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IMPROVING INPUTS FOR ORGANIC FARMING

Farm gate nutrient budgets of organic farms in Germany – Sustainability of the nutrient management

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FiBL

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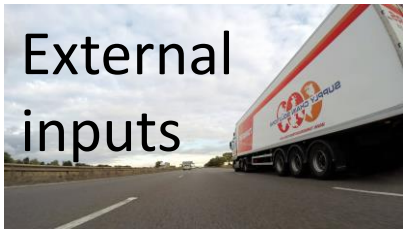
Why do we need external fertilizers?



- Conventional manure
- Rock phosphate

Closed Cycle?

- Compost
- Sewage sludge
- Waste products from industry

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Need to assess the current nutrient supply of organic farms

- In order to substitute unwanted "contentious" inputs, we need to know:
  - What is the current nutrient supply on organic farms?
  - What kinds of inputs are used?
- No comprehensive data available on nutrient supply of organic farms in Europe!

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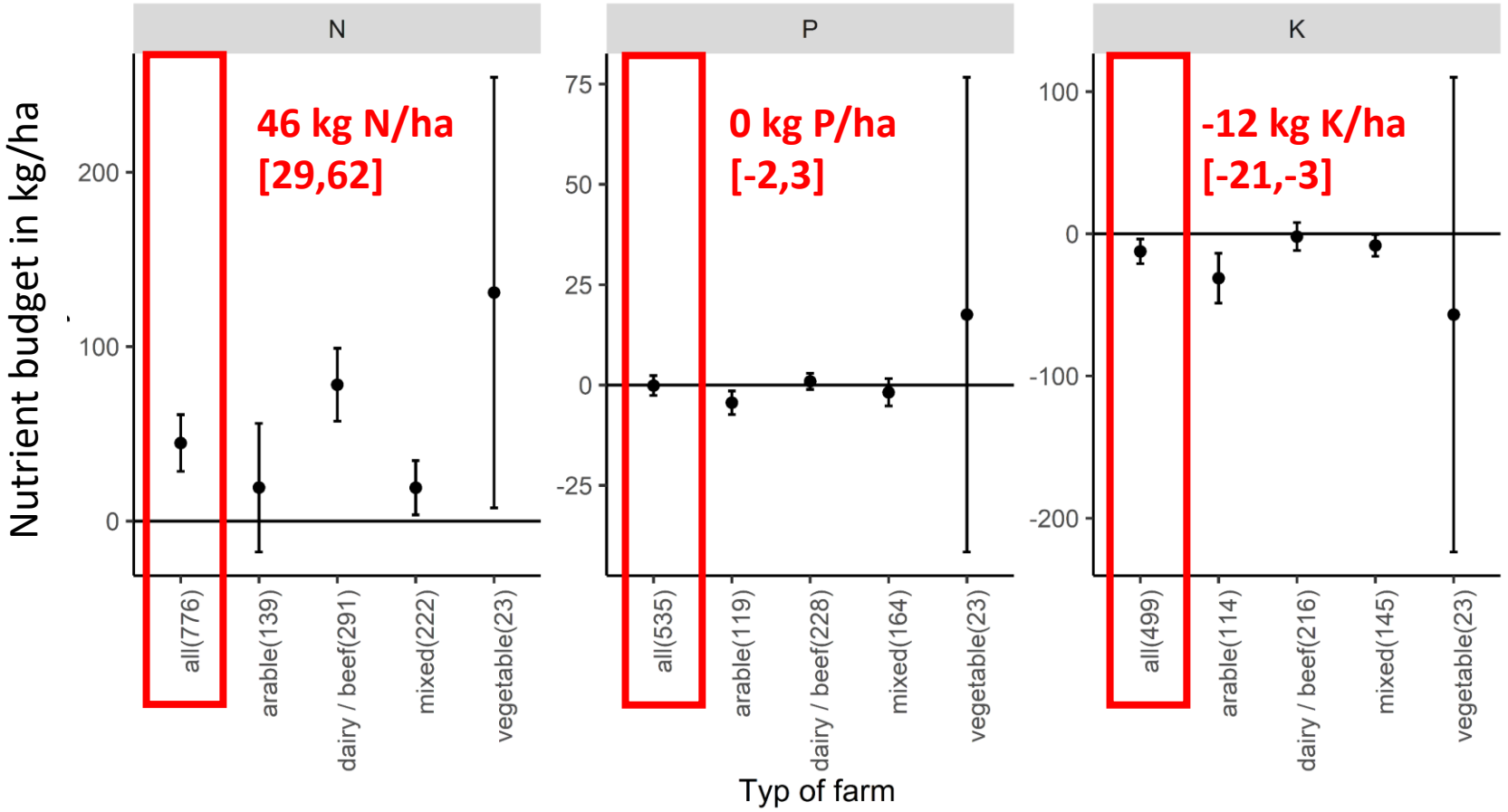
Literature study of nutrient budgets in Europe



