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IMPROVING INPUTS FOR ORGANIC FARMING

Summary of RELACS WP3: Replacement of contentious fertilizers and manures in plant production

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Seminar/webinar: Which recycled nutrients for Organic Farming? And why?
Monday Sep 18, 2023 (Brussels and online)

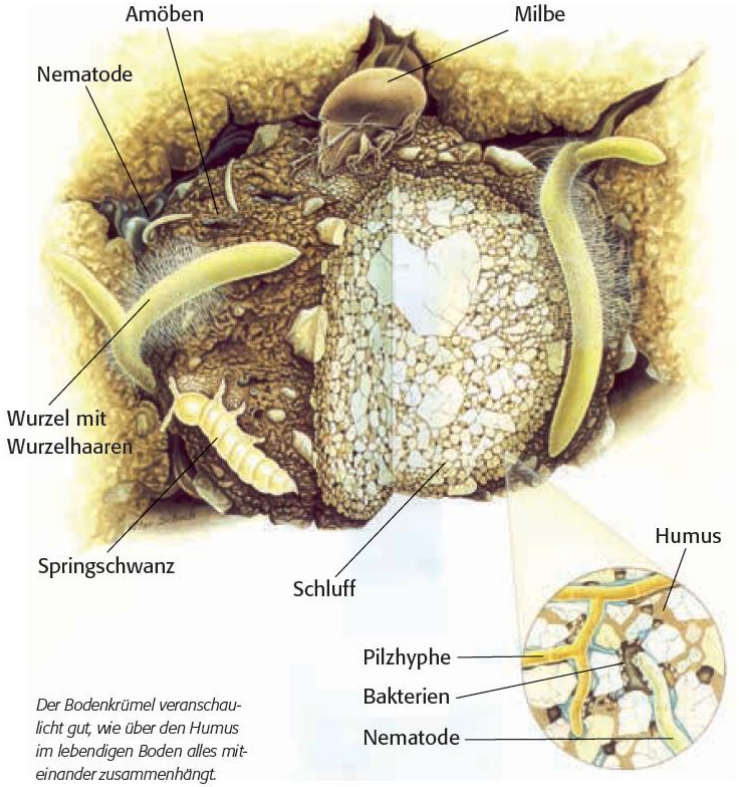
UNIVERSITY OF HOHENHEIM

UNIVERSITY OF COPENHAGEN

FiBL

RELACS has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 773431. The information contained in this communication only reflects the author's view.

Plant nutrition in organic farming (I)



Der Bodenkrümel veranschaulicht gut, wie über den Humus im lebendigen Boden alles miteinander zusammenhängt.

- Nutrient supply to plants primarily via the soil

=> Management of soil health is paramount.

