

Effects of organic matter input and cropping system on nitrate leaching, crop yield and soil quality in arable farming

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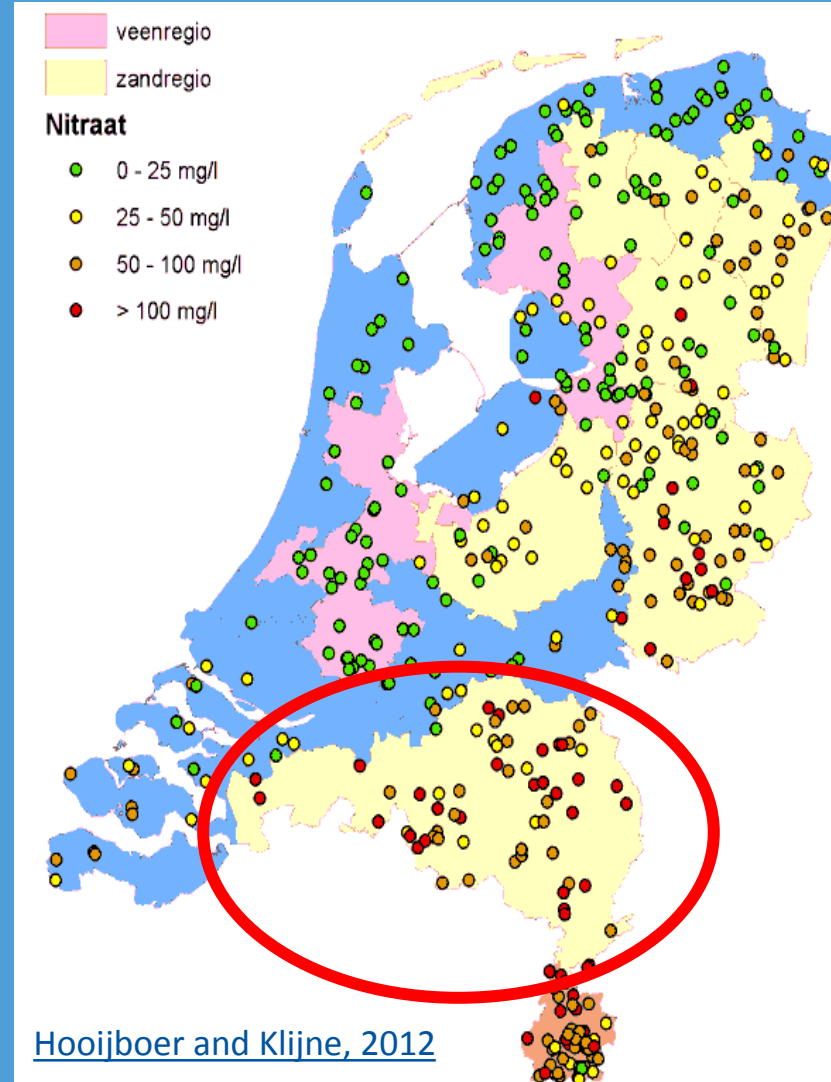
N-workshop Lisbon, 2 July 2014



High nitrate leaching in South East NL

Severe manure legislation

- Nitrate concentration too high
 - Arable farming sand region 79 mg/l
 - All farming Southern sand region 106 mg/l
- Legislation more severe
 - 2015: N-application norms leaching sensitive crops 30% lower than advice
- Decreasing crop yields and soil fertility expected



Is arable farming possible within the 50 mg/l?

- Optimization of fertilization is not sufficient
 - Easy measures have only limited effect
 - Measures with large effect have large bottlenecks
 - costs, applicability, unwanted side-effects,
 - System change needed
 - Soil and organic matter management
- Results of farming system trial Vredepeel



Research question

- What is the effect of organic matter input on:
 - Nitrate leaching
 - Crop yield
 - Soil quality
- Effective organic matter (EOM)

**Farming systems
research**

1989
2000



2001

2003



2005

2008

**Soil Quality on
Sandy Soils**

2011

2016

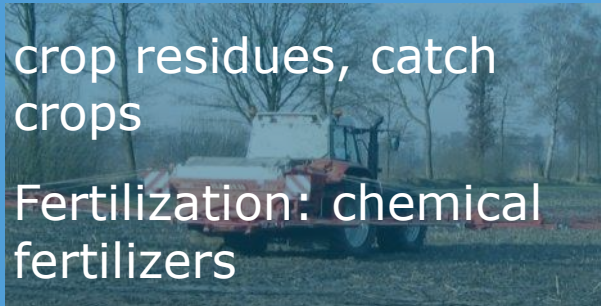
Comparison effective organic matter input

