STRIP CROPPING IN PRACTICE

IT CAN BE DONE!

HEMUS

INTRO

Strip cropping has many advantages:

- The yield is comparable to a monoculture
- There are fewer opportunities for pests and diseases
- There is much more biodiversity
- And it is practicable!

ERF BV and Hemus have therefore been experimenting with how to integrate agriculture and nature. As organic growers, we want a more resilient cultivation system as well as more biodiversity. We have therefore been exploring since 2017 how to apply strip cropping (and since 2022 also agroforestry). How do you create more (bio)diversity while keeping it profitable and feasible? We are investigating this together with WUR and the Practice Network for Strip Cropping. We are happy to share our practical knowledge here.

CONTENTS

1. WHAT IS STRIP CROPPING?

About strip cropping

In strip cropping, you grow several crops in strips next to each other on a single plot. You manage each crop separately. The strips can be 3, 6, 12 or 24 metres wide. From our experience, strips of 6 metres work best for us, because of our current machinery.

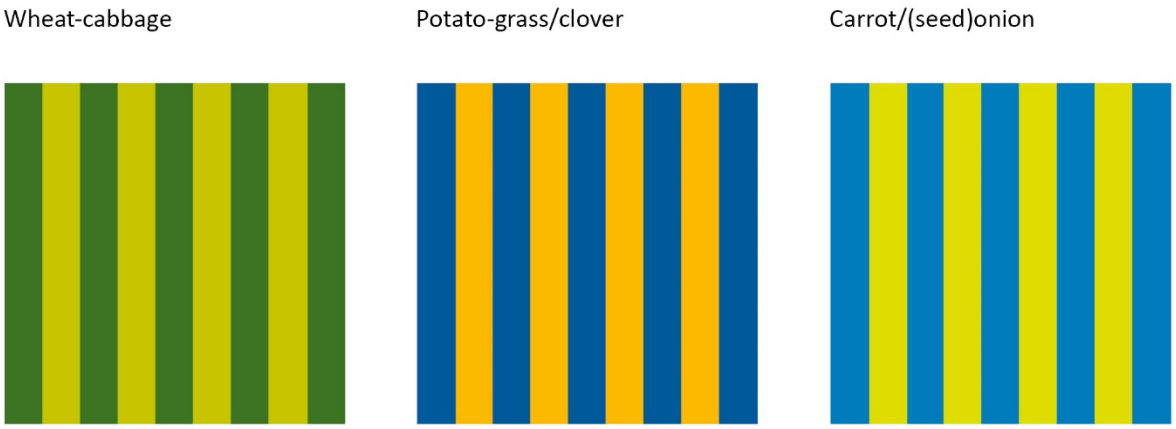


Figure 1. Strip cropping in crop pairs

You can start with two crops in alternation, to keep it manageable. But you can also grow all the crops in your crop rotation plan in strips. With strip cropping, you strive for more diversity on the plot.

Figure 2. Strip cropping

Every year, each crop shifts at least two strips to avoid diseases and pests.

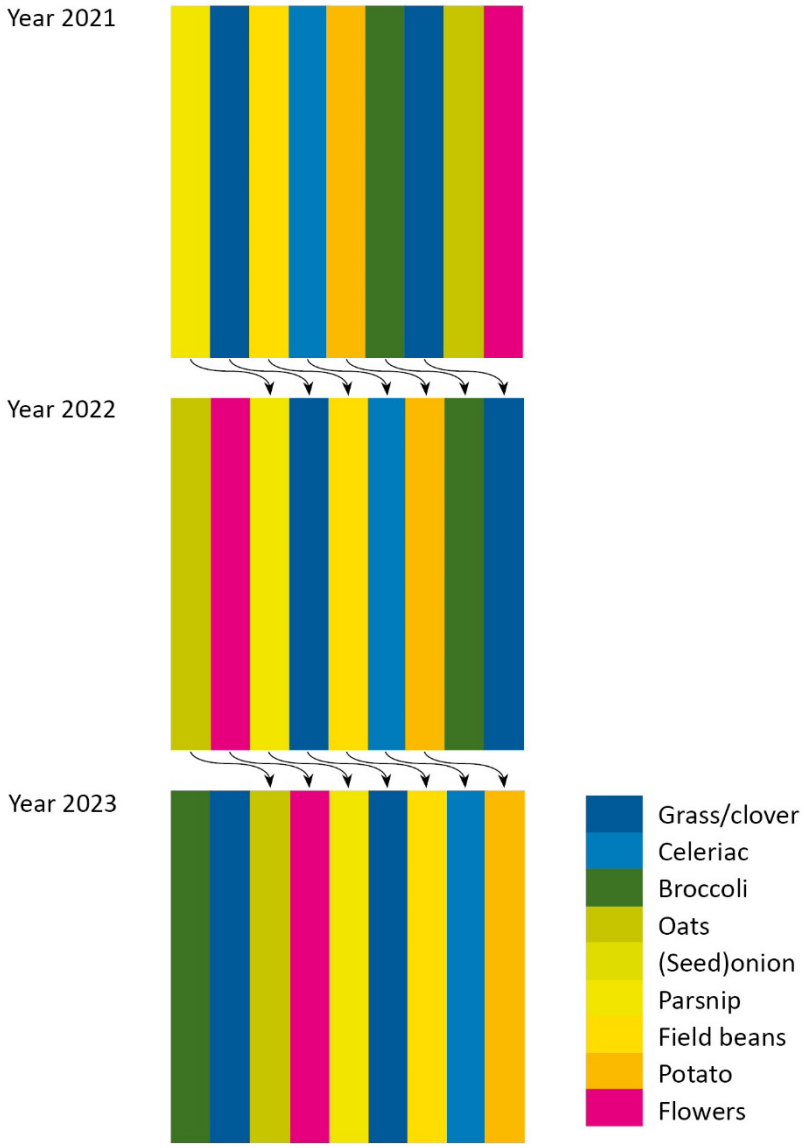


Figure 3. Crop rotation per year in strip cropping

Strip farming strengthens organic farming

Organic farming traditionally operates with a wide crop rotation of at least once every six years (1:6). This is important to contain pest and disease risks, control weeds and, above all, keep the soil fertile.

So organic farmers have a different crop in the field every year, but this is often a monoculture per field. This means that any disease or pest can spread at lightning speed within that entire field.

Strip cropping is a promising next step for an organic farmer. It generally fits well with the organic farmer's mechanisation, and his focus on natural pest control. Indeed, strip cropping slows the spread of diseases and pests because:

- the crop is divided into separate strips, with other crops in between,
- neighbouring crops and flower strips offer more space for natural pest controllers.

In crop rotation in strip cropping, a crop preferably moves up a minimum of two strips to prevent the spread of soil layers to an adjacent strip. This is also known as the 'hop-step-and-jump'.

