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AGRICULTURE 4.0 – WITHOUT CHEMICAL-SYNTHETIC PLANT PROTECTION (NOCSPS)

Ingrid Claß-Mahler, Ingrid.Classmahler@uni-hohenheim.de

Department of Farm Management UNIVERSITY OF HOHENHEIM

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Agri culture 4.0

NOcsPS

without Chemical-Synthetic Plant Protection

UNIVERSITY OF HOHENHEIM

JKI

GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN IN PUBLICA COMMODA SEIT 1737

NOcsPS – Introduction and analysis of Experimental Setup

Development of a new cropping system without chemical-synthetic plant protection products but with optimized use of mineral fertilizers and with innovative cultivation measures

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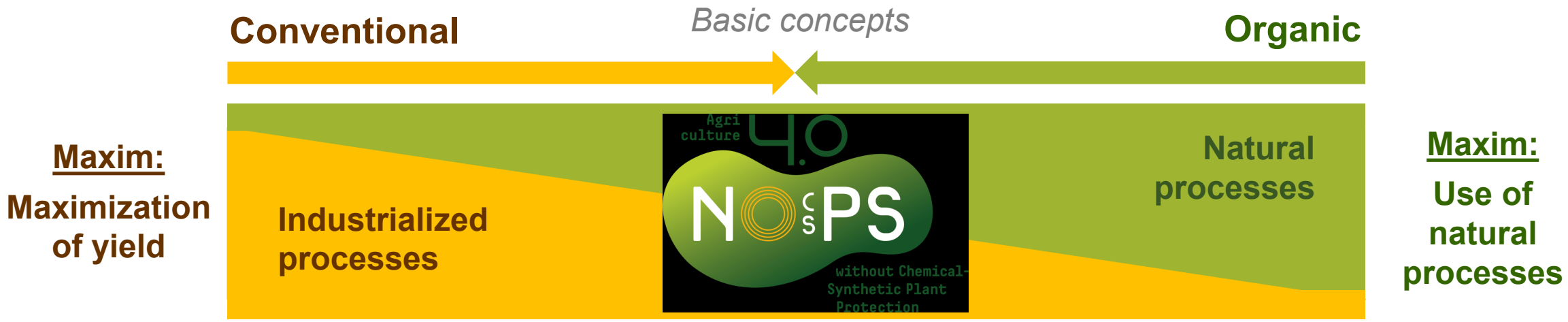
Agrarsysteme der Zukunft

Farming Concepts



Source: Zimmermann et al., 2021. https://doi.org/10.3390/agronomy11091710

- ✓ **No use of CSPs**
- ✓ **Moderate use of mineral fertilizer**
- ✓ **Use of new technologies and agro-ecological measures**

Why do we need a NOcsPS farming concept/cropping system?

- ➢ Registration restrictions for future and fewer active ingredients for CSPs
- ➢ Securing the quantitative supply of food
- ➢ Residues viewed critically by society

Challenges for NOcsPS farming concepts / cropping systems

- Yield depression or yield losses
  - Diseases
  - Pest infestation
  - Weeds
- Economic risk
- Marketing
  - Quantity
  - Quality
- Valorization
  - Sustainability
  - Consumer acceptance

Objectives of the NOcsPS project

Objective: Improvement for ecosystem services of agricultural landscapes

- Production of healthy food and high **supply performance**
- Preservation and promotion of **biodiversity**
- Increasing **sustainability** with a contribution to climate protection
- **Consumer acceptance**

SUSTAINABLE DEVELOPMENT GOALS

What characteristics must a NOcsPS cropping system have in order to achieve the stated objective and goals?

Main characteristics of NOcsPS cropping sys

Agro-ecological measures

- Diverse crop rotations
- Disease-resistant varieties
- Optimized sowing patterns
- Landscape elements

Promotion of resilience, yield stability and resource protection

Environmentally friendly use of nutrients and bio-based crop protection products

- Mineral micro- and macronutrients
- Bioeffectors (bacteria, algae)
- Beneficial organisms

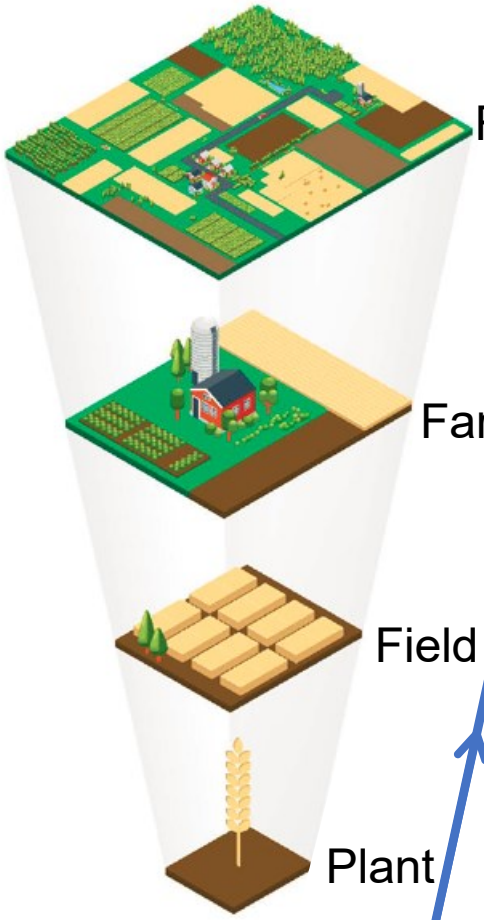
Promotion of plant growth and plant health