Conventional

Low EOM input

AF

800 kg eom/ha/yr



crop residues, catch
crops

Fertilization: chemical
fertilizers

Average EOM input

MAN

1550 kg eom/ha/yr



slurry, crop residues,
catch crops

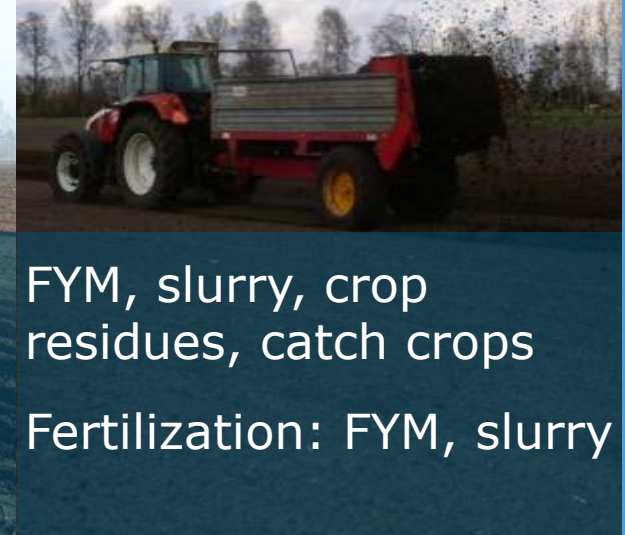
Fertilization: chemical
fertilizers, slurry

Organic

High EOM input

BIO

2750 kg eom/ha/yr



FYM, slurry, crop
residues, catch crops

Fertilization: FYM, slurry



Crop rotation



- Full crop rotation
- Important crops of the region
 - Arable crops, vegetables and feed crops
 - Mow crops and root crops
- Maximum use of green manure crops
- Organic
 - Different rotation than conventional before 2011
 - Carrots in stead of sugar beet



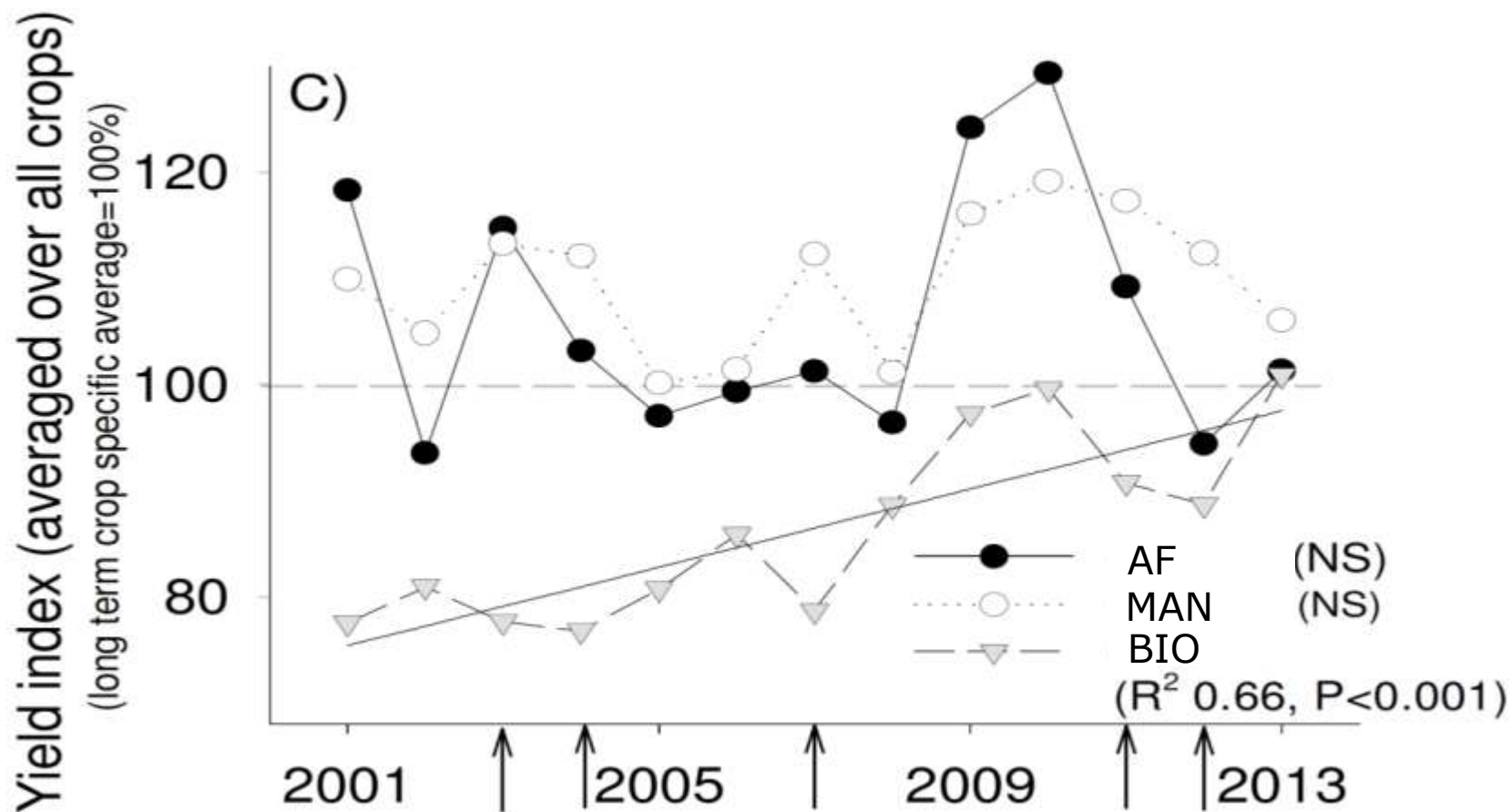
Difference in crop condition: MAN and AF



