented to 65 participants during a Webinar on 23rd April to obtain their feedback. A one-page summary and a video describing each scenario was produced and participants were asked to feedback in a poll on the consistency and level of extremity of each scenario, as well as provide other useful feedback via the webinar Chat function.

As shown in the figure above, these scenarios have been developed along two axes, related to different types of policy instruments: future challenges to mandatory instruments (e.g. regulations) and future challenges to voluntary instruments (e.g. subsidies). We have identified types of future worlds where there would be few or significant challenges to either type of instrument. We have done this because understanding what facilitates or inhibits the acceptance and implementation of these instruments may help us to design policies that are well adapted to specific socio-economic contexts or sufficiently robust.

Links to a description of the scenarios, the scenario videos, the presentations used in the Webinar and a recording of the Webinar can be found on the SoilCare website here. **We are still looking for feedback on these scenarios and there is a link to a Google form on the website to collect this feedback or click here.**

The feedback received will then be used to further develop the scenario narratives which will provide input to the modelling and a second workshop at the end of 2020 focusing on assessing the impact of the scenarios on policy-relevant criteria, the barriers and enablers to the uptake of sustainable agricultural practices and policy support.

For further information about the development of these scenario, please contact Hedwig van Delden hvdelden@riks.nl



New Report: Demonstration activities in the study sites

It is well known that demonstration activities and field days are an important and popular way for farmers, researchers and other stakeholders to share knowledge about new innovations. These events offer an opportunity for all stakeholders to inspect and reflect on the experiments in the field. As a result demonstration activities are a key part of the SoilCare stakeholder engagement strategy.

A new report has been published led by SoilCare partners from the Katholieke Universiteit Leuven, with contributions from the study site partners detailing demonstration activities that have taken place within the project. The report can be downloaded here.

Over the last two years a total of 31 demonstration events/field days have taken place in the 16 study sites, with around 937 stakeholders attending these events. The average number of participants in the events was 30.

The report provides details of the main criteria or indicators that were used in discussions to evaluate the different cropping systems in terms of their performance, advantages or limitations. Among the different indicators used in the study sites, crop yield or similar economic criteria were prominent. Another common criterion discussed is weed infestation and general weed control. It appears that weed management is an issue in many different cropping systems and participants consider that as an important aspect of their performance.

The report also gives an overview of the main feedback received from the participants during the demonstration activities or the main discussion messages. These messages are study site-specific and reflect the diversity of SICS being tested. Nevertheless, in the vast majority of study sites, the discussions tended to focus on the effectiveness of the cropping systems, the ways to properly implement them to minimize the negative impacts and the economic implications.

The next three news items in this newsletter report on the recent demonstration events undertaken in the German,Crete and Italian study sites.

For further information about this report, please contact guido.wyseure@kuleuven.be

