Belgium study site experiments 2 & 3: SOIL CULTIVATION AND SOIL COVER IN MAIZE ROTATIONS

The problem

Crop production in Flanders, Belgium is generally highly intensive with high inputs and high yields. However, there are increasing problems with soil erosion and compaction, low soil organic carbon content and high phosphorus content.

The proposed solution

These experiments sought to improve soil health in maize crops through various forms of reduced tillage and better soil coverage during the winter. The goal of these SICS was to reduce soil erosion and compaction.

Experimental design

The experiments involved 4 or 5 treatments and 4 replications laid out in strips. The treatments were:

- Conventional ploughing
- Non-inversion tillage
- Strip till in dead grass or mustard&phacelia cover
- Strip till in living grass cover (only experiment 2)
- Undersowing with grass simultaneously (exp. 2) or after maize sowing (exp. 3)

Replications: 4

The measurements taken were:

- Soil organic carbon
- Infiltration rate
- Bulk density and aggregate stability
- Mineral N (0-90cm)
- Crop establishment and yield

Experiment 2	Experiment 3
Ploughing	Strip till (mustard+phacelia)
Undersowing (grass)	Non-inversion tillage
Strip till (living grass cover)	Ploughing
Non-inversion tillage	Undersowing (grass)
Strip till (dead grass cover)	
Undersowing (grass)	Undersowing (grass)
Ploughing	Ploughing
Non-inversion tillage	Strip till (mustard+phacelia)
Strip till (dead grass cover)	Non-inversion tillage
Strip till (living grass cover)	
Strip till (living grass cover)	Strip till (mustard+phacelia)
Strip till (dead grass cover)	Non-inversion tillage
Noninversion tillage	Undersowing (grass)
Undersowing (grass)	Ploughing
Ploughing	
Undersowing (grass)	Ploughing
Ploughing	Undersowing (grass)
Non-inversion tillage	Strip till (mustard+phacelia)
Strip till (dead grass cover)	Non-inversion tillage
Strip till (living grass cover)	

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

SoilCare

Belgium study site experiments 2 & 3: SOIL CULTIVATION AND SOIL COVER IN MAIZE ROTATIONS

Results

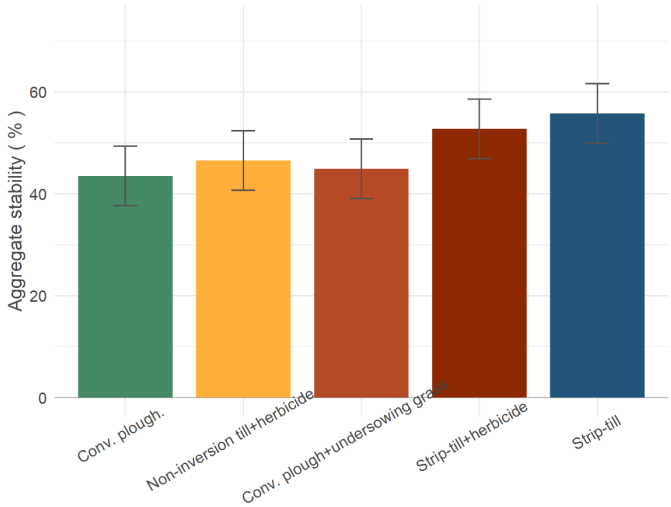

Figure 1. Aggregate stability in experiment 2. There were no significant differences found, however, strip till resulted in slightly higher stability than the other treatments.

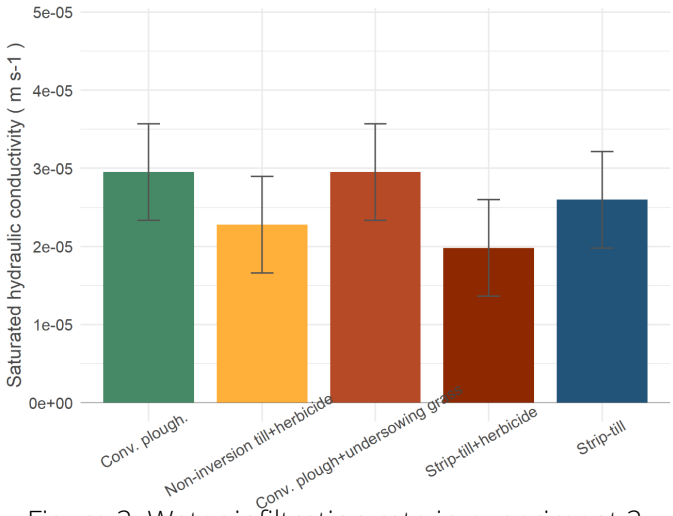

Figure 2. Water infiltration rate in experiment 2. There were no significant differences found.