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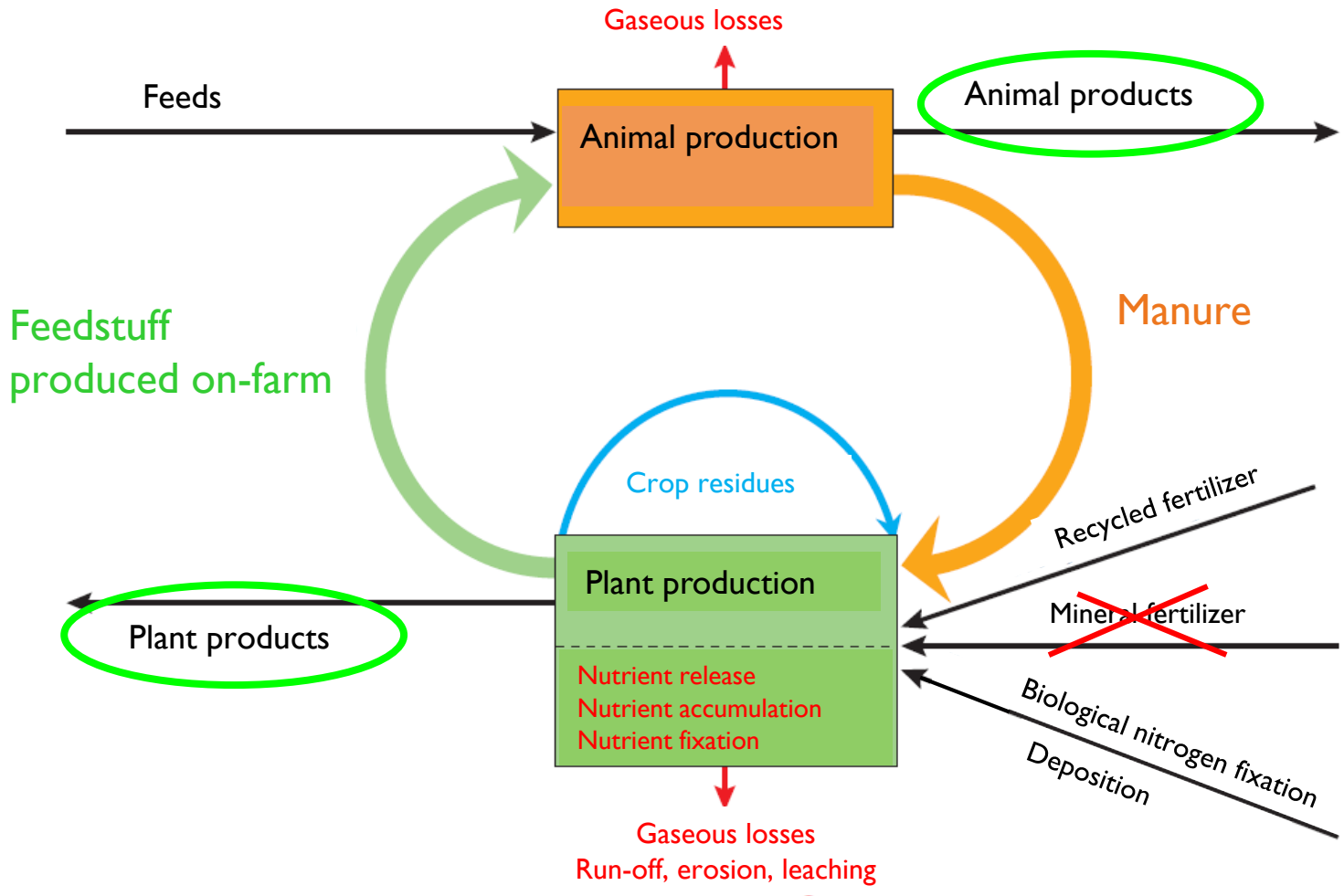
Plant nutrition in organic farming (II)



Richner et al. 2009

- Farms with largely closed nutrient cycles and few external inputs

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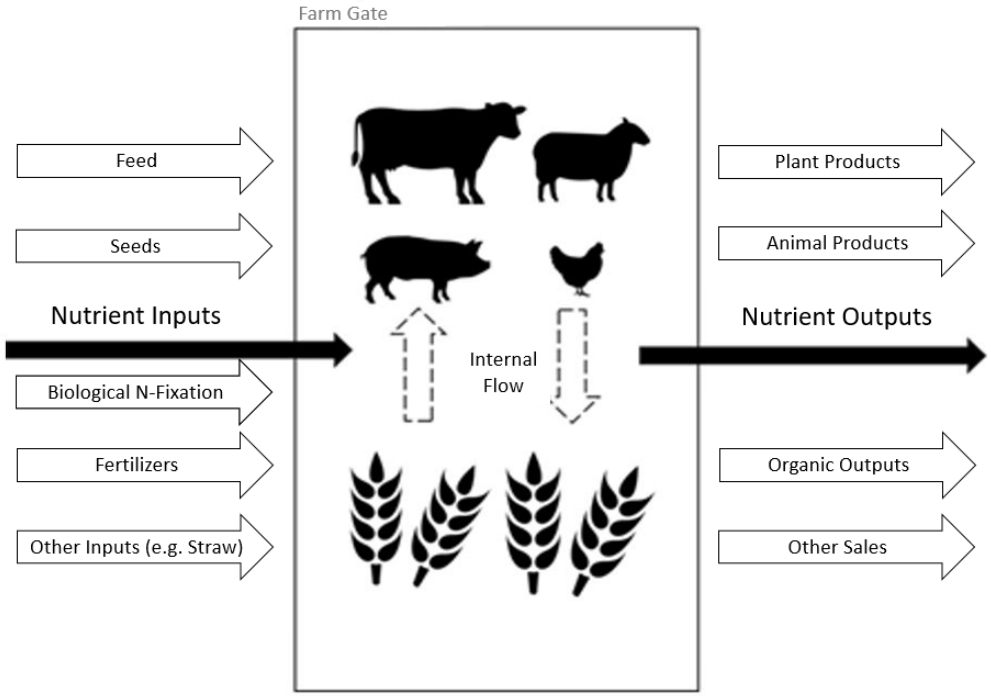
Current use of and need for external nutrient sources: Locations and approach