With strip cropping, organic farmers make even better use of the natural processes in organic farming, such as nutrient cycling and natural pest control. Although strip cropping makes the cultivation system more complex, it also makes it more robust. At the same time, yields remain at least the same, and sometimes even increase.

Aerial photo of both strip cropping plots: Noorderwold (in front) and Trekweg (across the A6).

Strip cropping in conventional agriculture

Conventional farmers can also use strip cropping to increase their agrobiodiversity. By doing so, they can reduce their diseases and pests in a more natural way. However, it is important to greatly reduce the use of chemical pesticides. Biodiversity (such as beetles, hoverflies or soil life), important in strip cropping, cannot develop optimally when using chemicals.

Another challenge is to adapt mechanisation to growing in strips. For each farmer, the optimal strip width may differ depending on his equipment/agricultural vehicles.

At the Agroecology and Technology Fieldlab (WUR), there is continuous research on how the usual machines can be used in strip cropping, and new machines are being developed and tested.

If conventional farmers with strip cropping want to join the Eco Scheme, category gold, in the new European Common Agricultural Policy (CAP), the following conditions apply:

- at least 5 strips
- agroforestry or field margins also count as strips
- strip width between 3 and 27 metres wide
- at least 2 productive strips and 1 resting crop

2. HOW IT STARTED AND OUR EXPERIENCE

Why we started strip cropping....

Roy Michielsen of ERF BV looks back on the early years: "On our organic farm, we grew our crops, including potatoes, in large-scale monocultures. Monocultures are very efficient in terms of mechanisation, but if a disease breaks out, it can spread very quickly. In organic farming, we are hardly able to intervene. With strip cropping, we hoped to make our cultivation system even more robust, and thus less susceptible to diseases and pests. And it works!"

The first good results

In 2015, we started with simple experiments. For instance, we placed flower strips along the edges and in the middle of our pea plots. This showed that significantly more natural enemies could be found in the crop when compared to a monoculture.

In a monoculture, few natural enemies

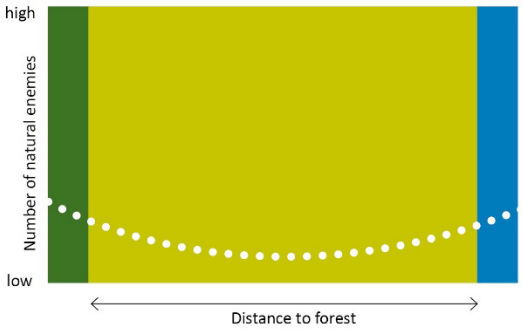


Figure 4. Pea field monoculture

In a plot with flower strips along it and in the middle, many natural enemies could be found.

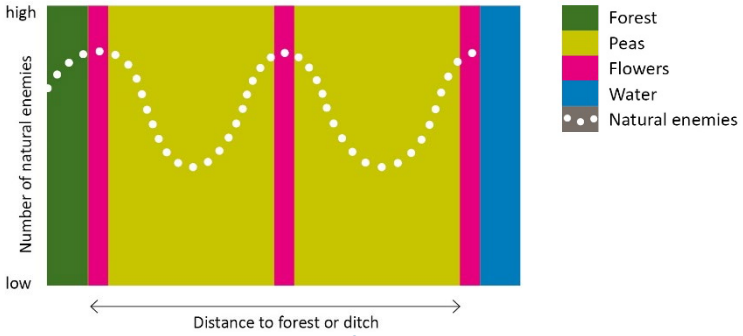


Figure 5. Pea bed with three flower strips

A study on strip cropping at Broekemahoeve (WUR pilot farm) and the effect on potato infestation by phytophthora showed that the infestation year-on-year was less in strip cropping than in monoculture. This result was the final push we needed to start strip cropping and growing multiple varieties of potatoes in strips ourselves. We then alternated two varieties in 6-metre strips on our potato plot. The results were positive: the plants in the strip cultivation were less affected by phytophthora than the plants grown full-field (see 4.5).

In 2017, we conducted research with WUR, sowing various crops on 45 hectares on strips of 6, 12 and 24 metres wide. Conclusion: the narrower the strip, the more natural pest predators such as ground beetles, spiders and beetles there are, and the less likely diseases and pests are to take hold. A strip width of 6 metres proved most effective considering the application of our machines (see 4.1).

Therefore, in 2020, we applied strip cropping on a second plot of about 65 hectares using only 6-metre strips. Here too, research was conducted on crop yields, pest and disease prevention and biodiversity.

Since 2020, ERF BV and Hemus have been growing crops in large-scale strip cropping on about 100 hectares. Meanwhile, Hemus has started applying strip cropping in a number of experiments, such as strip cropping combined with agroforestry and strip cropping combined with solar panels. We are always looking for new possibilities.

Three years of research in 2020, 2021 and 2022 on strip cropping, in 6-metre strips, provide as preliminary results:

- higher crop yields of field bean and parsnip
- fewer plant diseases
- more pest control
- more beneficial insects
- more field birds

Flower strip in strip cropping plot Trekweg

3. CULTIVATION CONDITIONS AND CROPPING PLANS

Experiments with strip cropping

On two plots (Noorderwold and Trekweg Almere), we experimented with strip cropping, with WUR monitoring the results.

Plot Hemus Noorderwold

The first experiments were carried out from 2017 on a 45-hectare plot leased by Hemus from nature organisation Het Flevo-landschap. This plot will be developed into new nature by the end of 2023 as part of Noorderwold-Eemvallei.

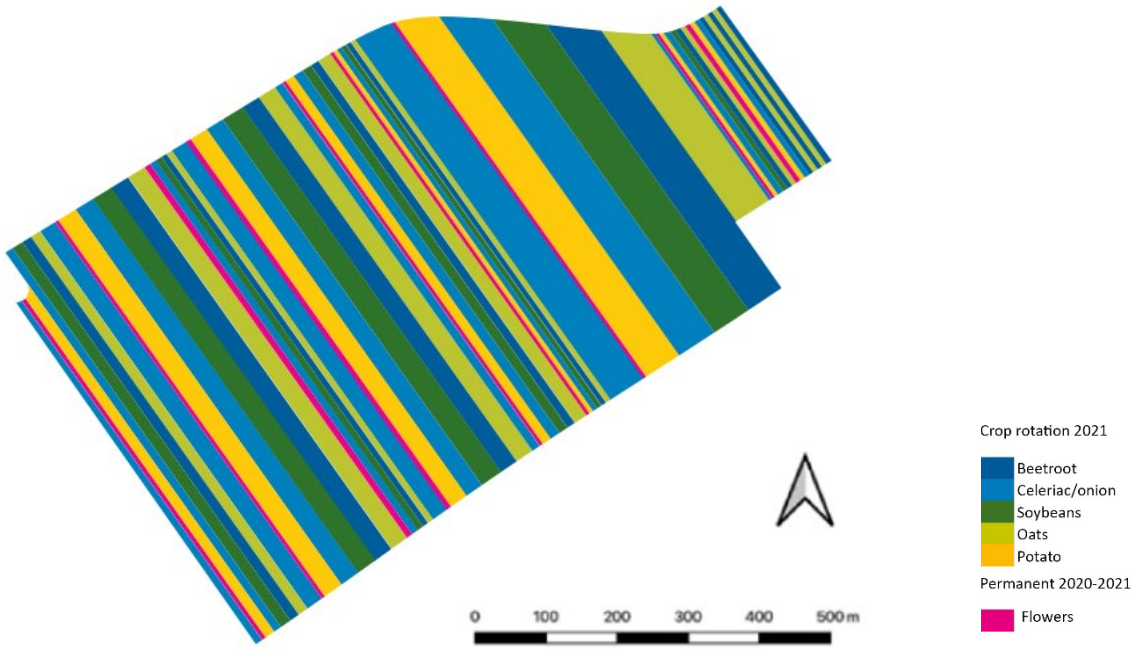


Figure 6. Cropping plan 2021 Hemus (45 ha)