News from the field: German demonstration day of cover crops and reduced tillage

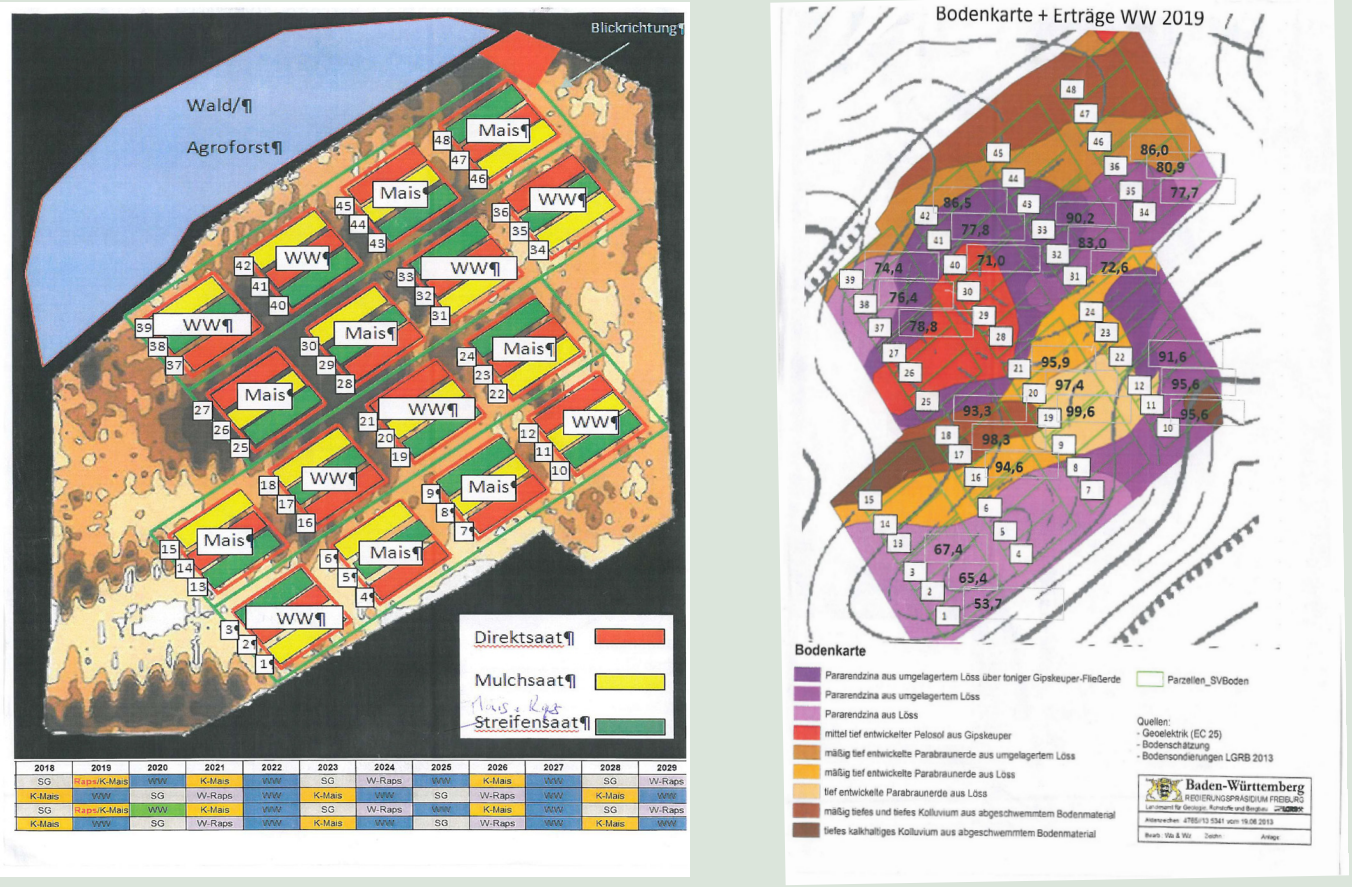
In November 2019, the German Study Site held a demonstration day for local farmers and other stakeholders. The aim of the day was to present the SoilCare field trial at Stifterhof, Östringen experimental farm of Agricultural Technology Centre Augustenberg in Germany. The tillage trial contains the SICS no tillage, reduced tillage, a strip till system and cover crops. The demonstration involved a visual assessment of the cover crops, soil type, soil structure and a discussion with the stakeholders about yields and soil conditions under different tillage systems.

The demonstration was attended by 19 stakeholders that included a mix of farmers, researchers, industry and agricultural extension service representatives.

Demonstration of field experiment and preliminary results and Participants investigating the experiments. Photo credit: Paula Meyer-Gruner

Yield results (Winter wheat, rapeseed, maize, summer barley)

The experiment is taking place on heterogeneous soils in gently rolling hills. Yield measurements show that the soil type in this field had more influence on the yields than the different tillage systems. The yields on eroded soils at the top of the hill were smaller than those at the bottom of the slope, where fertile colluvial material has accumulated over time. An interesting finding has been that winter wheat reacted strongly to poor soil conditions. This has resulted in a yield reduction of approximately 25%, whilst the reduction in yield of rapeseed and maize on poor soils was less pronounced. Overall, yields of all four crops stayed statistically unaffected by the tillage system over the last five years. Considering this, the choice of tillage system could be adapted to the best protection of the soil.