Farm… Technologie…

- Monitoring of plant gr… and plant health
- Application of seeds, nutrients, beneficial organisms and bio-based CSPs
- Weed control (camera-controlled, automated weed hoe)

Increasing resource efficiency

Research at all Scales



Region

Farm

Field

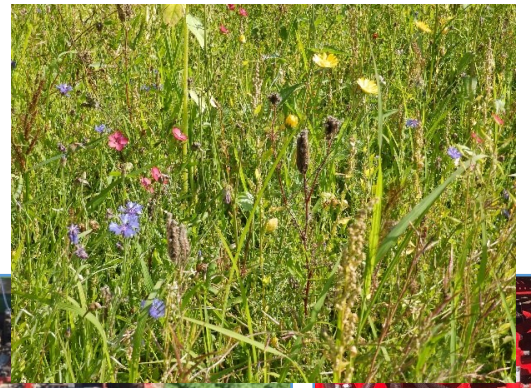
Plant

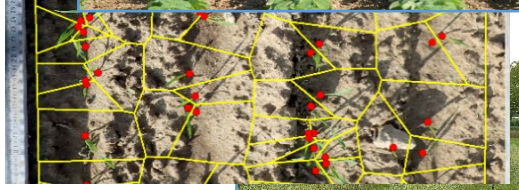
Conversion of the Cultivation System

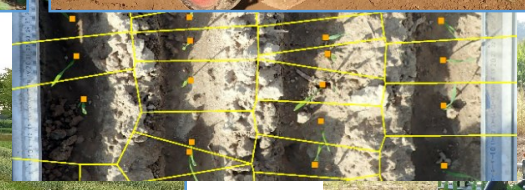
Farm Analyses Surveys

System- and Exact-Trials

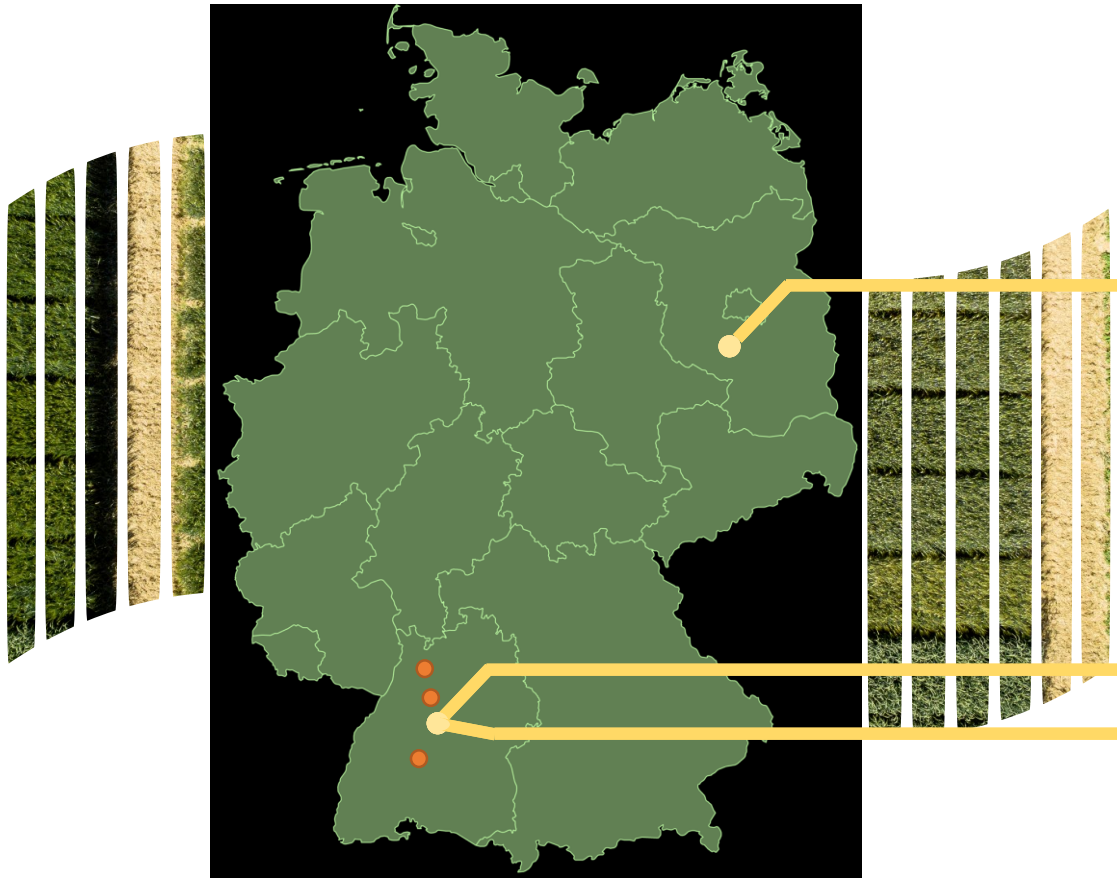
Lab Analyses and Greenhouse Experiments







Experimental sites and trials



System trial, Dahnsdorf, JKI

On-farm trials

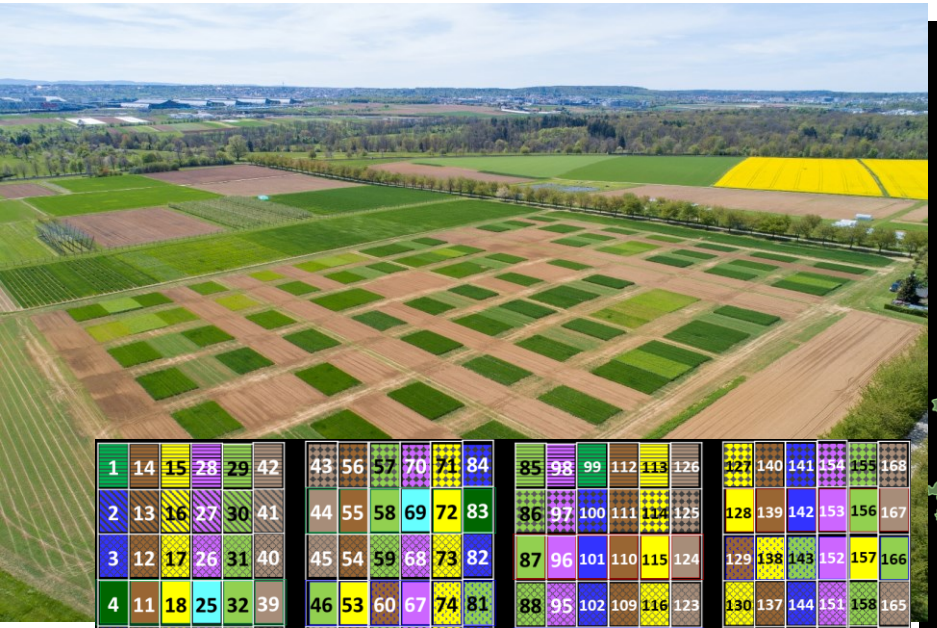
System trial Heidfeldhof, UHOH

System trial with special crops
SfG, Hohenheim

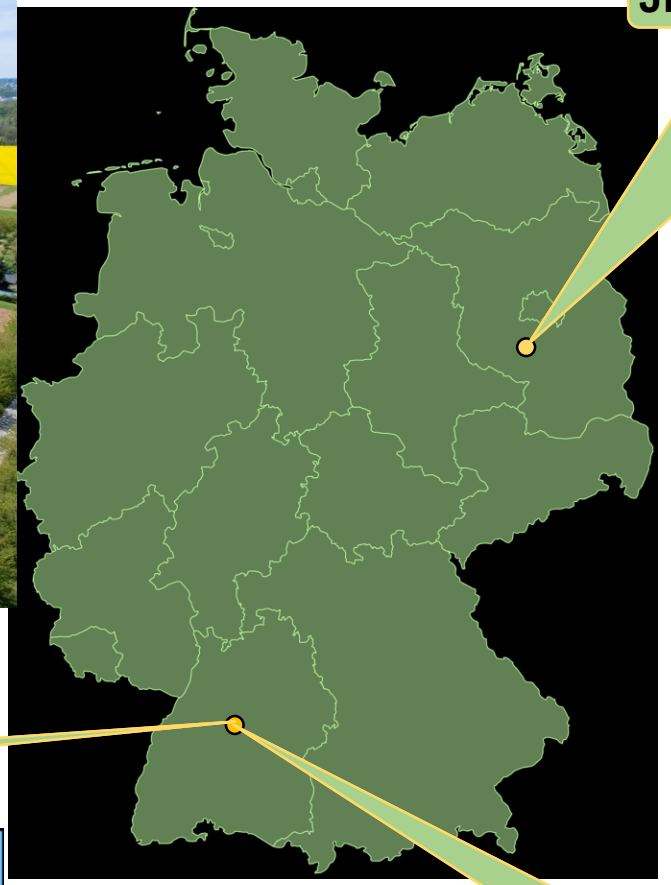
Crop rotation trial Heidfeldhof, UHOH