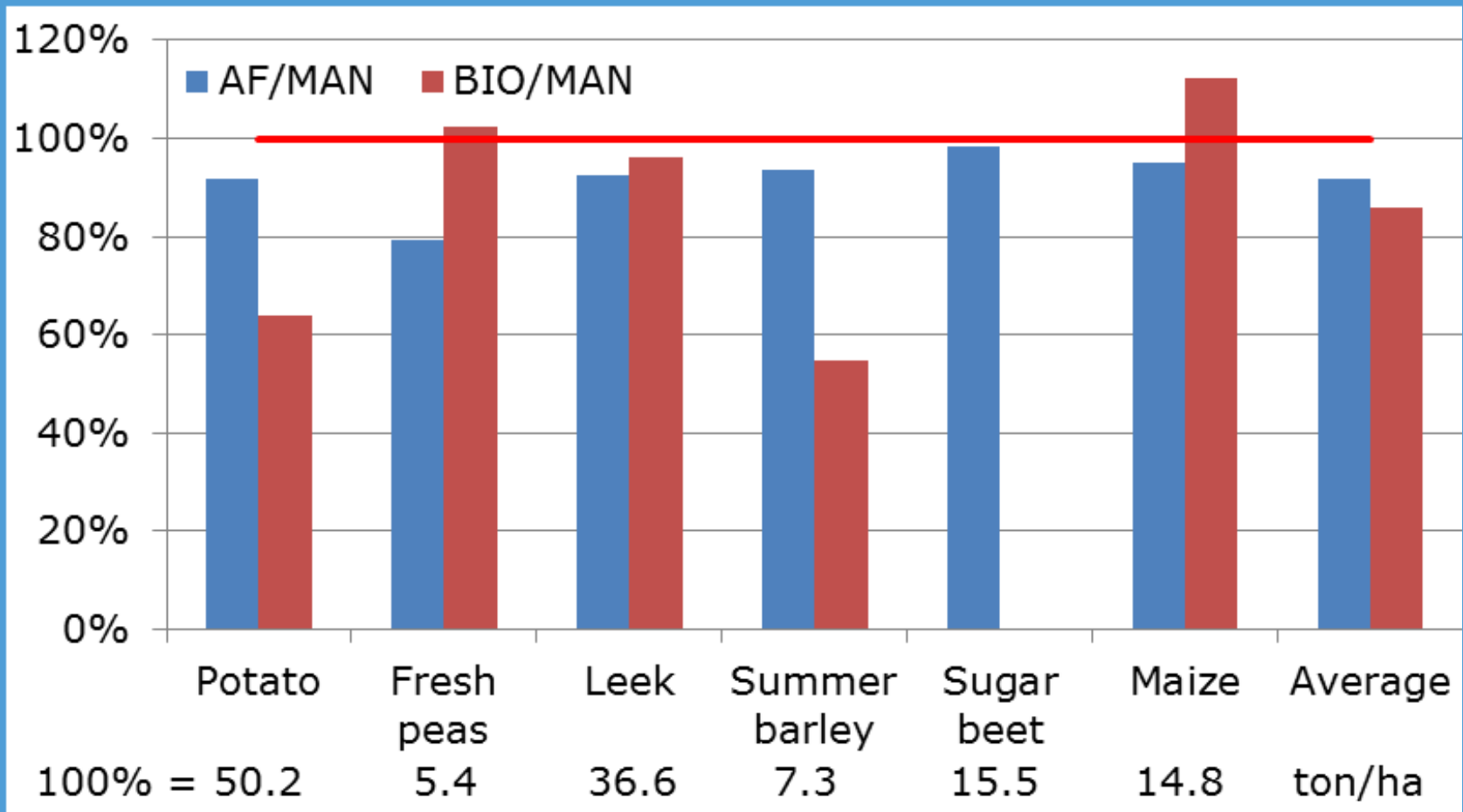
Difference in crop condition: AF and MAN



