Z ZNANJEM ZREMO V PRIHODNOST

EKOLOŠKO KMETOVANJE IN VARSTVO NARAVE – PRILOŽNOSTI IN IZZIVI ZA SLOVENSKO KMETIJSTVO

40. TRADICIONALNI POSVET JAVNE SLUŽBE KMETIJSKEGA SVETOVANJA IN DAN SISTEMA ZNANJA IN INOVACIJ (AKIS)

DEVELOPING ORGANIC FARMING: BENEFITS AND THE ROLE OF KNOWLEDGE

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ZREČE, 18. NOVEMBER 2025

REPUBLIKA SLOVENIJA MINISTRSTVO ZA KMETIJSTVO, GOZDARSTVO IN PREHRANO

Kmetijsko gozdarska zbornica Slovenije 25 LET
Chamber of Agriculture and Forestry of Slovenia

Sofinancira Evropska unija

SKUPNA KMETIJSKA POLITIKA

High productivity gains in (German) agriculture…

+283%

Ernteertrag für 1 ha Weizen (Winterweizen einschl. Dinkel und Einkorn)

1950*:	2.580 kg
1980*:	4.890 kg
Durchschnitt 2017–19:	7.303 kg

Ernteertrag für 1 ha Kartoffeln

1950*:	24.490 kg
1980*:	25.940 kg
Durchschnitt 2017–19:	40.400 kg

+333%

Milchleistung pro Kuh und Jahr

1950*:	2.480 kg
1980*:	4.538 kg
2019:	8.250 kg

Legeleistung einer Henne pro Jahr

1950*:	120 Eier
1980*:	242 Eier
2019:	298 Eier

* früheres Bundesgebiet

BMEL (2020) Landwirtschaft verstehen

…but at the expenses at high external costs! (ZKL, 2021):

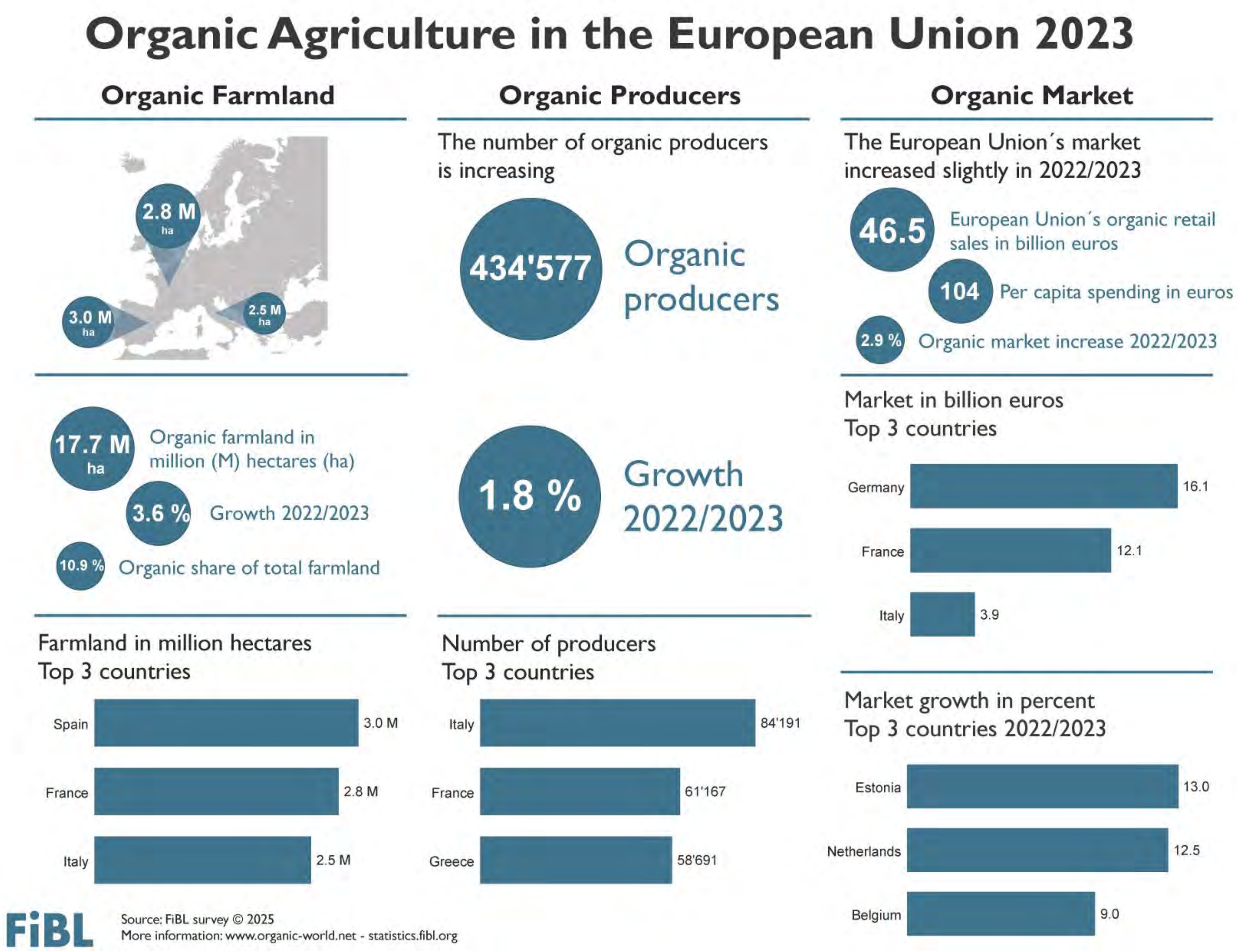
(21bn € < 90bn €)

Developing organic farming: benefits and the role of knowledge

1. **Organic Farming as a role model – what does science say about the benefits of organic farming**

2. The role of research in delivering the potential of organic farming
    - The yield problem and how to overcome this?
    - Eco-functional intensification in organic cropping systems
    - Organic crop-livestock systems: example of GreenDairy & ClieNFarms

3. Concluding words


Organic Agriculture in the European Union 2023
Organic Farmland
2.8 M ha
3.0 M ha
2.5 M ha
17.7 M ha
Organic farmland in million (M) hectares (ha)
3.6 %
Growth 2022/2023
10.9 %
Organic share of total farmland
Farmland in million hectares
Top 3 countries
Spain 3.0 M
France 2.8 M
Italy 2.5 M
Organic Producers
The number of organic producers is increasing
434'577
Organic producers
1.8 %
Growth 2022/2023
Number of producers
Top 3 countries
Italy 84'191
France 61'167
Greece 58'691
Organic Market
The European Union´s market increased slightly in 2022/2023
46.5
European Union´s organic retail sales in billion euros
104
Per capita spending in euros
2.9 %
Organic market increase 2022/2023
Market in billion euros
Top 3 countries
Germany 16.1
France 12.1
Italy 3.9
Market growth in percent
Top 3 countries 2022/2023
Estonia 13.0
Netherlands 12.5
Belgium 9.0
FiBL
Source: FiBL survey © 2025
More information: www.organic-world.net - statistics.fibl.org

EUROPE: ORGANIC FARMLAND 2023

Europe 19.5 M hectares

Spain 3.0 M hectares

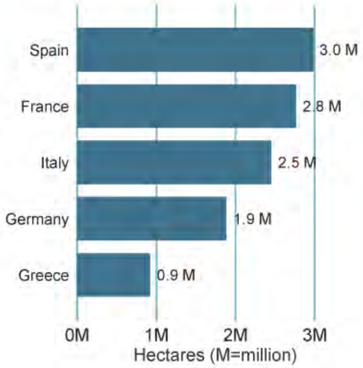
3.9 % of Europe´s farmland is organic

4.1 % growth since 2022

Four countries hold more than half of Europe's organic agricultural area.

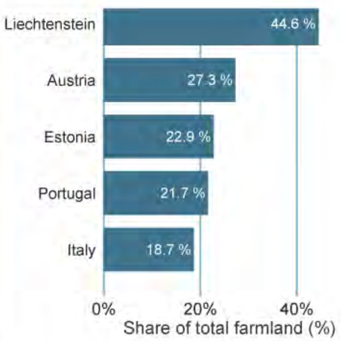
Distribution of organic agricultural land by country 2023

The countries with the largest organic agricultural area were Spain, France and Italy.



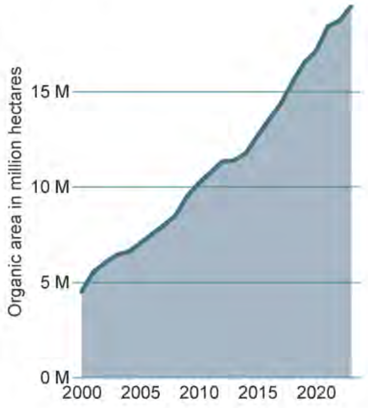
The 5 countries with the largest areas of organic agricultural land 2023

16 countries had 10 % or more of their agricultural land under organic management.



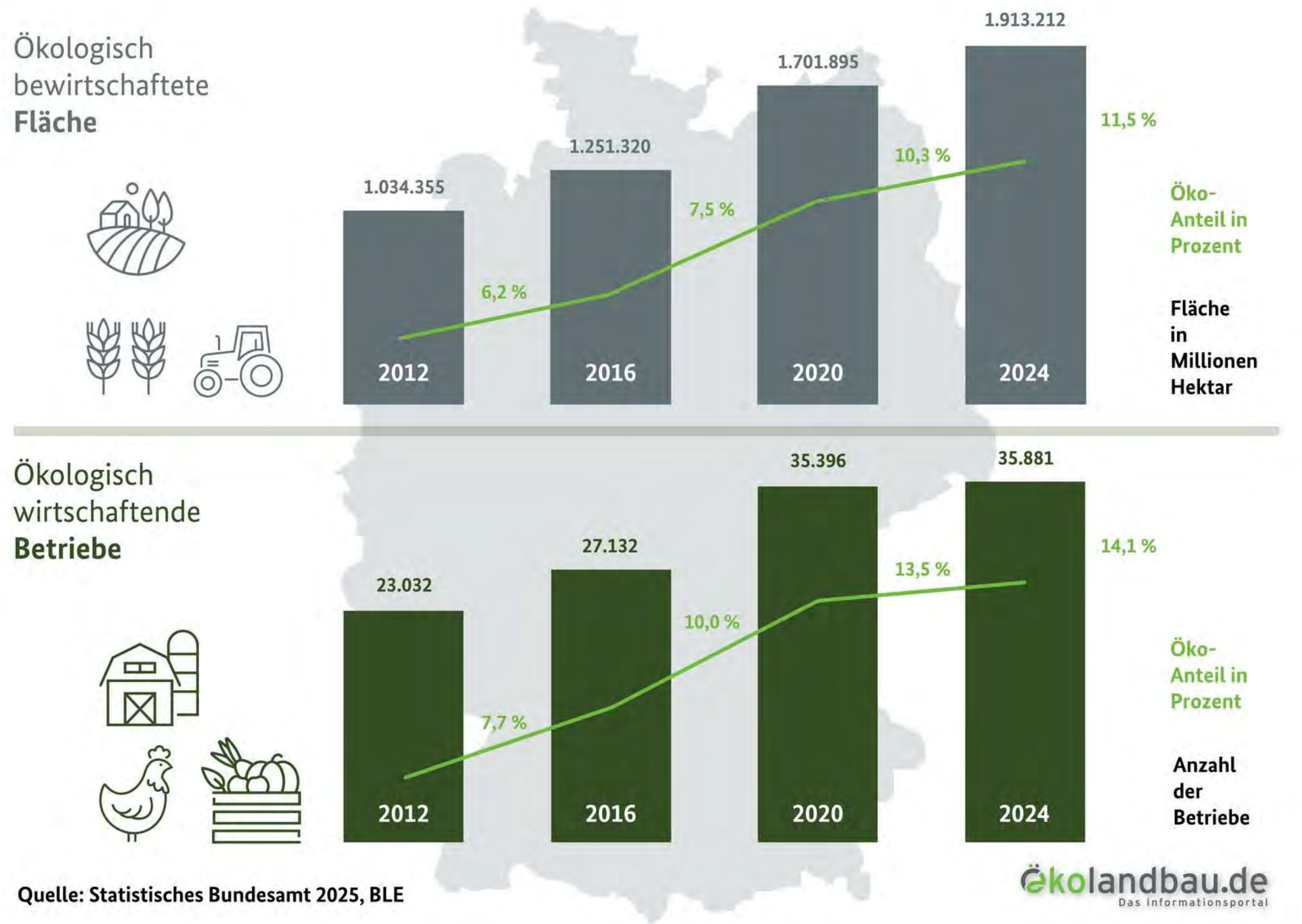
Top 5 countries with an organic share of more than 10 % of total agricultural land 2023

