Belgium study site experiment 1: ORGANIC SOIL AMENDMENTS FOR IMPROVING SOIL ORGANC MATTER CONTENT AND SOIL WATER BALANCE

The problem

Crop production in Flanders, Belgium is, in general, intensive with high inputs and yields. As a result, there are increasing problems with low soil organic carbon content, soil erosion and compaction and high phosphorus content.

The proposed solution

This experiment used different types of organic soil amendments to determine whether they alleviate any of the soil-health problems faced in Flanders, Belgium. These plots were compared against plots where mineral fertilisers were applied.

Experimental design

The experiment involved 5 treatments and 4 replications, laid out in strips and compared with control strips without fertilization or where only mineral fertilisers were applied.

The treatments applied were:
- Only mineral fertilizers
- VFG compost
- Wood chips
- Solid pig manure
- Solid pig manure and lava grit

The rotation was: winter wheat (+ cover crop of yellow mustard), winter barley (+ turnips) and potatoes

The measurements taken were:
- Soil organic carbon
- Infiltration rate
- Bulk density and aggregate stability
- Mineral N (0-90cm)
- Crop establishment and yields

Solid pig manure
VFG compost
Wood chips
Only mineral fertilizers
Solid pig manure + lava grit
Wood chips
Solid pig manure and lava grit
Solid pig manure
VFG compost
Only mineral fertilizers
Solid pig manure and lava grit
Only mineral fertilizers
Solid pig manure
VFG compost
Wood chips
VFG compost
Only mineral fertilizers
Wood chips
Solid pig manure and lava grit
Solid pig manure