(Reimer, unpublished data)

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Conclusion from literature research

- Nutrient deficits mostly found for P and K
- Very few studies found for Mg (3) and S (2)
- High differences between studies
- Farm type is a very determining factor
  - Lower nutrient availability in arable or mixed farms
- Many studies do not take into account soil nutrient contents

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Research Questions

Farm gate nutrient budget study in Germany

- Is there an imbalance of nutrients (N, P, K, Mg, S) within German organic farms?
- What are the factors influencing the nutrient budgets? Why is there such a huge variance between farms?
- What are the main nutrient inputs?
- How sustainable is the current nutrient management in terms of soil fertility?

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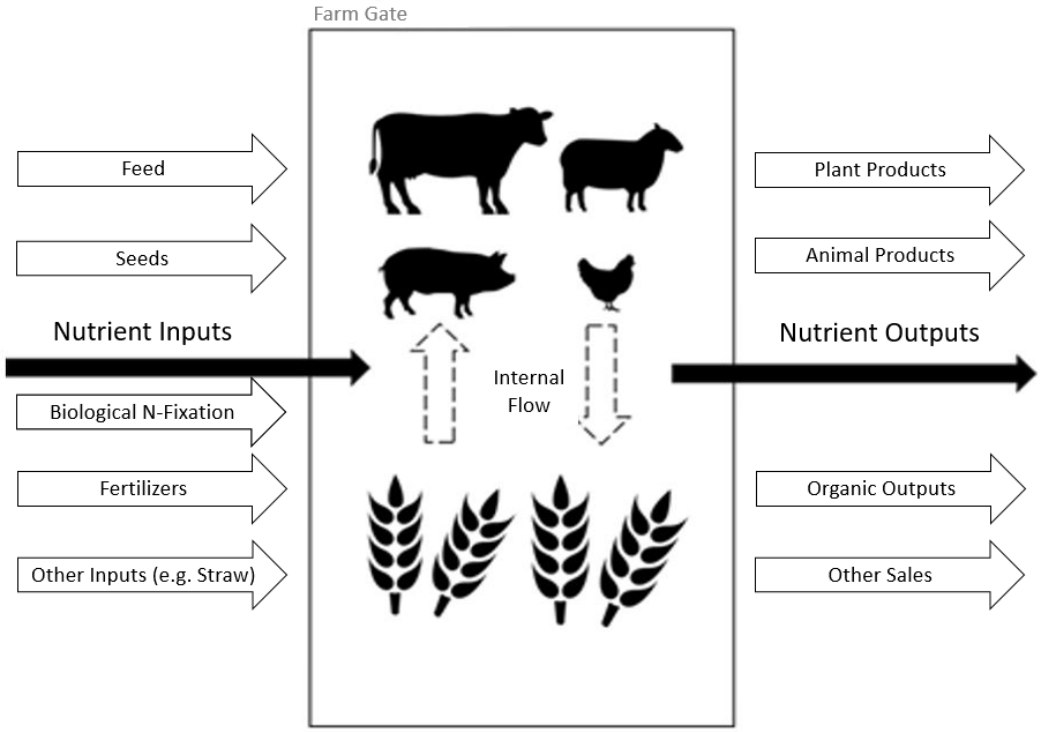
Method for obtaining farm gate budgets