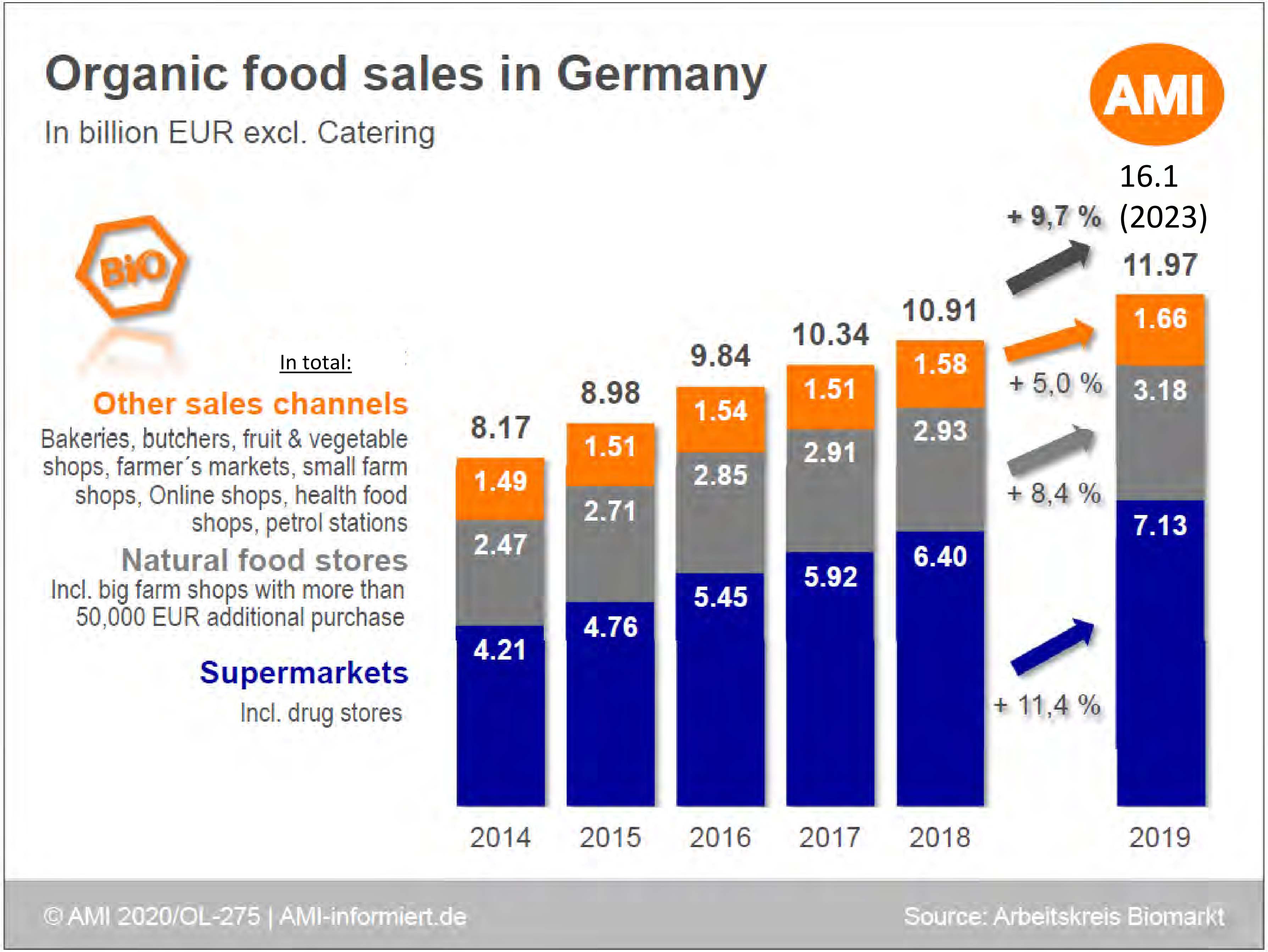
In 2023, about 767'000 hectares more were reported compared with 2022.



Growth of the organic agricultural land 2000-2023

Development of organic farming in Germany (area, farms)





Organic food sales in Germany
In billion EUR excl. Catering
AMI
BIO
In total:
Other sales channels
Bakeries, butchers, fruit & vegetable shops, farmer´s markets, small farm shops, Online shops, health food shops, petrol stations
Natural food stores
Incl. big farm shops with more than 50,000 EUR additional purchase
Supermarkets
Incl. drug stores
8.17
1.49
2.47
4.21
8.98
1.51
2.71
4.76
9.84
1.54
2.85
5.45
10.34
1.51
2.91
5.92
10.91
1.58
2.93
6.40
16.1 (2023)
+ 9,7 %
11.97
1.66
3.18
7.13
+ 5,0 %
+ 8,4 %
+ 11,4 %
2014
2015
2016
2017
2018
2019
© AMI 2020/OL-275 | AMI-informiert.de
Source: Arbeitskreis Biomarkt

The 4 principles of organic farming

Principle of Health

Organic agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible.

Principle of Ecology

Organic agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them.

Principle of Fairness

Organic agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities.

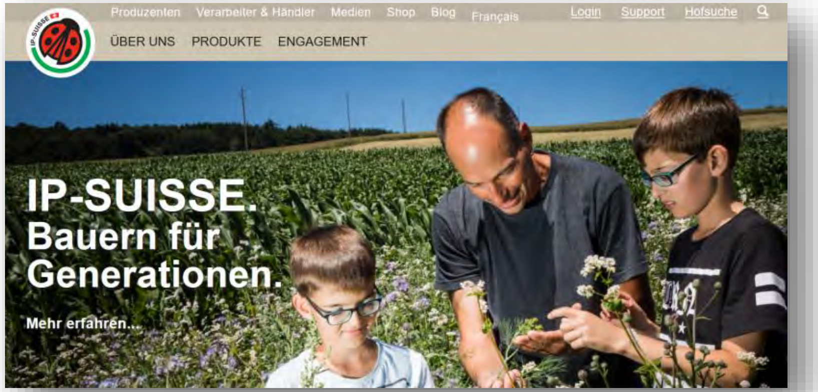
Principle of Care

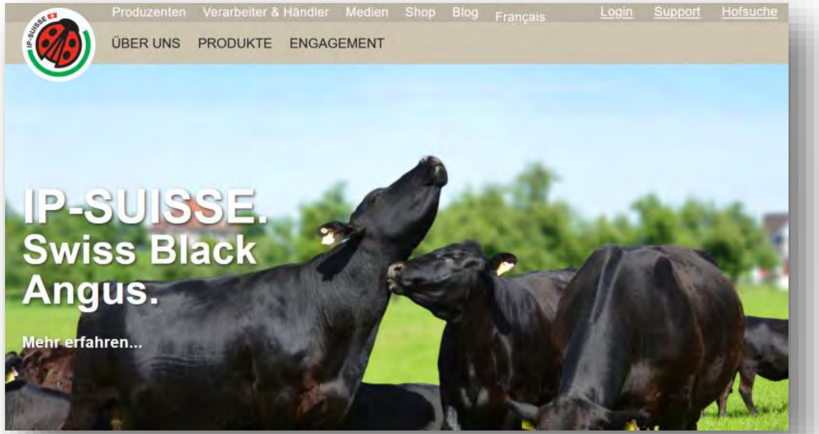
Organic agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment.

IFOAM ORGANICS INTERNATIONAL

www.ifoam.bio/why-organic/shaping-agriculture/four-principles-organic

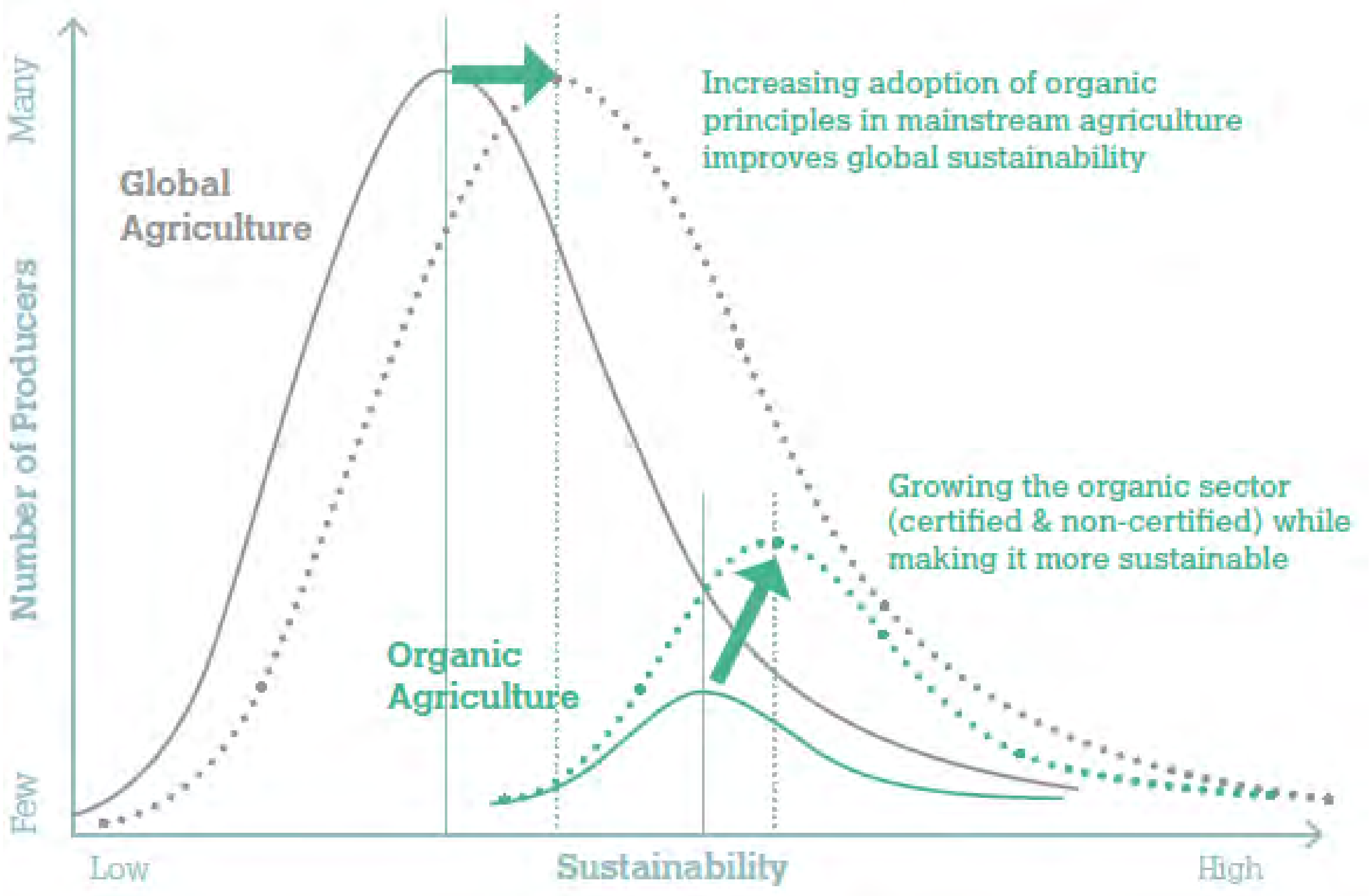
Other non-organic labels drawing on organic (IFOAM)principles