Conversion trial Meiereihof, UHOH

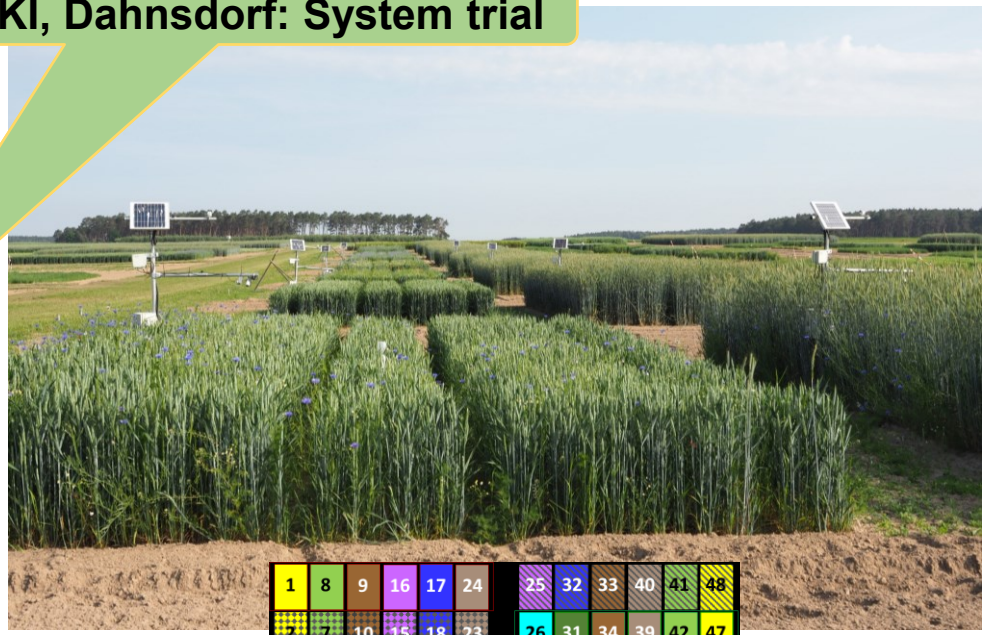
System trials

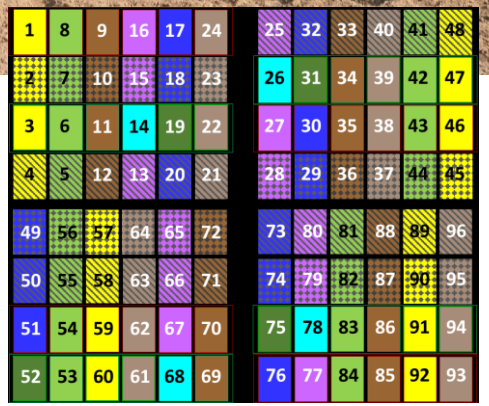


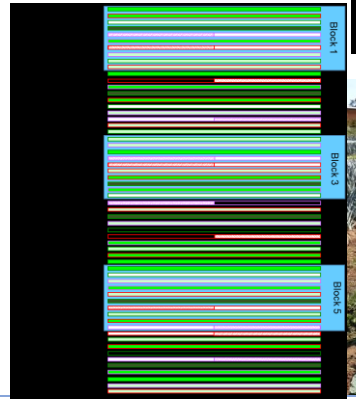
UHOH: System trial



JKI, Dahnsdorf: System trial







SfG: System trial with special crops

Cropping Systems and Crop Rotations of the system trials

Cropping System	Conventional (CI)	Conventional (CII)	NOcsPS I	NOcsPS II	NOcsPS III	NOcsPS IV	Organic
Sites	**UHOH**	**UHOH / JKI**	**UHOH / JKI**		**UHOH**		**UHOH / JKI**
Crop rotations	Winter wheat	Winter wheat I	Winter wheat I	Winter wheat I	Winter wheat I	Winter wheat I	Winter wheat I
	Maize	Maize	Maize	Maize	Maize	Maize	Maize
	Soybean	W-Triticale / W-Rye	W-Triticale / W-Rye	W-Triticale / W-Rye	W-Triticale	W-Triticale	W-Triticale / W-Rye
		Soybean / Pea	Soybean / Pea	Soybean / Pea	Soybean	Soybean	Soybean / Pea
		Winter wheat II	Winter wheat II	Winter wheat II	Winter wheat II	Winter wheat II	Winter wheat II
		Spring barley	Spring barley	Spring barley	Spring barley	**Ryegrass**	**Clover grass**

		Crop rotation	Seed pattern	CSP application	Mineral fertilizer application
Conven-tional	CI-1	3-year standard	normal	standard	standard
	CI-2	3-year standard	normal	standard	standard
	CII	6-year NOcsPS adapted	normal	standard	standard
Organic	ORG	6-year NOcsPS adapted	normal	no	no
NOcsPS	NOcsPS I	6-year NOcsPS adapted	normal	no	NOcsPS adapted standard
	NOcsPS II	6-year NOcsPS adapted	aES	no	NOcsPS adapted standard
	NOcsPS III	6-year NOcsPS adapted	aES	no	NOcsPS adapted standard, placed application using Cultan technique, bio-stimulants, micronutrients, zinc, manga-nese and silicon as well as algae extracts
	NOcsPS IV	6-year NOcsPS adapted	normal	no	NOcsPS adapted standard