In 2021, the cropping plan consisted of potato, soybeans, celeriac, oats, onion and beetroot. In 2022, green beans were grown instead of soybeans. The strips were 6, 12 and 24 metres wide. As a comparison, some blocks of monoculture were grown (the wide strips in the figure), consisting of blocks 48 metres wide.

Plot Trekweg Almere

On the Trekweg in Almere, a 65-hectare plot with 6-metre strips is located since 2020. The plot is highly visible from the A6 motorway and is really on the urban fringe. The cropping plan has an 8-year rotation of the following crops: grass-clover, celeriac, broccoli, oats, onion, parsnip, field beans and potato. Between the strips are fixed flower strips of 6 metres including umbelliferous plants for insects and creeping creatures. For the study, reference fields were established to compare the strip cultivation with a monoculture (the large blocks on the map).

The soil consists of heavy humic clay, 43% siltable with 3.5% organic matter.

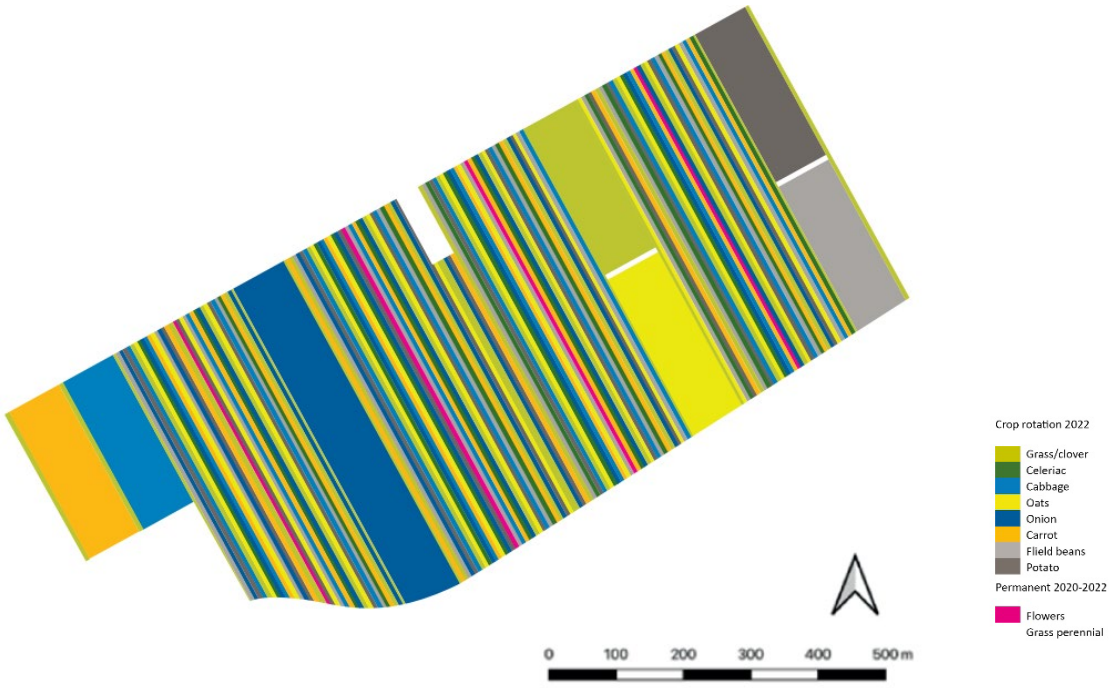
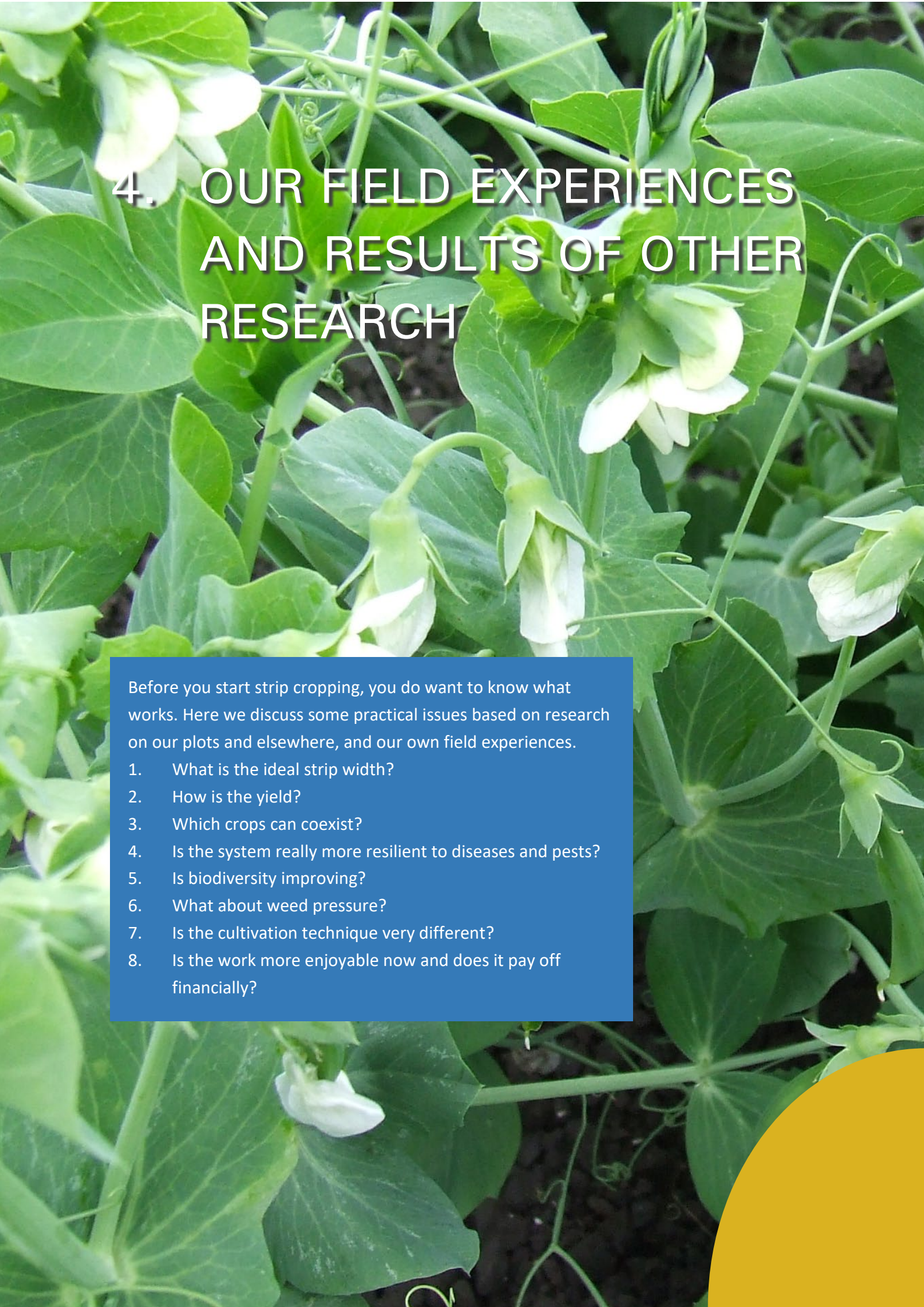