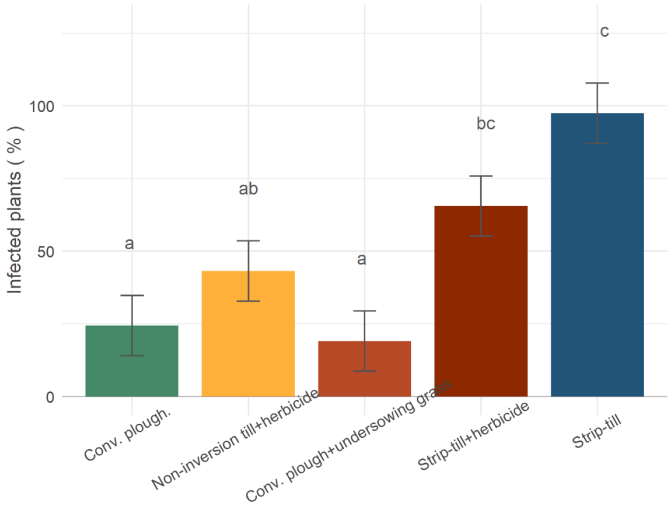

Figure 3. Infected plants by wireworms (%) in experiment 2. Strip tillage resulted in significantly more plant infections than the other treatments.

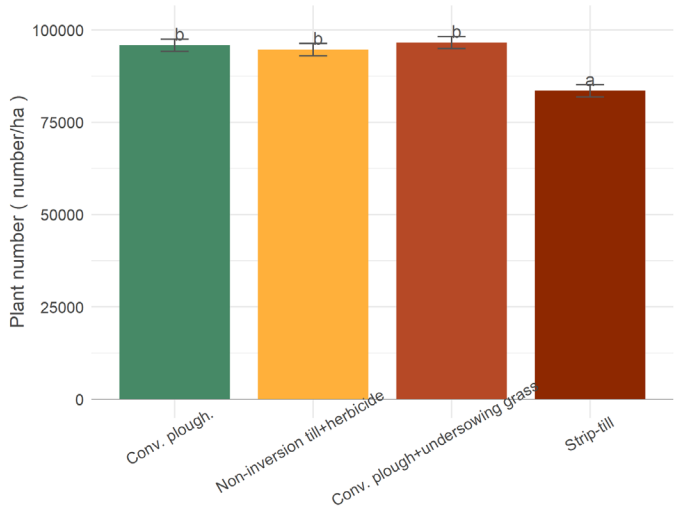

Figure 4. Number of plants in experiment 3. Due to inaccurate sowing of the maize, strip tillage resulted in significantly less plants than the other treatments.

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

SoilCare

Belgium study site experiments 2 & 3: SOIL CULTIVATION AND SOIL COVER IN MAIZE ROTATIONS

Results

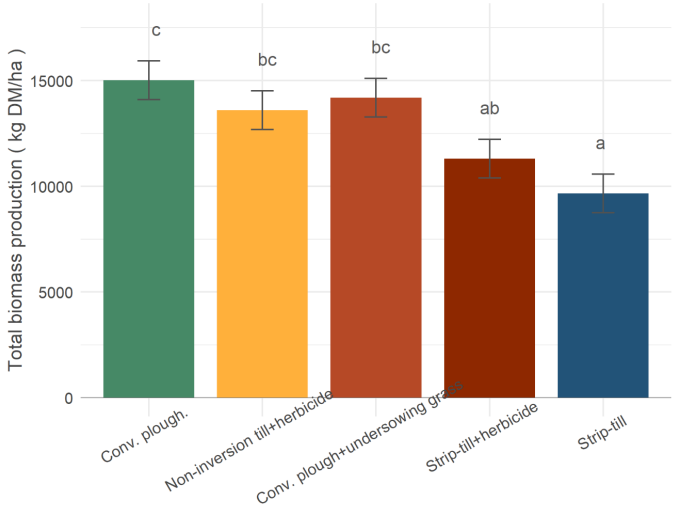

Figure 5. Total biomass production in experiment 2. Significant differences were found, with strip-till resulting in irregular and consistently lower yields.