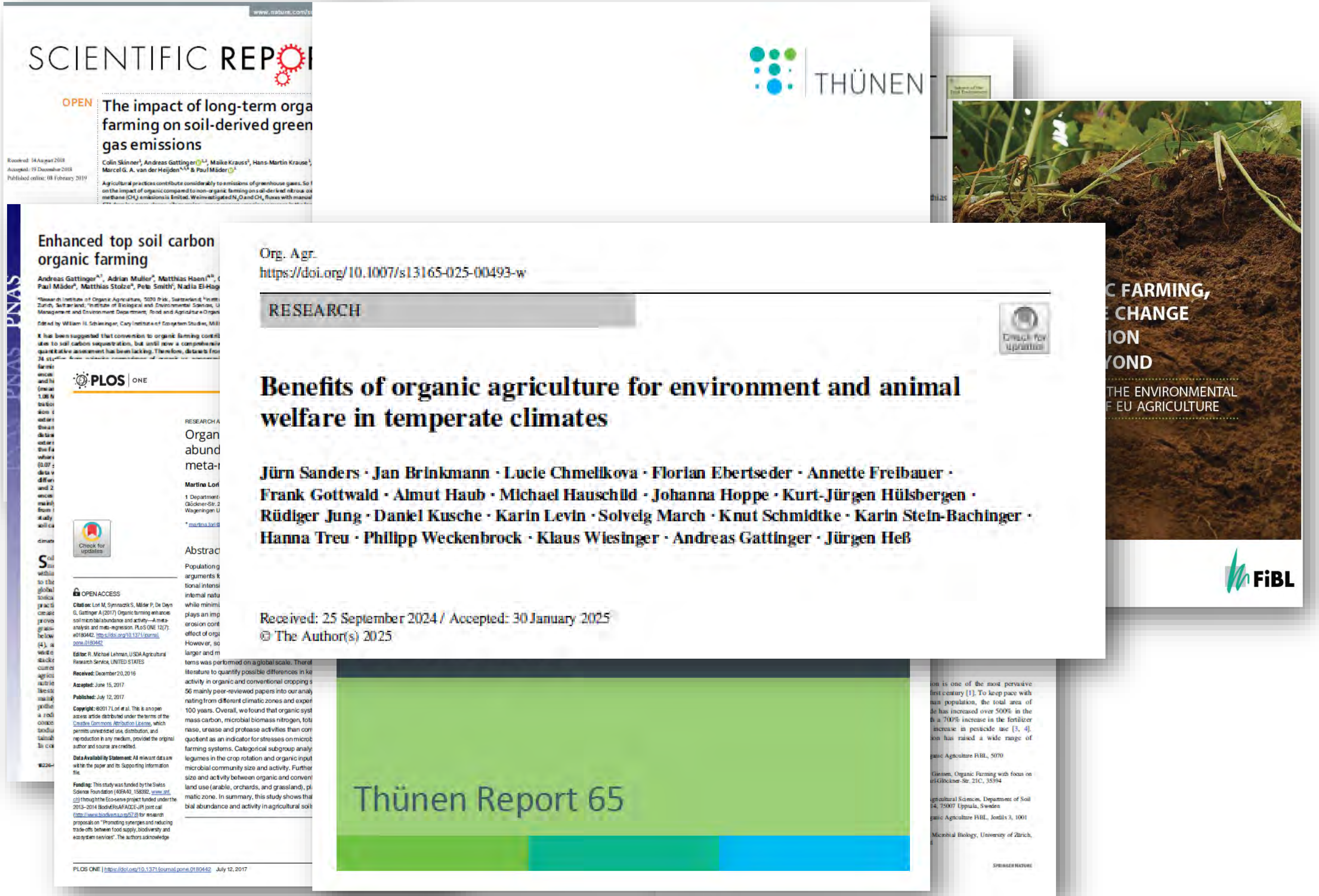
But: Organic farming is the system with the highest level of legal certainty and consumer trust (since 1993)

Organic farming as role model for agricultural tranformation



Eyhorn et al., Nature Sustainability, 2019

Organic Agriculture – the answer to the multiple crises?



Bundesministerium
für Ernährung
und Landwirtschaft

The research was funded by German Federal Ministry of Food and Agriculture (BMEL) within the framework of the Federal Organic Farming Scheme (BÖL)

Sanders et al., «Benefits of organic agriculture for environment and animal welfare in temperate climates», Organic Agriculture 2025, https://doi.org/10.1007/s13165-025-00493-w

Systematic and quantitive literature analysis

889/2008
Richtlinien
EU-Öko-Verordnung
Prinzipien
Privat-rechtliche Standards
Produktionsregeln
Durchführungsbestimmungen

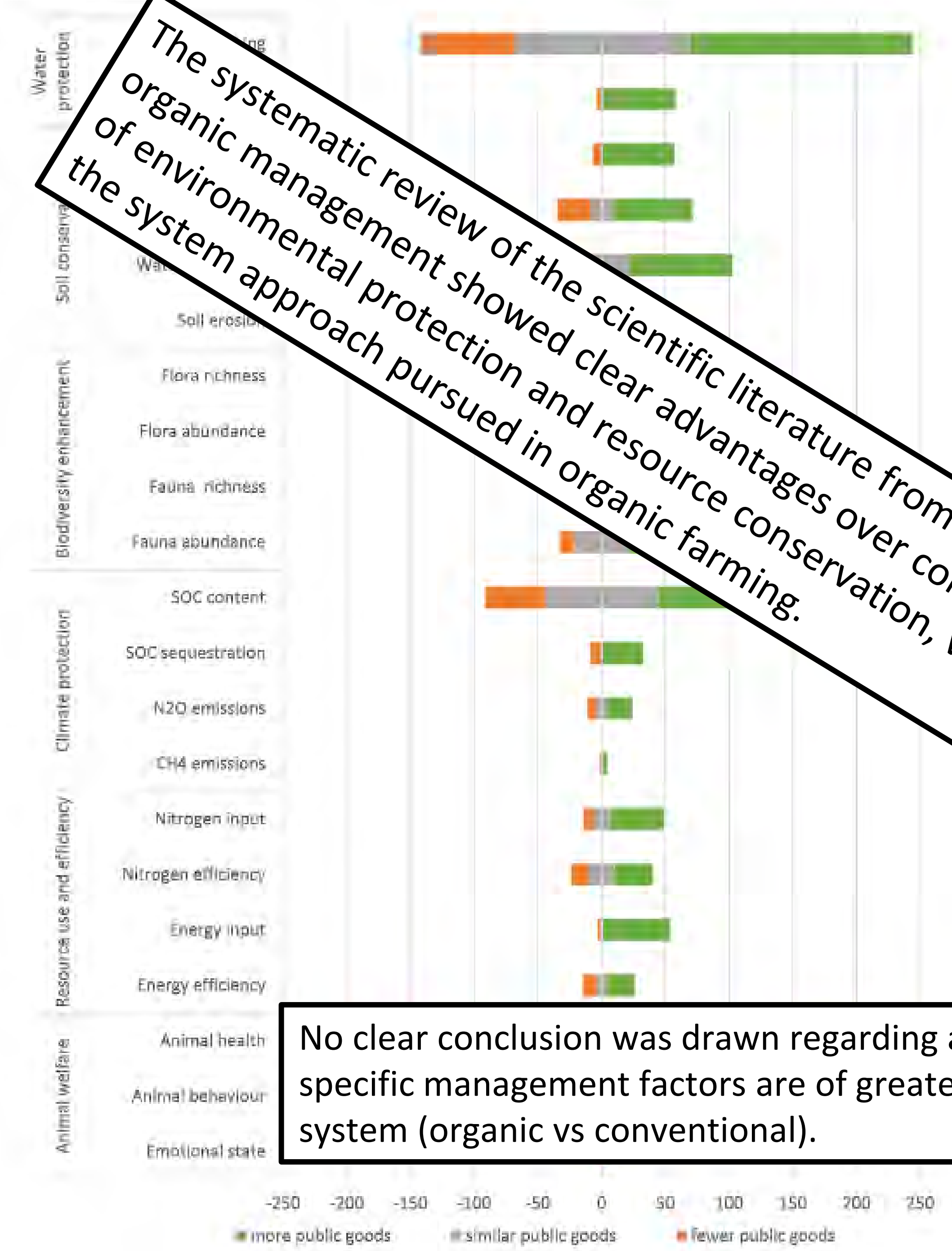
Qualitative analysis of the organic farming legislation

Pairwise comparisons

Further analysis of scientific literature

based on
528 scientific studies
2.816 single pairs

Sanders et al., «Benefits of organic agriculture for environment and animal welfare in temperate climates», Organic Agriculture 2025, https://doi.org/10.1007/s13165-025-00493-w

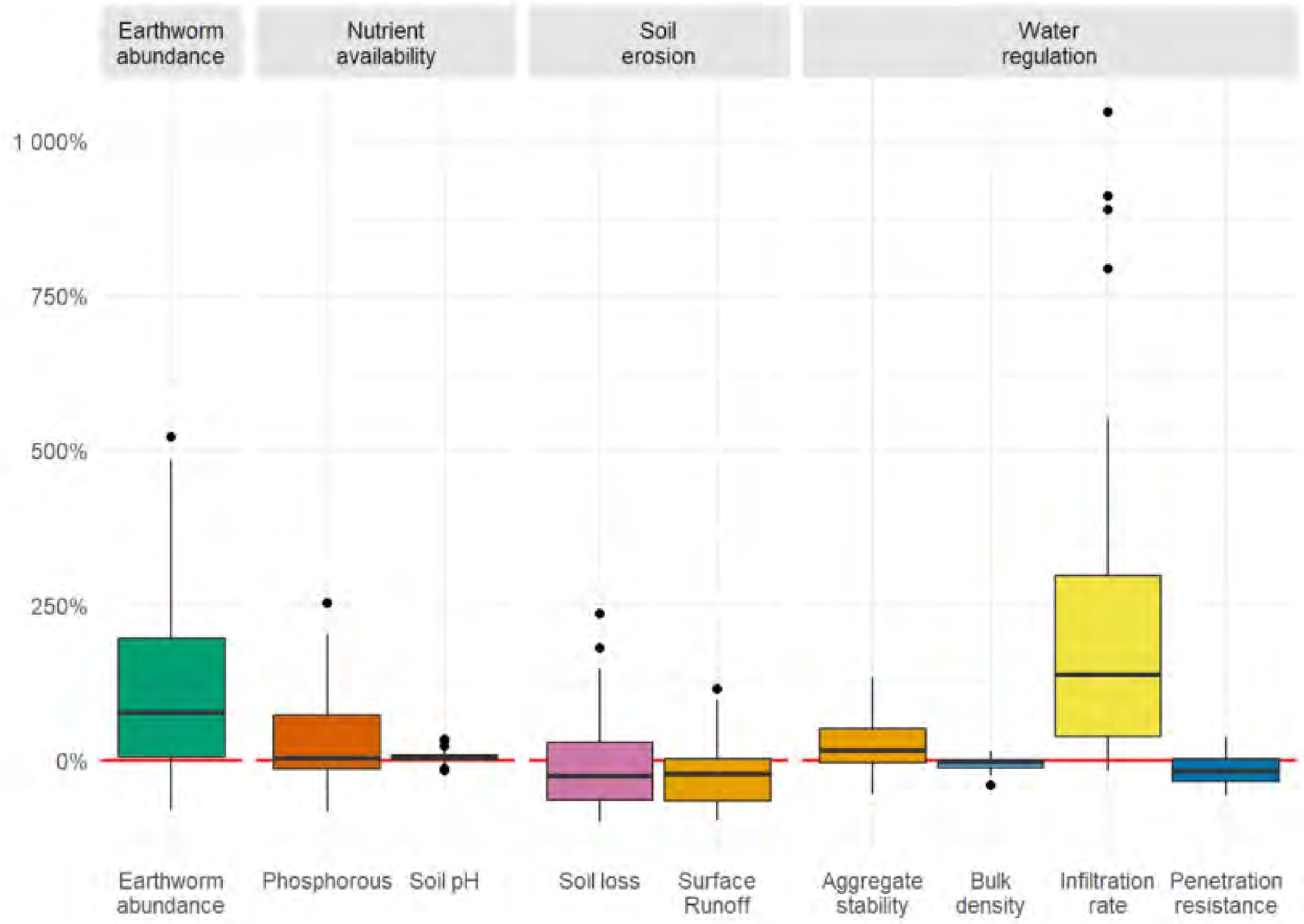


The systematic review of the scientific literature from pairwise comparisons found that organic management showed clear advantages over conventional management in the fields of environmental protection and resource conservation, which can be mainly explained by the system approach pursued in organic farming.

No clear conclusion was drawn regarding animal welfare indicating that farm-specific management factors are of greater importance than the production system (organic vs conventional).

