

## CASE STUDY 6

### Contrasting soil management strategies in an arable crop rotation inclusive of potatoes to improve soil quality while minimizing external input of P

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EV-ILVO

Case-study 6 is organised by EV-ILVO (Flanders Research Institute for Agriculture, Fisheries and Food). EV-ILVO performs international, multidisciplinary and innovative research targeting an economically, ecologically and socially sustainable agriculture and fisheries in a from-farm-to-fork approach. EV-ILVO has 200 hectares for experimental field trials and is equipped with a full-scale open air compost site. Dedicated equipment for on-farm composting and field (experimental) management are available. At this moment, EV-ILVO has build up ample experience in setting-up and maintaining field trials.

Case-study 6 is positioned in the Atlantic Central pedoclimatic region, more precisely in the province of East-Flanders in Belgium (GPS coordinates: 50°59'05" N, 3°47'13" E). The climate is warm and temperate (mean annual temperature 10.5-11 °C, mean annual precipitation 800-900 mm). The soil texture of the field is sandy loam. Such soil types normally have no shortage of water or suffer from flooding's. Only during summer, problems with drought are possible.

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### Objective

A questionnaire and regional discussion group meetings with stakeholders and end-users revealed and prioritised the main threats affecting the agro-ecosystems of the Atlantic Central region and the qualitative assessment of their severity. Use of chemical fertilizers and liquid manure or slurry still cause a too large leakage of nitrate and phosphate in surface water and groundwater, intensive management regimes cause a deficit of soil organic matter, and a general drop of 'soil health', recognized by degraded biological and structural conditions, which causes additional problems like soil erosion and water shortage.

Field experiments have been established to test different management practices for wheat, potatoes and vegetables in order to address the above mentioned agricultural threats. Especially attention is paid to soil fertility, organic matter content and biodiversity in each case-study in a different way: case-study 6 will investigate the combined effect of application of farm yard manure, whether or not co-composted with 'brown' material, and a differential management of the cover crops (incorporation or mowing), case-study 7 will focus on the effect of cover crop mixtures which will diversify further the cropping system (from simple till 12 species mixtures), case-study 8 will compare different agricultural systems (intensive versus extensive, conventional versus organic), and case-study 9 will investigate the use of different organic fertilization sources like farm yard manure, compost and silage (fermented) grass-clover.

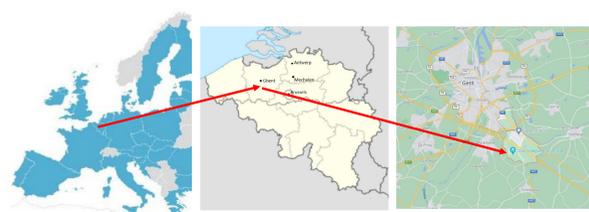
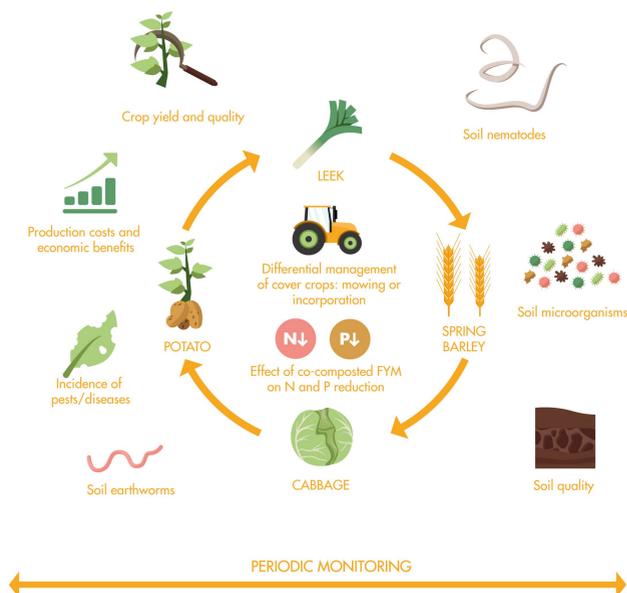
The obtained data of the case-studies will contribute to the analysis of the environmental and economic impact on a farm and regional level. This will finally result in the proper selection of the most promising crop diversification methods (including cover crops), organic fertilizers, and farming systems to enhance the functionality of soil macro- and microorganisms, responsible for enhancing soil health, crop productivity and other ecosystem services.

