



FIELD LAB FOR PRECISION FARMING

# The computer helps work it out

**Precision farmers can dose fertilizer, control diseases, irrigate crops and look after nature with greater precision, shows the National Field Lab for Precision Farming. We visit a precision arable farmer, a fruit grower and a dairy farmer. 'The nice thing about the Field Lab is being able to exchange knowledge in a network.'**

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## ‘With precision agriculture you regain an overview’

On Slichtenhorst estate just south of Nijkerk in the province of Gelderland, four woolly Hungarian Mangalica pigs are rooting around and basking in the sun. They keep the blackberry bushes short so the saplings can grow better. Someone from a nature organization is counting the herbs in the nearby arable fields to see whether the farmer on the estate qualifies for a grant for nature management. That farmer is Pieter van Leeuwen Boomkamp, who lives with his family in a historic 16th century farmhouse on the estate. Van Leeuwen Boomkamp grows potatoes, onions, beets, maize, wheat, carrots and chicory on 140 hectares of land. Because he has 96 small fields, most of them surrounded by hedgerows or ditches, he practises precision agriculture. Each plot has a different soil type and humidity level, so the growing conditions vary.

‘Every plot gets its own approach. In the old days, when my father was farming, that was called common sense. Now it’s done digitally and the computer helps work it out,’ says Van Leeuwen Boomkamp.

Since 2018, he has been participating in the National Field Lab for Precision Farming programme that helps farmers and horticulturalists use precision farming to increase yields, reduce costs and the environmental impact, and improve food quality. ‘The essence of it is dealing with varied conditions,’ says Corné Kempenaar, who coordinates the programme for Wageningen University & Research. ‘The technology – sensors, drones and satellites, for instance – is the means.’ In the Field Lab, WUR gives advice on new techniques that have already been tested and proven to work in practice. Wageningen explains the options, the farmer chooses which technique to apply, and the experts help monitor the effects it has on farm operations.

### VARYING DOSES

Van Leeuwen Boomkamp drives a huge tractor into the farmyard after spraying his fields with weedkiller using an electronic soil scanner – one of the many gadgets on his tractor. The scanner measures the amount of organic matter and the acidity of the soil. The farmer uses that measurement to dose the weedkiller. Whereas the sprayer on the tractor used to treat all the plants in a 36-metre band identically, the new sprayer can vary the dosage. This leads to a saving of 10 to 15 per cent on herbicides, he reckons.

For his potato crop, Van Leeuwen Boomkamp has a harvester with a location-specific yield meter, so he knows which parts of the plot produce high and low yields. He links that information with his soil scan so he can see how his soil management affects the yield. His aim is to have soils with plenty of organic matter that sequesters CO<sub>2</sub>. For that reason, he fertilizes the soil mainly with compost and green fertilizers and practises non-inversion tillage rather than ploughing. ‘I hope I will be recompensed for this CO<sub>2</sub> storage once the government has drawn up a climate policy for agriculture.’

Van Leeuwen Boomkamp also makes use of drip irrigation, known as precision irrigation. Weather



PHOTO JAN WILLEM SCHOUTEN

Pieter van Leeuwen Boomkamp, an arable farmer in Gelderland, tests underground drip irrigation in a field of onions.

stations and sensors that measure soil humidity deliver the data for customized watering, thanks to which crops suffer less drought stress in the summer and the farmer can use less water. He is testing drip irrigation on five hectares of carrots this year.

Van Leeuwen Boomkamp continuously weighs up the costs and environmental benefits of his crop-farming methods. 'If chemical and technological methods cost the same, I opt for the technological ones. The nice thing about the Field Lab is that you can exchange knowledge in the network. I'm in a WhatsApp group, for instance, with 15 pioneering farmers. What's more, Wageningen has linked me up directly with the suppliers of products and equipment.' But Van Leeuwen Boomkamp learns the most from his own network. 'I went to technical college and then worked for a farm machinery company for 10 years. I have a network of guys who know a lot about technology and electronics, and who will come over to spend an evening fixing a machine or a program that isn't working. Without that network I would have gone bust.'

