Programme booklet

VU Athena Institute
Connecting science and society for a better tomorrow

CropMix

Consortium meeting 12 November 2024
Athena Institute

Programme

09.30 - 10.00	Walk-in
10.00 - 10.10	Welcome and updates
10.10 - 11.00	Introduction theme ‘Cooperation and competition’ by Kristiaan Kok (Athena) & Niels Anten (WUR)
11.00 - 11.20	Coffee break
11.20 - 12.05	Panel discussion living labs with Helma Verberkt (Artemis), Marius Monen (Avans), Carla Overgaauw (RVO), and Maria van Boxtel (Land&Co), moderated by Anne Loeber (Athena)
12.05 - 12.25	Pitches first results
12.25 - 13.30	Discussion break and lunch break
13.30 - 14.45	Workshop ‘Who is the consumer?’
14.45 - 15.15	Break
15.15 - 15.35	Pitches first results
15.35 - 16.00	Plenary conclusion
16.00	Drinks

Disclaimer: These results are preliminary and not public yet. Please do not share these results without permission of the researchers involved.

Summaries of pitches by PhD candidates – first results

Lisa Marijke van den Berg – Technological readiness for mixed cropping

For my first study, I aim to explore the technological requirements for diversified cropping systems from the farmers' perspective. This pitch presents early insights from my first data collection round, focusing on how technology influences decisions regarding strip widths, which vary within our consortium.

We identified two main decision-making patterns among the farmers I interviewed. The first group bases their choices on available machinery, while the second group envisions an ideal farm layout and adjusts their equipment accordingly. When discussing strip width, farmers provided various arguments, some linked to technology.

Notably, the same reasons were cited for both wide and narrow strips. For instance, soil compaction was a concern for both; some farmers argued that wider strips reduce compaction by minimizing field crossings, while others claimed that narrower strips require lighter tractors, thus lessening compaction. Risk reduction also emerged as a factor for both strip types. Some farmers preferred wider strips to limit edge damage from pests, while others favored narrower strips to prevent pest spread.

Moreover, opinions on biodiversity varied, with some believing wider strips enhance biodiversity better than narrower ones, while others disagreed. Neither of these argument is superior, but it's important to recognize that farmers in our consortium have varying beliefs.

More info:
https://cropmix.nl/en/onderzoek/werkpakketten/werkpakket-2-socio-economie-technologie-en-logistiek/onderzoek-technologische-gereedheid-voor-gemengde-teelten/

Rik Waenink – The value of strip cropping for farmland birds

How does growing a crop in strips affect crop yield, pest suppression and biodiversity? That was investigated this year with a large research team. The research is in cereals (20 different strip crops) and potatoes (16 different strip crops). We compare strip cropping with a monoculture of the same crop with the same management (organic/conventional). So we compare an organic spring wheat in a strip crop with an organic spring wheat in a monoculture. The initial findings are:

- Potato yield is lower on average in strip cropping.
- The number of herbivores (potential pests) in potato is on average 60% higher in conventional strip cropping. The number of natural enemies increases by 20% on average. This increase can be attributed to bochelion flies and flower bugs. Other groups - such as parasitic wasps, ladybirds and lacewings - do not differ clearly.
- In common potato in strip crops, about 10% more insect eggs are eaten. The number of insect eggs eaten is a measure of pest suppression.

- In cereals in strip cropping, there are 2-3 times more slugs. The effect is strongest in organic farms and on sandy soils.
- The number of species of arable flora (or weeds) in conventional cereals is on average 45% higher in the middle and 70% in the edge of a strip compared to a conventional monoculture. In organic strip cropping compared to organic monoculture, there is no such increase.

More info:
https://cropmix.nl/en/onderzoek/werkpakketten/werkpakket-1-agro-ecologie/de-waarde-van-strokenteelt-voor-akkervogels/

Chiara Boeri – A pathway towards sustainable agriculture: farmers' willingness to adopt mixed cropping systems

My study focuses on understanding the factors that lead farmers to adopt agricultural innovations, taking into account the multiple stages that farmers face in the adoption process. From a literature review (with no geographical focus) it emerged that in each stage of adoption different factors come into play: for example at the beginning emotions and perceptions are an important driver; while during adoption technological and economic aspects related to innovation are fundamental. There is therefore heterogeneity among farmers at different stages of the adoption process, and policy making should take this into account.

At the moment I am working on a survey to investigate which factors are relevant specifically for Dutch farmers. Therefore I will check the different attitude and beliefs that farmers at different adoption stages have; and the role of information in reducing the perception of risks arising from strip cropping adoption. Finally, I will test how the fact of having to be committed (in terms of cost and time) to mixed cropping influences its adoption and to broader farmers' business choices. The feedback from our consortium will greatly help me design the survey better.

