

# Switzerland experiment 2: GREEN MANURE AND MINIMUM TILLAGE FOR AVOIDING GLYPHOSATE USE

## The problem

The major soil threats existing at this site include compaction, erosion, decline in SOM, decline in soil biodiversity, and soil contamination (excess of nutrients, persistent organic pollutant).

The soil-improving cropping systems tested here aimed to result in increased biodiversity and SOM whilst reducing soil erosion, reducing the need for pesticides (mustard green manure suppresses weeds), alleviating soilborne diseases and nematodes, and improving water infiltration rates. The effect on biodiversity, yield and quality were important properties to investigate.

## The proposed solution

Green manuring and minimum tillage were used between crop rotations to minimise or eliminate reliance on glyphosate.

The main objective of the experiment was to compare the effects of glyphosate use for destroying the green manure applied in the field which results in bare soils, against green manure being left in the field. The experiment was established in June 2018 and was set up in control versus treatment (elementary) experimental design. The treatments are replicated three times in two different experimental fields.

## Experimental design

The management operation in the fields included minimum tillage (disk harrow at 5 cm). In one field (FD5) the main crops were: 2019: sugar beet, 2020: onions. For the other field (FD6), the main crops are: sugar beet (2019) and potatoes (2020). The green manure included the following crops: Large grain legumes, sunflower, phacelia and oats. Different fertilizers were applied to both fields as well as several chemicals (pesticides, insecticides etc.) according to the needs. In this study, the SICS were compared to control:

- Control: Conventional agriculture. Green manure and glyphosate.
- SICS: Green manure (intercropping), minimum tillage, reduced use of pesticides (no glyphosate, fungicide applications).

## Results

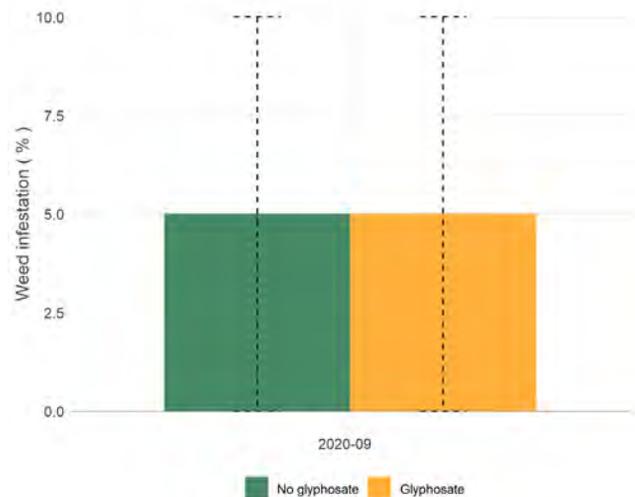


Figure 1. Weed infestation levels in plots treated with and without Glyphosate. The use of minimum tillage and green manures appears to be just as effective at controlling weeds as glyphosate.

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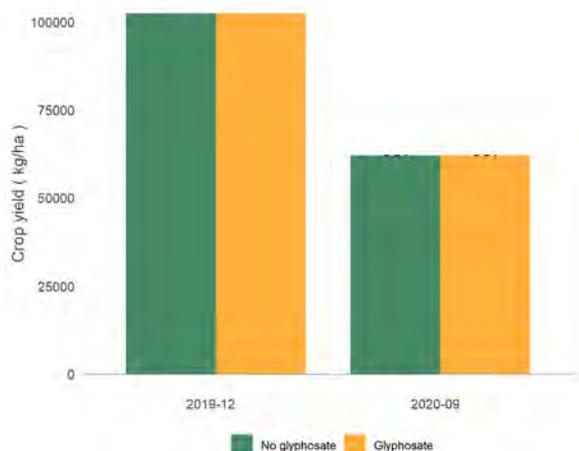


Figure 2. Crop yields (kg/ha) in plots treated with and without glyphosate. Yields did not differ between plots, indicating that Glyphosate may not be necessary for maximising yields. Green manures and minimum tillage may deliver the same levels of productivity as Glyphosate.