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NOcsPS - Results

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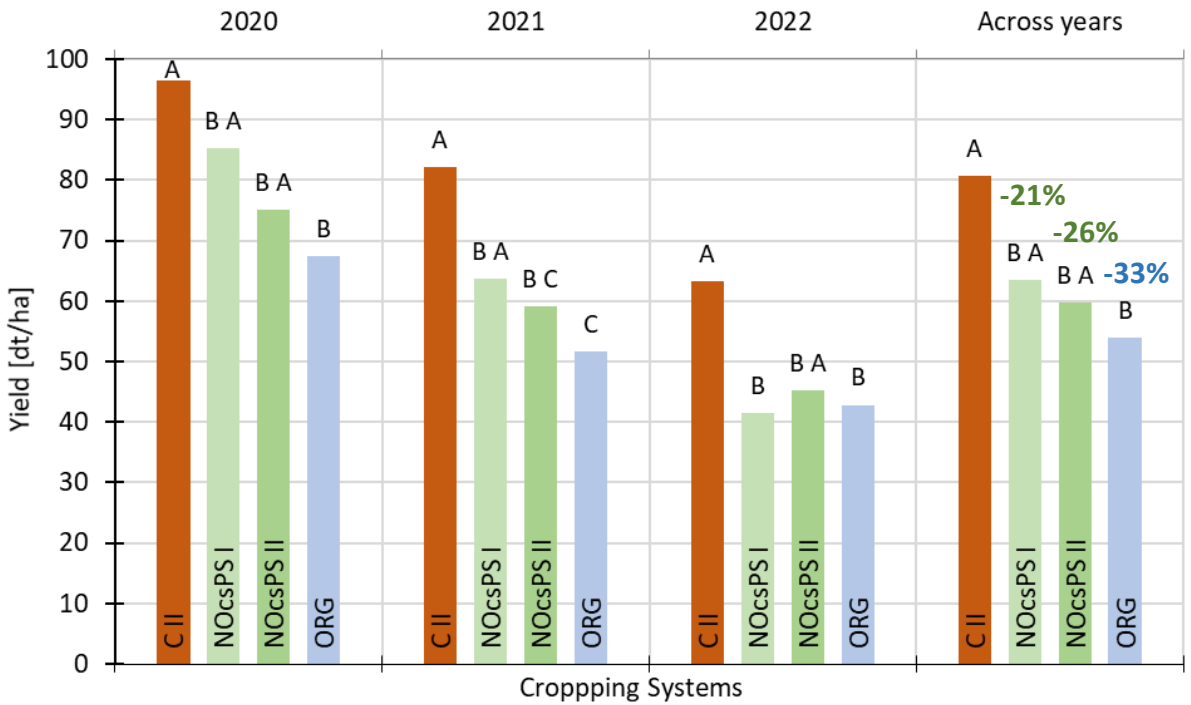
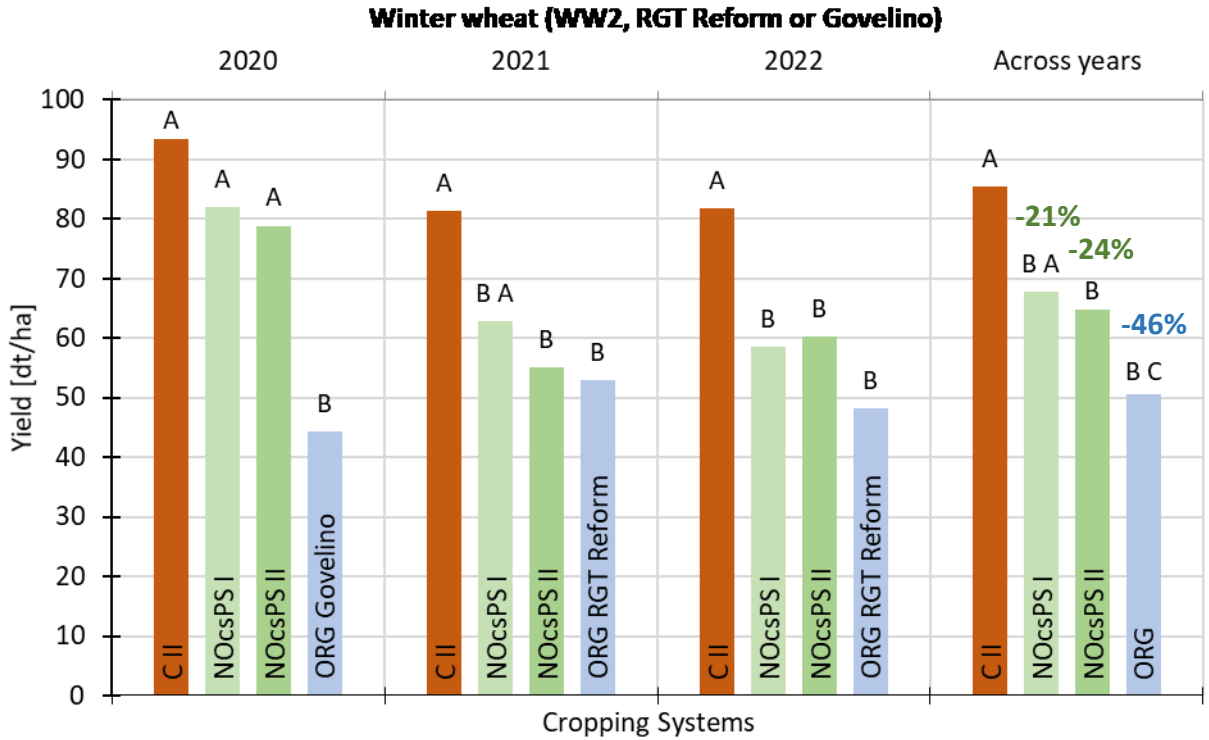
Winter wheat yields Dahnsdorf, JKI 2020-2022