- Personal Interviews with the farmers
- Additional taking of soil samples

Excel Sheet

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Overview of case farms

	Farms	Farm size (ha)	Stocking rate (LU ha^{-1})	BNF rate (%)	Years organic	Farming system types
North	10	160.2 (24-422)	0.4 (0.1-0.9)	41 (16-98)	18.0 (5-36)	Arable (6) Mixed (4)
South	10	60.1 (15-125)	0.6 (0.4-0.7)	70 (23-96)	22.6 (10-32)	Arable (6) Mixed (4)
All	20	122.1	0.49	55	20.3	Arable (12) Mixed (8)

- All farms certified by Naturland or Bioland
- Mainly laying hens and cattle on mixed farms
- Main crops:
  - Cereals: wheat, spelt, barley, rye, oats
  - Grain legumes: field peas, field beans
  - Forage legumes: clover grass, alfalfa
  - Vegetables (7 out 20): potatoes, carrots, beets, parsnip

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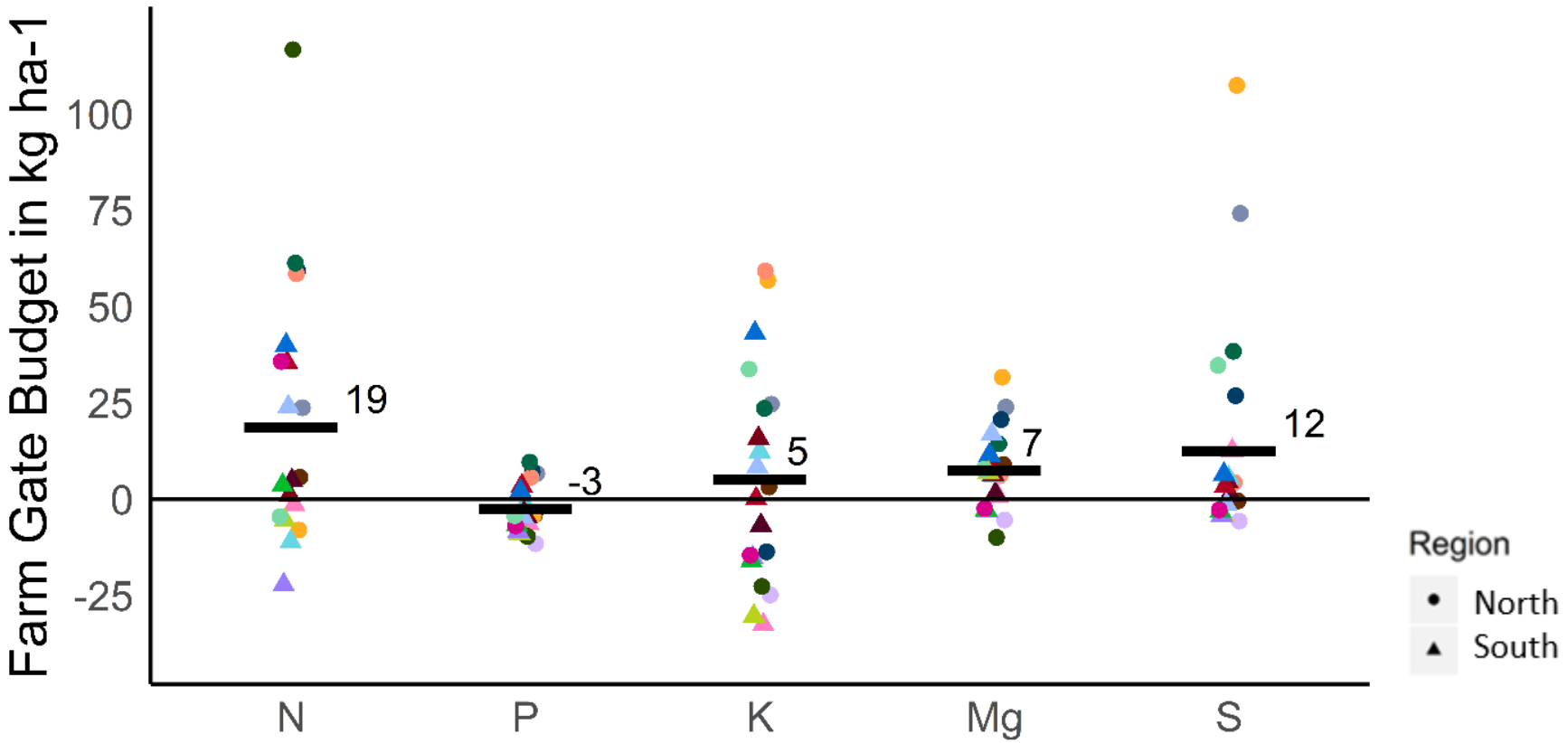
Farm gate nutrient budgets



