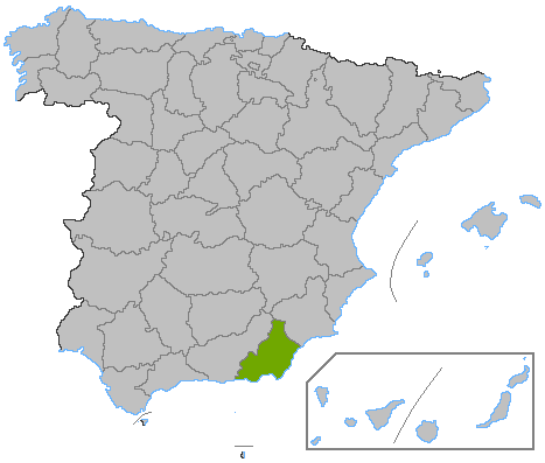
Spain study site experiment 1: IRRIGATION AND SOIL MANAGEMENT TREATMENTS FOR IMPROVING SOIL HEALTH

The problem

The Aguamarga experimental site in South East Spain (Almería) suffers from desertification, wind erosion, and organic matter decline. The climate is semi-arid. Rainfall is low in the region (<300 mm per year.



The proposed solution

Soil-improving cropping systems, including deficit irrigation and top soil management, were expected to increase soil fertility and reduce wind erosion whilst increasing fruit production and quality.

The study site was located on a high density commercial peach orchard. A total of six different treatments relating to irrigation and soil management were used. There were 3 blocks and each treatment was replicated 3 times.

Experimental design

Treatment	Key	SICS/control?
Full irrigation (FI)		Control
Regulated deficit irrigation (RDI)		SICS
Non-tillage	1,3	Control
Temporary weeds	2,4	SICS
Temporary cover crops	5,6	SICS

The parameters measured were:

- Water savings
- Plant water status
- Soil organic matter
- Electric Conductivity
- Flowering and harvest dates
- Fruit set and quality, and yield
- Pruning requirements