Preceding crop: Spring Barley



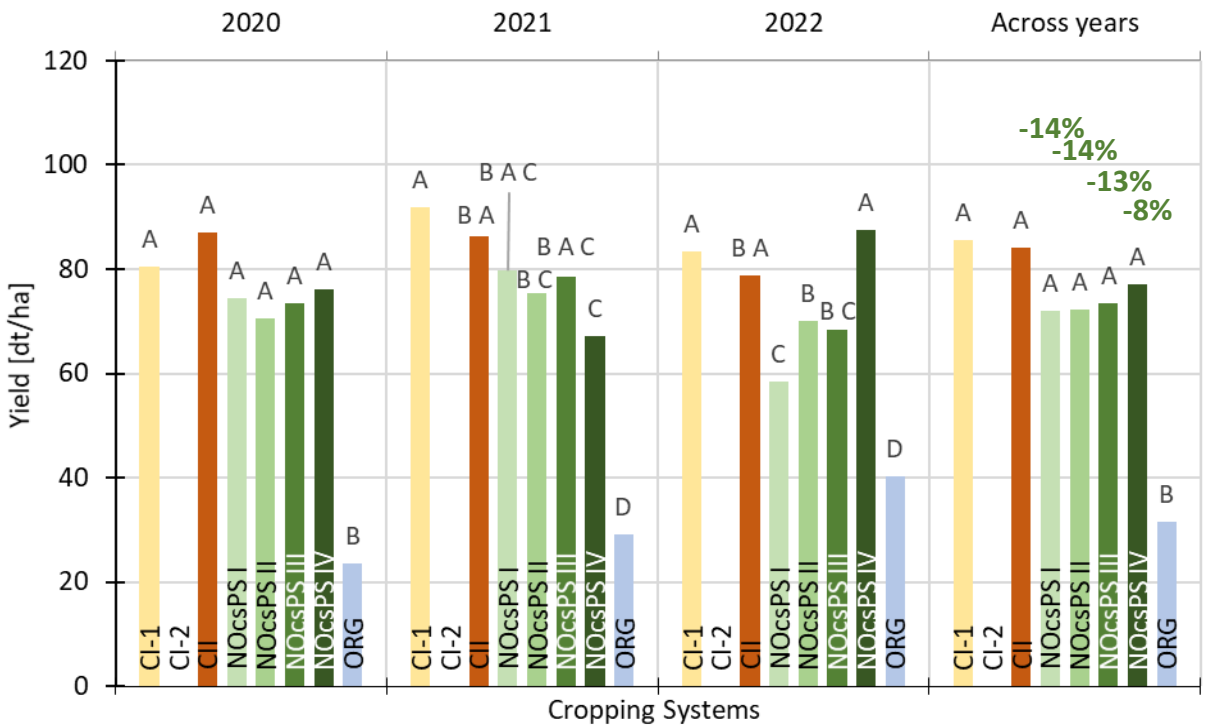
Preceding crop: Legumes (Peas)



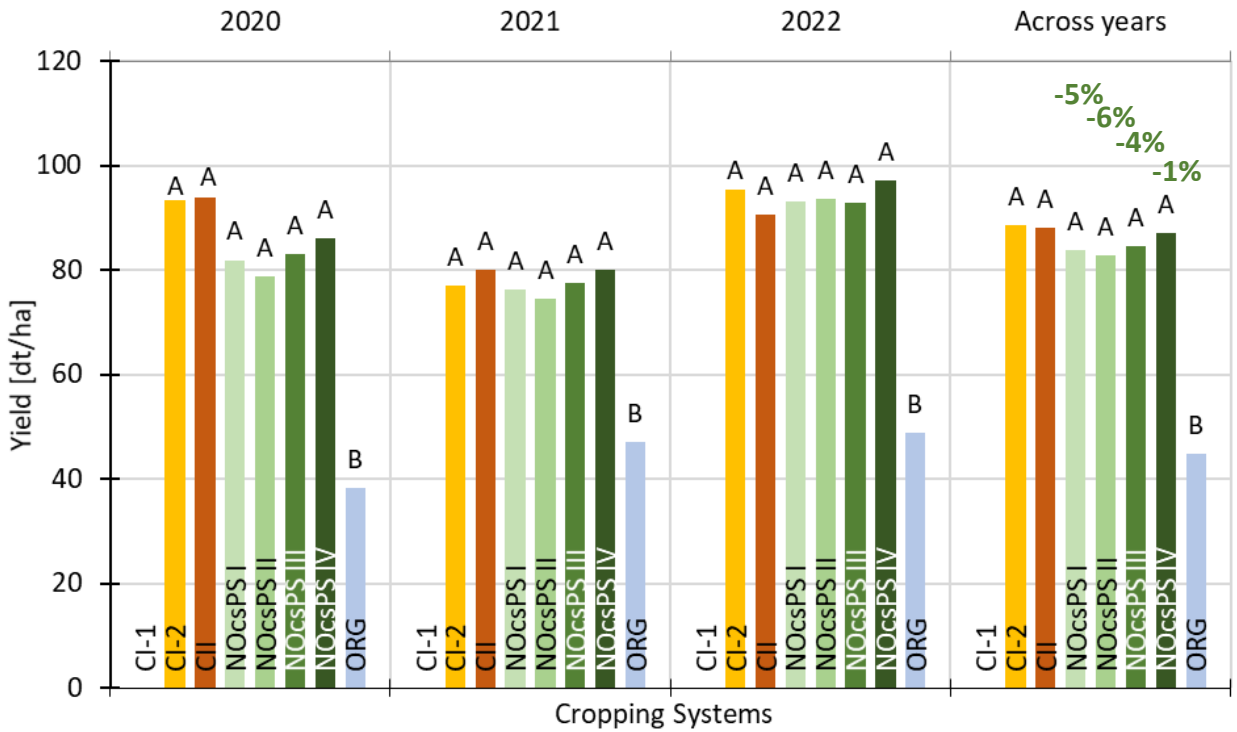
Source: Claß-Mahler et al., 2024. https://doi.org/10.5073/LBF.2023.01.05