...lture for environment and animal
...ic Agriculture 2025, https://doi.org/10.1007/s13165-025-00493-w

Soil quality & function



Sanders et al., «Benefits of organic agriculture for environment and animal welfare in temperate climates», Organic Agriculture 2025, https://doi.org/10.1007/s13165-025-00493-w

Long-term organic farming and soil quality
(DOK Trial Switzerland, *1977)

Conventional (CONMIN)

Organic (BIODYN)

Mäder et al. 2002, Science

Water retentention of arable soils after heavy rain (20 mm/h)
DOK Trial Switzerland

Conventional (CONMIN)

Organic (BIODYN)

Mäder et al. 2002, Science

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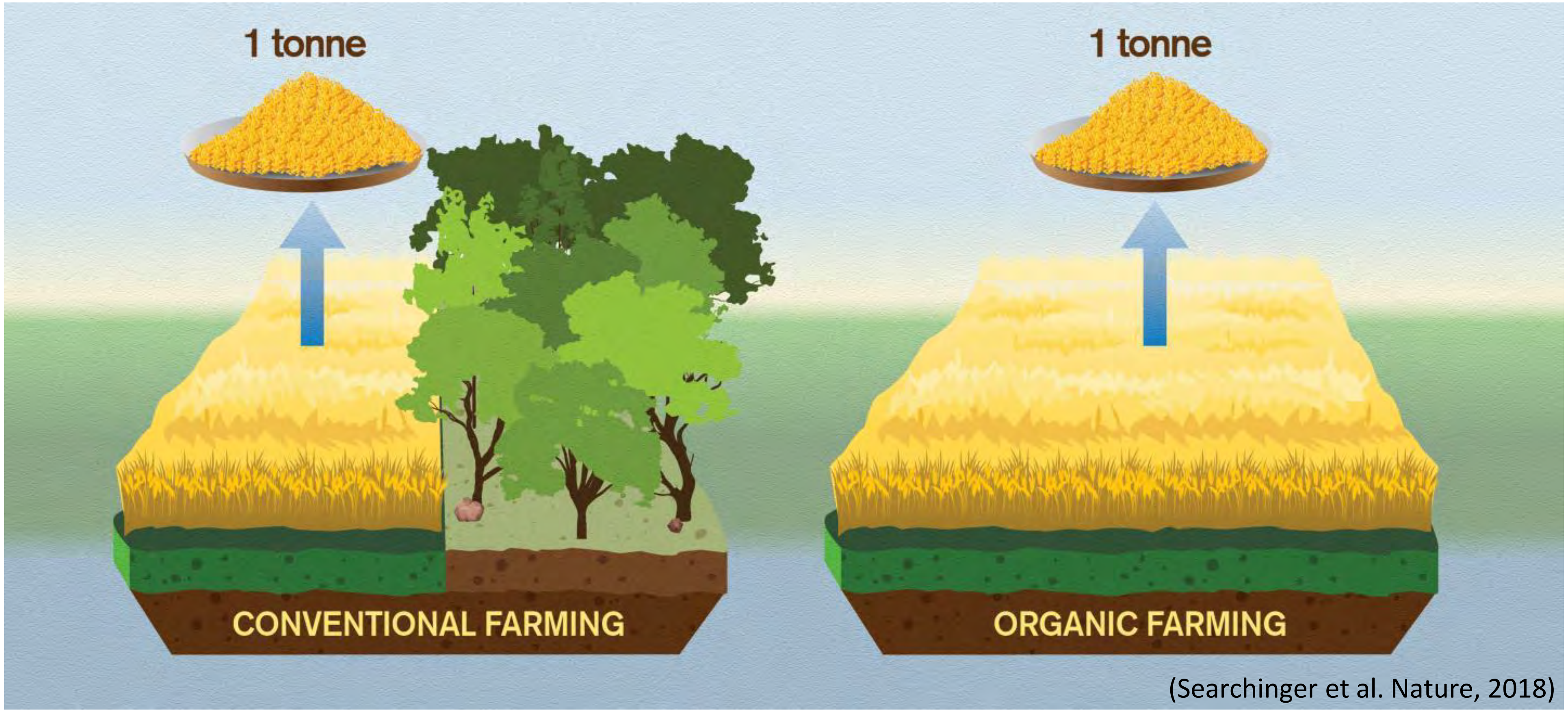
3. Concluding words

Organic Farming and the long shadow of less yield…



Yen Strandqvist/Chalmers University of Technology

Globally: -9 to -25% (Seufert et al. 2012, De Ponti et al. 2012, Ponisio et al. 2015, Wilbois & Schmidt, 2019)

Germany: -20 to 43% (Noleppa 2016, Treu et al. 2017, BMEL 2019)

Less crop yields in organic farming

Category of differentiation	n[a]	Relative yield (%)	Remarks
Overall	362	80	
Asia	22	89 a	Many from India, rest from five other countries
Central Europe	16	88 ac	Switzerland, Austria
Middle-East & North-Africa	14	85 ac	Incl. Turkey (7) and four other countries
North-America	126	84 ad	USA, Canada
Southern Europe	34	81 ab	European Mediterranean countries
Eastern Europe	18	80 ab	Post-communist economies, excl. Albania, Croatia
NW-Europe	78	73 bc	Germany, Denmark, Netherlands, GBR
Latin-America	8	73 ab	Vegetables (7), coffee (1)
Australia & New Zealand	12	73 bcd	
Northern Europe	34	70 b	Finland, Sweden, Norway
Netherlands & Denmark vs. rest	50 vs. 312	74 vs. 81	High external input countries. $P = 0.019$
Developing vs. developed countries	33 vs. 296	84 vs. 79	$P = 0.13$ (ns)
Tropical vs. non-tropical countries	29 vs. 327	86 vs. 80	$P = 0.12$ (ns)
Long-term vs. Short-term	66 vs. 249	84 vs. 80	Long = > 5 years. Short = 1–5 years. $P = 0.17$ (ns)
On-farm vs. trial	42 vs. 226	88 vs. 81	$P = 0.038$
On-farm statistics	59	76	

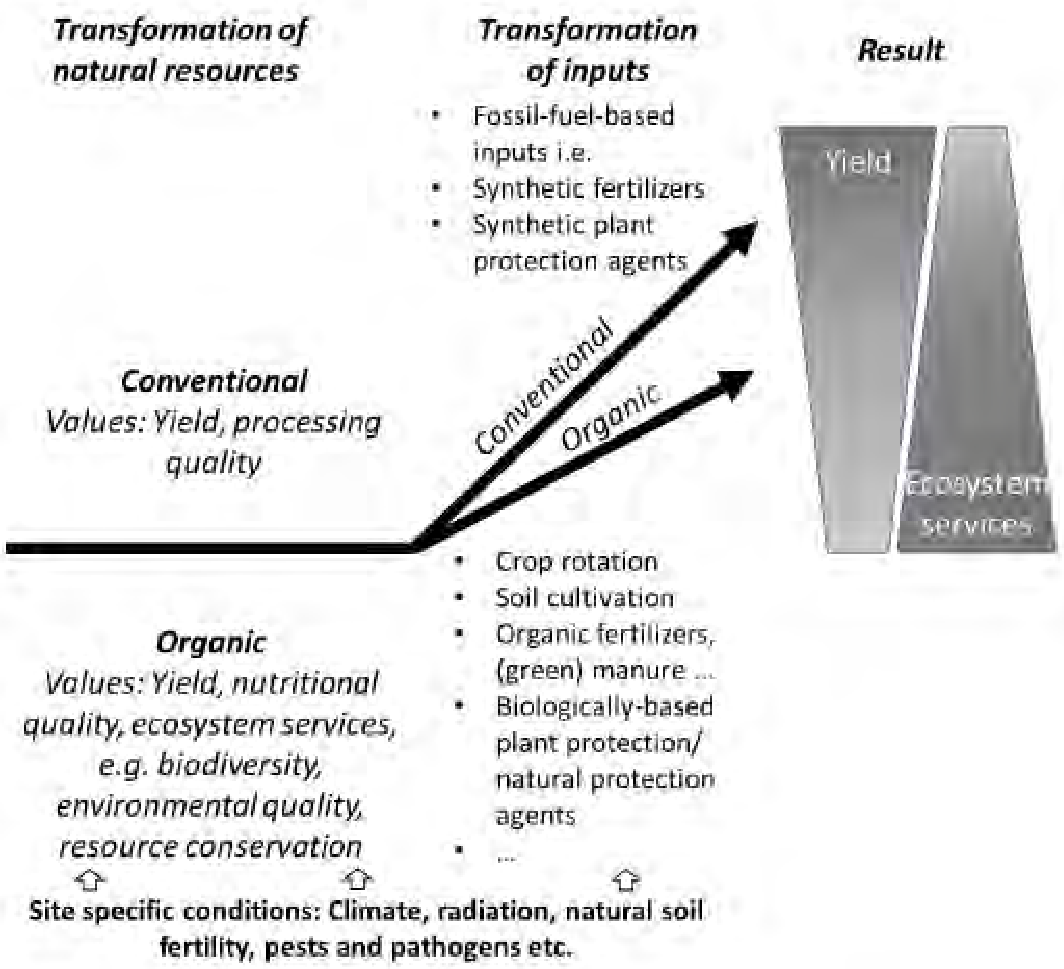
[a] Categories do not always add up to the total number of entries, as for some data it was uncertain to which category they belong. There may also be partial overlap of categories.

On a global level in average 20% less yield in organic farming. In high external input countries, yield gap is even more pronounced. Poor data base for developing countries.

De Ponti et al. 2012; Seufert et al. 2012

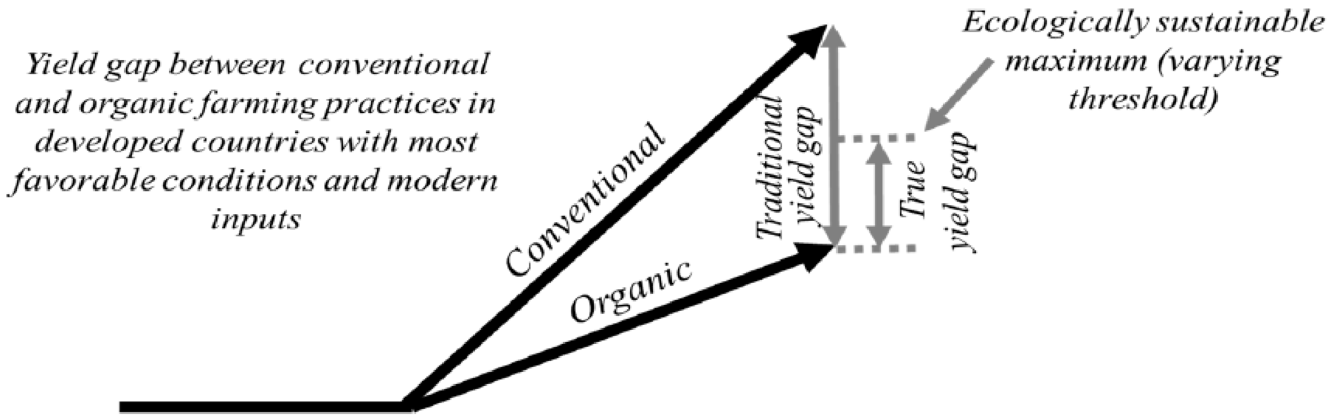
Cereal yield gap in Germany

Trade-offs between productivity and ecosystem services



Wilbois and Schmidt, Agronomy, 2019

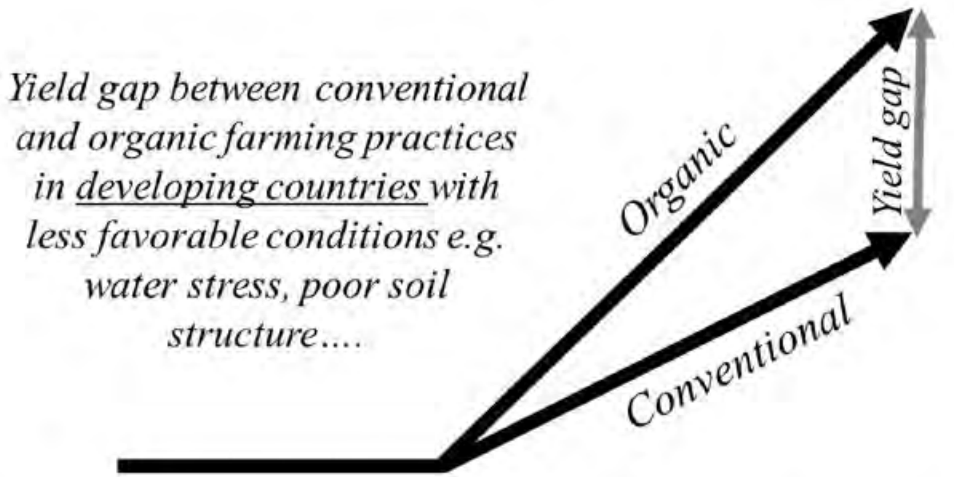
Yield as a result of transformation processes in cropping systems/agro-ecosystems



➢ **The true yield gap between organic and intensive conventional management shrinks when an ecologically sustainable threshold is set as benchmark when productivity is balanced out with ecosystem services.**

Wilbois and Schmidt, Agronomy, 2019

Yield as a result of transformation processes in cropping systems/agro-ecosystems

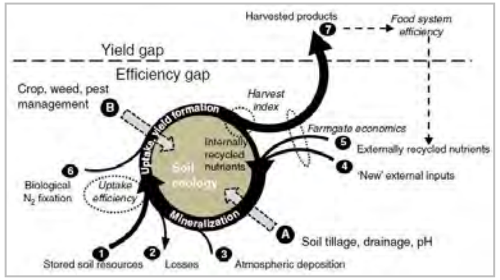


- **The gap between organic and conventional yield may go into reverse under less favorable conditions. (see Lal, Science, 2004)**