More info:
https://cropmix.nl/en/onderzoek/werkpakketten/werkpakket-2-socio-economie-technologie-en-logistiek/bereidheid-boeren-om-gemengde-teelt-toe-te-passen/

Frank Lee Harris – Soil food web and nutrient cycling

As industries such as insect proteins for animal feed increase, using byproducts from them becomes more appealing than ever. Insect frass as a fertilizer has shown a lot of interesting properties. From delayed mineralization to inducing systemic resistance in crops, this new substance has promise! In these frassinating finds we examine how insect based fertilizer from Protix (Flytilizer) might interact with strip cropping, might be better suited to some plants than others and may decrease the nitrogen losses a field experiences. We test this in strip cropping of barley and cabbage. Particularly we tackle the following:

- Do the nitrogen dynamics of insect based fertilizer differ from conventional organic fertilizers such as chicken manure? → Yes! They seem to.

- Does any shift in the nitrogen dynamics also change between strip and monocropping? → Maybe, this has not been analyzed yet.
- Do these nitrogen dynamics have a significant effect on yield? → While this has not been observed with barley, it may still be the case with cabbage.
    - How do alterations in nitrogen dynamics effect nitrogen use efficiency (NUE)? → Maybe, this has not been analyzed yet.

More info:
https://cropmix.nl/en/onderzoek/werkpakketten/werkpakket-1-agro-ecologie/bodemvoedselweb-en-nutrientencyclus/

Gabriele Bolletta – Effects of plant diversity on biocontrol of insect pests

In our study, we investigated how strip cropping with either two or six crops affects the biocontrol of caterpillar pests on cabbage, in comparison to monoculture systems. The experiment was conducted over two years at two locations in the Netherlands, Wageningen and Lelystad.

Across both years and locations, the parasitism rate of caterpillar pests (*Pieris brassicae* and *Plutella xylostella*) was significantly higher in the strip cropping systems, with an increase of approximately 50% over monoculture systems. Notably, we observed no substantial difference in parasitism rates between the strip cropping systems with only two crops and those with six.

Additionally, we measured predation rates among various farmers in the network, by placing egg cards with eggs of butterflies, comparing strip cropping systems to monoculture references. For cereals specifically, there were no significant differences in predation rates between the monoculture and strip cropping systems. However, in other crops, such as potatoes, strip cropping substantially enhanced pest predation by approximately 10%.

Overall, our findings indicate that strip cropping can enhance biological control of insect pests, at both the egg and larval stages, providing better ecosystem services compared to monocultures.

More info:
https://cropmix.nl/en/onderzoek/werkpakketten/werkpakket-1-agro-ecologie/biocontrol/

MoestuinMix

One of the aims of our experiment was to gain insight into the knowledge of vegetable gardeners that could be of value to arable farming, especially crop-diverse cropping systems. We asked them which crop they chose to combine with faba beans and why.

Below you can see the top 10 choice crops and some reasons participants gave.

1. **Red beets**
2. **Potatoes** - because of the use of nitrogen from the beans
3. **Lettuce** - because of the use of nitrogen from the beans and because they cover the soil
4. **Peas and pods**

5. **Maize** - because it fits in with the idea of 'Three Sisters' - combination cultivation of pumpkin, maize and beans
6. **Onions** - because they repel harmful insects
7. **Other beans** - because of equal nutrient requirements, as both are nitrogen fixers and thus store more nitrogen in the soil for next year's crop, or as a distraction for pests in the later (stick) beans
8. **Chard**
9. **Courgette** - because of their resemblance to pumpkin, because they attract pollinators or because low courgettes also save space in the garden alongside tall broad beans
10. **Spinach** - can be harvested before broad beans are tall so that light is maximised

We are now analysing the yield data. A little sneak peak: faba beans next to celery had statistically significantly more pods on average per plant (about 2 pods more on average) than broad beans next to pumpkins in the same gardens. On average, there were about 6.5 pods per garden bean plant at the time of the first harvest, but there was a lot of variation: ranging from less than 1 pod per plant to more than 40 pods on one plant.

Stay updated through www.cropmix.nl/en/moestuinmix/resultaten.

Thijmen van Loon – Designing agricultural landscapes and the role of strip cropping

The goal of my PhD is to better understand how we can design agricultural landscapes to increase biodiversity. In my first study, I focus on crop diversity. Increasing crop diversity in agricultural landscapes can offer many benefits, from enhanced biodiversity to natural pest control. New forms of farming, such as strip cropping and pixelfarming, can contribute to a more diverse landscape.

Quantifying the exact contribution of growing multiple crops in a single field to the overall diversity of a landscape is challenging. It also depends on what is grown in surrounding fields. Moreover, we cannot assume that any crop can be grown everywhere. There are costs and benefits associated with increasing crop diversity that can vary for each farmer, depending on factors such as current farming practices and soil quality.

For this reason, we developed a model that can optimize crop diversity in agricultural landscapes. The model selects a crop plan for each farm in the landscape from a predefined set. These farm plans can vary in diversity and consider what has been previously grown on specific fields on each farm. We applied this model to the municipality of Flevoland. Our initial preliminary results show how much and where crop diversity increases when the current crops are grown in strips.

More info:
https://cropmix.nl/en/onderzoek/werkpakketten/werkpakket-2-socio-economie-technologie-en-logistiek/onderzoek-inrichten-van-agrarische-landschappen/

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