2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
SG	Raps/K-Mais	WW	K-Mais	WW	SG	W-Raps	WW	K-Mais	WW	SG	W-Raps
K-Mais	WW	SG	W-Raps	WW	K-Mais	WW	SG	W-Raps	WW	K-Mais	WW
SG	Raps/K-Mais	WW	K-Mais	WW	SG	W-Raps	WW	K-Mais	WW	SG	W-Raps
K-Mais	WW	SG	W-Raps	WW	K-Mais	WW	SG	W-Raps	WW	K-Mais	WW

Fig 1. a) Field trial, randomized block design with three factors: no tillage, reduced tillage, strip-tillage and the corresponding crop rotation since 2018: Winter wheat ("WW"), corn ("Mais"), summer barley ("SG"), rapeseed (W-Raps); b) Soil map of the field trial with calcaric Regosol, Vertisol, Luvisol, Anthrosol soil types.

Tillage system and yield results discussion

The stakeholders discussed the need to consider a variety of site-related factors before implementing a no-till system. The soil type, stone content of the soil and rainfall all need consideration. For example, direct drilling / seeding is possible for winter wheat after rapeseed with cover crops grown in between. The cover crops need to be sown quickly after the harvest of the rapeseed in order to avoid weed growth and exposed soil becoming eroded, the suggestion was within 24 hours of harvest. Moisture within the soil would also be protected, ensuring a good emergence of cover crops. Discussion on machinery led to the recommendation of using tines rather than discs for most situations. The mix of cover crops suggested includes a combination of Vicia Faba, Pisum, Phacelia and Guizotia Abyssinica.

Discussion also included the controversial use of glyphosate, which is to be banned by 2023. The concern with the ban is that tillage will become more prevalent again, increasing soil erosion in the area. Techniques to enable a no-till system without glyphosate are not yet be available, although some researchers in Europe are testing mechanical destruction methods for cover crops.

In some cropping systems ploughing might be unavoidable. This might be the case in organic farming systems, where mineralization through ploughing is especially important as the use of easily available nutrients through synthetic fertilizers is not allowed. Ploughed soil gets warm earlier in springtime, this is important on sites with a short vegetation period. Where ploughing is unavoidable, it should be done only 7 cm deep.

Feedback

The stakeholders found the demonstration day very useful for discussing cropping systems from different points of view. Having the opportunity to see and discuss the methods being used allowed them to understand which SICS are appropriate for different farm situations.

Stakeholders learnt that parameters such as the number of earthworms, quality of the soil structure, erodibility and crop yields are useful indicators to evaluate soil health. They were also made aware that SICS implementation is dependent on machine availability, site conditions, application of glyphosate and the crop rotation.

A key piece of stakeholder feedback was that regional, site-specific advice is needed for farmers to choose the right technique, appropriate crop rotations and sowing timing.

For more about the SoilCare experiments in Germany please click HERE or contact Ellen Kandeler: kandeler@uni-hohenheim.de

Soil samples cut out by spade. I) Strip-tillage (Plot 33). II) No-tillage (Plot 32), the stratification of the aggregates may only disappear after several years when catch crops regularly root through the soil. The root exudates of the catch crops enhance the development of the soil fauna and by this recover the aggregate stability. III) Reduced tillage (Plot 31), residues were incorporated.

News from the field: Greek demonstration day - preventing soil loss and changing crops from oranges to avocados

In December 2019, Greece also held another demonstration day for local farmers and stakeholders. The group visited two of the farms participating in the SoilCare experiments. One of the Greek Study Sites is managed by an orange and avocado producer in Koufos (Chania Prefecture, Crete). Through the Technical University of Crete (TUC), the SoilCare project is working with the producer to investigate and assess the impact of changing crops, where orange orchards are converted to avocado orchards. Specifically, the quantity of deposition/erosion processes and the sustainability of the production are being assessed.