Figure 7. Cropping plan 2022 Trekweg Almere (65 ha)



4. OUR FIELD EXPERIENCES AND RESULTS OF OTHER RESEARCH

Before you start strip cropping, you do want to know what works. Here we discuss some practical issues based on research on our plots and elsewhere, and our own field experiences.

1. What is the ideal strip width?
2. How is the yield?
3. Which crops can coexist?
4. Is the system really more resilient to diseases and pests?
5. Is biodiversity improving?
6. What about weed pressure?
7. Is the cultivation technique very different?
8. Is the work more enjoyable now and does it pay off financially?

4.1 The ideal strip width: as narrow as possible with your machines

"At 6 metres, compared to wider strips, you really see a difference and an exponential increase in beneficial insects"

Dirk van Apeldoorn (researcher Farming Systems Ecology and open cultivation at WUR)

Previous research has shown that the narrower the strips are, the more positive effects there are on natural pest control and soil life. It also appears that there is sometimes a higher yield in the strip edge. It is still being investigated why this is, but presumably it has to do with the presence of mycorrhiza in the soil or a created microclimate. Of course, again, the narrower the strips, the greater this positive strip edge effect.

Figure 8. Strip edges

In 2017, in cooperation with WUR, we completely laid out a plot on the 45-hectare Hemus Noorderwold plot with strip cultivation (see 3.1). On this plot, we laid strips of 6, 12 and 24 metres wide to investigate the ideal strip width for us. In addition, the strips would have to fit well with the operating widths of our machines, with which we sow, weed, and harvest.

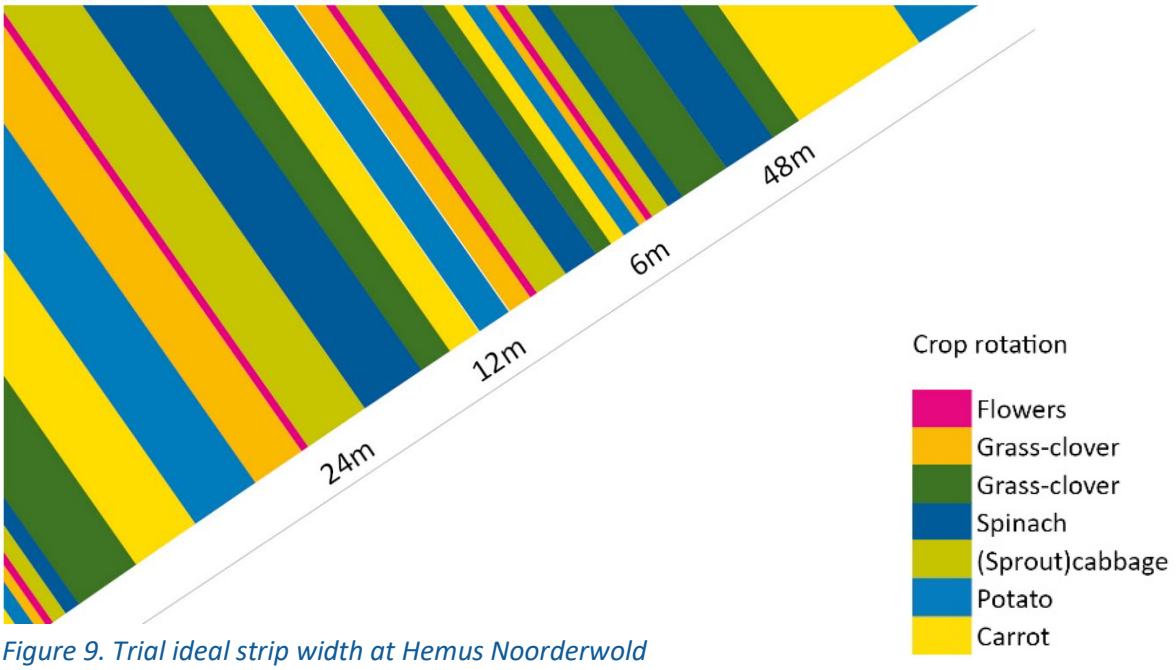


Figure 9. Trial ideal strip width at Hemus Noorderwold

The results were very positive. Indeed, we saw that in strip cultivation we have less disease and pest problems, more biodiversity and can achieve (at least) the same yields with more or less the same efficiency as in monoculture. We saw the best effect in the 6-metre strips. Therefore, in 2020, we set up a second 65-hectare plot (see 3.2 Plot Trekweg Almere) with only 6-metre strips. On this plot, we look at which crops fit well or less well next to each other.

So although the ecological benefit of 3-metre strips is even higher, that width proved impractical because of our machinery. We therefore opted for a minimum strip width of 6 metres, as this would allow us to use almost all our current machines in strip cultivation as well.

Making sure all crops were sown and planted on the right strips was a big challenge at the start. But we succeeded thanks in part to GPS and an Excel list showing the strip and crop per GPS line. And it is still going well. Only once in the last few years has one strip of the more than 250 strips been sown wrongly.

> “We wouldn't have started it without GPS”
> *ERF business manager*

4.2 Revenue equal

The results of the study on yields of strip cropping are positive: yields are very similar and regularly higher than in monoculture.

To compare yields properly, we also grew these crops in monoculture, with the same treatments, in addition to strip cropping. The yields are being monitored by WUR and the first results are now available.