Winter wheat yields UHOH 2020-2022

Preceding crop: Spring Barley



Preceding crop: Legumes (Soybean)



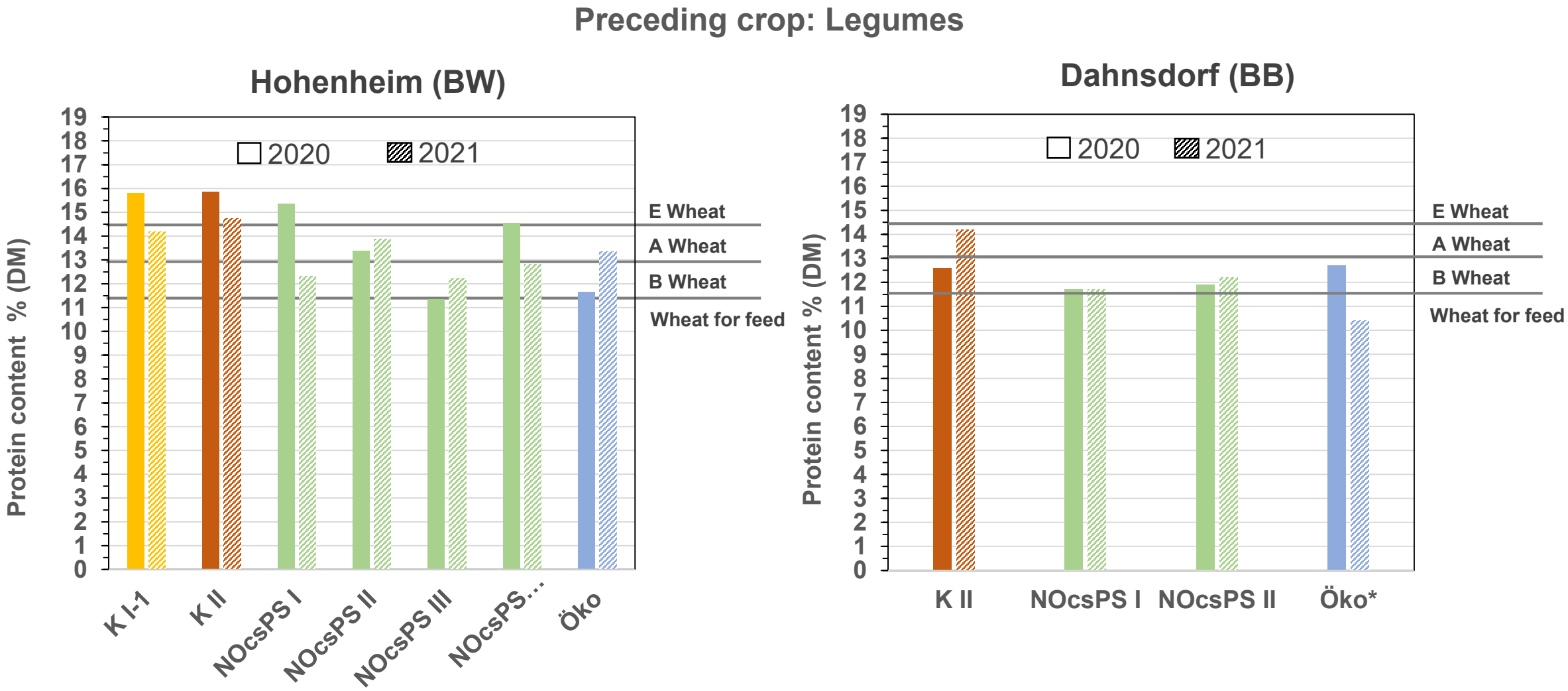
Source: Claß-Mahler et al., 2024. https://doi.org/10.5073/LBF.2023.01.05

Grain equivalent unit (GE) for the crop rotation (mean 2020-2022)

Cropping system	Hohenheim (BW)		Dahnsdorf (BB)	
	GE/ha	GE in comparison to Conv. II. [%]	GE/ha	GE in comparison to Conv. II [%]
Conventional II	**415**	**100**	**376**	**100**
NOcsPS I	366	88	303	81
NOcsPS II	358	86	270	72
NOcsPS III	356	86	-	-
NOcsPS IV	362	87	-	-
Organic	210	51	291	77

Source: Hermann, W., Schwarz, J., 2023. Yield data University of Hohenheim and Julius Kühn-Institut 2020 to 2022. AdZ Statusseminar, September 2023, Berlin.

