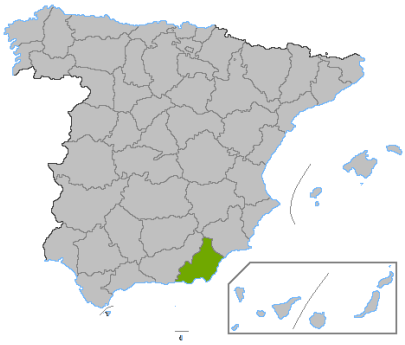
Spain study site experiment 2: SICS FOR IMPROVING SOIL HEALTH IN TABERNAS, SPAIN

The problem

The main soil threats facing olive groves in Tabernas, Spain, are desertification, the loss of soil organic matter, and soil erosion.



The proposed solution

It was expected that altering irrigation from continuous to regulated deficit irrigation may improve productivity.

In addition, using various soil treatments including cover crops and pruning residues was also expected to increase soil organic matter and reduce erosion.

Experimental design

Experiment 1. Standard irrigation (1443 m^3 randomised blocks)

Treatment	Colour	Irrigation
Minimum tillage, bare soil	Blue	Standard irrigation
Minimum tillage after cover crops	Brown	Standard irrigation
Minimum tillage plus pruning residues	Green	Standard irrigation

Experiment 2. Regulated deficit irrigation (same 1443 m^3 considering critical periods).

Treatment	Colour	Irrigation
Minimum tillage, bare soil	Blue	Regulated deficit irrigation
Minimum tillage after cover crops	Brown	Regulated deficit irrigation
Minimum tillage plus pruning residues	Green	Regulated deficit irrigation

SoilCare is funded by the EU's Horizon 2020 research and innovation programme.
Grant agreement No. 677407

SoilCare

Spain study site experiment 2: SICS FOR IMPROVING SOIL HEALTH IN TABERNAS, SPAIN

Parameters measured: Stem water potential, Flowering, Fruit set, Yield, Fatty content, New shoots growth

Results

Continuous deficit irrigation represents the current irrigation schedule put in practice by the owner due to the strong restriction in water availability and regulation in the area (Tabernas desert). Under this severe scenario, adding chopped pruning wood or growing cover crops is challenging due to a lack of water availability.

The estimated yields based on fruit set which were measured in each treatment and yield per plot suggest that deficit irrigation alongside disposing of pruned wood chopped between tree rows, can result in higher yields.