Crop yield comparison strips and monoculture

Crop yield comparison is part of the multi-year study by WUR. PhD-student Stella Juventa compared yields in monoculture versus strip cropping on the Trekweg plot for different crops:

- celeriac (*Apium graveolens var. rapaceum*)
- broccoli (*Brassica oleracea var. italic*)
- oats (*Avena sativa*)
- onion (*Allium cepa*)
- parsnip (*Pastinaca sativa*)
- potato (*Solanum tuberosum L.*)
- field bean (*Vicia faba*)

The eighth crop, grass-clover, went to a livestock farmer and not into mainstream market channels.

Figure 10 compares the yield of strip cultivation with the yield in the monoculture plots (the dotted line at 1.0 'Relative yield'). It shows that yields are very similar and sometimes even higher in strip cropping.

This study shows that parsnips and field beans in particular do well in strip cropping compared to monoculture, both in terms of fresh weight and marketable weight.

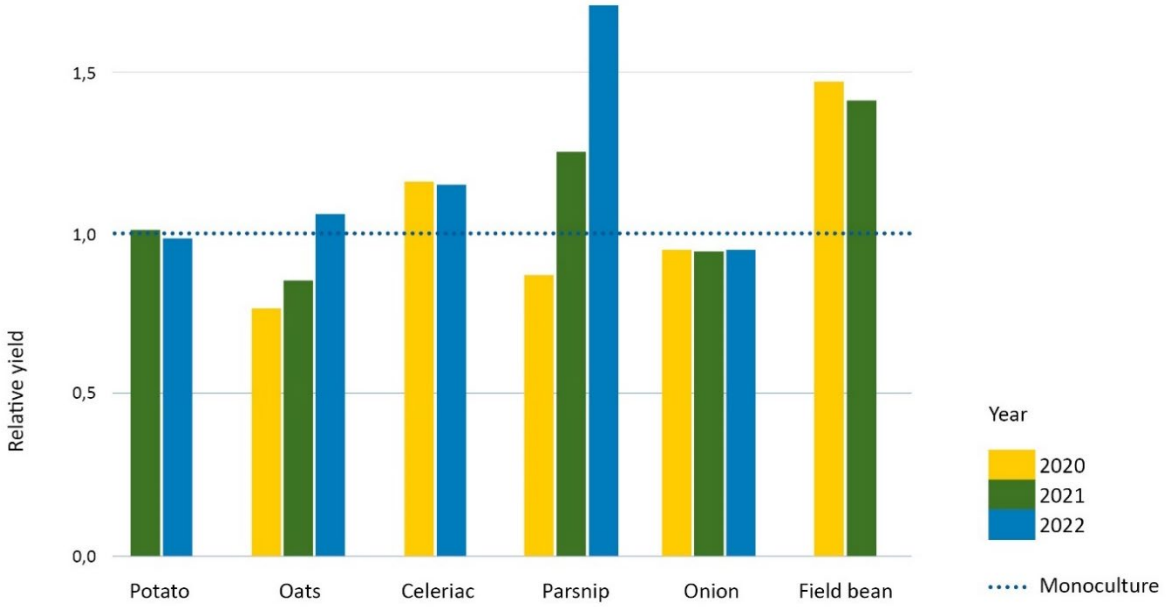


Figure 10. Research results crop combinations and crop yields

Remarkably, the fresh yield of potatoes in strip cultivation was similar to monoculture, but the marketable yield was lower. The potatoes grew longer because they were less prone to disease. But in strip cultivation, more small potatoes grew, which are not accepted by the market.

Parsnip harvest

4.3 Good neighbour crops

In strip cropping, it matters which crops you put next to each other. There is a lot of research on good neighbour crops, as they can influence each other positively, but also negatively.

Research with us and others shows that good neighbour crops are:

- wheat and cabbage
- grass and potatoes
- carrot and onion
- sugar beet/pumpkin and barley
- parsnips and grass-clover
- celeriac and field bean
- celeriac and oats
- broccoli and parsnips

With the last four crop pairs, HEMUS itself has had positive experiences. These show that, in general, tuberous crops such as celeriac and parsnip are a good neighbouring crop because they have a different growing season than many other crops and therefore do not compete for water or nitrogen. Tubers start growing only when field beans and oats have already been harvested.

Research on cropping plan

Our strip cropping plots are part of the multi-year study by WUR. Which crops become neighbouring crops is determined at random by the researchers in order to investigate good crop combinations. From an ecological point of view, the fact that there are different crops in strips is even more important than which crop is next to which. However, we have made interesting field observations in recent years:

- Field beans right next to oats are taller with more stalks and more flowers, so more yield. Perhaps the oats, which are taller earlier, thus have a beneficial effect on the beans.
- Do not put oats next to potatoes, because if you have to burn because of phytophthora, you will damage the oats.
- Celeriac and broccoli do better next to field beans or oats. Perhaps they benefit from the shade of their tall neighbour, evaporating less moisture. A favourable microclimate is then created.

Tips

Moreover, from other research and all practical experiences, we can give the following tips for the cropping plan for strip cropping:

- Combine crops with different sowing and harvesting times.
- Provide a pest-sensitive crop next to an overwintering crop, so for example leafy crop next to cereals.
- Combine mowing with grubbing crops (when grubbing, the groundcreepers can then move to the stubble of the mowing crop).
- Always have a crop in which natural enemies can survive.
- Do not put next to each other what comes after each other in the crop rotation, always skip a strip ('hop-step-and-jump').
- If you apply multiple strips, make sure the layout is mirrored across the field (much more efficient execution of work).

Strips with potato, celeriac and oats

4.4 Fewer pests and diseases

A monoculture system is more vulnerable to diseases and pests. Crop diversity within a plot yields higher (soil) biodiversity, making the system more resilient. Diseases and pests also spread less quickly because a crop is spread over narrow strips spaced apart.

Spacious building plan

There are soil-borne and mobile diseases and pests. Some are specific to one crop, and others affect everything. Soil-borne pests and diseases can generally be minimised with a broad crop rotation of at least six years. If you also apply strip cropping, you also reduce the chances of mobile diseases and pests targeting a specific crop. To also reduce damage from mobile diseases and pests that can affect all crops, as much biodiversity as possible on the plot is desirable. One crop in a plot attracts a dominant disease or pest insect, whereas a diversity of crops attracts a multitude of species that more or less control each other.

An important maxim in strip cropping is not to put crops next to each other that come after each other in the crop rotation. Otherwise, you run the risk of pests that remain for a season immediately finding a new host in the strip next to it. Crops should therefore move up two strips in the crop rotation, the so-called 'hop-step-and-jump'.

Delaying phytophthora in potatoes

In the scientific study *Identifying crop neigbour combinations to improve crop yield in strip cropping* (A. de Rooij et.al, 2021), Stella Juventis investigated the difference between diseases and pests in a crop in strip cropping or in monoculture on the Trekweg plot.

This shows that potatoes in strip crops suffer less from the fungal disease phytophthora. The distance between potato strips slows the transmission of phytophthora. It also shows that the spread of phytophthora is further inhibited by growing different potato varieties. Eventually, phytophthora always occurs, but every extra day not having to burn is a win. Because every extra day the potato tuber can grow means more yield. So the aim is not to prevent phytophthora, but to delay it. The spread is also slower, because the spread goes only along the length of the strip and the next strip of potatoes is metres away.