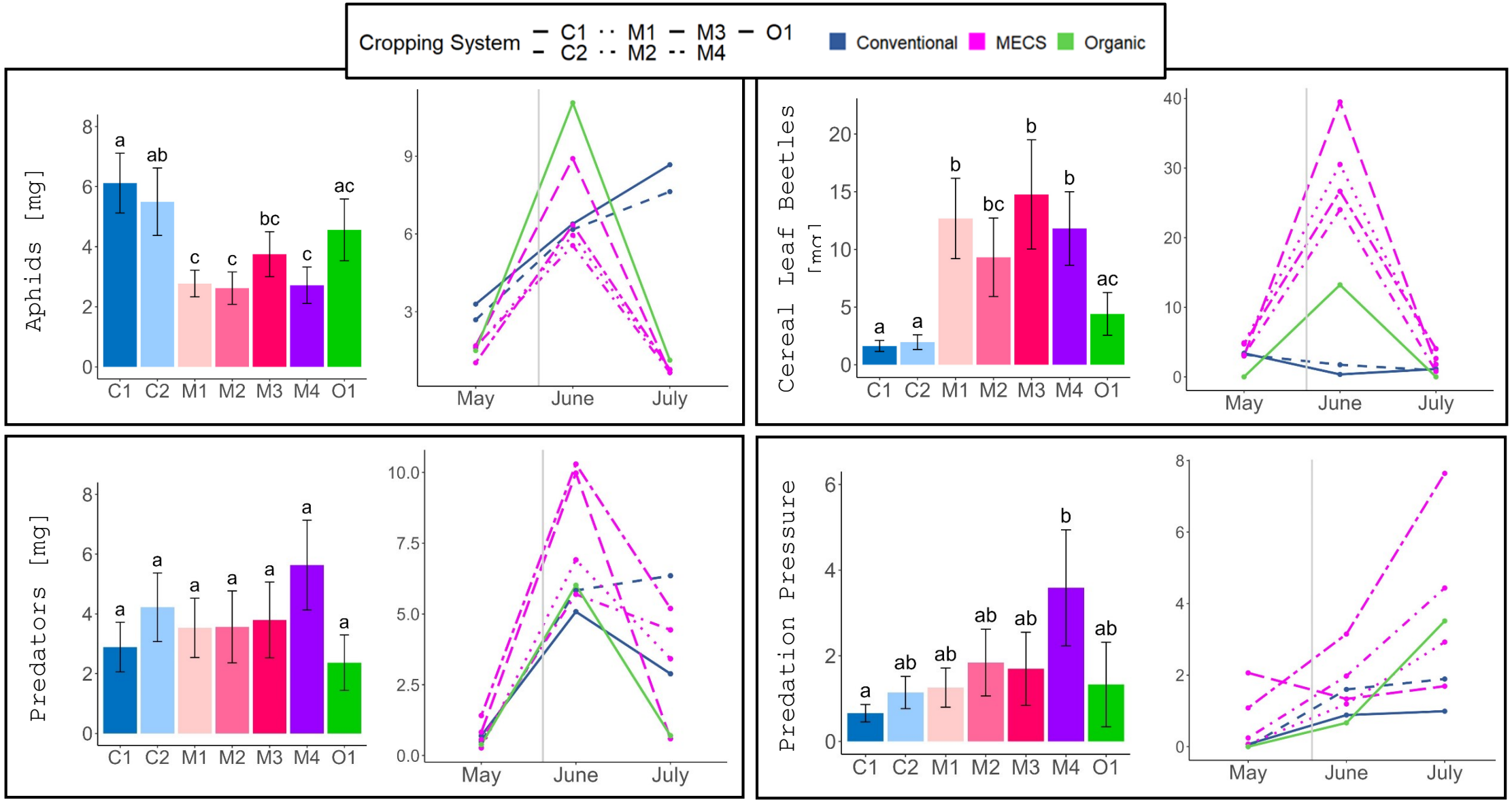
Protein content in winter wheat II



Source: Hermann, W., Schwarz, J., 2023. Yield data University of Hohenheim and Julius Kühn-Institut 2020 to 2022. AdZ Statusseminar, September 2023, Berlin.

Biodiversity results at plot scale – System trial UHOH

BIOLOGICAL PEST CONTROL



Source: Riemenschneider et al. (manuscript in preparation)

Conclusion and Outlook

- In NOcsPS cropping systems, reduced yields compared to conventional systems depend on the location and the position of the crop in the crop rotation
- Yield losses in NOcsPS cropping systems were lower than expected
- NOcsPS cropping systems have a positive effect on biodiversity

- The project is to be continued to ensure long-term effects on biodiversity, economic aspects and a reliable assessment of sustainability
- In our project, yields in organic system should be increased by organic fertilization

Thank you for your attention

Ingrid Claß-Mahler

www.NOcsPS.de