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Grant agreement No. 677407

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Results

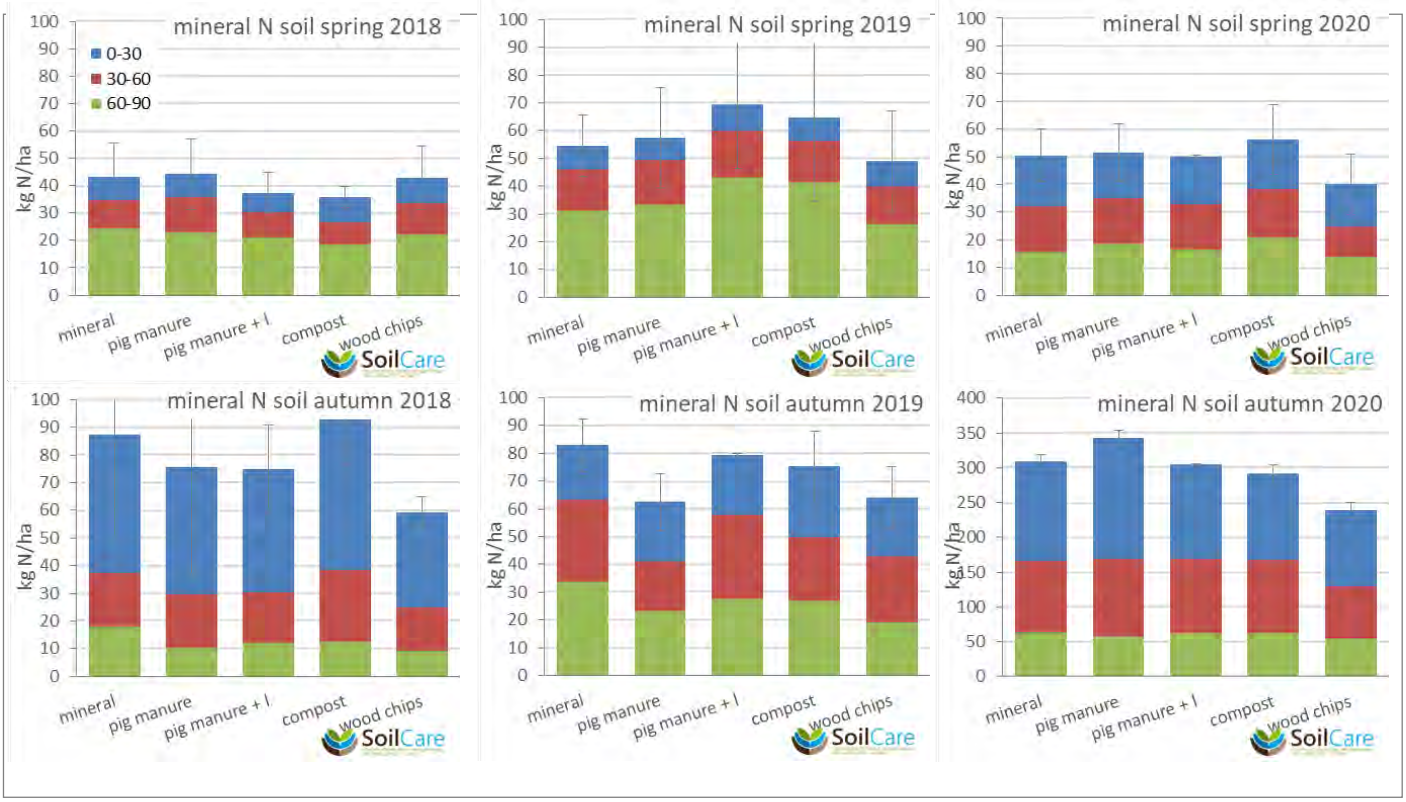

Figure 1. Mineral N in the soil profile in spring and autumn during 3 years after the incorporation of organic soil amendments; visible N-immobilization effect of wood chips in autumn 2018

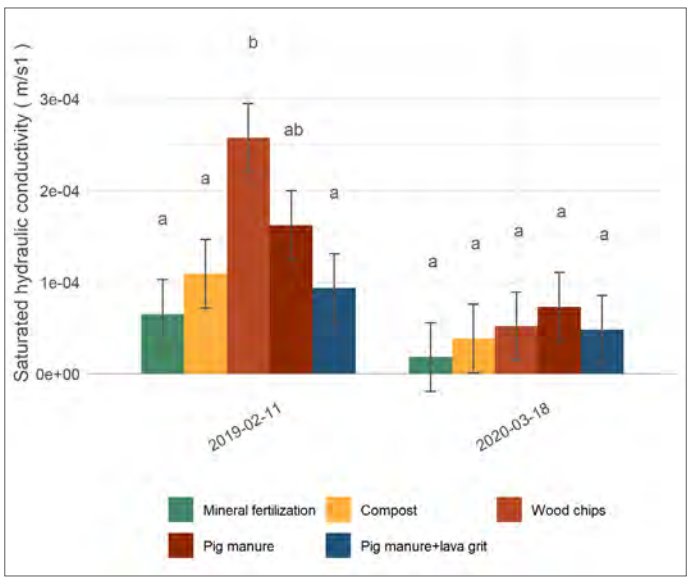

Figure 2. Water infiltration rate after incorporation of organic soil amendments; significant positive effect of wood chips

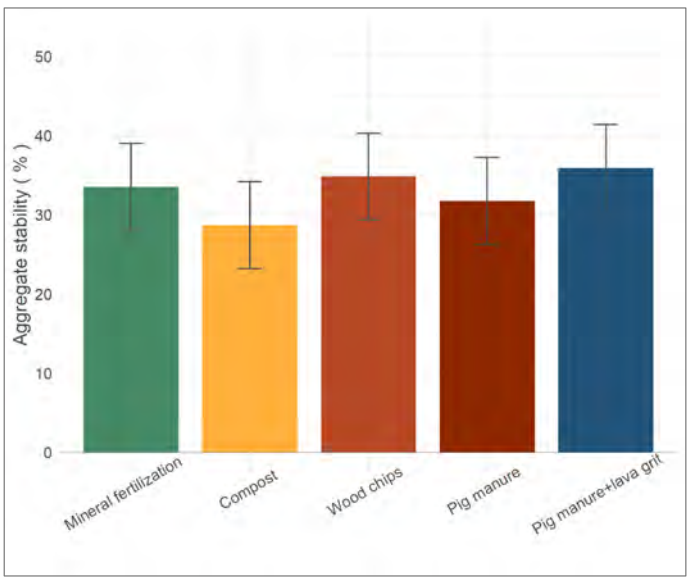

Figure 3. Stability of soil aggregates after incorporation of organic soil amendments; no significant differences measurable

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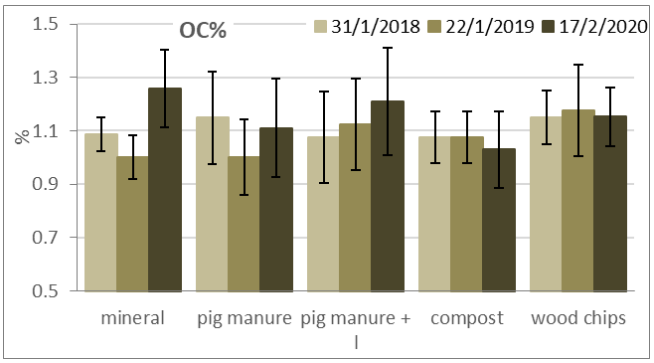

Figure 4. Soil organic carbon after incorporation of organic amendments; no significant differences.