This poster presents case-study 6. The farming system is organic. The objective is to explore to what extent innovative strategies, contributing to soil quality and N supplying capacity, might reduce P surpluses compared to the usual soil management.

### State of the art

In densely populated Flanders, the pressure on biodiversity has been too great for centuries. This makes it increasingly difficult to protect biodiversity and ensure the long-term survival of our ecosystems and the services they provide.

The biodiversity value of the intensive, homogeneous agricultural landscapes in Flanders is low. As well as further reducing the use of pesticides and fertilisers, there is a need to diversify production methods while giving farmers an active role in landscape management. Recently, farmers are voluntarily entering into more biodiversity-supporting management agreements and organic agriculture is also increasing in area. However, the proportion of the total area in both cases is still low.



### Preliminary results

During the first cropping cycle, potatoes were grown. Due to a very dry growing season the potato tuber yield was low (overall mean of 26 ton/ha), only enough to cover the costs. The plots with FYM showed a higher yield compared to FYM co-composted with brown material or no fertilization (see figure 1). During the growth, an outbreak of the Colorado potato beetle was discovered. The quality of the potatoes was low as well. After harvest, the presence of wireworms was revealed. Wireworms can cause damage to the potato tubers making them less suitable for processing or direct human consumption.

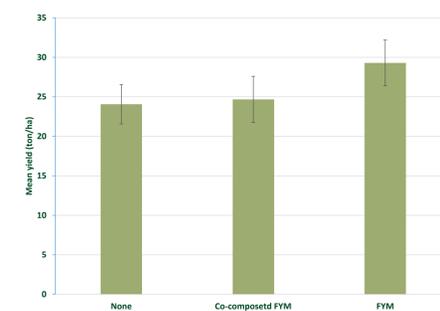


Fig 1. Mean yield of potato tubers (ton/ha) in function of the type of fertilization (n = 8).

### Proposed practices

N:P and C:P ratios of farm yard manure (FYM) will be modified by co-composting FYM with 'brown' material (e.g., grass clippings from nature reserves). The effect of co-composted FYM, compared to stockpiled FYM, on crop performance and soil quality are assessed in a multiyear field trial with repetitive application of both fertilization products. A blank treatment with no base fertilization is included as well. In the same trial, two different cover crop management strategies are applied. Cover crop mixtures are either used as green manure or harvested as a fodder crop. Differences in treatments regarding both factors will result in differences with regard to C, P and N input, and therefore possibly in differences with regard to main crop performance and soil quality.

### Problems to solve

An increasing amount of easily available P, as a result of a high soil P status (most of the Flemish agricultural and horticultural land) seems to counteract microbial activity in the rhizosphere. In particular, organic growers rely on this microbial activity in the rhizosphere as a plant feeding mechanism. Leakage of nitrate and phosphate in surface water and groundwater, can be caused by the use of organic manure on fields in order to increase fertility. Therefore, soil management strategies should aim at preventing P surpluses by reducing external input of organic matter.

This case study will develop soil management strategies for organic cropping systems aiming at the sustainment of soil quality on one hand and at a balanced P supply on the other hand.

Some plant-parasitic nematode genera are present in the soil of the field trial. Some genera, like *Meloidogyne*, *Globodera*, *Pratylenchus*, *Ditylenchus*, *Trichodorus* and *Paratrichodorus* can be economically very damaging for potato. Species of the genera *Meloidogyne*, *Globodera* and *Pratylenchus* were detected but at what extent this caused a yield reduction is unknown because the species was not identified and the disease suppressiveness not assessed (relation with biodiversity condition).