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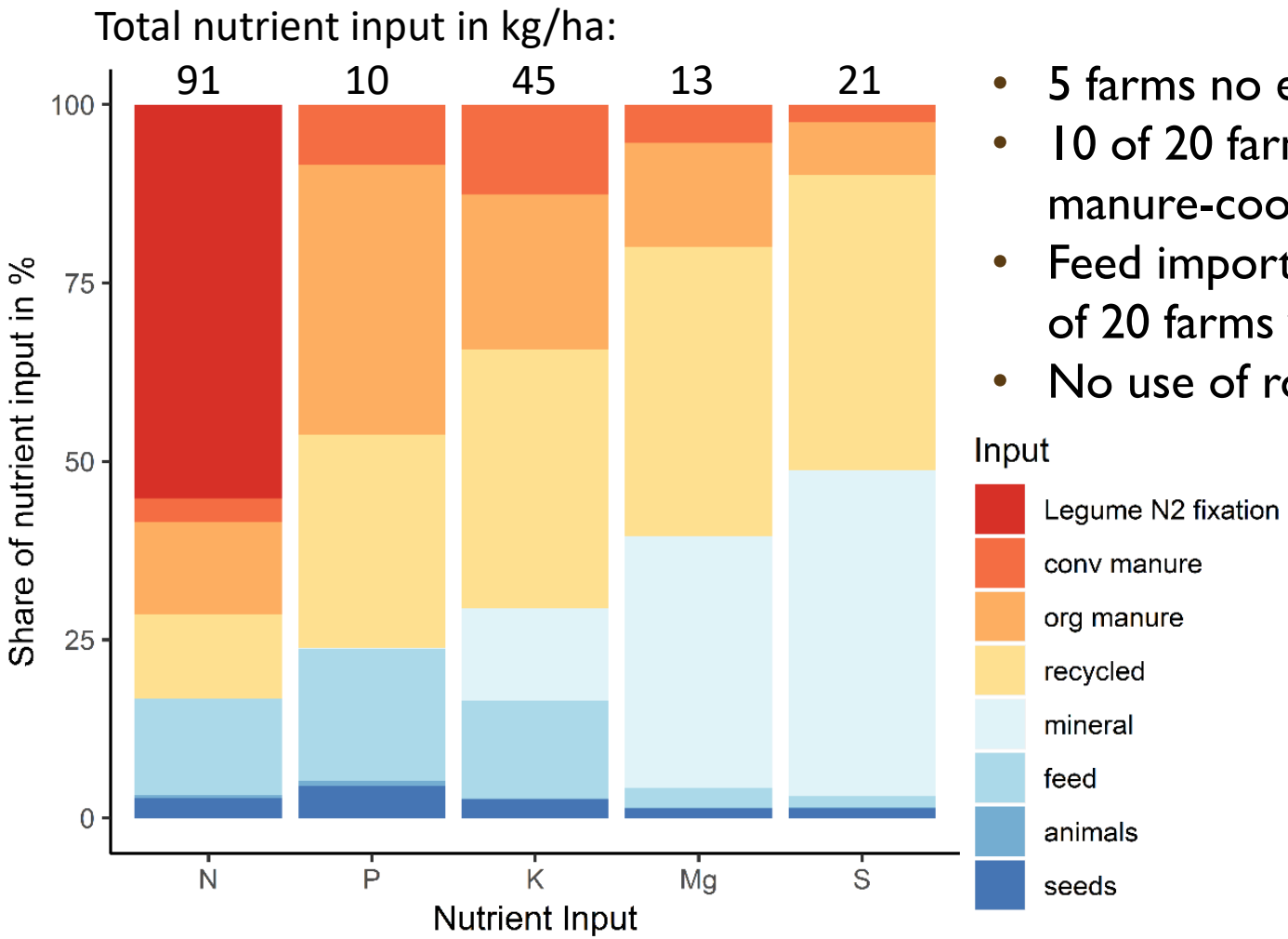
3.1: Types of Inputs used