### PIONEER IN FRUIT

Martijn Slabbekoorn is another pioneer of precision agriculture. He runs a family farm (he is the sixth generation) that grows apples and pears in Kapelle in Zeeland. The fruit farm now covers 70 hectares, divided over three locations. Slabbekoorn runs the farm with his wife and one permanent farm worker, with the additional help of a regular team of Polish migrant workers and some casual labour. At harvest time, 40 to 50 people work at Slabbekoorn Fruit.

Six years ago, Slabbekoorn asked the supplier to provide him with a sprayer with GPS that could dose each plant separately and would also record where it had sprayed. That was a new development in fruit farming. The machine manufacturer had the machine but no software. A few years later, when Slabbekoorn met a fellow fruit farmer with an IT background, the connection was made and a breakthrough followed. The result is a sprayer with nozzles that can open and shut independently of each other. The data are sent to a registration program. 'Say we see apple scab in certain rows on the farm. We can then see in our registration



Martijn Slabbekoorn, a fruit farmer in Zeeland, with the sprayer that has nozzles that can open and shut independently, and that collects data about the crops.

program what treatments those rows had and whether they were any different. That enables us to assess the effect of treatments. That internal check is the most important thing for me.'

### FEWER PESTICIDES

Using these precision instruments, Slabbekoorn has now discovered that he shouldn't spray his crops with insecticides after 10 o'clock in the morning. In the summer, the humidity is generally too low then and the insecticides don't work well. But the precision machinery also ensures that only the leaves are sprayed, reducing the amount of liquid that gets blown away. As a result, Slabbekoorn uses smaller quantities of pesticides than other fruit farmers. How much the environment is spared varies per fruit type and variety. 'GPS delivers savings of roughly five per cent. The sensor sprayers that only spray the plant produce an average saving of 50 per cent of the product when used on young trees and 10 to 20 per cent for mature trees.'

Slabbekoorn has three diseases and pests to contend with. Firstly, scab, a fungal disease that spreads through the air, so the entire plot has to be sprayed against it. In this case it is the sensor sprayer that makes savings. Secondly, aphids, which he combats with insecticides. He used to spray with broad spectrum insecticides, but these killed off useful insects as well. So he now uses selective agents as part of an Integrated Pest >

Management (IPM) approach. He gets some help with this from WUR, which runs a practical course in IPM on his farm. He does use biological agents too, but says, 'Using biological agents alone wouldn't work.'

### DRONE LOCATES WEEVILS

And that is demonstrated by the third pest Slabbekoorn has to deal with: the pear bud weevil. There are still no biological or selective agents for combatting these weevils, so a strong old-fashioned insecticide is required. He now uses a drone to locate the weevils. The weevil lays eggs in the flower buds and the larvae eat the buds, so no blossom develops. The drone sees the places

in the orchard with less blossom, and that is where the farmer needs to spray. That can only be done after the harvest, but at least the pest will be gone next year. Like Van Leeuwen Boomkamp, Slabbekoorn doesn't see precision agriculture as anything new. 'In the old days, a fruit farmer would walk through his orchard, and he knew exactly what was going on in it. Nowadays, thanks to upscaling, you don't have that overview anymore. And the workers don't have that knowledge or interest. Precision agriculture gives you back that watchful eye and the overview.'

### HERB-RICH GRASSLAND

Precision agriculture can be used when growing grass as well as potatoes and apples. Proof of that is provided by Gerard Uijterlinde and his wife Els Uijterlinde-Mentink, who live on a farm called Erve Mentink, near Oldenzaal. Gerard studied Agrotechnology at Wageningen, and Els did Animal Sciences. Together, they run a farm with 200 cows and 80 hectares of land in the rolling Twente countryside. Besides the usual routines of dairy farming, they conduct several different kinds of research into things like feed additives, housing and working with herb-rich grassland.