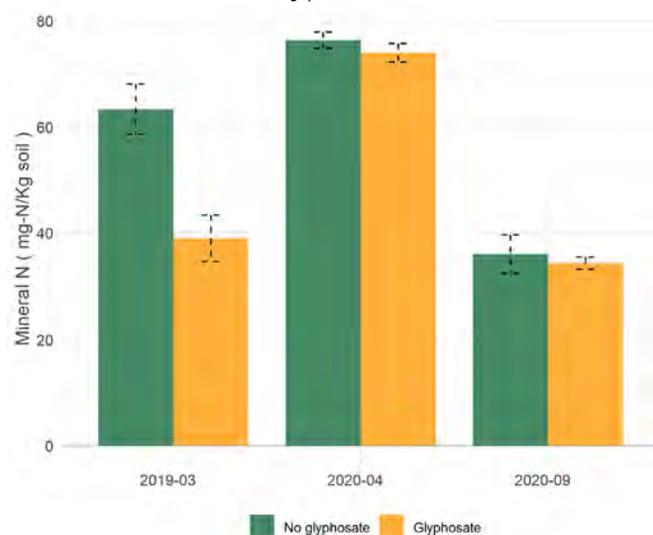


Figure 3. Mineral N (mg-N/kg soil) was higher in plots not treated with glyphosate in year 1 before becoming less significant in following years. Mineral N levels do, however, remain slightly higher in the green manure and minimum tillage plots, suggesting that this treatment may make more N available to crops.

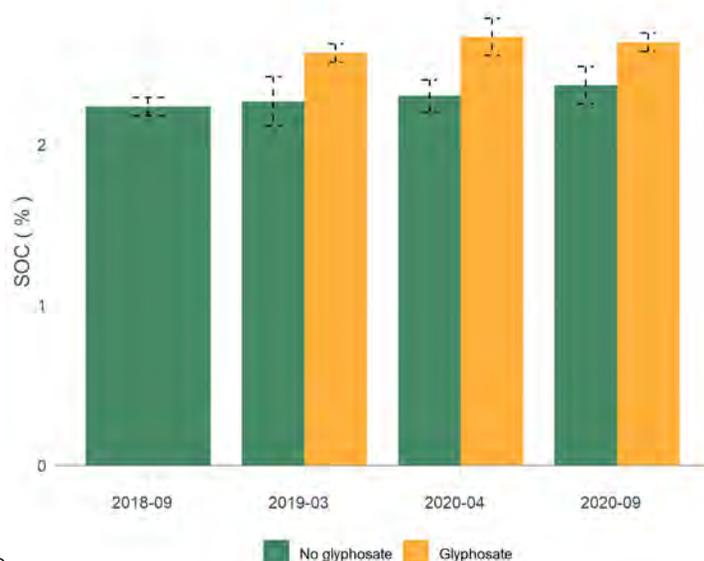


Figure 4. Soil organic carbon (SOC) was slightly higher in plots where glyphosate was applied.

## Key findings

The results obtained while comparing the performance of SICS with the control consisting attest to the potential of green manures as offering an alternative to pesticides.

The main drawback of the SICS was the perceived risk that some plants or weeds might survive winter. This would negatively affect the quality and quantity of the following sugar beet crop. The practices of some farmers are far removed from sustainable farming. There is, therefore, a need to encourage and support them in the transition away from pesticide use. It is, however, important to recognise that sustainable beet cultivation is not yet well established. In addition, pests can lead to a significant loss in yield. These considerations show that without concrete support such as subsidies, this task will be challenging.



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## Conclusions

The results reveals no difference between most properties when comparing the SICS and the control, e.g., Ksat, bulk density, mineral nitrogen, pH, crop yield, crop cover characteristics and weed infestation.

For the aggregate stability and SOC, there was a slight deterioration due to the SICS implementation (Fig 4). These results should be seen in the context of a transition phase between the extensive use of glyphosate and the non glyphosate use and should be considered as encouraging.

There are two main challenges to address when encouraging farmers to adopt sustainable management practices: (i) inform the farmer about the impact of using pesticides on environmental, animal, and human health, and (ii) support financially the farmer for the complete transition.

## Fact sheet authors

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