- 5 farms no external input
- 10 of 20 farms fodder-manure-cooperation
- Feed important but only 8 of 20 farms with animals
- No use of rock phosphate

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Factors influencing the farm gate budgets

	N	P	K	Mg	S
% of total N input supplied by legumes					
Nutrient yield					
Livestock density					
Region					
Cropped cultures					

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Influencing factors of farm gate nutrient budgets

- Differences in regions (GER N and GER S) can be explained by rate of BNF
  →Reliance on BNF for fertilization determines budget
  →Higher BNF / lower use of external inputs results in negative budgets for especially P and K
- Higher animal density resulted in higher N surpluses
- Total farm output not correlated to yield
  → high yields do not entail high nutrient surpluses
  → however, higher inputs resulted in higher outputs
- Cropped cultures and size of the farm did not influence the budgets

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Nutrient content in the soil

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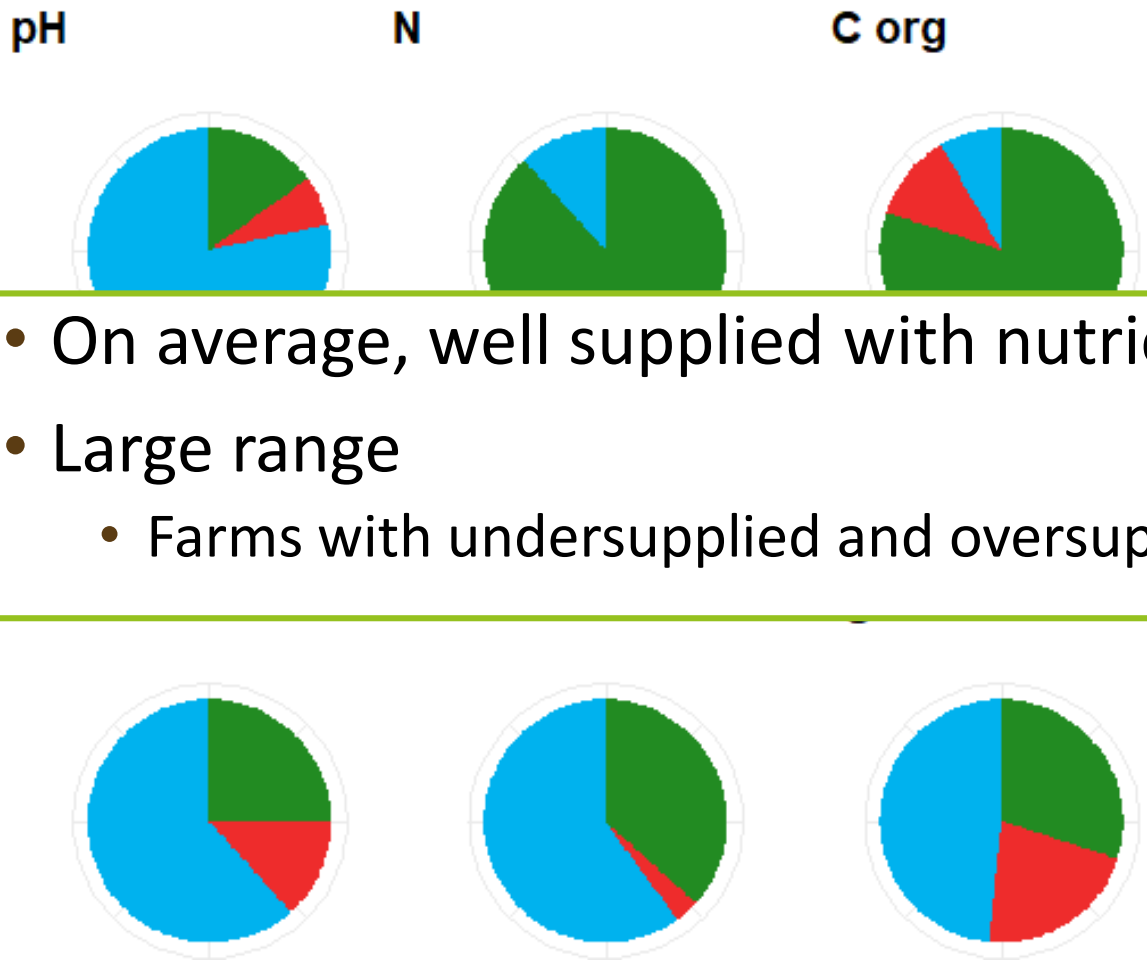
Soil nutrient contents