Figure 11. Distribution of pests and diseases in mono and strip crops

Much less sclerotinia in celeriac

A similar story applies to the fungal disease sclerotinia (leaf spot disease): sclerotinia in celeriac occurs much less in 6-metre strips than in 48-metre monoculture strips.

Conclusion

Strip cropping has a marked delaying effect on the spread of diseases and pests.

Celeriac

4.5 More biodiversity also helps against pests

Biodiversity provides not only pest control, but also pollination and healthy soil.

Functional agrobiodiversity (FAB) is biodiversity essential for agricultural operations, such as wild bees for pollination, soil life for healthy soil and insects and soil animals for natural pest control. More biodiversity thus strengthens the natural ability to control diseases and pests in cultivated crops.

Strip cropping and also perennial flower strips in the cropping plan increase (functional agro)biodiversity on the plot. This is because there is always food, shelter or a hibernation site for crawling critters and insects. There are several reasons for this:

- the strips with the various crops are worked and harvested at different times;
- flower crops are included in the cropping plan;
- in early harvests, a cover crop is sown to keep the soil covered;
- there are perennial flower strips;
- the narrow strips allow insects to easily flee to the neighbouring crop during tillage or harvesting, and return when needed.

It would be especially nice if there is also landscape diversity around the plots. A nature-friendly embankment, flowering verge or biodiverse hedge further along increases biodiversity in the area.

Field bean for nitrogen fixation and biodiversity

In an organic cropping plan, a legume should not be missing because it can fix nitrogen from the air. Therefore it is a plus that field beans are doing well in strip cropping. Also because other research shows that more mycorrhiza is built up in the soil during field bean cultivation. In addition, the field bean forms nectar during flowering (not in the flower, but in the leaf base) which attracts ants and parasitic wasps. Also, the field bean in bloom is a large attraction for insects and hence insectivorous field birds. Apart from field bean, we also include soybean. This is still an experiment, but the prospects for this crop are good.

Active soil life above ground

On the ground, we see large armies of spiders, beetles and ground beetles that, among other things, control aphids. Researchers and students took a prolonged look at the beetle traffic between the strips and put the tiny critters under the microscope. They concluded

that more species are present in greater numbers in strip cultivation than in the monoculture field. For a balanced ecosystem, more species are also preferred.

Field observation: the army is on its way

We certainly see diseases and pests of the crops, but we also see many more natural enemies of these pests and diseases. If black bean aphid is spotted in the beans, we already see the larvae of ladybirds, lacewings and cutworms on the oats, wheat or grass. The army to exterminate the aphids is already on its way.

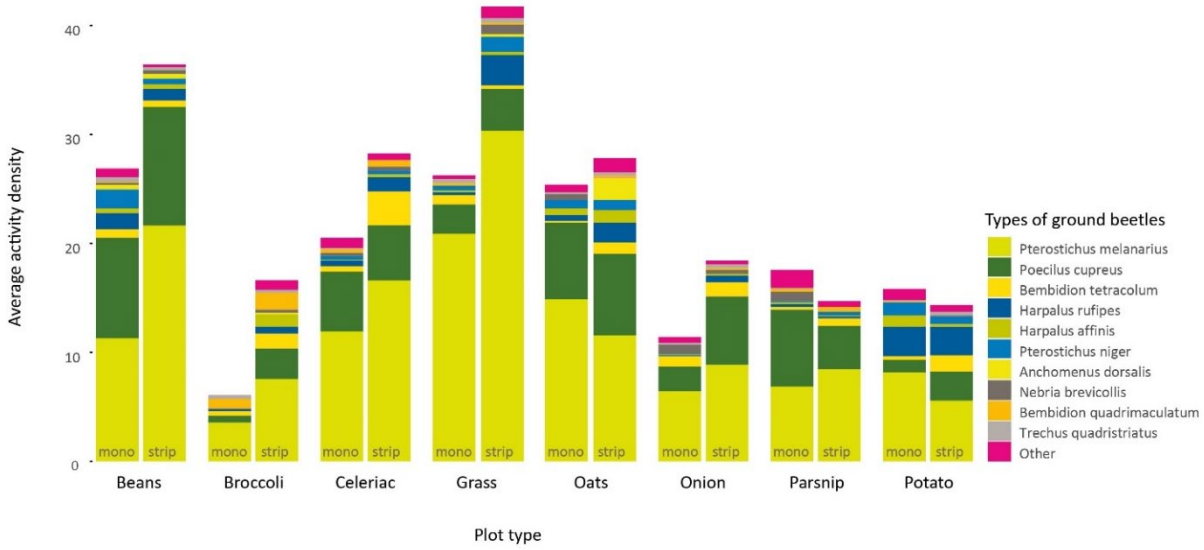


Figure 12. Higher activity and diversity of ground beetles in strip crops

It swarms not only on top of the soil but also in the soil. Nationwide research on soil life in 3-metre-wide strip crops shows that more springtails and mites are found in the soil than in monoculture (see Figure 12). These critters are the staple food for the beetles and spiders. In coming years, soil life research will also be carried out on our Trekweg plot.

Keeping soil covered

To prepare the soil for a new season, heavy clay is often ploughed in autumn. In strip cropping, ploughing is not useful because the plough displaces the strips. To feed the soil life as much as possible and leave it alone, we sow a cover crop immediately after harvest to keep the soil covered. It is also therefore preferable to leave the cover crop until spring and not to dig the plot. This is not always feasible in terms of planning and fear of weed pressure, so sometimes parts of the plot are dug in autumn.

In our broccoli, we have found that a cover crop has an additional advantage: it provides a longlasting supply of nitrogen to the broccoli.

By using natural pest control, there can sometimes be spots on the crops or caterpillars in the broccoli. It's good to explain to consumers that this can happen if you don't use chemicals.

Flower strips for more insects

In strip cropping, it is good to put flower strips between crop strips. Like field edges, these help increase biodiversity. But because our flower strips are between the crops, the insects don't have to walk or fly as far. In the beginning, we simply used a standard FAB (Functional Agro Biodiversity) mixture. In recent years, we have started looking for more specific mixtures that attract fewer cabbage white butterflies, for example, which in fact have a negative effect on cabbage crops. For instance, our flower strips have a high proportion of umbelliferous plants in the mixture. Umbelliferae such as chicory and fennel easily provide food for hoverflies and lacewings.

Grass-clover and herb strips can attract mice, though. This can cause foraging damage, especially in beet and carrots, as we saw in 2022. As part of the solution, we keep the grass short and have installed poles for birds of prey.

More field birds

In recent years, we see that strip cropping also benefits the field bird population. The past three years have seen intensive monitoring of ground-breeding field birds: yellow wagtail, skylark, lapwing, meadow pipit, oystercatcher, quail, partridge, pheasant and curlew (see box).