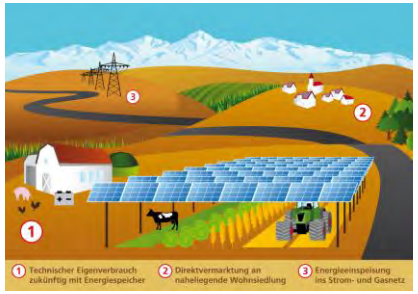
Wilbois and Schmidt, Agronomy, 2019

Eco-functional intensification and circular economy in the crop-livestock system

- **Closing yield and efficiency gaps according to best ecological practices**
- **Targeted utilisation of natural processes and ecosystem services**



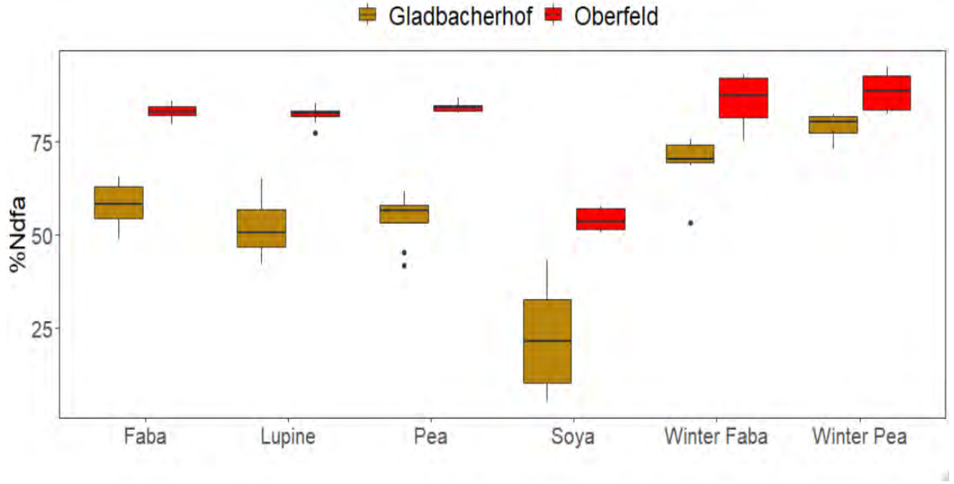
Nordwijk & Brussard (2014), Current Opinion Environmental Sustainability, 8:62-70

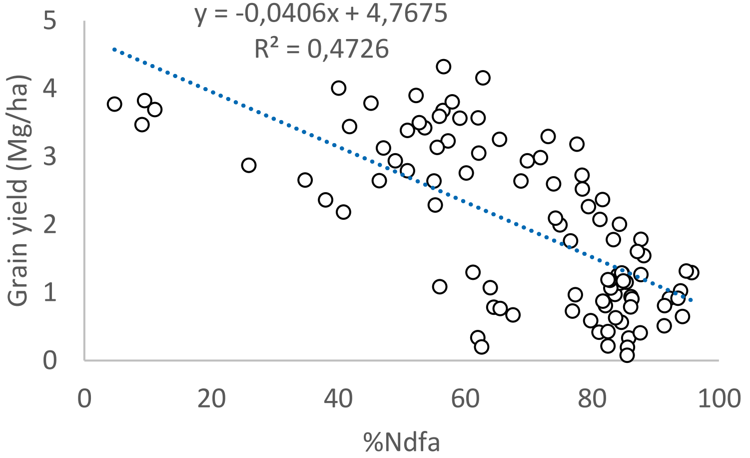


Diverse crop rotations with legumes – keyword: N autonomy!

Monitoring of biological nitrogen fixation (BNF) in grain legumes shows a fluctuation between 9 and 92% (highest at site Oberfeld and winter varieties)

$$\% \text{ Ndfa} = \frac{\delta^{15}N_{Control} - \delta^{15}N_{Legume}}{\delta^{15}N_{Control} - B_{Legume}} \times 100$$





Gladbacherhof→soya fixed lowest N (17-71 kg N)
faba highest (113.3-157.3 kg N)

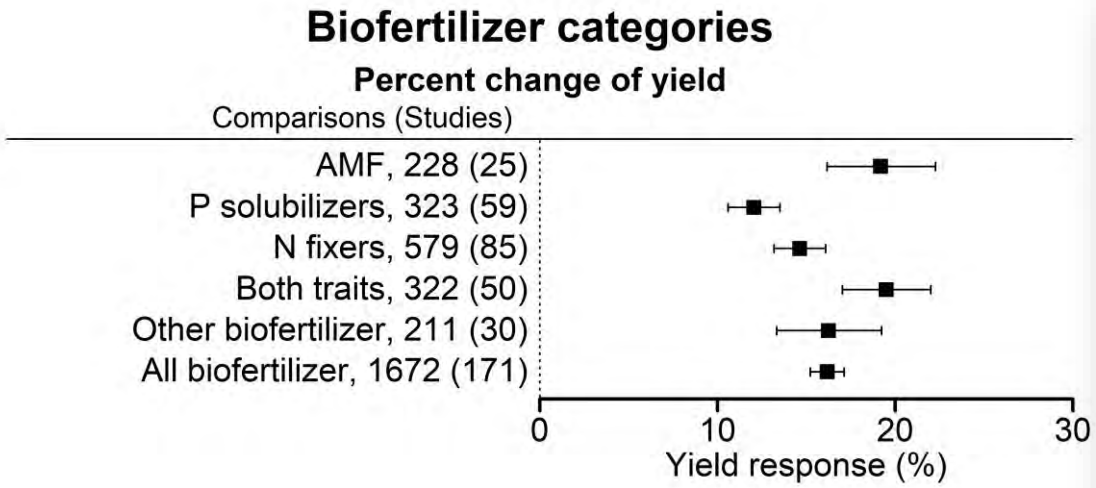
BNF as a response to limited soil N availability

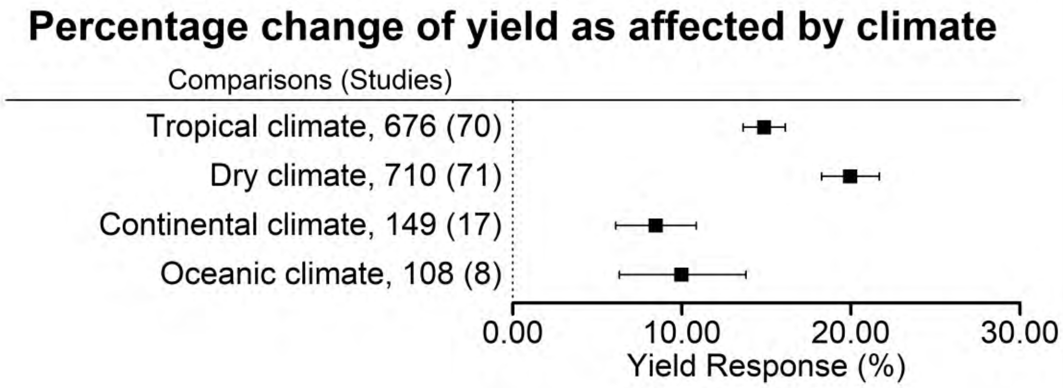
5

Oberfeld→ pea lowest (30.4-38.7 kg N)
soya highest 63.4-66.8 kg N)

Binacchi et al., 2023, AGEE

Biostimulants for improved nutrient uptake and productivity (without mineral-synthetic nitrogen fertilization)





Schütz, Gattinger et al., Frontiers, 2018

OXFORD FEMS

FEMS Microbiology Ecology, 2024, **97**, fiae023
DOI: 10.1093/femsec/fiae023
Research Article

Long-term detection of *Hartmannibacter diazotrophicus* on winter wheat and spring barley roots under field conditions revealed positive correlations on yield parameters with the bacterium abundance

Santiago Quiroga[1], David Rosado-Porto[1,2], Stefan Ratering[1], Azin Rekowski[3], Franz Schulz[4], Marina Krutych[1], Christian Zörb[3], Sylvia Schnell[1,*]

[1]Institute of Applied Microbiology, IFZ, Justus-Liebig University Giessen, 35392 Giessen, Germany
[2]Faculty of Basic and Biomedical Sciences, Simón Bolívar University, Barranquilla, Colombia
[3]Quality of Plant Products 340e, Institute of Crop Science, University of Hohenheim, 70593 Stuttgart, Germany
[4]Organic Farming with Focus on Sustainable Soil Use, Department of Agronomy and Plant Breeding II, Justus-Liebig University Giessen, 35394 Giessen, Germany
*Corresponding author. E-mail: Sylvia.Schnell@umwelt.uni-giessen.de
Editor: Anton Hartmann

Abstract

Monitoring of bioinoculants once released into the field remains largely unexplored; thus, more information is required about their survival and interactions after root colonization. Therefore, specific primers were used to perform a long-term tracking to elucidate the effect of *Hartmannibacter diazotrophicus* on wheat and barley production at two experimental organic agriculture field stations. Three factors were evaluated: organic fertilizer application (with and without), row spacing (15 and 50 cm), and bacterial inoculation (*H. diazotrophicus* and control without bacteria). *Hartmannibacter diazotrophicus* was detected by quantitative polymerase chain reaction on the roots (up to 5×10^5 copies g^{-1} dry weight) until advanced developmental stages under field conditions during two seasons, and mostly in one farm. Correlation analysis showed a significant effect of *H. diazotrophicus* copy numbers on the yield parameters straw yield (increase of 453 kg ha^{-1} in wheat compared to the mean) and crude grain protein concentration (increase of 0.30% in wheat and 0.80% in barley compared to the mean). Our findings showed an apparently constant presence of *H. diazotrophicus* on both wheat and barley roots until 273 and 119 days after seeding, respectively, and its addition and concentration in the roots are associated with higher yields in one crop.

Keywords: coating; detection; gum arabic; PGPR; qPCR; root colonization; seed inoculation; survival