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Results

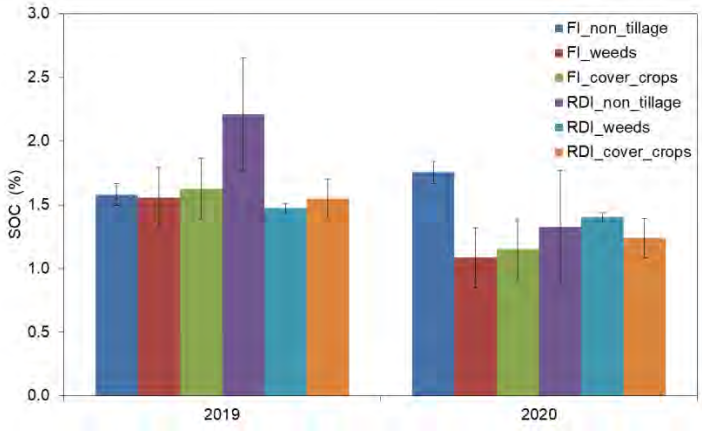

Figure 1. Soil Organic Content versus treatments

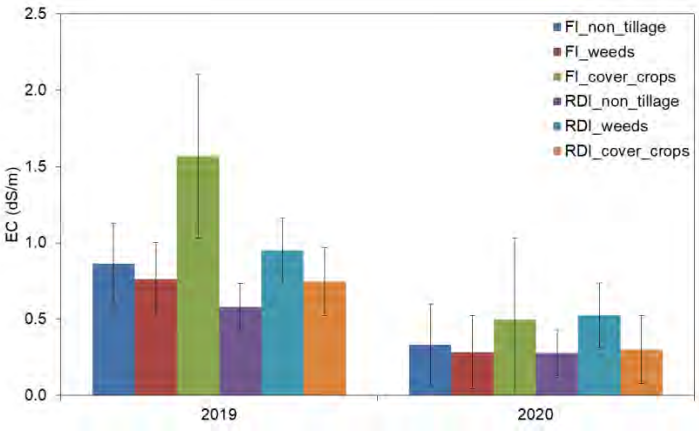

Figure 2. Electric Conductivity versus treatments

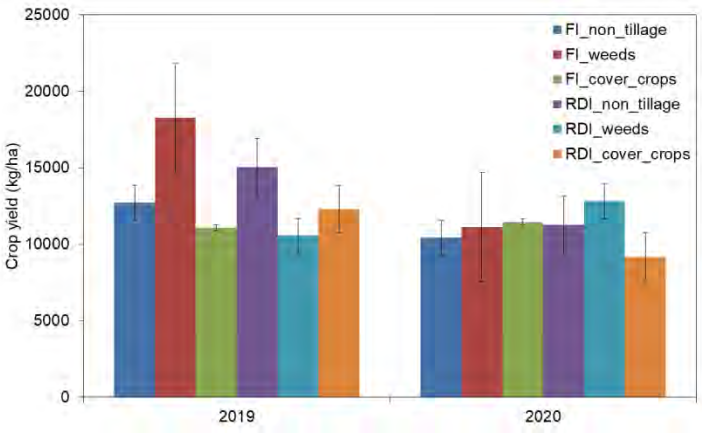

Figure 3. Crop yield versus treatments

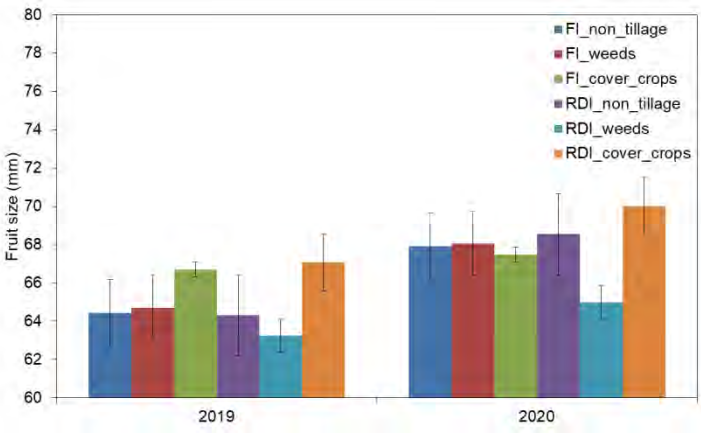

Figure 4. Fruit size versus treatments

The application of different combinations of irrigation and top soil managements did not result in significant differences in yield (Figure 1) or fruit quality during either year of the experiment.

The intended reduction in pruning needs as a result of reducing tree vigor was not accomplished. Roughly the same amount of wood was removed in all treatments and the same amount of time was needed for pruning. Fruit quality, estimated by size, skin color and sweetness, was not significantly affected by the SICS either.

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Stakeholder analysis

- Farmers expressed interest in knowing the impacts the methods had on production yield and quality as a certain positive impact was achieved in both quality and yield. However, such improvements in quality and yield are not common when applying deficient irrigation.
- Stakeholders pointed out the need for a longer term study to obtain more robust results and further investigate the benefits of these practices.
- Some farmers still appear to hold the view that soils should remain bare over winter
- Farmers were, in some cases, reluctant to consider cover cropping due to a perception that it would increase risk of pest infestations

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Enablers of controlled deficit irrigation and vegetative ground cover:

- High provision of inputs
- Dissemination of efficiency potential as wind erosion control
- Access to technology / machinery
- Possibility of management agreements

Barriers preventing the uptake of controlled deficit irrigation and vegetative ground cover:

- Lack of enforcement and monitoring
- Farmers' resistance to new practices
- Plant cover selection
- Lack of training for farmers

Economic analysis

There are no data on the economic benefits for this study.

Positive results have, however, been obtained with regard to cost savings, primarily due to the reductions in water consumption.

As for the rest of the items that come with a cost, the resulting trade-off meant no significant impacts could be observed. In relation to crop yield and quality, there was a positive impact.

Key findings

Soil characteristics did not change in the short term. However, an unexpected increase in EC was observed where cover crops were used (Figure 3). It is difficult to deduce clear explanations from this short-term experiment. Further research is needed as there may be sustained impacts of using these SICS.

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Key findings

Although no significant results were obtained during this experiment, there were some benefits of using the SICS tested in this experiment. For example, there were higher yields in 2019 under some treatments. In 2020, however, yields were similar in 2020 regardless of treatment. This was as expected in a crop where fruit load is adjusted by hand thinning. Water savings achieved by regulated deficit irrigation (RDI) added some benefits too.

However, it seems that allowing the growth of weeds and/or cover crops under RDI resulted in lower profitability. In addition, these approaches may pose certain risks if weed and cover crops are not eliminated on time, including a risk of lower yields.

As a result of the SoilCare experiments, the owner of the experimental site has decided to increase water savings by adopting Deficit Irrigation strategies, thus reducing their water usage by 25%,

Conclusions

Water savings (8-15% depending on the year) were achieved in an area with severe limitations in water availability without negative effect on yield or fruit quality.

This water saving was possible because the levels of water stress measured by stem water potential were mild and limited to the hotter periods of summer, a postharvest period for peaches, which are harvested between April and May.

Plant vigor was not obviously controlled by deficit irrigation and pruning wood and time needed for its execution was not significantly reduced. Fruit quality was not affected, since fruit size, color, and sweetness was not modified by any SICS.

The implementation of different SICS resulted in positive socio-cultural impacts. The improvements in the soil properties were modest when measured in the short term, but it was higher for the cost-benefits.

The most important impact of the SICS tested here related to the social capital and reputation gained by the land manager. This is particularly important in this experimental site, since it is located within a National Park where regulations are very strict. Therefore, the land manager not only complied with mandatory regulations, but also adopted practices that improved sustainability and their reputation.

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