A second Study Site is an olive orchard at Biolea in Astrikas (Kissamos, Chania Prefecture), where tillage vs no tillage treatment plots are being compared. The aim of these experiments is to assess deposition/erosion processes within the field. The results will be fed into an erosion model calibration which will enable upscaling from farm to regional level.

Demonstration activities

A few farmers attended the demonstration event, including olive growers and others undertaking orange to avocado crop changes. At first, the participants were taken to the olive orchards of Biolea in Astrikas where they were informed about the main aim of the field experiments within two different plot areas, the Control area (no-till) and the Soil Improving Cropping System (SICS) area (tilled).

One of the farmers taking soil samples for laboratory analysis. Photo credit: Ioannis Tsanis

In the orange and avocado producer's field, the participants were told about the innovative SICS techniques that are being assessed for their potential to improve soil quality and mitigate erosion. The avocado orchards incorporate the SICS treatments, which are being compared to the orange orchards, which act as the control treatment.

Although orange cultivation is still a major crop in Crete (mainly in Chania), recently avocado farms are increasing, with a current total production area of 590 ha. A quarter (25%) of the production is exported as surplus, with the total avocado production in Greece roughly 6,600 tn/year.

The change from orange to avocado production is proposed as a sustainable alternative not only for its financial benefits but also to reduce soil erosion. However, to date soil erosion for avocados has not yet been measured and it is now being undertaken by researchers at TUC.

A demonstration of the two treatment areas were given to the participating farmers. These are located within the study field, where the collection of the deposited soil from extreme rainfall events takes place within two sediment traps. Stakeholders were encouraged to join the demonstration activities through monitoring, experimenting and evaluating soils. They collected soil samples and looked at earthworm density to assess the biological quality of the soils.

The SICS sediment trap demonstration of the avocado orchard and active involvement of stakeholders in the soil sample collection process. Photo credit: Ioannis Tsanis

It was a very nice moment of collaboration when the farmer from the neighbouring field asked the team of participants and SoilCare researchers to perform the simple earthworm density experiment, using the mustard technique, in his newly planted avocado field, in order to indicate the biological health and condition of his soil.

The farmer guided the team to another point of interest within his field, to show them a recent and exceptional incident of soil erosion which has been difficult for him to address. After the extreme rainfall events and severe flooding of February 2019 he has noticed new areas of soil erosion forming (rills), which have started to become a major problem. The SoilCare team provided advice on how to remediate this erosion problem.

The farm owner also shared his worries about the orange trees, which have recently developed a black colour on their skin. This new infection needs to be directly addressed by spraying.

New erosion phenomenon within the field area and black colour in orange crops' skin reported by the stakeholders.

Discussion of SICS experiments

Several questions were discussed about the change to avocado orchards, with regard to it being a profitable crop and whether it improved soil quality. The stakeholders agreed that the orange cultivation is no longer advantageous to the producers compared to avocado cultivation. They said that this year oranges are being sold for 0.70 euros/kg whereas avocados are being sold for 2.60 euros/kg.

Despite this, the effect of this crop on maintaining a superior soil quality was queried and stakeholders requested feedback from the TUC research team on soil erosion/deposition quantification process within SoilCare project.

The farmers felt that as the specific SICS implementation would be difficult, they require extensive scientific support and recommendations from the research team both before and after any crop change. This would enable them to undertake any changes or SICS more effectively themselves. The decision to change crops would involve a high economic risk to the farmers, including the high costs per avocado seedling, crop failure risk due to the sensitivity of the avocado to extreme hydrometeorological events, the importance of the soil physical structure and the need for drainage investigation before planting, since avocado crops have particular irrigation and water drainage needs.

Farmers should also take into consideration that it takes five years of avocado growth before a crop can be harvested. In conclusion, although the avocado crop seems a profitable and promising investment, it is also accompanied by a lot of risks for the farmer and should only be adopted after serious consideration of the farm's environmental situation. Tailoring the environment to the irrigation and fertilisation for avocados may be necessary.