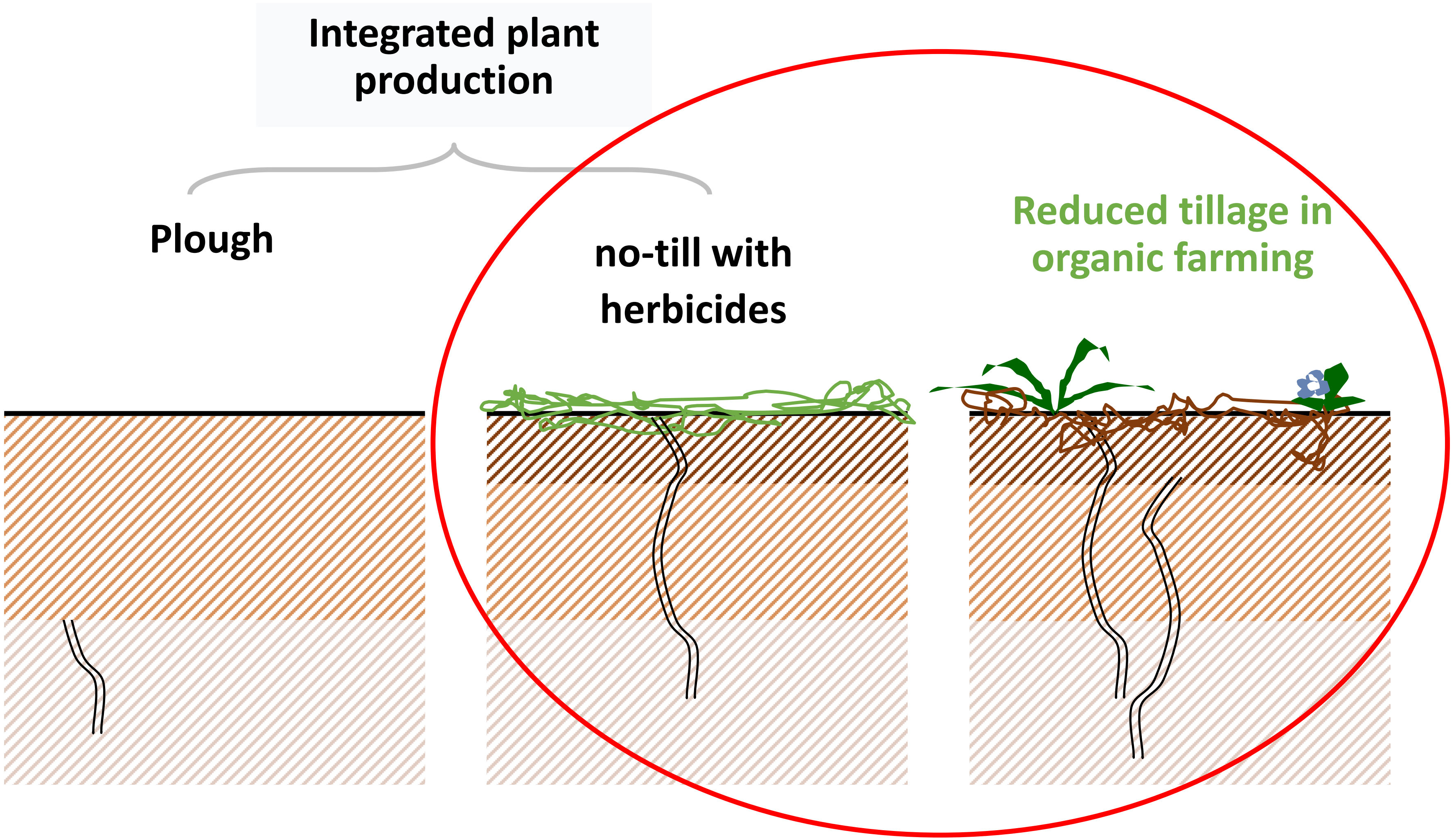
Introduction

Since Kloepper and Schroth (1978) introduced the term plant growth-promoting rhizobacteria (PGPRs), a broad spectrum of research has focused on revealing the complexity of plant–microbial interactions and how they are able to induce beneficial effects on plant immunity, growth, and productivity (Kloepper 1981, Kirchhof et al. 1997, El Zemrany et al. 2006, Burns et al. 2015, Singh et al. 2022). PGPRs enhance plant performance through different mechanisms that have been widely reported over the years, such as nitrogen fixation (Hartmann et al. 1988), phosphorus solubilization (Wani et al. 2007), phytohormone production (Goswami et al. 2014), or triggering plant defense responses (Kloepper et al. 2004). These advances in PGPR research over the last decade have been linked to a paradigm shift toward sustainable agriculture (Singh et al. 2011, Backer et al. 2018). The current global attempt to reduce the use of mineral fertilizers and chemical pesticides has become an important issue, with special attention paid to most cultivated crops because of their environmental, economic, and social impacts (Thudi et al. 2021). The excessive use of mineral fertilizers contributes to not only the release of nitrous oxide (N_2O) to the atmosphere but also soil erosion and nitrate (NO_3^-) leaching into groundwater. The latter has become a serious problem in Germany, reporting an excess of the maximum NO_3^- permissible value (50 mg l^{-1}) in several groundwater-sampling sites in recent years (Sundermann et al. 2020).

Wheat and barley are among the six most produced cereals around the world, being fundamental in human nutrition, but at the same time, their cultivation may have a negative environmental impact due to the energy consumption for the production of fertilizers and pesticides, whose excessive use can lead to eutrophication and contaminated drinking water. Thus, several strategies have been considered to enhance yield from a sustainable perspective, including molecular breeding (Würschum et al. 2017), bioformulations (Yahya et al. 2022), or disease resistance (Skoppek et al. 2022). In this context, the use of PGPR has led to the release of several biofertilizers into the market. They aim to avoid soil degradation, reduce greenhouse emissions, and, at the same time, maintain soil fertility without reducing crop production (Aloo et al. 2022). However, PGPRs have to face and overcome many challenges. The effectiveness of PGPRs tested *in vitro* under

Received 1 December 2023; revised 9 February 2024; accepted 15 February 2024

Conservation tillage



29

Mulch vegetable farming – planting vegetables into a mulched biomass enables open-field vegetable production without irrigation and more soil carbon and similar emissions

Saat einer geeigneten Zwischenfrucht

- Gemenge aus Grünschnittroggen-Zottelwicke- Erbse (60;20;20)
- Benötigt ca. die geplante Gemüsefläche x Faktor 2 (zzgl. 100 %)

Mulchen und Nachstreuen

- Geräte: Schlegelmulcher, Ladewagen mit Streuwerk
- Ziel: min. 15 t TM ha^{-1}

Pflanzung der Jungpflanzen

- Pflanzung mit spez. Pflanzmaschine („MulchTec“)

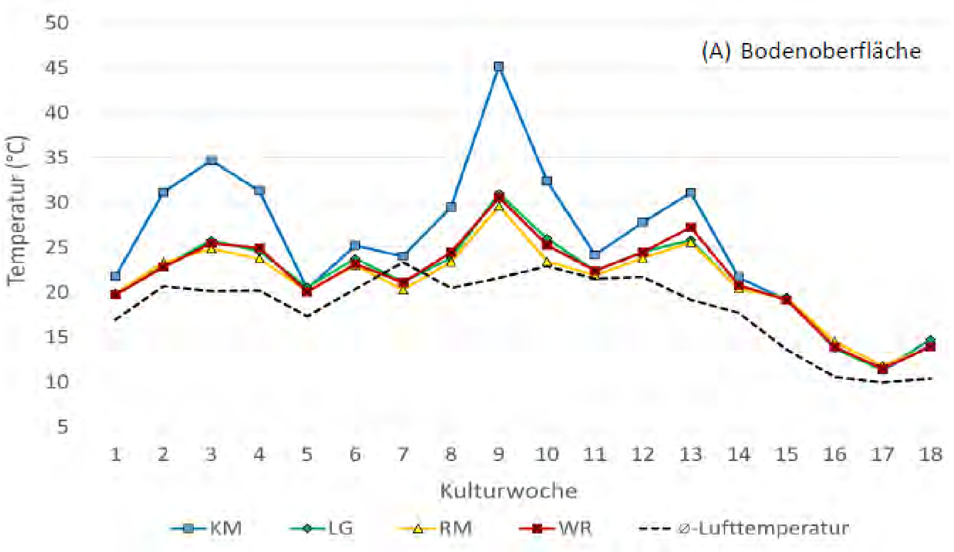
Dix, Hauschild et al. 2023a, in prep.

Organic cabbage cropping as influenced by different green mulch materials (August 2022)

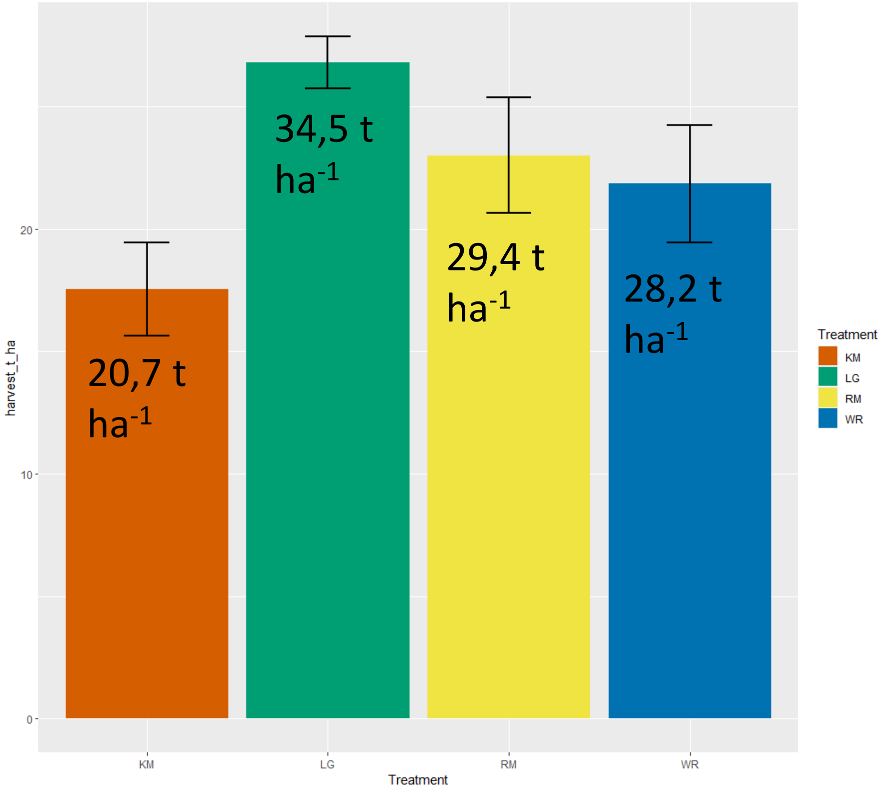
Dix, Hauschild et al. 2024, Hauschild, Dix et al. in prep.; Dix et al. in prep.

Europäischer Landwirtschaftsfonds für die Entwicklung des ländlichen Raums: Hier investiert Europa in die ländlichen Gebiete.

Mulch reduces ground temperature, reduces water losses and increases yields in dry conditions



Yields – white cabbage



Without mulch 3 Mulch variants

Dix, Hauschild et al. 2024, AGEE

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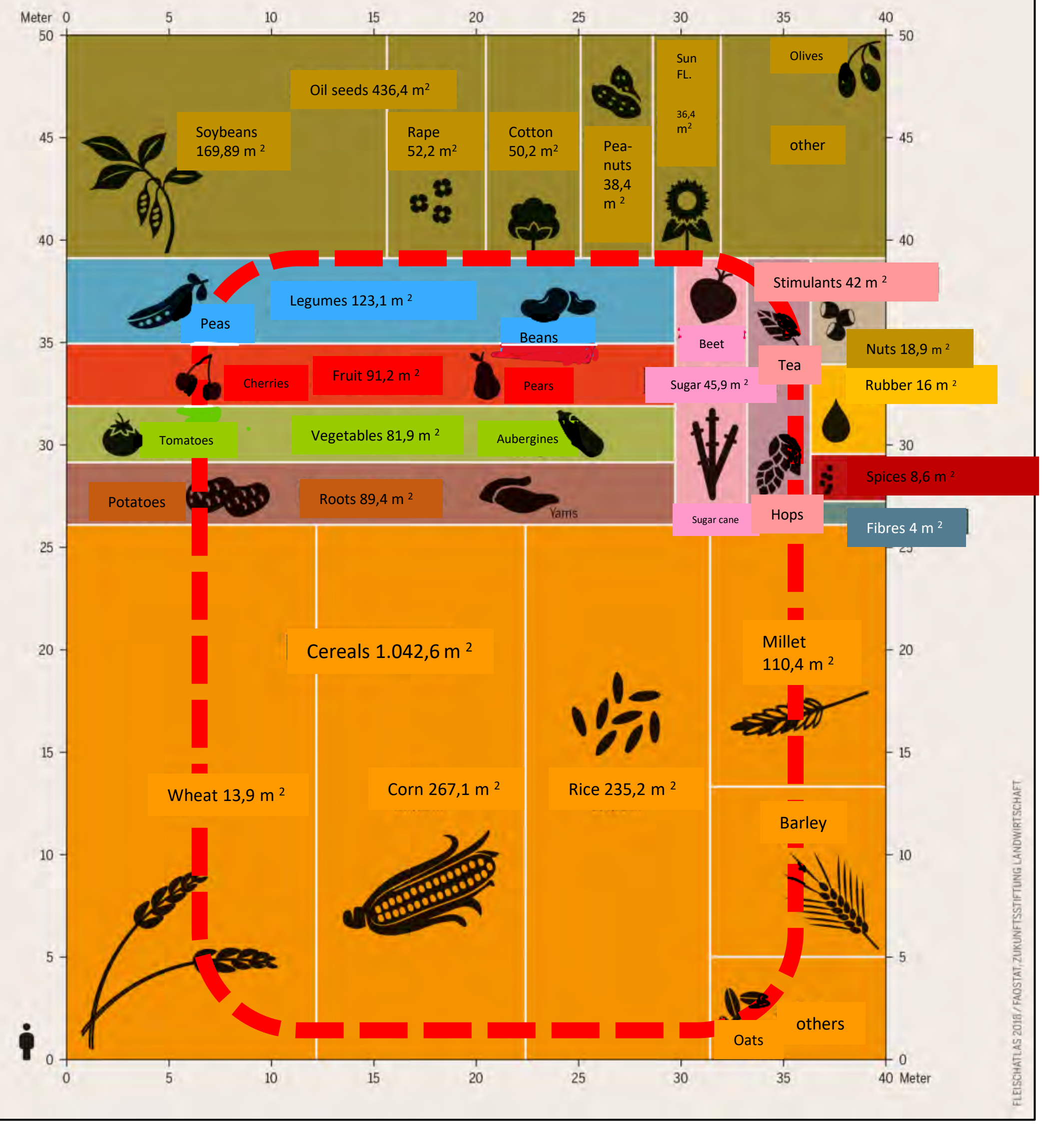
High land use due to livestock farming

A GLOBAL ACREAGE OF 2.000 SQUARE METERS

Global cultivation of crops on fields and in permanent crops, area per capita of the world population, 2014, selection



77% (of 2.000 m²) = 1.540 m² for animal feed (meat, milk, eggs)

FAOSTAT, Zukunftsstiftung Landwirtschaft (CC BY 4.0)

Reduction in grass feeding in favour of increased proportions of maize, cereals and soya in the ration... decline in grazing! (ruminant nutrition?)