Survey of 71 organic farms in 7 European countries: Interviews and farmgate budgets covering 3 years

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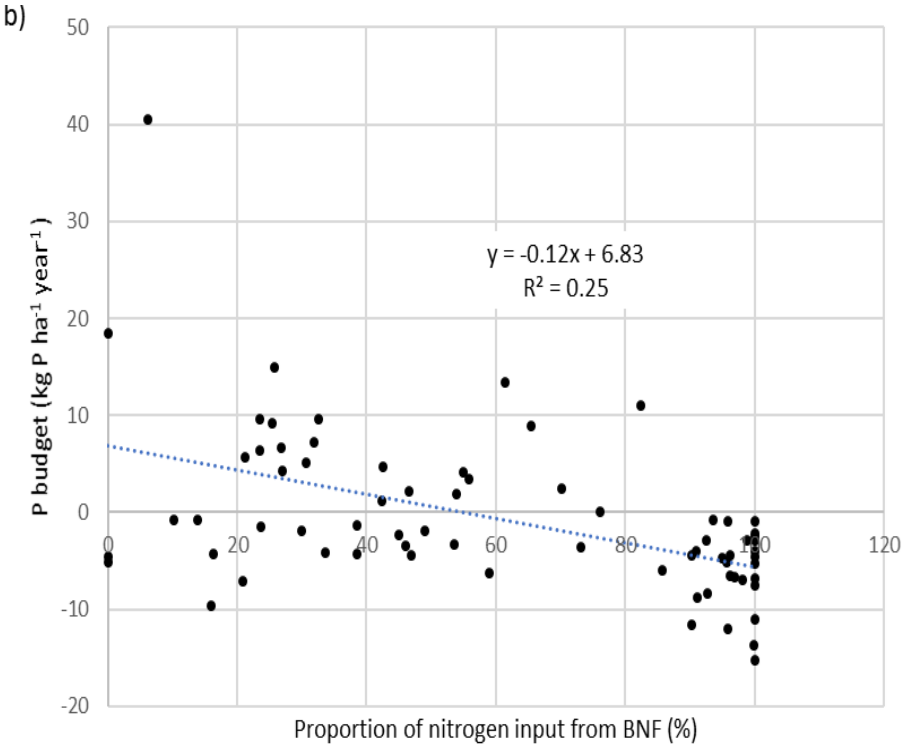
Current use of and need for external nutrient sources: Farm-gate budgets

- 24% of farms deficient for N; on average 61% of N derived from BNF
- 66% and 56% of farms with **negative balances for P** and **K,** respectively
- **Farm type most important factor** →Stockless farms have highest deficits
- **High reliance on BNF correlated with low output, and with negative P and K budgets**