- On average, well supplied with nutrients
- Large range
  - Farms with undersupplied and oversupplied soils

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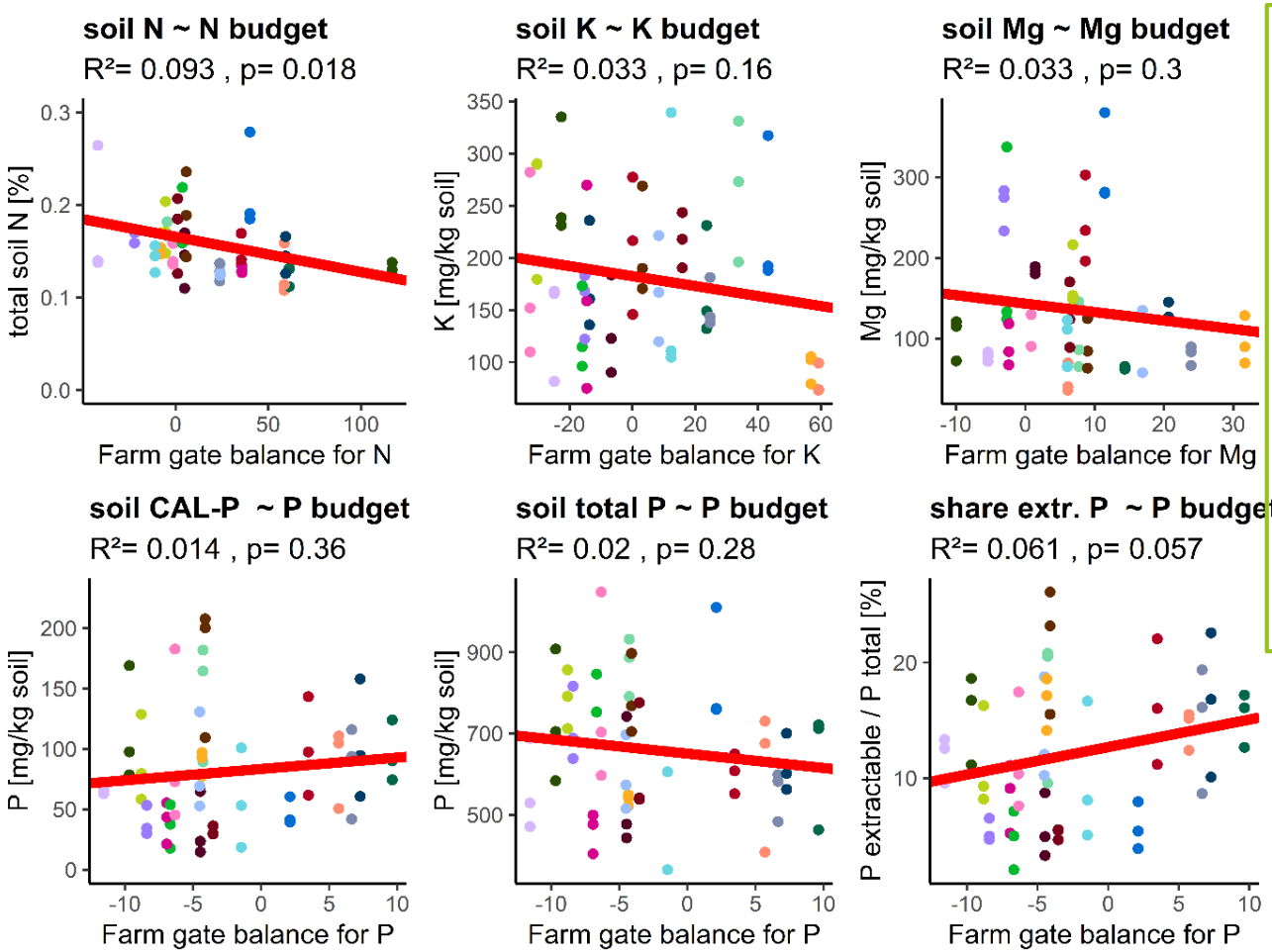
Relation of soil measures to nutrient budget