For proper comparison, monitoring took place in strip cropping, a monoculture plot, and a Staatsbosbeheer bird field. More birds were found in the strip cropping than in the monoculture. Another result: the number of wintering birds in the bird field was higher, but more species were found in the strip cropping. This could argue in favour of growing not only cereals but also some root crops on bird fields as well.

Yellow wagtail in oat strips

The Trekweg plot went from one breeding pair of yellow wagtail in 2020 to as many as 6 breeding pairs in 2021. All yellow wagtails nested in the strips of oats.
Interestingly, all the wagtails chose the oat strips, and none chose the oat monoculture. The wagtails collected many insects from the adjacent field bean strips and flew back to their nestlings with them. The nests of the wagtails were therefore monitored more extensively in 2022. It was then found that the wagtails (4 breeding pairs) were also foraging in the roadside/ditch-side along the A6.

Birds need time to raise and feed their young. But in dry weather, as a grower you want to get down to agricultural work, such as preparing soil for cultivation so you can plant and sow in time. If the young have not yet fledged by then, there is a dilemma.

Yellow wagtail on field beans

4.6 Weed pressure does not affect yield

‘Every plant its own customer’

Dirk van Apeldoorn (researcher Farming Systems Ecology and open cultivation at WUR)

There is always some weed pressure when you don't use herbicides. Because of the diversity in the field, there is also a diversity of weeds. Especially in the edges of the strips, we see more weeds because you actually create a new biotope. The more diverse weeds in the edges have more biomass, possibly because tillage in the strip next to them provides more germination incentive.

However, this does not have a negative effect on yields. Perhaps more species of weeds mainly compete among themselves rather than with the crop. Moreover, precisely because of this diversity of weeds, there are also fewer unwanted pests. And the beetles present eat weed seeds. In general, if different crops are alternated, proliferation of a particular weed is less likely.

Hoeing and harrowing the beans

4.7 Cultivation similar

Cultivation-wise, strip cropping is doable, but cultivation management is more complex.

Strip cropping basically does not require more labour. The invoice we receive from the contractor is the same for strip cultivation as for monoculture.
However, you will have to spend more time in advance on a good cropping plan. Our cropping plan has eight crops. The placement of the crops in the field – which crop next to which crop – was chosen ad random because of the research design. Within these crop combinations, a number of conditions were taken into account to keep the disease and pest pressure as low as possible: so no crop on the strip where the same crop was planted a year earlier. And also no crops next to each other in the crop rotation scheme. In concrete terms, this means that each crop can have 5 different neighbours and not 7. GPS makes it possible to set the right working route on tractors and machinery for each crop. As a result, we know exactly which crop is in which strip on the plot and the necessary work can be done accurately.

We are still running into some challenges in our trial fields: such as watering, manure application and harvesting of certain crops. We hope to solve this by applying drip irrigation and smarter planning of manure application and harvesting.

We have set up strip cropping, with strips 6 metres wide, so that we can use mostly the same machinery as in monoculture. A beginning strip grower can work with crop pairs to keep it practical.

Strips of 6.10 - 6.20 metres are more practical

The machines are theoretically adjusted to 3 metres, but in practice it varies slightly, so we only have to move hoes occasionally. Most strips are 6 metres. From a tillage point of view, strips of, say, 6.10 or 6.20 metres would be even more convenient, because then there is less risk of damaging the neighbouring crop if the tillage strays just a little too far.

Since we do not use a sprayer or fertiliser spreader in organic farming that takes 40 metres or more in operations, this is not a problem for us. However, it would help us if there are good autonomous machines/robots in the future that are applicable in strip cropping.

Overhanging crops

The perennial flower strips are 3 metres wide with 1.5 metres of grass on both sides. This grass is necessary because the flowers sometimes grow so high that they start hanging over neighbouring crops, which is undesirable.

Watering

It is not effective and efficient to irrigate full-field when only one crop needs water. This does happen now in spring. We apply drip irrigation by strip for drought-prone crops, such as potatoes, cabbages, celeriac and onions. The hoses for drip irrigation are about 10 centimetres below the ground, so it is easy to hoe. After cultivation, the hoses are taken out again. Unfortunately, the hoses cannot be reused. In terms of sustainability, we still want to find a solution for this. If we sow parsnips, cabbage and celeriac at the same time, irrigation via a small arm might be a solution. We would have to build this ourselves. This is not yet practical.

Manure application

The machines used to spread manure do have working widths other than 6 metres. For solid manure, we use a solid manure spreader that spreads 12 metres. For liquid manure, we use a drag hose injector that also takes 12 metres. For both machines, this means we fertilise several strips at once. For solid manure in autumn, we do it this way. For liquid manure, we have asked another contractor, who uses a 6-metre manure spreader, but this is a heavier machine. So applying manure is possible, but requires a bit more attention.

Harvesting

The biggest challenges we still face in harvesting. This requires inventiveness.

- We harvest *potatoes* using a bunker harvester and unload them on the headland, as side unloading is often not possible because of the neighbouring crop (unless we can drive over the cereal stubble).
- *Celeriac* is also harvested with a bunker machine.
- We do harvest the *onions* with a side unloader and a 3-metre trailer.
- With *parsnips and cabbage crops*, we drive over neighbouring crops if we can. Sometimes this is a dilemma, because if a crop has already been harvested and the cover crop has just been sown, you don't want to damage it.
- For harvesting oats and beans, after some searching, a contractor was found with a 6-metre-wide combine. This drives on the crop strip.
- If there is a very good harvest, the 500-metre strips are just a bit too long, as the bunker or trailer will be full before we reach the end of the strip.

If we can drive over grass-clover or green manure for tillage instead of over the crop, there is less risk of structural degradation of the soil. Sometimes it is useful to harrow the winter cereals earlier in spring, even then it is advantageous to be able to drive over a grass-clover strip or green manure crop. For the grass-clover strip, make good arrangements with the livestock farmer who buys the grass-clover mixture, because the more often it is driven over, the less fast the grass grows.

Field visit by an international group of researchers and consultants led by WUR

4.8 More work pleasure and appreciation

It is challenging and inspiring to be able to contribute to sustainable agriculture with new cultivation knowledge.

Because the strip cropping system is still relatively new, we encounter all kinds of challenges. So it calls for a lot of expertise and creativity. It is challenging and inspiring to always think from the whole of the (eco)system.

Appreciation from society

Citizens seem to appreciate the diversity of crops on the plot and also understand why we do it. On the Trekweg plot, which is really on the urban edge of Almere, interested passers-by ask the farmer many questions and voice their appreciation. With a monoculture, passers-by never say anything.