Feedback

The stakeholders are willing to participate in further demonstration events, share their insights and concerns with the scientists and other farmers.

They also agreed that they need a continuing education programme to make sure that recommendations are disseminated and followed by avocado growers and avocado grove managers. They strongly supported the organization of workshops that aim to properly inform the farmer on crop switch treatment to avocado orchards.

For more about the SoilCare experiment in Crete please click HERE or contact Ioannis Tsanis tsanis@hydromech.gr

Discussion with a stakeholder converting oranges to avocados during SoilCare plenary meeting 2017 Photo credit: Jane Mills

News from the field: Italian demonstration day - deep-rooting cover crop using tillage radish

The main purpose of this third SoilCare demonstration event in Italy was to show the development of the deep-rooted cover crop "tillage radish" experiments at the University of Padova experimentation site and on a private farm. In total, eight stakeholders participated.

Demonstration activities

During the demonstration day, a private farm was visited where "tillage radish" has been adopted as a winter cover crop. In the field the possible benefits and drawbacks of adopting these practices was discussed. Next, a visit was made to the Padova University experimental farm where the two experiments related to the SoilCare project are situated. Firstly, a trial was visited where the radish life cycle as related to its seeding period is studied. A discussion was held about the possible relationship between seeding date and crop winter kill. Afterwards, the SoilCare main experiment was visited where the cover crop is combined with different types of tillage management. The demonstration ended with an open discussion in the field.

Tillage radish experiments

Tillage system discussion

The main issues raised by stakeholders regarded tillage radish management and its lifecycle. The stakeholders learnt that this cover crop is considered beneficial in terms of soil benefits if sown early, such as reduced compaction and increased soil organic matter. The most suited sowing time was agreed to be September because the crop is sufficiently developed by this stage to generate soil improvements and it may also be susceptible to freezing later in the year.

Feedback

Stakeholders are looking forward to participating in the final SoilCare stakeholder meeting at the end of the next cropping season. They suggested presenting the experimentation results and main findings on the website and developing short guidelines for the successful implementation of SICS. Both of these suggestions are already planned and will be available in 2021.

For more about the SoilCare experiments in Italy please click HERE or contact Antonio Berti Antonio.berti@unipd.it

SICS Focus: Salinization-specific SICS

Each issue of the SoilCare newsletter focuses on soil threat-specific SICS. In this newsletter the focus is on salinization-specific SICS.

Salinization refers to the accumulation of water soluble salts in soil. It leads to a lower soil fertility, poor soil structure, decreased infiltration, lower crop yields, lower biodiversity and biological activity.

Soil salinization can result from the accumulation of salts from natural processes, such as physical or chemical weathering or transport from parent material, geological deposits or groundwater. It can also be caused by seawater intrusion as a result of sea level rise, seawater seepage and seawater infiltration into groundwater, or from the use of salt-rich irrigation water or other inappropriate irrigation practices, and/or poor drainage conditions.

The SoilCare review of SICS (see here) has identified salinization-specific SICS that prevent salinization and/or lower the accumulation of unwanted salts and contribute to improving soil structure. Salinization-specific SICS are highly site-specific, and may involve three mechanisms, (i) changes in input-output ratio's, (ii) substitution, and (iii) redesign.

The first mechanism involves improved drainage through groundwater level control and channelling, reduced evaporation (through mulching), less input of soluble fertilisers, and targeted irrigation with low electrical conductivity (EC) water. The second mechanism involves drip irrigation instead of surface irrigation. The third mechanism includes ridging, (plastic) mulching, and growing tolerant crops.

The most promising salinization-specific SICS (i) reduce the input of unwanted salts into the soil, (ii) decrease the content of unwanted salts in soil, and (iii) minimize the impact of unwanted salts in soil on soil functioning (see Table). The greatest effects can be expected from irrigation and drainage management.