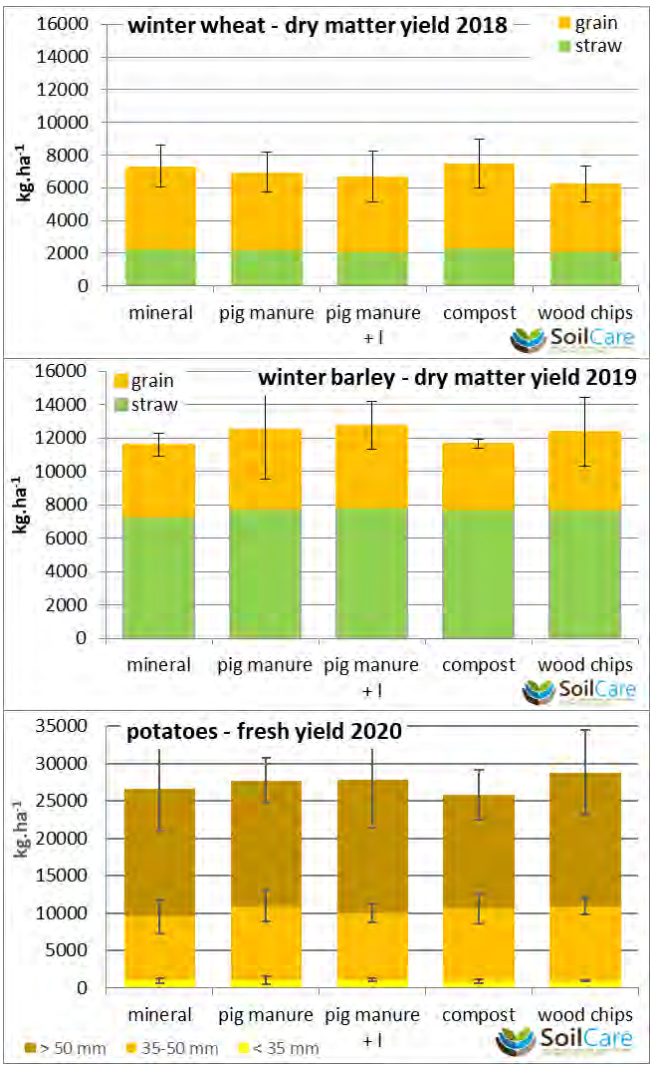

Figure 5. Crop yields during 3 years after incorporation of organic amendments; no significant differences.

Variable	Significant differences due to soil amendments?
Soil organic carbon	No (but highest in wood chips)
Bulk density	No (but lowest in wood chips)
Infiltration rate	Wood chips > only mineral
Aggregate stability	No (but highest in wood chips)
Mineral nitrogen	No (but temporary N immobilization observed)
Crop establishment	No
Crop yield	No

Economic impact

The costs and workload associated with woodchips were higher than applying pig manure.

Agricultural management technique	Incorporation of solid manure (control)	Incorporation of woodchips (SICS)
Investments costs	77	2078
Maintenance costs	0	0
Production costs	0	0
Benefits	2964	2806
Summary=benefits-costs	2887	728
Percentage change	296.5	

Summary of the benefits of woodchips in comparison to solid manure, the numbers are in euro/ha.

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Stakeholder feedback

- 80% of stakeholders believed the results were logical and plausible with the remaining 20% expecting different results relating to yield
- After seeing the results, a third of farmers said they would like to apply woodchips on their fields (versus 27% compost, 22% solid manure)
- Some farmers said it would be useful to have a longer term trial
- Farmers do not seem concerned about negative risks associated with applying woodchips

Factors encouraging the adoption of woodchips:

- Sufficient supply of woodchips
- If farmers used or purchased machinery collaboratively, this would make uptake of organic soil amendments much easier to achieve

Barriers preventing the adoption of grass leys in the rotation:

- Costs of implementation to farmers
- Inconsistent legislation which prevents farmers from acting in the long-term or taking up new measures
- Insufficient awareness of the advantages of using these amendments amongst farmers

Key findings on wood chips

- No measurable differences in **soil organic carbon content** were identified within the timeframe of the project, but potential for carbon build-up in the long term is demonstrated by RothC simulations.
- Significant increases in **water infiltration rate** were found as a result of applying the organic soil amendments.
- Temporary **N immobilisation** (high C/N ratio): if in autumn: decreased risk of nitrate leaching during winter; if in spring: less crop available N; follow-up and adaptation of N fertilization required.
- The SICS had no negative effects on **crop development** nor on **crop yield**.
- Context of **Flemish manure legislation:** low N and P content allow to apply larger quantities.
- Current waste legislation, availability of wood chips as well as costs are possible **barriers**. (Financial) support and incentives from policy are needed.
- Stakeholders appear to be **broadly receptive** to the idea of applying woodchips as organic soil amendments
- **Longer term** studies are needed to determine whether there are any long-term effects of using these amendments.

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