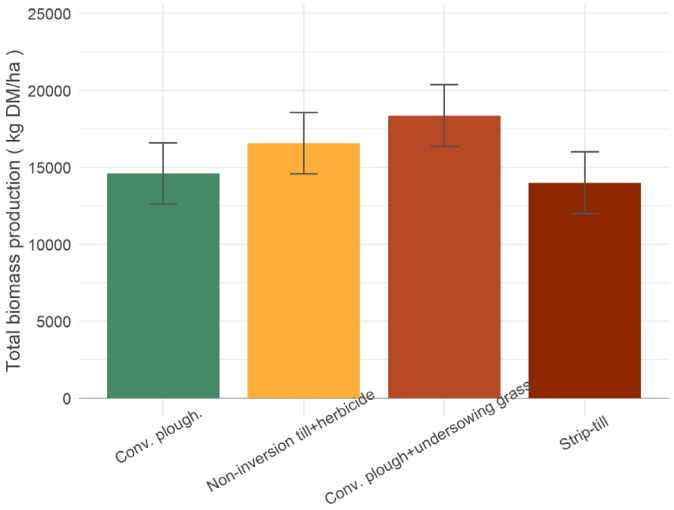

Figure 6. Total biomass production in experiment 3. No significant differences were found.

Variable	Significant difference due to cultivation/cover?
Soil organic carbon	No
Infiltration rate	No
Bulk density	No
Aggregate stability	No (but higher in strip till)
Mineral nitrogen	No
Crop establishment	Yes in experiment 2: significant losses under strip till due to wireworm infestations. in experiment 3: significant plant losses due to inaccurate sowing.
Crop yield	Yes in experiment 1: lower/irregular yields under strip till

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

SoilCare

Belgium study site experiments 2 & 3: SOIL CULTIVATION AND SOIL COVER IN MAIZE ROTATIONS

Stakeholder feedback

- Farmers shared mixed views surrounding the observed effects of the SICs tested here, with 40% finding them plausible and logical whilst others expected a greater effect on mineral N, a different result surrounding crop yield, or a more positive effect on soil structure
- Grass undersowing was seen as a useful soil cultivation technique by many farmers, with 44% stating that they either apply this or would consider applying this in maize to increase soil quality
- No farmers were open to the idea of using strip tillage in maize due to the cost, risks, and practical feasibility.

According to the stakeholders, there are several barriers and enablers surrounding strip tillage in maize.

Enablers:

- Strip tillage can prevent soil erosion which is costly to farmers
- Prevention of soil compaction, a soil threat facing many farmers with profound implications for productivity
- The maize can often act as a contractor crop, making farmers more money

Barriers

- Cover cropping can result in lower yields under certain conditions
- There can also be an increased need for pesticides which are costly to farmers
- Many farmers may need new machinery to be able to plant cover crops

Key findings

Strip tillage in maize:

- There are serious bottlenecks regarding practical implementation, ecological impact (Roundup for destruction of grass cover) and pest control (wireworms).

Grass undersowing in maize:

- The context of CAP greening measures and derogation rules regarding cover crops are important to note when considering adopting this SICS.
- Knowledge and expertise are required in terms of when to undertake undersowing, sowing technique, grass species, and weed control.
- Results varied depending on the weather conditions.
- Promising technique for erosion prevention, reduction of nitrate leaching and improving soil organic carbon content.

Fact sheet authors

Mia Tits, mtits@bdb.be

Annemie Elsen aelsen@bdb.be

Contact information

Project website: soilcare-project.eu

Study site leader: aelsen@bdb.be

Project coordinator: Rudi.Hessel@wur.nl

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

SoilCare