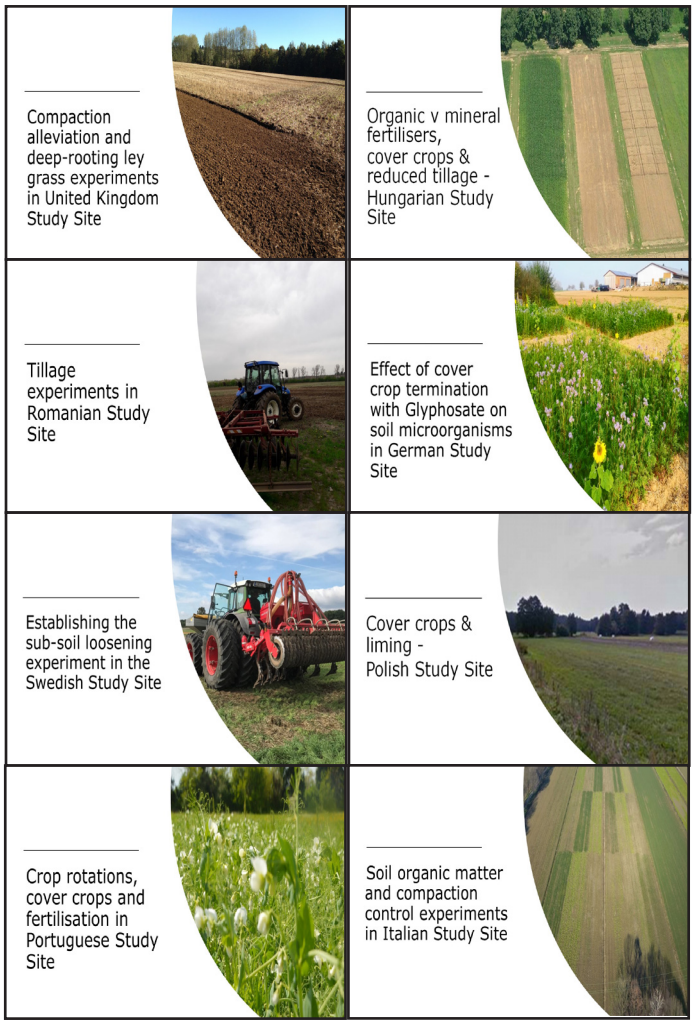
Components of cropping system	Components of salinization-specific SICS	Change in profitability
Crop rotations	When possible/ needed: +salt tolerant crops/ varieties	+
Nutrient management	Minimise salt input	+
Irrigation management	Excess/drip irrigation (leaching fraction), using low salt irrigation water	++
Drainage management	Lower groundwater level	++
Tillage management	Ridging	+
Pest management	Optimal	
Weed management	Optimal	
Residue management	Surface mulching, to lower evaporation	+
Mechanization management	Optimal	
Landscape management	Optimal	

For more information about these different SICS, please visit the SoilCare website here https://soilcare-project.eu/soil-improving-cropping-systems

New SoilCare Study Site Videos

Since the last newsletter, a series of videos have been produced that aim to explain the experiments undertaken in each of the 16 SoilCare study sites.

These videos can be found on the individual Study Site pages on the SoilCare website here, or they can be viewed from the list of videos on the website here.



A further video was produced by the German Study Site showing soil data collection in action!

SoilCare Stakeholder Videos

Some of our study sites (pre-Covid-19), have also been busy interviewing their study sites' farmers and stakeholders for new short videos. These aim to share the perspectives of farmers/ stakeholders on how the experiments have been progressing, and why they were interested to take part in the SoilCare project. We hope that these videos can inspire more farmers and farm advisors to undertake SICS. We also hope that more researchers will be motivated to work directly with farmers.