⇒ N needed to increase productivity

⇒ P and K needed to prevent soil mining

Reimer et al., Nutr. Cycl. Agroecosyst., 2023

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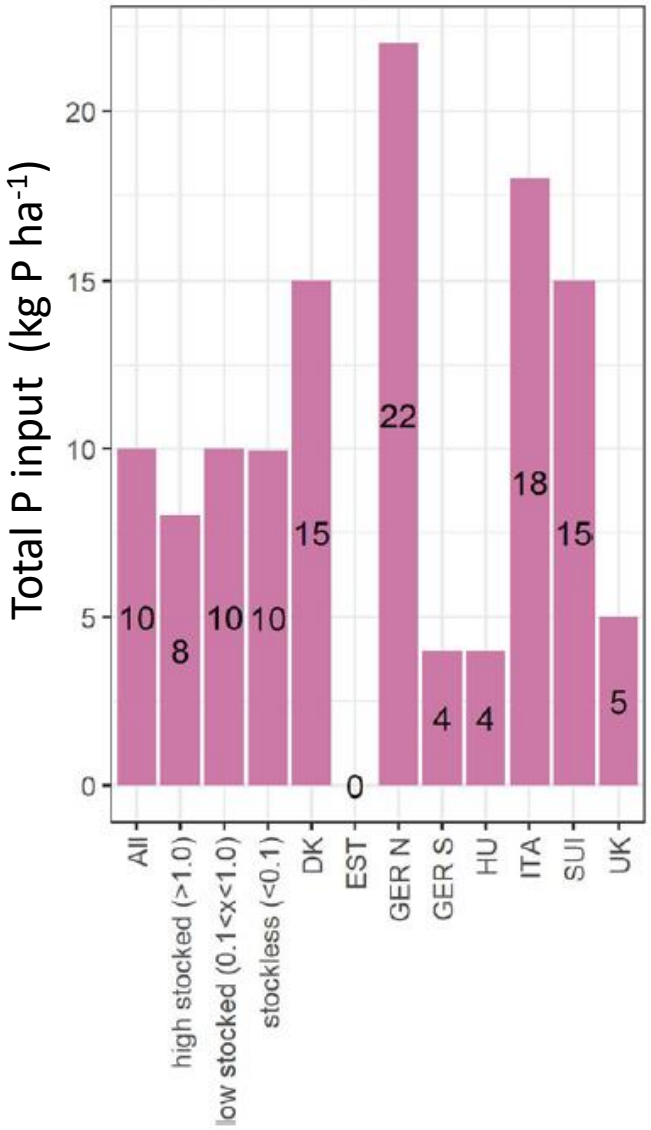
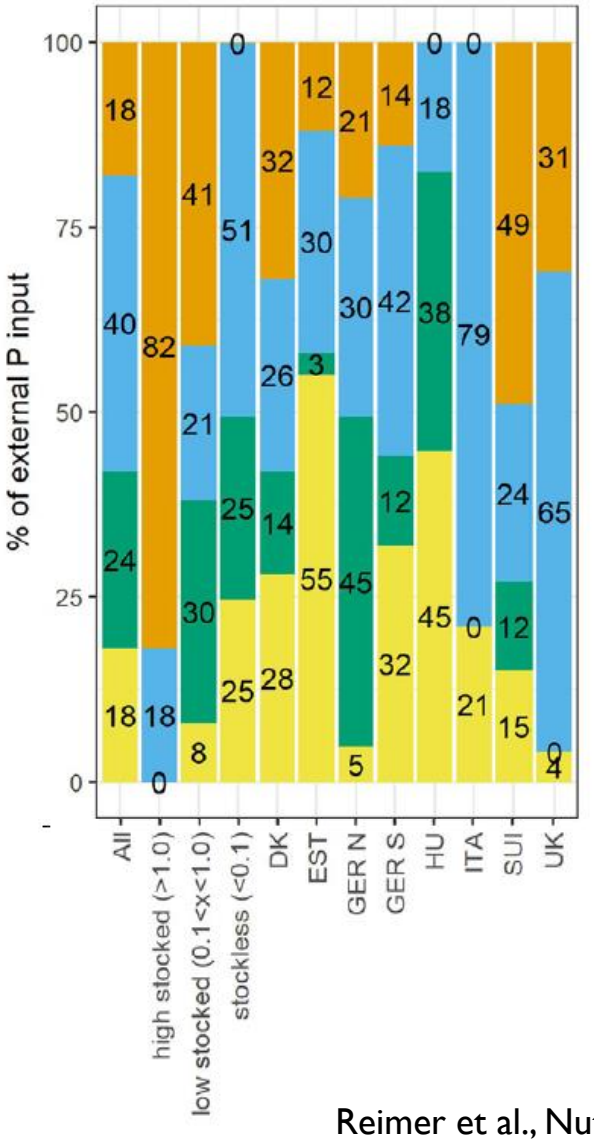
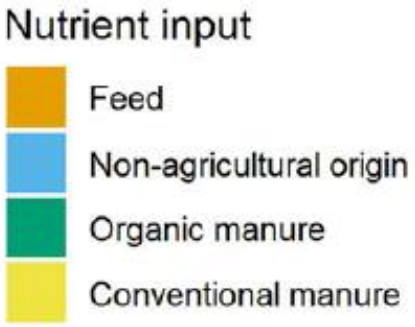
Current use of and need for external nutrient sources: External inputs (e.g. P)