- Only relation fond for N
- Trend found for share of extractable P
- No relation due to differences in soil content at time of conversion

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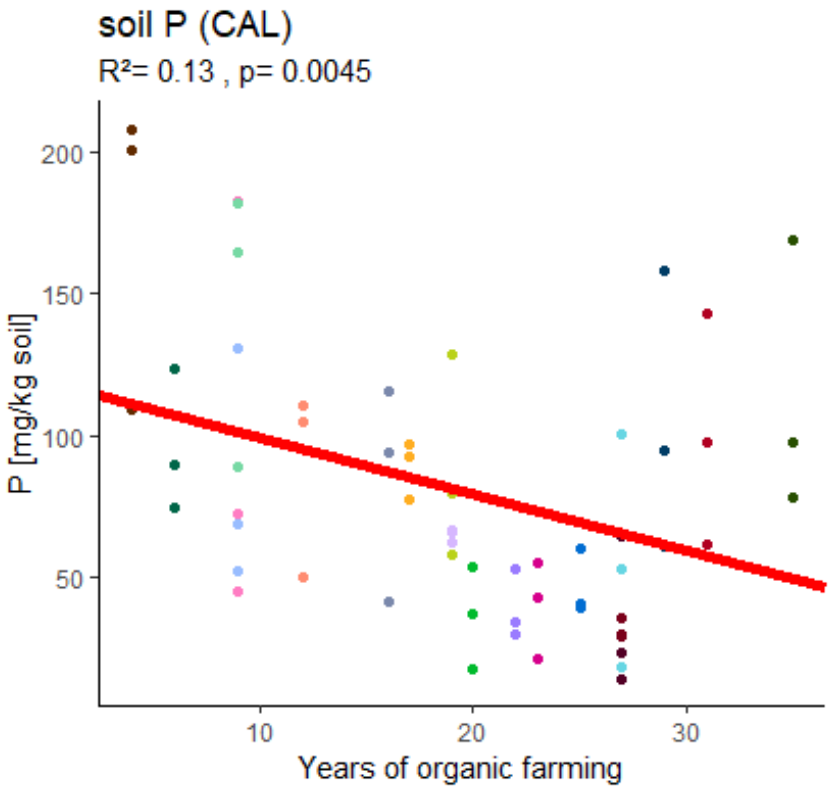
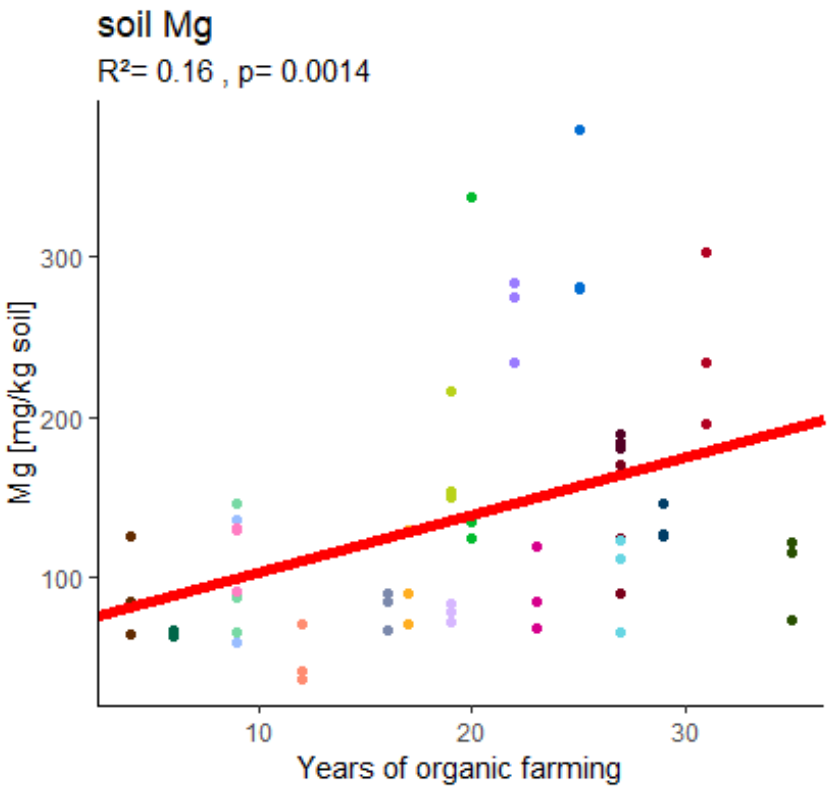
Soil nutrient content by time of organic management