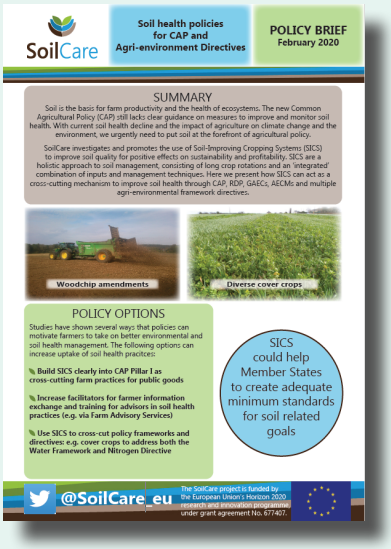
Italian study site farm advisor talks about his work with SICS (Italian with English subtitles)

Swiss study site farmers discuss the use of CULTAN fertilisation technique (English subtitles)

New Publications

Policy brief

The first in a series of SoilCare policy briefs has been produced jointly with WP7 and WP8 entitled 'Soil health policies for CAP and Agri-environment Directives'.



The brief is based on the SoilCare report D7.1 'Inventory of opportunities and bottlenecks in policy to facilitate the adoption of soil-improving techniques.' The aim of the brief is to explain what Soil-Improving Cropping Systems (SICS) are and how policy-makers can incorporate them into current regulatory frameworks. The brief illustrates how SICS are able to cut across policies including CAP Pillar 1 and 2 as well as a range of Directives due to their holistic approach to soil management

The post-2020 CAP provides an opportunity to incorporate SICS through the three overarching environmental objectives on climate change mitigation and adaptation, efficient management of natural resources, as well as protecting and enhancing biodiversity.

A key ask is for the European Commission to take a long-term view in developing soil health. Within this, it must be ensured that Member States allocate enough of the transferable Pillar 1 & 2 budgets to soil health measures. This will include the need for facilitation of knowledge exchange and therefore increasing the capacity of farm advisory services.

SICS Erosion Factsheet

The first in a series of soil-threat specific factsheets has been produced, this one focusing on erosion. The factsheets are farmer-facing to enable knowledge sharing and encourage the uptake of SICS which can help remediate specific soil threats.

A range of SICS components are suggested to help tackle erosion and increase soil health. Crop rotations, tillage management, crop residues / mulching and landscape management can be combined depending on suitability for the farm and its situation. The factsheet can be downloaded here.

New Journal articles

Rust N.A., Ptak E.N., Graversgaard M et al. Social capital factors affecting uptake of sustainable soil management practices: a literature review *Emerald Open Res* 2020, 2:8 (https://emeraldopenresearch.com/articles/2-8/v2)

Aznar-Sánchez J.A., Velasco-Muñoz J.F., Galdeano-Gómez E., Del Moral-Torres F. (2020) Smart Agricultural Waste Management in Traditional Mediterranean Crops. In: Hussain C. (eds) Handbook of Environmental Materials Management. Springer, Cham.

Past Events/Presentations

12/11/2019 - Stakeholder demonstration day in Brittany, France
13/11/2019 - Stakeholder demonstration day in Tachenhausen, Germany
13/11/2019 - Stakeholder demonstration day in Almeria, Spain
3/12/2019 - Stakeholder demonstration day in Chania, Crete
01/2020 - Oral conference presentation Plantekongres Session 52, Denmark
11/02/2020 - Stakeholder demonstration day in Prague-Ruzyně, Czech Republic
19/02/2020 - Stakeholder demonstration day in Legnaro, Italy

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.

PROJECT PARTNERS

1 Wageningen Environmental Research, The Netherlands
2 University of Newcastle upon Tyne, United Kingdom
3 KU Leuven, Belgium
4 University of Gloucestershire, United Kingdom
5 University Hohenheim, Germany
6 Research Institute for Knowledge Systems, The Netherlands
7 Technical University of Crete, Greece
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22 University of Pannonia, Hungary
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25 Crop Research Institute, Czech Republic
26 University of Almeria, Spain
27 Fédération Régionale des Agrobiologistes de Bretagne, France
28 Scienceview Media B.V., The Netherlands
29 Milieu Consulting SPRL, Belgium

Participants at the SoilCare 4th Plenary meeting 2nd - 5th April 2019 in Almeria, Spain (Photo: LA VOZ)

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For further details about the project please email rudi.hessel@wur.nl

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