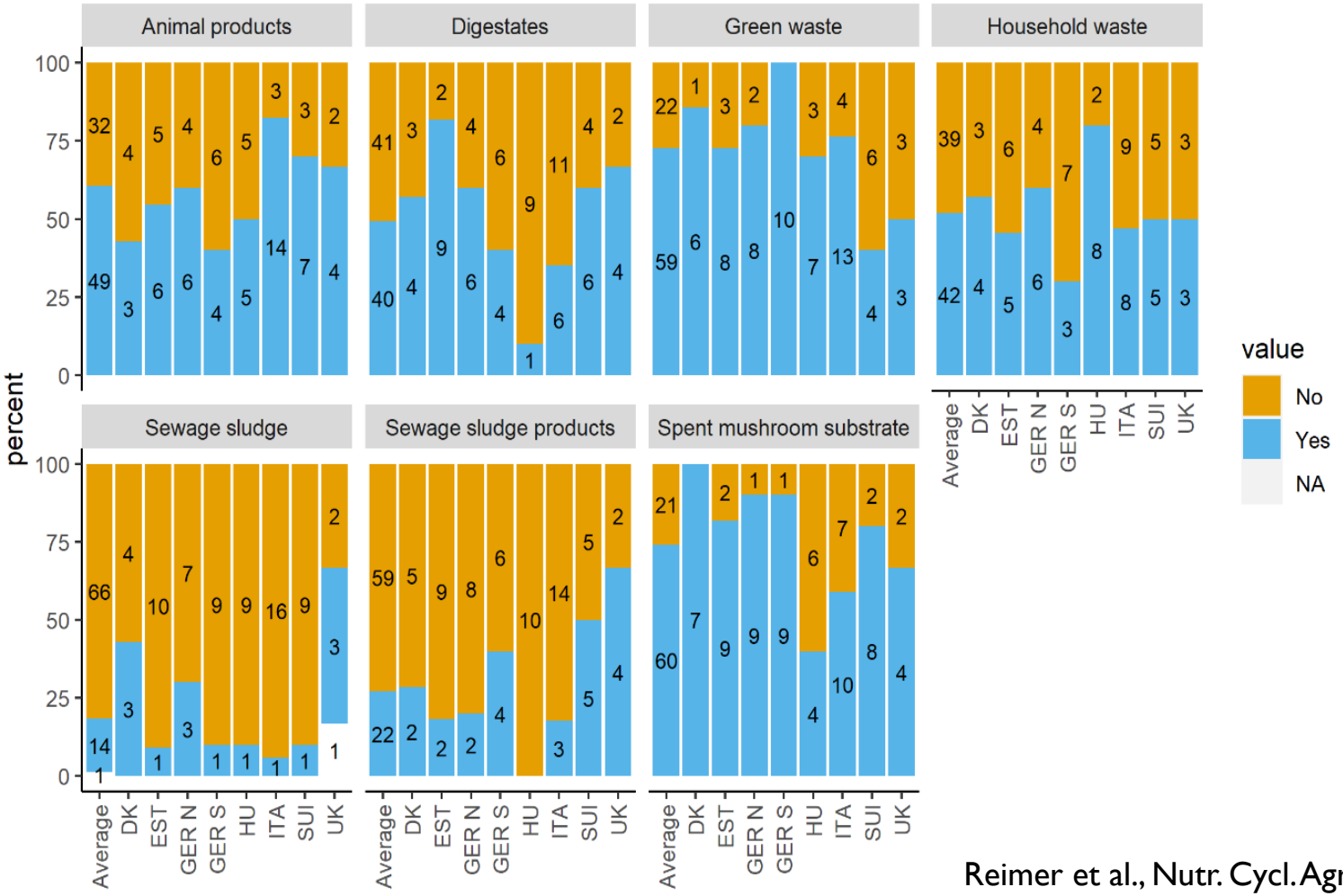


- Total P inputs: between 0 (Estonia) and 22 (Northern Germany) kg P ha^{-1}
- On average, 18% of external P input from conventional manure, 40% from non-agricultural origin, 18% from feed

Reimer et al., Nutr. Cycl. Agroecosyst., 2023

Current use of and need for external nutrient sources: Interviews

Would you use recycled fertilizers on your farm?

