Benefits of cereal-legume mixtures on soil biology

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Integrating Pulses into the Market Garden

- Bean and soybean in Marbais
- Belgium
- Jean-Luc







Intercropping: a millennia old agricultural practice

Growing multiple crops together in the same field, promoting diversity, efficient resource use and resilience

"Milpa"

intercrops forming the basis of the pre-Hispanic Mesoamerican diet such as maize, squash, tomatoes, beans

Florentine Codex, book X, page 72, 136r. Reproduction: Gerardo Montiel Klint / Raíces.



Maize, chili, and cotton intercropping

"**Maslin**" or "**Mashlum**" in Scots intercropping of ancient cereal and legume for bread (from 15th century onwards)



Oat-bean intercropping in Scotland

My field-based research on cereal-legume intercropping at the University of Reading

News and events

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Sustainable agriculture through legume-cereal intercropping

The LEGUMINOSE project will provide science-based, farmer-led, and economically viable systems and techniques for legume-based intercropping.









My lab-based research on cereal-legume intercropping



My interest: Plant-soil interactions in intercropping





- Roots influence soil microbial communities and their activities
- In turn, soil microbes influence plant health and productivity
- These interactions affect nutrient cycling, soil carbon sequestration, soil aggregation ...

Roots fuel soil microbial processes underpinning soil functions



Rhizosphere: Hotspot for microbial activity



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Root exudates:

energy-rich, readily-decomposable available to a wide range of microbes



Up to 20% of in the rhizosphere

photosynthetic C is leaked $\leftarrow \rightarrow$ Energy for SOM turnover

Does intercropping modify soil processes driven by microbes?



100 µm



Rhizosphere microbial communities

Yes, intercropping modify soil processes driven by soil microbes



Rhizosphere



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Rhizosphere microbial communities



Increased biomass

Same composition e.g., Fungi: Bacteria

Changed composition of the active component

Modified activities : **Increased** microbial use and incorporation of root exudates



Decreased SOM decomposition

Soil Organic Matter Decreased enzyme activities

What I learned from my research on cereal-legume mixtures

Other findings:

- Soil management history matters
- In mixtures, the **legume had a stronger effect** on soil microbes and their processes.

Take home message:

 Intercropping has the potential positive effect on SOM build up (more research is required)