Ecosystem services

The potential for a financial gain from this way of working lies in more stable yields over time and in being able to meet ecosystem services more easily. Examples of ecosystem services provided by organic strip cropping:

- healthier soil
- more biodiversity
- climate adaptation
- improved water quality
- improved landscape quality

5. NEW OPPORTUNITIES FOR STRIP CROPPING

First year hazelnuts for agroforestry

Strip cropping still offers many new opportunities for more biodiversity

Seeing that diversity in the plot has many positive effects, we are enthusiastically continuing strip cropping and research, and trying to develop the cropping system further. Our plans:

Experiments

Combining strip cropping and agroforestry

Strip cropping with annual crops challenges us to also experiment with including perennial crops such as trees and shrubs in the strips on land we manage for longer periods.

Hemus therefore started agroforestry on a 4-hectare plot at the end of 2022. The plot is part of the Noorderwold Eemvallei plan of nature organisation Het Flevo-landschap. The combination of perennial and annual crops further increases biodiversity, which is expected to create an even more robust system with more stable yields. The row of trees consists of a mix of three species of hazel and 20% shrubs for extra biodiversity and food for birds. Crop yields, diseases and pests and biodiversity will be monitored through the PPS Agroforestry.
hemus.nu/project/agroforestry/

Combining strip farming and solar panels

Hemus is participating in the Symbizon study and from 2023 will experiment with the combination of strip cropping (including flower strips) with tilting solar panels on a plot of about 5 hectares, sandwiched between the A6 and the A27, near Almere. Hemus leases this from the Rijksvastgoedbedrijf. The ambition of this concept is to find out whether and how energy production and sustainable agriculture can go hand in hand with maintaining or even strengthening biodiversity. The consortium, consisting of Vattenfal, TNO, Aeres Hogeschool and WUR besides Hemus and ERF, aims to develop an optimal solar tracking system in combination with strip cropping.
hemus.nu/project/symbizon/

New research

Cropmix

In 2023, WUR launched the Cropmix study, in which Hemus/ERF is participating. In this, an interdisciplinary team of researchers will work with 24 arable farmers to develop new knowledge about the ecological principles for sustainable cropping systems and the socio-economic and social factors that hinder or enable the transition to farming systems with crop diversity. The strip cropping plot on Trekweg is one of the research plots in this study.
www.wur.nl/nl/nieuws/Transitie-duurzame-akkerbouw-krijgt-impuls-dankzij-onderzoeksbeurs-van-10-miljoen-euro
(transition to sustainable arable farming gets boost thanks to 10 million euro research grant)

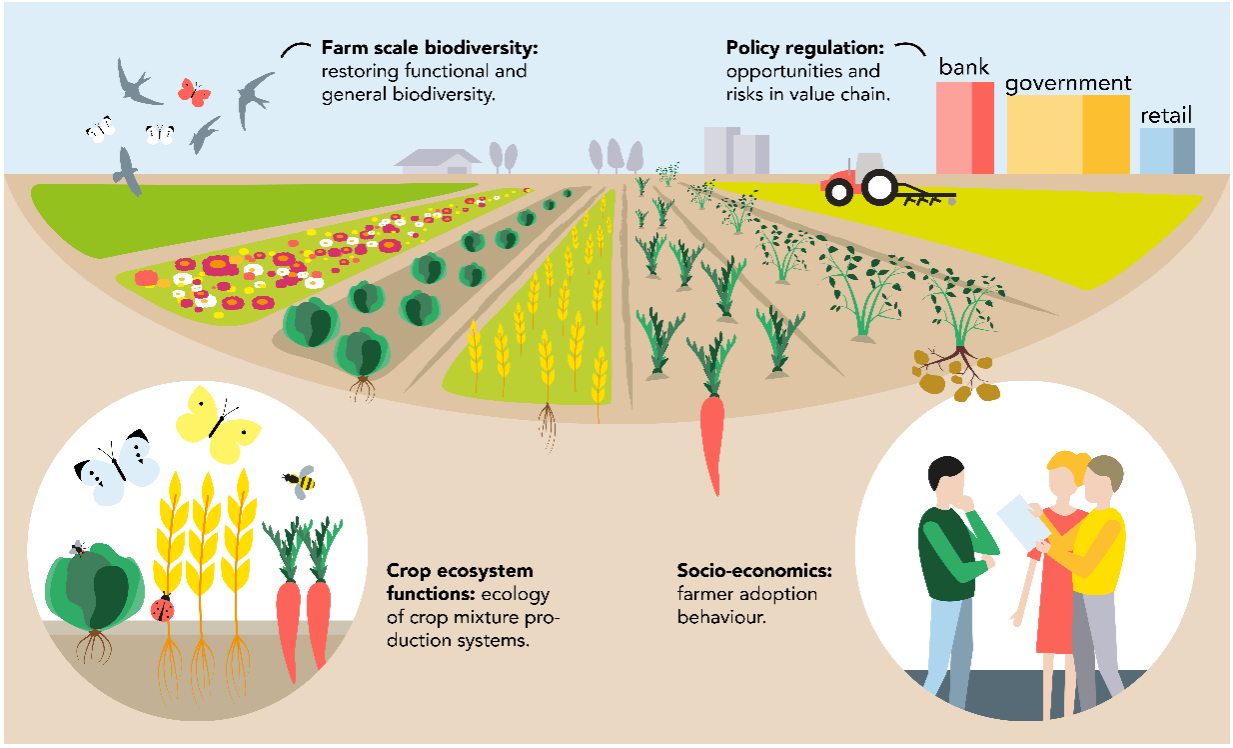


Figure 13. Cropmix

Benchmarks

Benchmarks is a 5-year European project to contribute to the EU mission that 75% of soils in the EU are healthy or significantly improved by 2030. The project is developing a tool to measure and assess soil health using different landscapes, taking into account the local context of agricultural management. Hemus/ERF are also participating in this WUR study and the Trekweg plot is the subject of research.
www.wur.nl/en/research-results/research-institutes/environmental-research/show-wenr/pan-european-research-for-better-soil-health-across-europe

Development questions

All in all, strip cropping is only the beginning of an evolution. We observe, we measure, but there's still a lot we don't know and we're far from finished learning. If we find significant results, for instance on crop combinations, we don't always know why, and whether it would be the same for someone else. Because it naturally also depends on soil type and management. That's why, as an arable farmer, you have to learn to look carefully and develop your skills.

Questions we want to explore further in the future, are for example:

- What effect does strip cropping have on soil life?
- Can we suppress soil-borne diseases with strip cropping?
- How can crop combinations make the overall plot more robust against pests and diseases?

Want to know more?

Despite all the questions, the biggest 'mistakes' have now been made and the basic knowledge is there. There is a lot of information in Ekoland magazine and on the WUR and GroenKennisnet websites.

- *www.wur.nl/nl/onderzoek-resultaten/onderzoeksinstituten/plant-research/show-wpr/strokenteelt*
- *groenkennisnet.nl/dossier/strokenteelt-dossier*

The research continues. It is also always possible to request an excursion from us via *hemus.nu/excursies*

COLOPHON

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