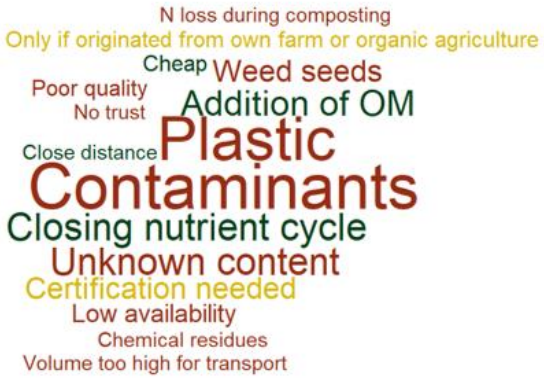


Reimer et al., Nutr. Cycl. Agroecosyst., 2023

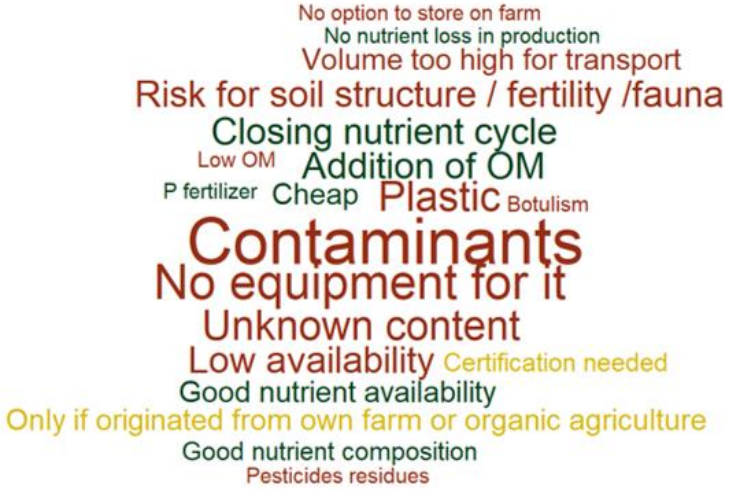
Current use of and need for external nutrient sources: Interviews

State the main rationale why you consider using a given nutrient input or not.

Household waste compost



Biogas digestates



Sewage sludge

Green: reason for
Red: reason against
Yellow: condition

- Main benefits: addition of OM, closing nutrient cycle
- Main obstacles: contaminants, plastic

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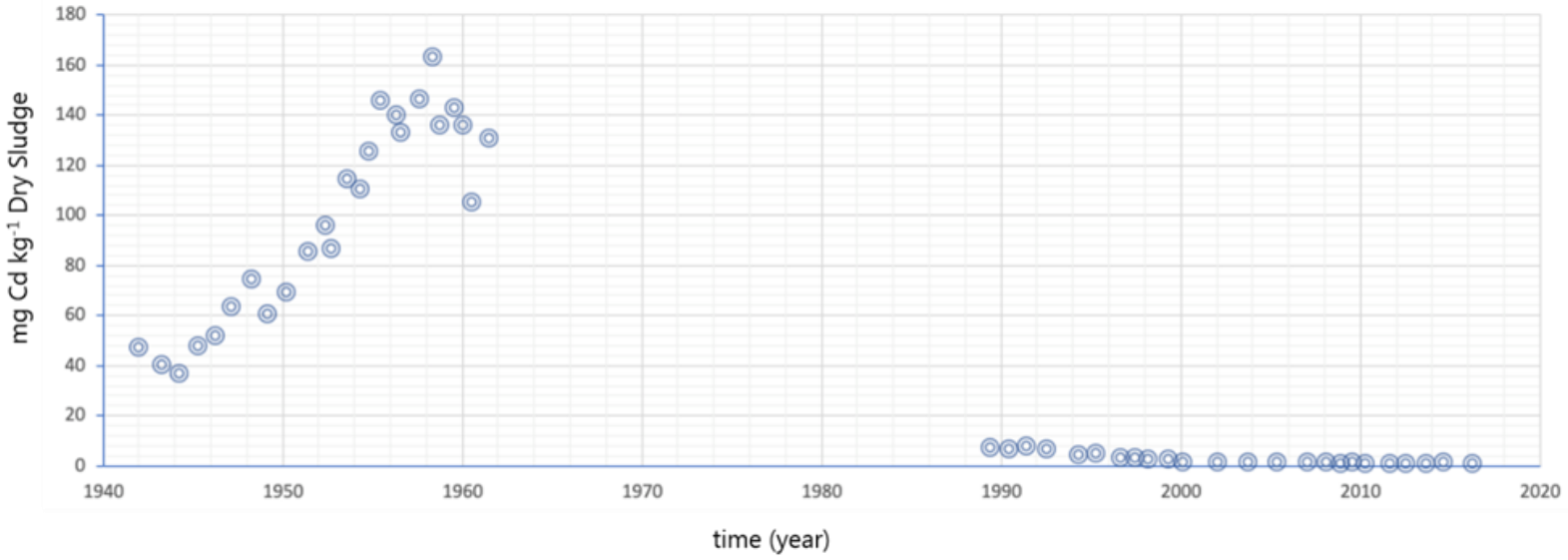
Workshop on contaminants in recycled fertilizers and their fate in soil-plant systems