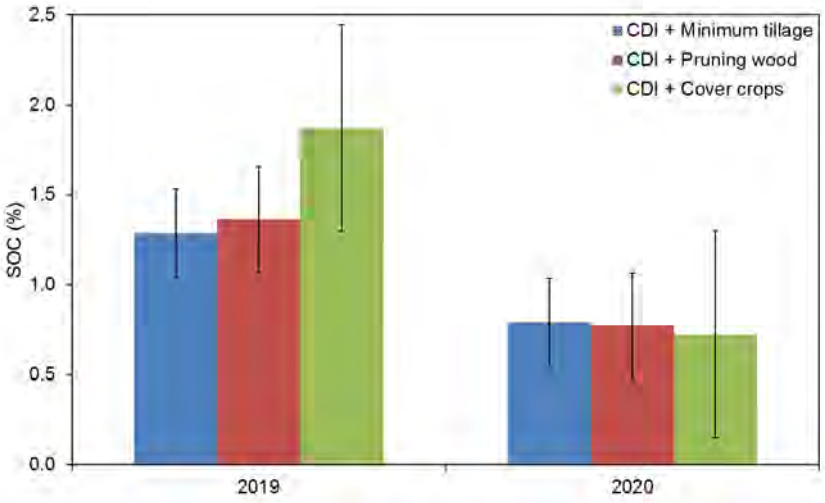


Figure 1. Soil Organic Content versus treatments

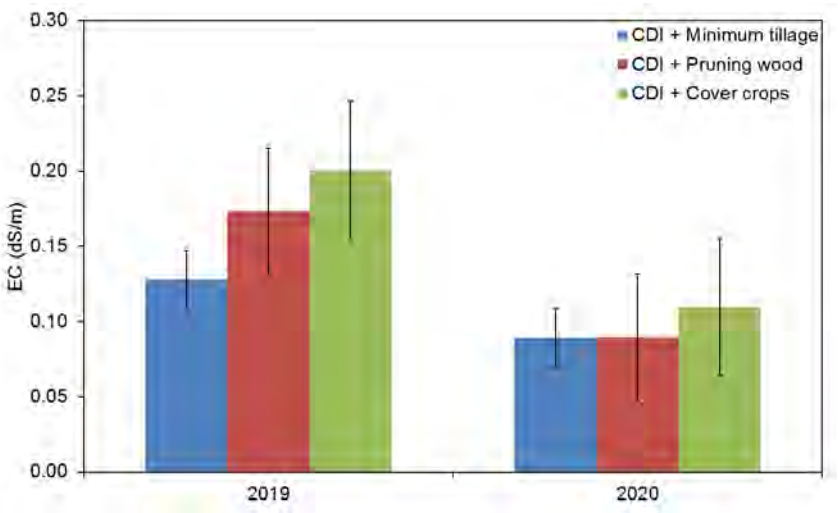


Figure 2. Soil Electric Conductivity versus treatments

Cover crops had mixed results: positive in the first year, but slightly negative in the second. An improvement in organic matter was limited to the first season, suggesting that this depends on weather conditions. As observed previously in the experiments carried out in Agua Amarga, cover crops seem to result in significant increases in electric conductivity.

The reasons for these effects are unclear and deserve close monitoring. The short-term results, however, encourage the implementation of both SICS.

SoilCare is funded by the EU's Horizon 2020 research and innovation programme. Grant agreement No. 677407

SoilCare

Spain study site experiment 2: SICS FOR IMPROVING SOIL HEALTH IN TABERNAS, SPAIN

Results

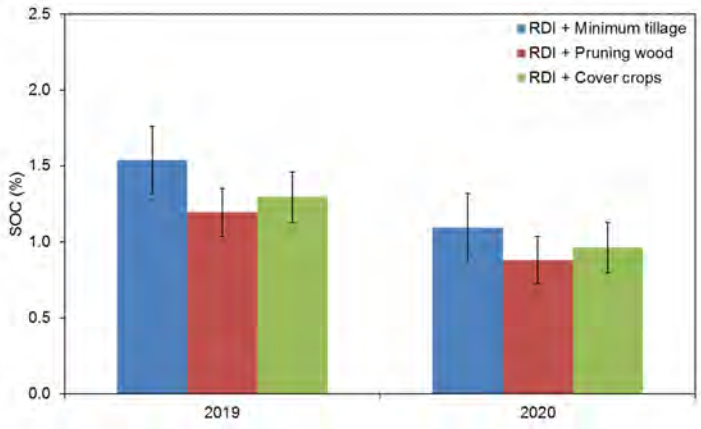


Figure 3. Soil Organic Content versus treatments

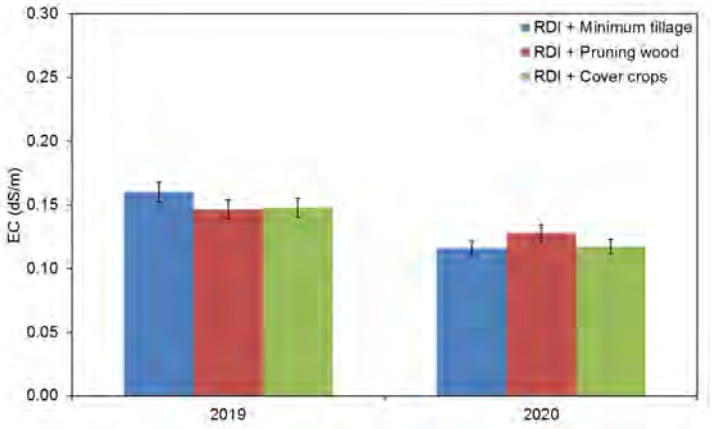


Figure 4. Soil Electric Conductivity versus treatments

Economic analysis

There are no data on economic benefits for this study.