When the cows step outside, they find themselves in a large meadow with 13 demarcated strips of grassland. Gerard and Els are experimenting with precision agriculture here. On some of the strips is herb-rich grassland, while uniform English rye grass grows on others. Together with the Louis Bolk Institute, the farmers are testing to see which plot of herb-rich grassland performs the best. They are guessing it will be the strips on the drier land because herbs take deeper root than grass and perform better than grass in dry periods. 'We want to get more out of the soil, which is the starting point for production,' says Gerard. Their irrigation trial might clear up a persistent misconception among livestock farmers: that uniform grass without herbs provides more protein. 'We are now getting a higher yield on the herb-rich strips than on the strips with only English rye grass, but the plots with grass and clover mixes are doing better too. The 20 hectares of herb-rich grassland pays off for our farm. We didn't start growing herb-rich grassland for the



PHOTO: REYER BOXEM

Gerard Uijterlinde and Els Uijterlinde-Mentink, dairy farmers in Twente, test which plot with herb-rich grassland is doing the best.

## ‘We get a higher protein yield on the herb-rich strips than on English rye grass’

sake of nature and biodiversity,’ says Gerard, ‘but to improve the soil.’

The fact that more herb-rich grassland is also good for nature is a nice extra, says Els. ‘We see more deer in the herb-rich strips and the pigeons, herons and storks visit them more often because there is more life in herb-rich grassland. That’s really nice.’

Gerard and Els learned the ropes of doing research as students and now they offer their farm as a research location. The cows in their barn can be divided into four testing groups fed on different diets. Out in the fields, the farmers are doing trials with variable fertilizing regimes based on satellite images. ‘Wageningen converts those images into information that we can use,’ explains Gerard. They have also started an irrigation trial in which they use soil humidity sensors to measure how fast the turf dries out in the summer, and how much they therefore need to irrigate it. Besides that, they measure the effect of irrigation on the yield and on soil life. ‘That is quite new for grassland,’ says Gerard. ‘Sensor suppliers all think their own product is perfect, so it was nice to be able to rely on the experience already

gained by Wageningen Plant Research. Together we also measure the differences in microbial soil activity between herb-rich and herb-poor grassland and in the amount of irrigation. It looks funny, with teabag labels sticking out of the ground all over the place. The teabags are buried and the degree to which they have disintegrated after three months reflects the activity in the soil.’

### GETTING ADVICE

Gerard and Els joined the Precision Farming Field Lab last year. Every participant has a mentor from WUR, and they also got advice on herb-rich grass seed from ecological consultants. ‘When we first started, we were advised to sow the herb-rich grassland in the spring. But that’s not a good idea, because that’s when the weed pressure is highest. And we were advised against fertilizing. But we do fertilize because otherwise even herbs run low on nutrients. We try things out, but we do keep our feet on the ground.’ ■

[www.wur.eu/precision-agriculture](http://www.wur.eu/precision-agriculture)

### FIELD LAB FOR PIONEERS

WUR started the National Field Lab for Precision Farming (NPPL) in 2018, at the request of the ministry of Agriculture, Nature and Food Quality. The ministry hopes to achieve several of its objectives through precision farming, such as reducing pesticide use and nitrogen losses.

In the Field Lab, Wageningen provides advice on new techniques and monitors their effects on farm operations. The Field Lab started in 2018 with six farmers, and now 30 farmers are testing about 20 precision agriculture techniques. The participants are pioneers who want to work with technology: they have sensors, data, a program for converting the data into decision guidelines, and a machine for implementing decisions. All this calls for coordination between farmers and suppliers, and that is done by WUR, explains Corné Kempenaar, WUR’s coordinator for the Field Lab. ‘Sometimes we put suppliers in touch with each other too, so they can link up their systems effectively. For example, we use satellite images that show the variation in crop growth. Doing that involves three sets of calculation from the satellite via electronics to the machine, so they have to line up very well.’

Misset Publishers promotes the sharing of knowledge through sector magazines, and the involvement of Aeres University provides a link with ‘green’ education institutions.