„Feedlots“ in Argentina

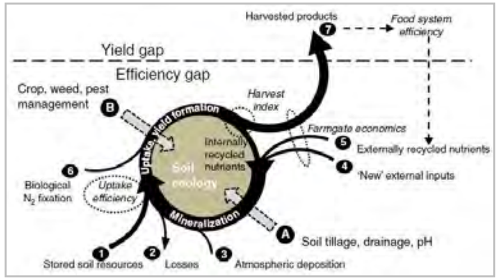
http://portaldelinterior.com

Bull fattening barn in Germany

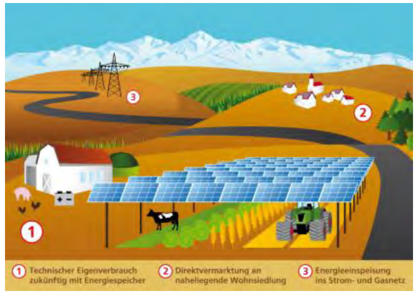
agrarheute.com

Eco-functional intensification and circular economy in the crop-livestock system

- Closing yield and efficiency gaps according to best ecological practices
- Targeted utilisation of natural processes and ecosystem services
- **Strong linkage between crop production and animal husbandry: soil-animal-plant systems, no competition between livestock and humand food/feed**
- **Instead symbioses, synergies, multidimensionality incl. bioeconomy**



Nordwijk & Brussard (2014), Current Opinion Environmental Sustainability, 8:62-70



Equal „Carbon footprint“ in grass based / low-input dairy production despite lower productivity compared to in-door systems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ELSEVIER

Is low-input dairy farming more climate friendly? A meta-analysis of the carbon footprints of different production systems

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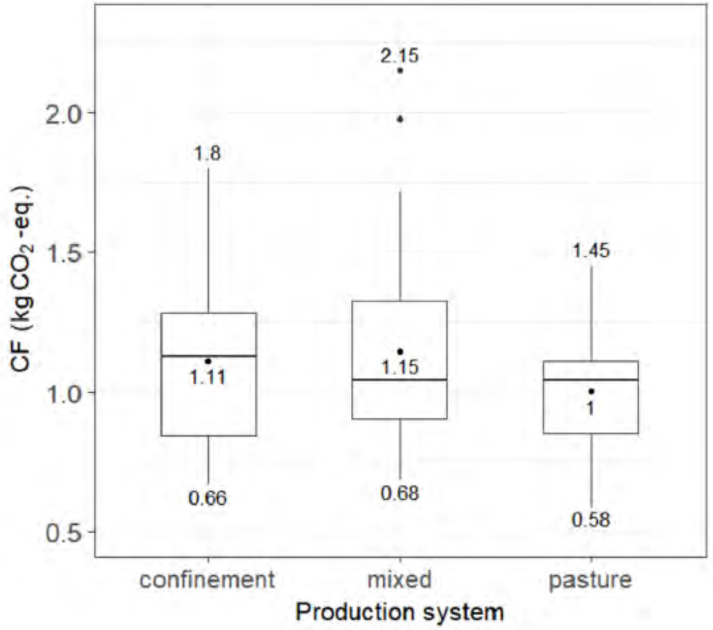


Lorenz,...Taube, 2019

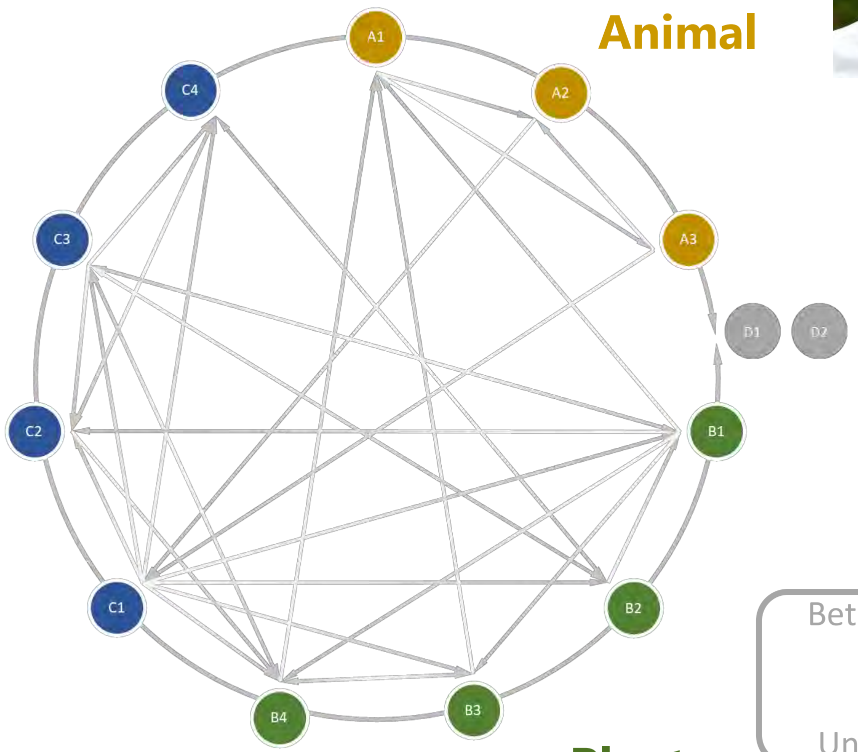
GreenDairy: Goals

…Developing innovative crop-livestock systems, which are ecologically and economically sustainable at highest animal welfare levels and so they will be accepted by the society.

Information and data flow

Animal

Environment



Plant

Bewertung

Datenintegration

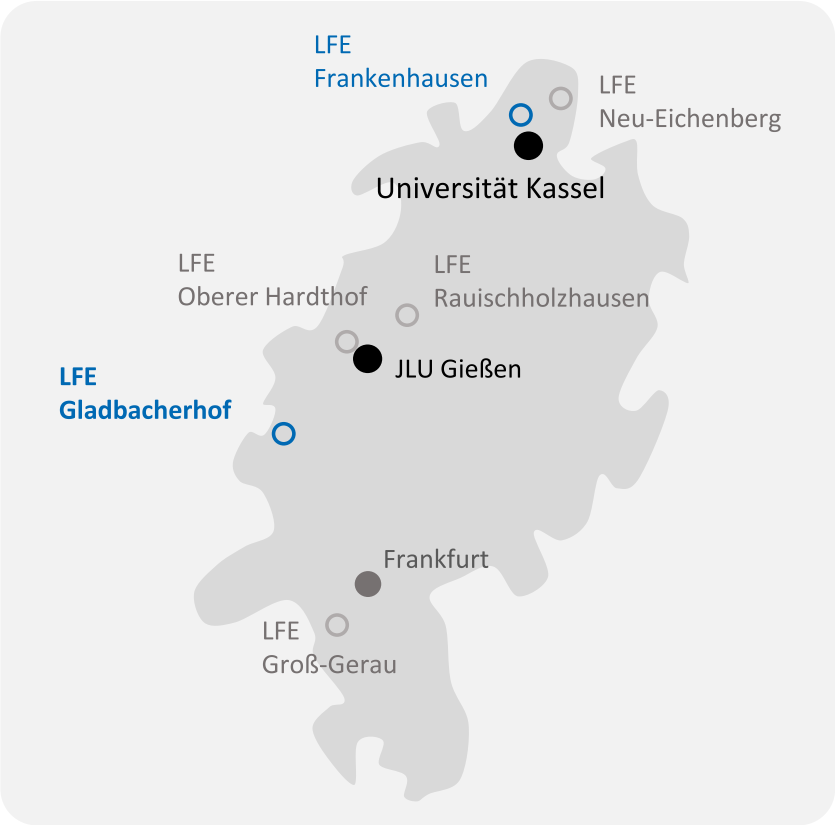
Synthese

Übertragbarkeit

Betriebsnetzwerk Upländer Bauernmolkerei
LLH Eichhof
Uni Kassel Frankenhausen

LOEWE
Exzellente Forschung für Hessens Zukunft

Research Farm Gladbacherhof



Gladbacherhof in short

Agricultural Teaching and Research Facility (LFE) for Organic Farming at JLU Giessen (since 1990)

- Mixed farm in a low mountain range location (9.5°C avg T, 655 mm annual precipitation)
- 110 ha arable land, 77 ha permanent grassland
- 8-year crop rotation with maize cultivation

Main areas of operation:
- Dairy farming (2x 64 Holstein Friesian cows with 9,000 or 7,200 kg milk/cow/year), breeding goal: lifetime production
- Seed and planting material production
- Laying hens (mobile chicken coop)
- Direct marketing

Impacts of our research
- Working together with extension services in several research projects
- New Leibnitz Institute: Innovation Centre for Agricultural Transformation (IAT) in Brandenburg and Hessen (5 Living labs)




GreenDairy – Research platfrom Gladbacherhof, Uni Gießen: Organic farming since 1983 (110 ha arable, 70 ha permanent grassland; Rainfall: 640 mm; silty-sandy loam)

GreenDairy – modern technologies in organic cattle husbandry

Feeding robot Lely Vector, but also Slurry robot (Lely Collector) and milking robot (Lely Astronaut)

GreenDairy – cows have 24/7 free access to pastures and milking robots

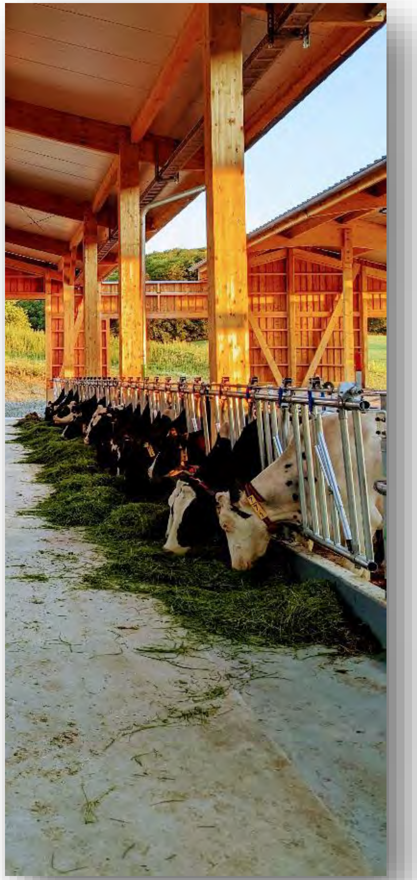
Grasshopper platemeter for determination of forage uptake through grazing

GreenDairy – which feeding intensity for dairy cows in organic crop-livestock systems?

Feeding regime since 01/2024 after 9 months of transition

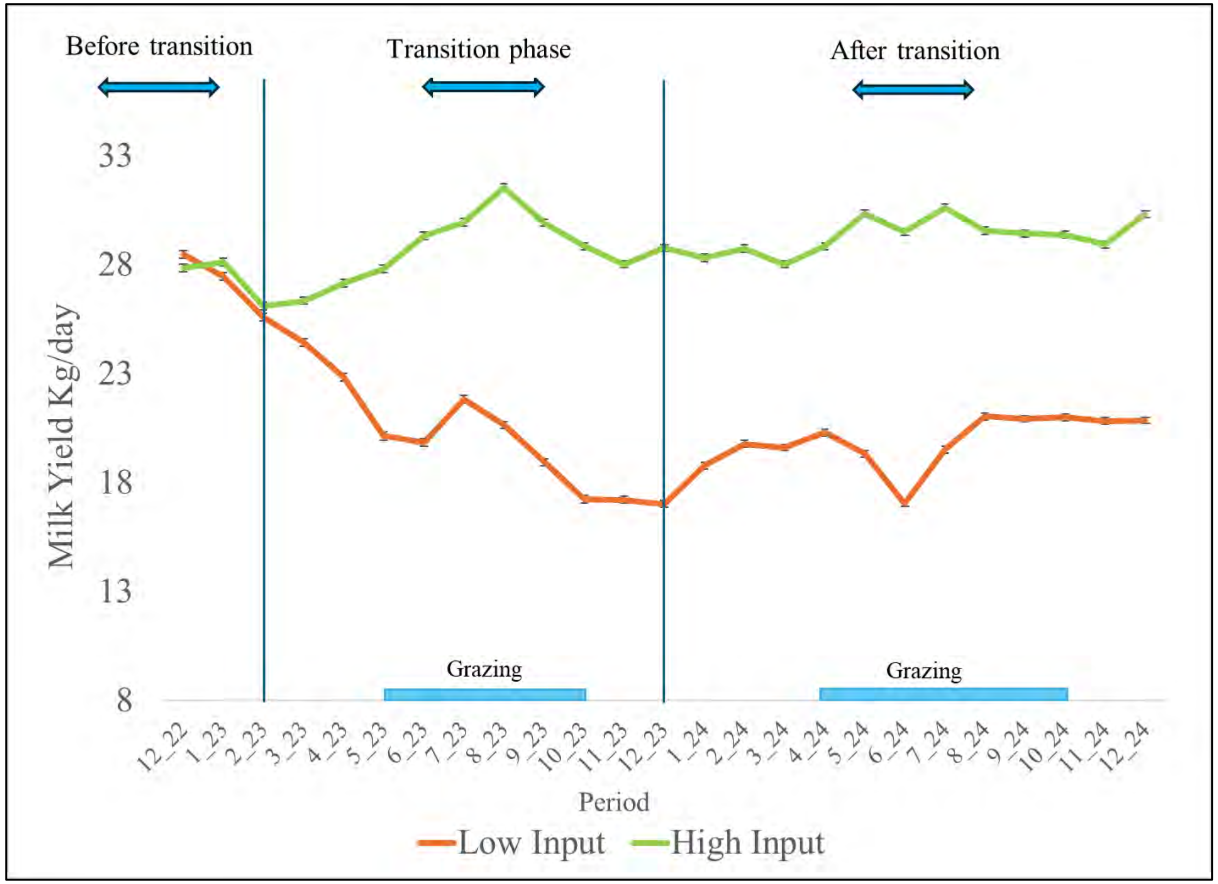
Share on the total DMI	High-Input	Low-Input
Dry matter intake Kg/cow/day	22.1	20.3
Alfalfa Silage % (N-fixation)	36	27
Grass Silage %	12	49
Corn Silage %	23	0
Concentrate %	29	24