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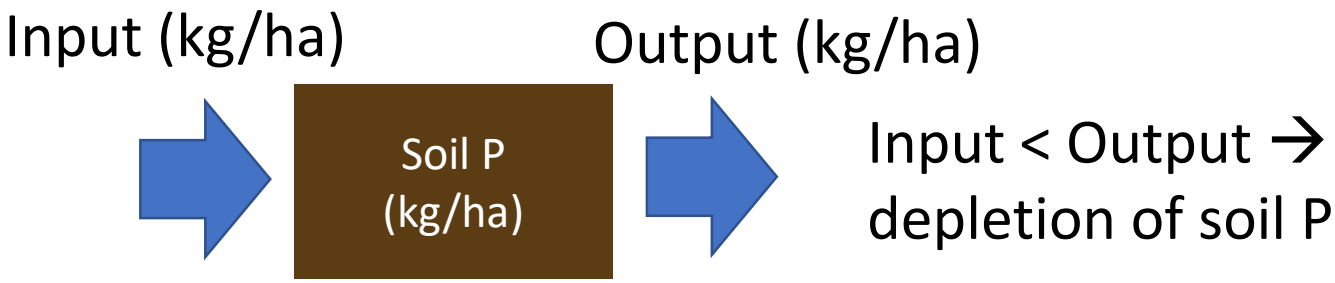
Soil P depletion over time



- On average, 39 years until soils are not in the optimal range of soil P anymore (for farms with negative P budgets)
- BUT 5 farms less than 10 years

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Conclusion

- Is there an imbalance of nutrients (N, P, K, Mg, S) within German organic farms?
  - Lack of P, while there is a small surplus of N, K, Mg, and S
  - Big differences between farms
- What are the factors influencing the nutrient budgets? Why is there such a huge variance between farms?
  - High reliance on biological N_2 fixation results in negative budgets for P, K, Mg and S
    → reasonable amounts of external inputs are needed to replenish nutrient offtake

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Conclusion

- What are the main nutrient inputs?
  - Main input for N is biological N_2 fixation
  - Conventional manure only partly used, no use of rock phosphate
  - High nutrient inputs via feed, compost and organic manures from fodder-manure cooperation
- How sustainable is the current nutrient management in terms of productivity and soil fertility?
  - On averages, soils are well supplied with nutrients BUT proportion of soils undersupplied → negative nutrient budgets need to be avoided

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