Although no water savings were observed, there was an improved distribution of water resources over the course of the year which allowed an increase in fruit quality. There was a trade-off between the increase and decrease of some costs which means no significant impacts were observed.

Stakeholder analysis

- Farmers discussed the benefits of planting adventitious root grass or cover crops in olive groves and were concerned about the scarce water supply and low rainfall.
- Farmers recognised the benefits of cover crops for increasing nutrient availability
- Stakeholders remarked that the study was too short term to obtain robust results, with a consensus emerging that the effects of practices are only observable in the long-term
- Despite the results being non-significant, farmers still saw the results of this study as useful as positive trends began to emerge.
- The study has had an impact on the case study farmer, who is now going to plant a cereal cover crop every year and will also use controlled deficit irrigation as proposed by SoilCare researchers.

Barriers preventing the adoption of controlled irrigation and mulch cover with pruning

- Maladapted policy setup
- Farmers' resistance for new practices
- Lack of awareness and information
- Lack of access to technology and machinery
- Lack of enforcement and monitoring
- Water scarcity
- Operational costs
- Size of exploitation

No enablers were identified for this SICS

SoilCare is funded by the EU's Horizon 2020 research and innovation programme. Grant agreement No. 677407

SoilCare

Spain study site experiment 2: SICS FOR IMPROVING SOIL HEALTH IN TABERNAS, SPAIN

Key findings

This experiment aimed to determine if adopting regulated deficit irrigation instead of continuous deficit irrigation might increase profitability whilst improving soil quality. The rationale behind this experiment was to apply less water on the olive groves during less sensitive periods whilst increasing irrigation rates during critical phases (blooming and setting).

The results reject the initial hypothesis, since yields were higher under CDI (Exp. 2) and fat content did not change significantly. This finding was particularly pronounced in year 1 of the study. Electric conductivity did not change in this experiment.

The differences among soil management treatment were small and non-significant. The content of organic matter was increased under Continuous Deficit Irrigation the fist season, but not in the second. On the contrary, a trend towards higher electric conductivity was detected by using cover crops. Similar results were observed in the second experimental site (Aguamarga).

Contrary to what was observed in the experiment carried out under Continuous Deficit Irrigation, the use of cover crops did not lead to increased soil salinization (EC) when regulated deficit irrigation was imposed. No increase in organic matter was observed either. This was, however, likely due to the short term nature of the trial and the problems associated with having seedlings established in dry autumns-winters.

Conclusions

The negative economic impact of the SICS applied was due to the acquisition of equipment to perform the tasks associated with the SICS. Positive effects on soil characteristics are expected after prolonged use of both SICS, but differences were not huge nor consistent in the short term.

As previously observed in Experiment 1, in Aguamarga, a deterioration in electric conductivity was observed by using cover crops. It is not easy to explain these findings, thus further research is needed in the future, particularly due to the serious threat posed by salinization in the Taberanas area of Spain.

As a result of this experiment, the field owner has decided to switch from Continuous Deficit Irrigation to Regulated Deficit Irrigation and use temporary cover crops.

Fact sheet authors

F. M. Chiamolera, V. Pinillos, F del Moral, J. Cuevas, JJ Aznar and E Galdeano J. Mills, and C. Chivers

Contact information

Project website: soilcare-project.eu

Study site leader: Julian Cuevas jcuevas@ual.es

Project coordinator: Rudi. Hessel rudi.hessel@wur.nl

SoilCare is funded by the EU's Horizon 2020 research and innovation programme. Grant agreement No. 677407

SoilCare