



Innovations in Agroecology – a case study from the Netherlands

Introduction

In Noord-Brabant, a region in South-West Netherlands, Govert van Dis and his wife Phily Brooijmans are running an organic arable farm. The farm, around 100 hectares, is a family farm for many generations. Govert took over the farm from his parents 1980. The farm is located in a polder of reclaimed fertile clay soil, originating from 1564. From 1978 to 1992 consolidation of land in the region was undertaken to optimise agricultural practices. This resulted in rectangular fields surrounded by ditches and creeks. To manage the water level in the field, each field has a drainage system that ends up in the bordering ditches.



Figure 1. Govert and Phily at the farm

Initially crops were cultivated in a conventional system. However, as Govert and Phily were aware of the impact of chemical fertilizers and pesticides on the environment, they limited the use of chemical inputs. Besides their concerns about the environment, Govert and Phily were questioning the meaning/value of various labels appearing in Dutch supermarkets, such as a label indicating that consumers made a ‘conscious’ choice. They decided to convert the farm into an organic farm, as organic certification is strictly controlled and has clear criteria for certification that can guide consumer choice.

During the transition into organic farming, which started in 2001 and was completed in 2006, Phily gave up her job as a livestock teacher and joined Govert in the farm. Today, they run the farm together and actively follow innovations in agroecology. They collaborate with a neighbouring organic farmer, by exchanging knowledge, experiences, labour and machinery. In the summer season, around fifteen youth from the region work in the farm to help with hand weeding. In the harvest time (late summer and autumn) farmers from the neighbourhood provide each other with additional help.

Description of the Agroecology system

Crop rotation

Crops are grown without the use of pesticides and chemical fertilizers, therefore crop rotation forms the basis of the farming system. The crops are grown in a 6-crop rotation, which means that the same crop is grown in the same field only once every six years. In addition, crops facing threats from the same or similar pests are not grown in bordering fields or in a sequential season in the same field. Also crops requiring high nutrient inputs are not grown in sequence in the same field. The main crops are chicory, sweetcorn, carrots, potatoes, peas, wheat and quinoa (since 2014). Also in the crop rotation, a grass/clover mixture is grown for two consecutive years and wheat with faba bean is grown as an intercrop to be used as animal feed.

Intercrops are difficult to manage as sowing dates, sowing depth and harvest time might be different. The wheat/faba bean intercropping shows a good example of an intercrop: the beans fix nitrogen which the wheat needs. Initially the wheat and bean were sown at the same time, but the beans were not sown sufficient depth. Currently, the beans and wheat are sown separately, first the beans at a



greater depth and after the wheat seeds. A GPS system is used, so that the wheat and beans are sown in exactly the same row.

GPS for weed management

As the farm is pesticide-free, weed management is one of the major challenges. Various measures are taken to control weeds, such as the use of machinery in the early stages of crop growth. A useful method to remove weeds before sowing the crop is through the preparation of a 'false seed bed'. The preparation brings weed seeds to the soil surface, the seeds receive daylight which activates germination. The germinated weeds can be hoed or removed by a flame weeder. After sowing the crops, different types machinery are used such as harrows, hoes and row crop cultivators. However, the machinery only remove the weeds in between the crop rows and not between or close to the crops, therefore additional hand weeding is needed.



Figure 2. Hand weeding in the carrot field; the youth can lay down while weeding to make it less physical intense



Figure 2. Weed management using the GPS

Hand weeding is a time consuming task; per growing season this can go up to 60-120 labour hours of weeding per hectare for carrots and chicory, 15-40 hours per ha for sweetcorn and 0-25 hours per ha for other crops. Therefore Govert and Phily follow innovations in weed management and the development of new machinery. They invested in a double GPS systems: for the tractor as well as for the machinery. With the use of the GPS, the tractor can steer and correct by itself, with a precision of 1 cm. By using this technique, the crops can be sown in very straight rows. As the GPS system saves the coordinates of the sown row, the weeding machines use the exact same pathways. In this way, the machinery can remove weeds very close to the crop without damaging the crops.

Manure management

Dutch manure regulations for organic production state that at least 65% of the nitrogen has to originate from manure of organic certified livestock. The other 35% of nitrogen is allowed to come from manure of conventional livestock, under the condition that the animals have access to pasture or a partly solid floor in the stable.



