Spatial and temporal crop diversification through new field arrangements in a heterogeneous agricultural landscape: the patchCROP landscape experiment and simulation study

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Fig. 1. On-farm patchCROP experiment in a ~70 ha field in Brandenburg Germany

Introduction

- Intensified cropping systems in Germany are highly productive but has also led to biodiversity loss and threats of ecosystem services (ESS) delivery by the agroecosystems.
- Diversified cropping systems offer multiple benefits to the agroecosystem for the provision and regulation of ESS.
- With the development of smaller robots and machinery in the future it will be possible to reduce field sizes that further promote biodiversity.
- Considering spatial-temporal field heterogeneities can additionally contribute to the improvement of resource use efficiency.

The patchCROP landscape experiment is a living lab to study how newly diversified field arrangements that consider field heterogeneities, affect the multifunctional response of agroecosystems, which will support the design of future cropping systems.

Fig. 2. Experimental field design for the patchCROP, 2020/21 season.

Materials and Methods:

- ✓ patchCROP is an on-farm experiment established in 2020, located in Eastern Brandenburg, Germany.
- ✓ A total of 30 "patches" (no replications, patch of 72x72 m of about 0.5 ha).
- ✓ Reference patches with sole crop cultivation and conventional field size.
- ✓ Yield potential zones were developed based on cluster analysis of 10-year yield maps & soil parameters.
- ✓ Site specific crop rotations:

Yield potential	Year 1	Year 2	Year 3	Year 4	Year 5
High	Rapeseed	Barley	CC-Soybean	CC-Maize	Wheat
Low	CC-Sunflower	Oats	CC-Maize	Lupin	Rye

*CC:cover crop

Crop management windows:

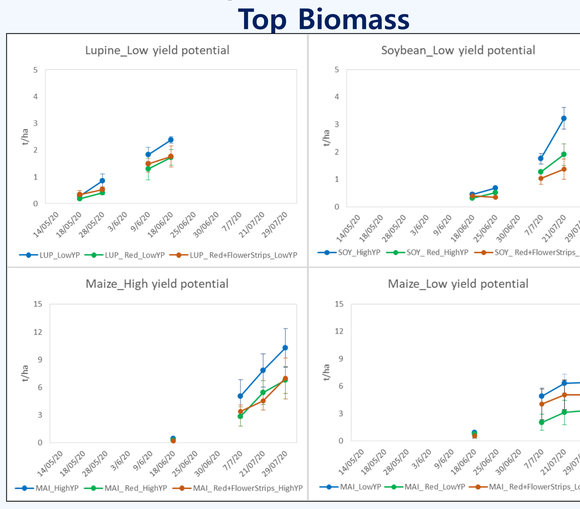
1. Conventional pest and weed management
2. Reduced pest and weed management
3. Reduced pest and weed management+flower strips

Conducted measurements :

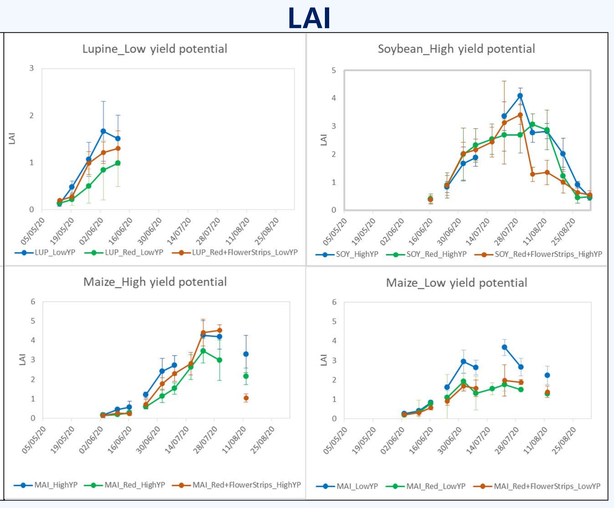
Weather, crop phenology, LAI, NDVI, plant height, soil moisture & temperature, aboveground biomass, biodiversity (e.g. birds, carabids, earthworms), multispectral imagery, comprehensive soil mapping and sampling with traditional and modern methodologies.

Preliminary results:

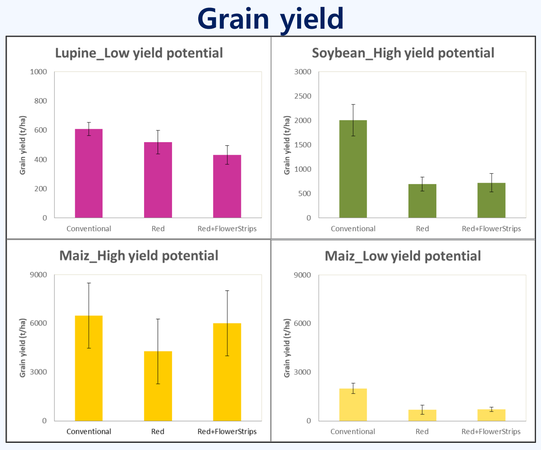
Top Biomass



LAI



Grain yield



Relationships

Preliminary results

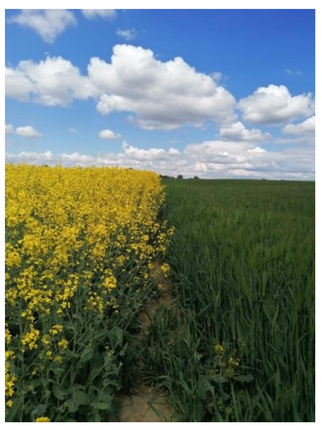
- ✓ Seasonal rainfall from March to October was 274mm with March, July and September being the driest months.
- ✓ Mean temperature ranged from 4.8 to 19.7°C
- ✓ Soil differences affect crop growth and maize yield, where high yield potential patches showed increased growth and yield.
- ✓ Conventional pest & weed management treatment generally resulted in higher crop growth and yield.
- ✓ Reasonable relationships were found between plant height and LAI with NDVI collected at the field.

Discussion

- ✓ Yield trade-off for reduced pesticide application and flower strip inclusion may be compensated by the additional delivery of ESS by the agroecosystem.
- ✓ Experimental long-term infrastructure provides platform and scientific framework to test digital tools and cropping systems of the future at multiple spatial and temporal scales.

COLLABORATE WITH US!

We cordially invite you to take action in this interdisciplinary and innovative project and collaborate with research from many disciplines to design, support and implement new digital technologies and ecological advances in patchCROP.



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