March – April 2021, online
Organized by Else Bünemann (FiBL) and Jakob Magid (UCPH)
~120 participants (academia, organic sector, ministries, companies)



Bünemann et al., STOTEN, in revision

Main findings:

- Contaminant levels in societal wastes have declined in many cases
- Soils show great resilience and degrade or stabilize most pollutants
- Recycling societal wastes is in line with the principles of organic agriculture
- Proposed a definition of «low solubility» of mineral recycled P fertilisers

Evaluation of recycled fertilizers in long-term experiments: yield effect, soil carbon and nitrogen, risk of PTE accumulation

- Compost, sewage sludge and straw-rich manure can increase soil C stocks, but increase productivity less than human urine, slurry and green manure
- N losses from different fertilizers: 35-55% (mainly as nitrate)
- Moderately positive budgets of Zn, Cd, Cu and Ni did not result in elevated levels in soil or plant
- Each fertilizer has advantages and disadvantages: utilize in mixtures

e.g. compost plus additional N sources

Reimer et al. 2023 JPNSS

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Overall synthesis & recommendation

Agreed positions from the RELACS European Workshop:

- External N besides BNF is needed for high productivity, esp. for stockless farms
- Focus should be on balanced long-term supply of all nutrients, not only P
- Recycling of societal waste streams and organic regulations need further development
- Waste streams have increased in quality => clear criteria needed
- With respect to heavy metals in agricultural soils, mainly Zn and Cu (from mineral feed supplements) are of concern
- Organic contaminants are mostly bound in soil => plant uptake negligible
- Low water solubility of many recycled P fertilizers => suitable for organic agriculture
- Acceptability of mineral N sources from recycling => further discussions needed

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Reflections on the acceptability of recycled P fertilizers for European organic agriculture

FiBL

Leschenne & Speiser, 2021
https://www.betriebsmittelliste.ch/info-themen/stellungnahmen.html

Aim: guide industry to focus on processes likely to receive an authorization for organic farming (but personal opinion of the authors).

Major aspects determining the acceptability:

- Raw materials: manure (not from ff), food industry waste, source separated household waste, bones, sewage sludge/wastewater
- Solubility: max. 25% of P present in water-soluble form
- Manufacturing process: use of synthetic reagents should be kept to the minimum, only nitric acid is problematic (synthetic N)
- Contaminants: limits of the EU fertiliser legislation provide adequate level of environmental protection

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Final remarks

A multi-criteria assessment of nutrient inputs for organic farming could follow these principles:

1. Maximize farm-internal recycling and/or cooperation between organic farms before sourcing external fertilizers.
2. External fertilizers should originate from nutrient recycling.
3. The fertilizer production process should have a low environmental impact.
4. The fertilizer should not harm the soil and ideally be beneficial for soil quality.

THANK YOU!

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