Figure 3. Flower margin around the field

To prevent pollution of waterways, run-off and volatilization, there are strict regulations regarding the use of organic manure in the Netherlands. For instance, a maximum of 170 kg/ha of Nitrogen per year originating from organic manure is allowed to be spread. Without the use of additional inorganic/chemical fertilizers, green manures are an important aspect of the agroecological farming system to ensure sufficient nitrogen for the crops. Besides a two-year grass/clover mixture in the crop rotation, green manures are sown after the harvest of



the main crop in the summer season or (early) autumn. The time up to when the green manures are left unploughed in the field depends on the soil type. The heavier clay soils are ploughed in Autumn (around November), while in the lighter clay soil the green manures stay until spring, before the new growing season. The latter is the most optimal situation, as the nitrogen will not run-off in the winter time.

In the quinoa and sweetcorn field a green manure (clover, or grass/clover mixture) is sown in the field during the growing season, when the crops are sufficiently growing already (so there is no competition in the early stages of the main crop). The advantage is that the green manure can immediately grow as soon as the crop is harvested.

Producing agroecologically includes trying to close the cycle as much as possible. Therefore Govert and Phily developed an exchange system with local livestock producers. Their grass/clover mixture is mown several times a year by a local organic goat farmer and a local organic cow farmer and fed to their livestock. In exchange the manure of the livestock is brought to the farm. The mixture of wheat/faba bean is grown for a local organic chicken farmer and is exchanged with the manure as well.

The farm fields are bordered by flower or grass/herbs margins. These margins prevent run-off of minerals from the field into bordering ditches. In addition, they attract natural enemies for pests in the crops, provide habitat for pollinators and have an esthetical value as well.

Soil health



Figure 4. Tractor with big tires and the eco-plough

use a recent innovation: the eco plough. This plough rotates the soil, but at a very shallow level compared to conventional ploughs. Weeds and residues are covered, but soil functions like mineralisation are optimised, run-off of nutrients are limited, soil compaction is reduced and fuel use is less.

Organic farmers in Europe must follow the regulations set by the European Union and receive a certification. In the Netherlands, SKAL supervises farms in the Netherlands to determine whether regulations are followed, which is commissioned by the Dutch government. Each farm is inspected at least once a year to ensure the reliability of certification.

Outcomes of the practices

Since the transition to an agroecological farming system soil health has increased. Over the past four years, Soil Organic Matter (SOM) has increased several decimals. In addition, Govert and Phily have the notion that the crops need less and less nitrogen (N) compared to the calculations on what they

Soil health is a major issue at the farm, as on any farm. They use a system of 'fixed paths'. The tractors are always driving in the same fixed paths throughout the season, so as not to compact the soil of the whole field. The GPS system provides help to achieve this. When no crop is grown, e.g. during field preparation or after harvest, they are using wide tires of 1-meter width. These tires divide the pressure of the tractor over a larger surface.

A point of discussion for Govert and Phily is tillage; it is important in weed management, but it has a negative impact on soil structure. Therefore, they started to



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should receive. In general, the crops keep up very well in the end of the growing seasons, without any additional manure.

On average, farm income has improved, although pests like lice in the peas and phytophthora fungi in the potatoes can be difficult to manage and can periodically reduce yields. The farmers are happy to cultivate crops for a market with demand for organic crops and the way of cultivating agroecologically gives a lot of satisfaction.

Webshop

To connect local consumers with the farm, Govert and Phily are associated with a regional webshop. Consumers from the neighbourhood can order their products online and every Friday afternoon the shop brings the ordered products to the farm. The consumers pick up their products at the farm. In this way consumers don't have to drive to another village to buy their organic products as well as it increases the connection of consumers with farmers.

Farmers' association

Govert and Phily are members of a regional farmers' association for agroecological farmers. During the cropping season, once every two weeks they organise farm visits. During these visits the farmers discuss ongoing challenges they are facing, for instance related to the weather conditions, a certain pest farmers are dealing with as well as regulations they have to deal with. They discuss possible solutions, their own experiences and they share innovations in agroecology. As these agroecological farmers sell their crops directly to retailers and the organic market is rather transparent, being part of the association helps their bargaining power on the price of their products.

There is also collaboration with researchers. Wageningen University and the Louis Bolk Institute use data from the farm as well maintaining test fields on the farm. Currently there is a potato trial with new varieties. Also the cultivation of Quinoa was initiated by researchers, as this farm produced the first Organic Quinoa in the Netherlands. The researchers advised on the cultivation of Quinoa, as it a new crop in the Netherlands. In return Govert and Phily share their practical experiences with the researchers, such as the challenges, the manure management that works best, practices that work well, etc.

Message from farmer to farmers

"If a farmer thinks he knows, he wouldn't be a farmer anymore"

— Message from Govert van Dis, Farmer