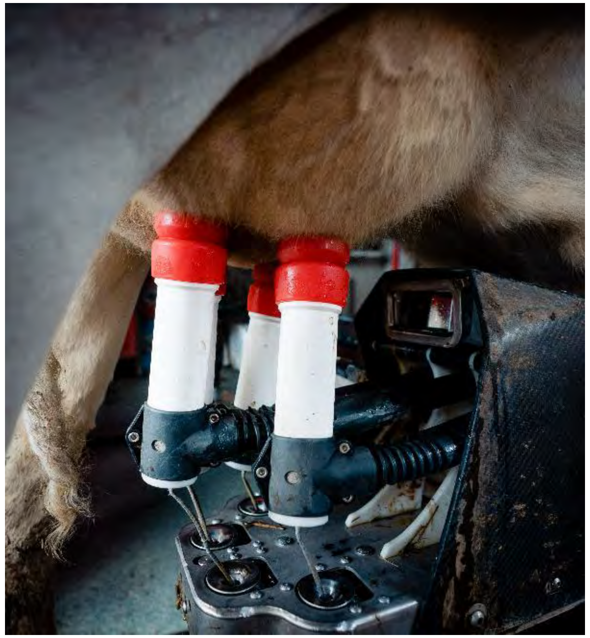
- Feed less food: High input cows take 88% of their feed and low input 51% feed from arable land; low input spares 27% potential human food
- All cows have continous grassland access from April to November
- Young livestock feeds 100% on pastures from April to November



GreenDairy – organic High Input dairy cows (Holsteins) in 2 groups

64x High Input (+maize), 64x Low Input (-maize) in a longterm trial





Knob, Gattinger et al. in prep.

GreenDairy – Milk yields 2024

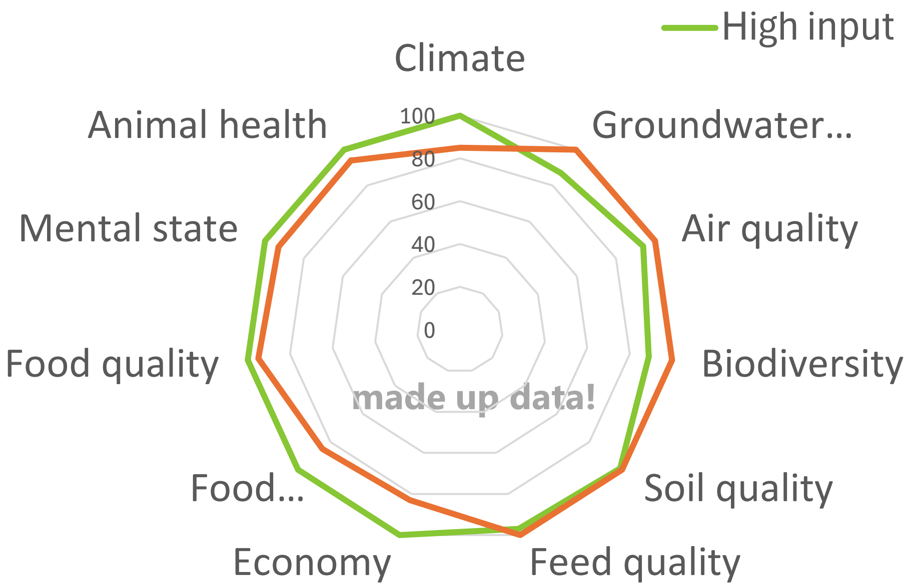
Variable	High-Input	Low-Input	
Milk Yield (kg/d)	29.3 ± 0.04	19.8 ± 0.04	
ECM (kg/d)	32.4 ± 0.05	22.7 ± 0.04	-30%
Milk Kg /Cow /Year	8800	6200	
Fat (%)	4.26 ± 0.004	4.43 ± 0.004	
Protein (%)	3.19 ± 0.002	3.27 ± 0.002	
Lactose (%)	4.54 ± 0.001	4.55 ± 0.001	
SCS	2.14 ± 0.01	1.38 ± 0.01	
Dry matter intake Kg/cow/day	22.1 ± 0.10	20.3 ± 0.10	
Concentrate Kg/Cow/day	7.1	5.1	-28%

Knob, Gattinger et al. in prep.

System analysis – organic High-Input performs better on 11 categories, but worse on biodiversity, air – and groundwater quality (reference year 2024)

- Steps:

1. Reduction of indicators (from >100 to <60)
2. Classification (n=11)
3. Data from subprojects: boxplot (min, Q1, median, Q3, max), year 2024
4. Standardization (median of better system = 100%)
5. Determination direction per indicator
6. Average % of all indicators per class
7. Radar chart for system comparison



High-Input

Low-Input

Sahrei et al. in prep.

RSITÄT GIESSEN

Living lab "Organic Dairy Germany" Developing innovative crop-livestock systems, which are ecologically and economically sustainable at highest animal welfare levels and so they will be accepted by the society.

1 Demonstration Farm:
Gladbacherhof

→

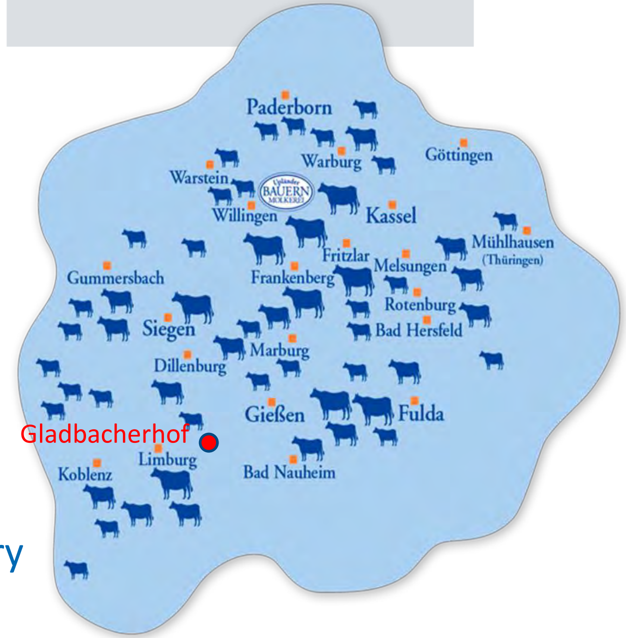
10 Lead Commercial Farms:
Upländer Dairy Network

→

100 outreach farms:
only Upländer Farms



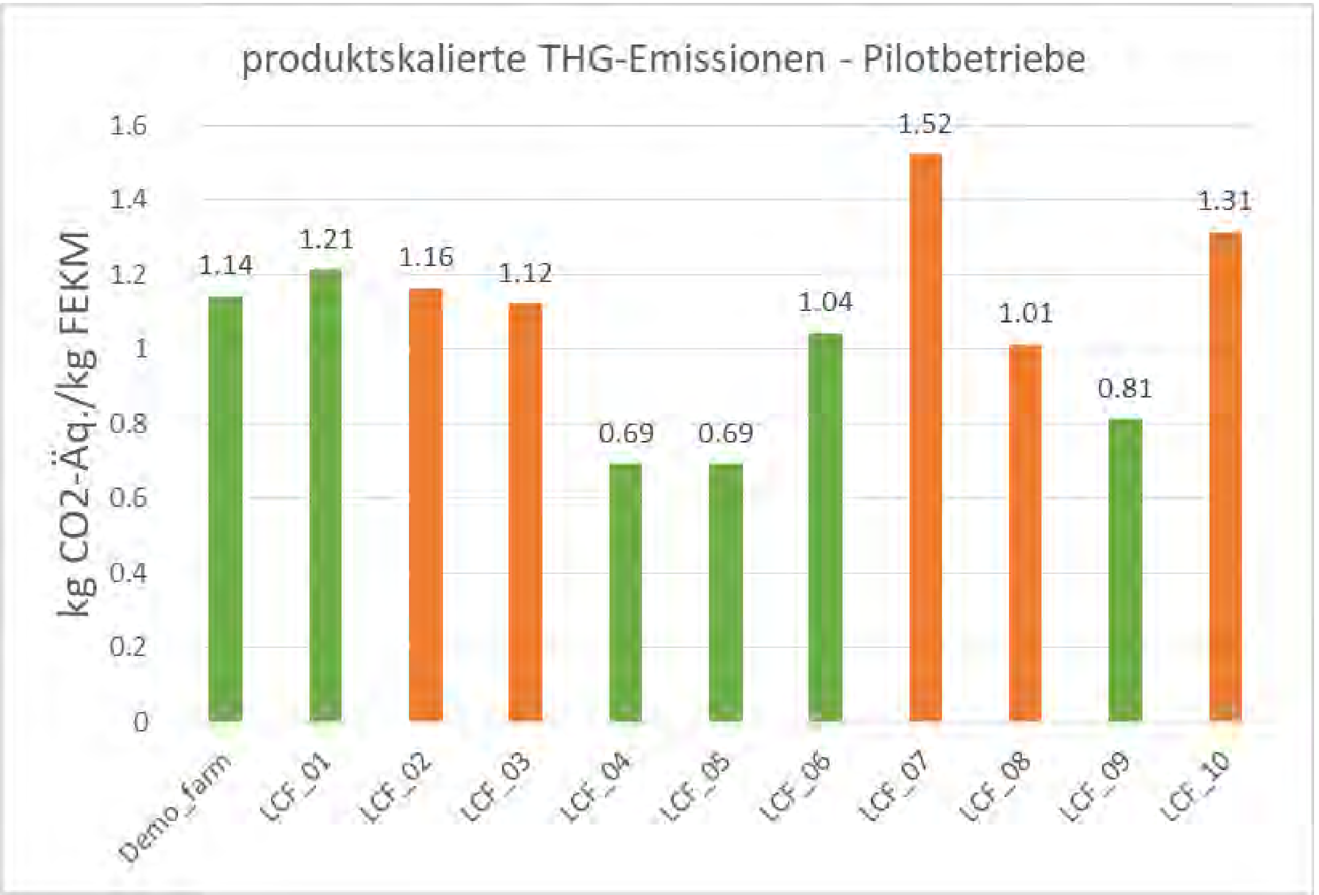




Milk producer of the Organic dairy factory „Upländer Bauernmolkerei“

ClieNFarms: Carbon Footprints of 1+10 organic dairy farms in the living lab “Organic Dairy Germany”

produktskalierte THG-Emissionen:
Durchschnitt von 11 Betrieben:
1,06 kg CO_2-Äq./kg FEKM



Milk yields of the farms (per cow and year):
High input: ca. 9.000 kg
Low input: ca. 6.000 kg

High-Input-Farms
Low-Input - Farms

Concluding words

- Organic faming is a system approach. It is a smart combination of traditional knowledge with modern technologies.
- Eco-functional intensification and crop-livestock integration as promising approaches for delivering the full potential of organic farming
- Organic farming is a knowledge-intensive approach: investments in research, demonstration, and advisory systems are central ingredients of success


Bundesanstalt für Landwirtschaft und Ernährung

BÖL

Empfehlungen zur Öko-Forschung bis 2030 des KT FÖLL — 18. Juni 2025

Empfehlungen zur Forschung für die ökologische Land- und Lebensmittelwirtschaft bis 2030