Leibniz Centre for
Agricultural Landscape Research
(ZALF)

An agricultural diversification trial by patchy field arrangements at the landscape level: The landscape living lab "patchCROP"

Kathrin Grahmann[1], Moritz Reckling[1], Ixchel Hernandez-Ochoa[2] and Frank Ewert[1,2]

[1]Leibniz Centre for Agricultural Landscape Research (ZALF), Germany,
[2]University of Bonn, Institute of Crop Science and Resource Conservation (INRES), Germany

Challenge

- Agricultural intensification is closely connected to large scale farming
- Biodiversity decline through high pesticide use and intensive tillage
- Spatial and temporal crop diversification together with digital technologies can contribute to sustainable cropping systems

Research Need

- Redesign agricultural landscapes of the future to reduce chemical-synthetic pesticide applications
- New field arrangements with smaller field sizes and new field shapes
- Replacing large uniform and mono-cropped fields
- Advancements in using ecological principles and new technologies
- Field robotics in the future may allow different patch sizes and forms
- Technical feasibility will increase & enhance sustainable intensification

Fig. 1: Experimental layout of patchCROP for the winter cropping cycle 2020/21 in a 70 ha field.

- Urgent need for experimental platforms at the landscape scale to assess the functioning of innovative field technologies
- In combination with multiple measures of sustainability indicators
- Support progress in the design of future cropping systems
- New landscape experiment addresses multiple-level problems:
  - Soil heterogeneity
  - Climate change
  - System resilience
  - Dependency on external inputs
  - Specifically aiming to reduce chemical synthetic pesticides.

Experimental approach of patchCROP

- Newly designed field arrangements within a 70 ha large field surrounded by more than 700 ha of agricultural fields (Fig. 1)
- Site-specific small structured field patches of 72 × 72 m size
- Heterogeneous soil conditions with varying soil texture & topography
- Identification yield potential zones (high/low) through:
  - Automated cluster analysis of the entire field
  - Using ten years of yield maps
  - Different soil quality parameters of the top soil (0–25 cm)
- Site specific crop rotations for each yield potential zone (Table 1)
- Three different land use intensities with varying pesticide use:
  1. Business as usual (conventional pesticide application)
  2. Dynamic approaches to reduce pesticides
  3. Same as no. 2 with additional 12 m wide perennial flower strips (flower strips may support natural enemies and pest suppression)

- The decision-making for pesticide reduction strategies in collaboration with the Federal Research Centre for Cultivated Plants (Julius-Kühn Institute)
- Co-design and co-innovation methods for high level of engagement with farmers' needs and new technologies' implementation potentials

Outlook

- Experimental long-term infrastructure providing space and scientific framework to test digital tools and cropping systems of the future
- Systematic analyses and monitoring of ecosystem services delivered from agricultural landscapes by compartmentalization of large fields

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 improve ecosystem services in patchCROP

Table 1: Five-year crop rotation for each yield potential zone (CC= cover crop)

Yield potential	1st year	2nd year	3rd year	4th year	5th year
High	Rapeseed	Barley	CC-Soybean	CC-Maize	Wheat
Low	CC-Sunflower	Oats	CC-Maize	Lupin	Rye

Contact person: Dr. Kathrin Grahmann
Leibniz Centre for Agricultural Landscape Research (ZALF) · Eberswalder Straße 84 · 15374 Müncheberg · Germany
www.zalf.de · Kathrin.Grahmann@zalf.de · +49 33432 82-142 · Date: January, 18th, 2021

PHENOROB · DAKIS Digitales Wissens- und Informationssystem für die Landwirtschaft · JKI Julius Kühn-Institut · Leibniz Association