Crop yield trend 2001-2013

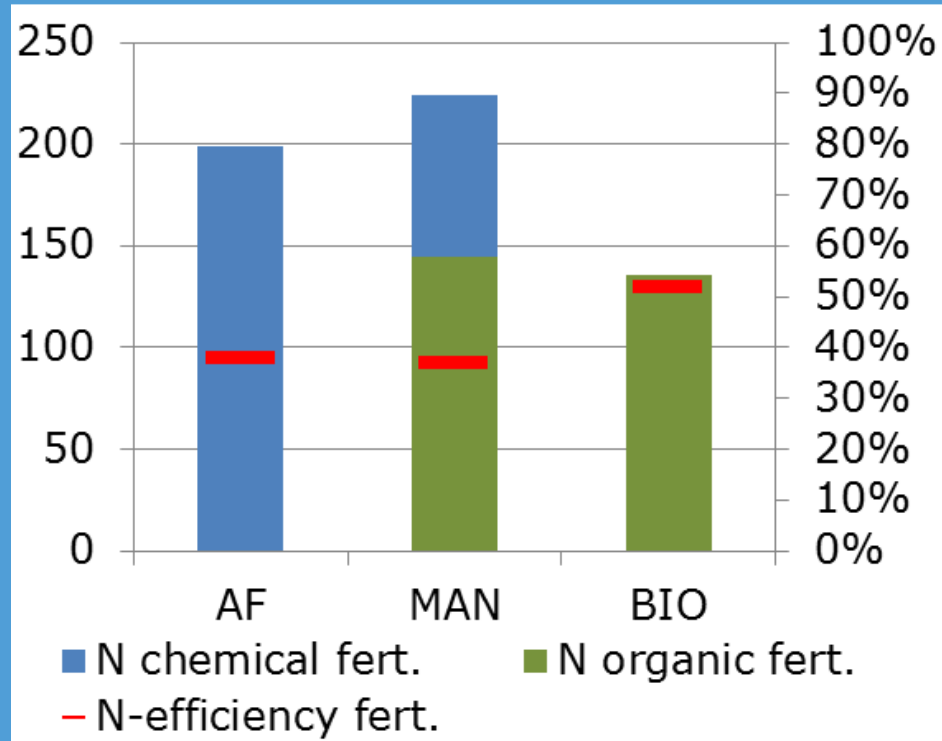


Relative crop yield AF/MAN and BIO/MAN average 2011-2013

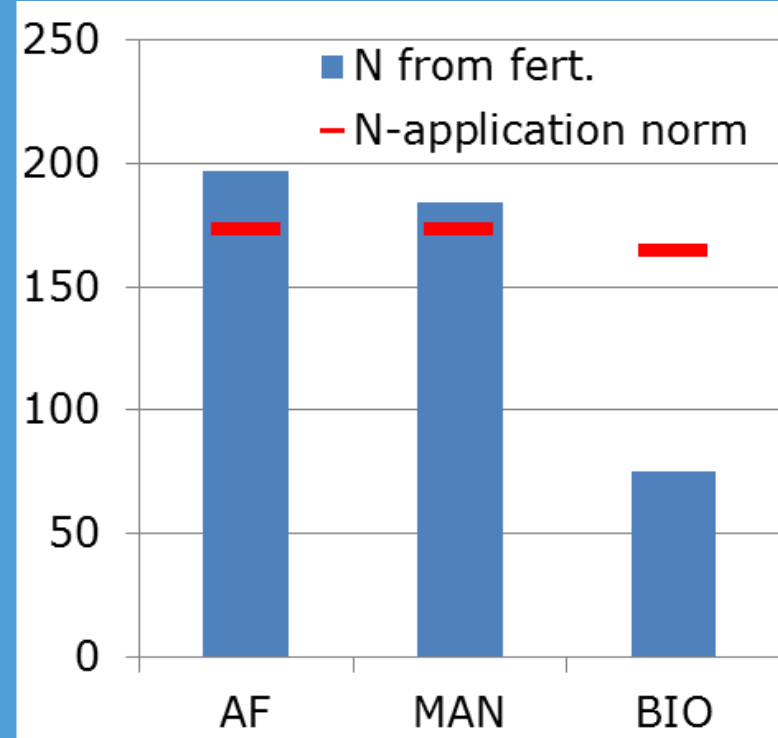


Nitrogen input 2011-2013 (kg/ha)

Total nitrogen input & efficiency

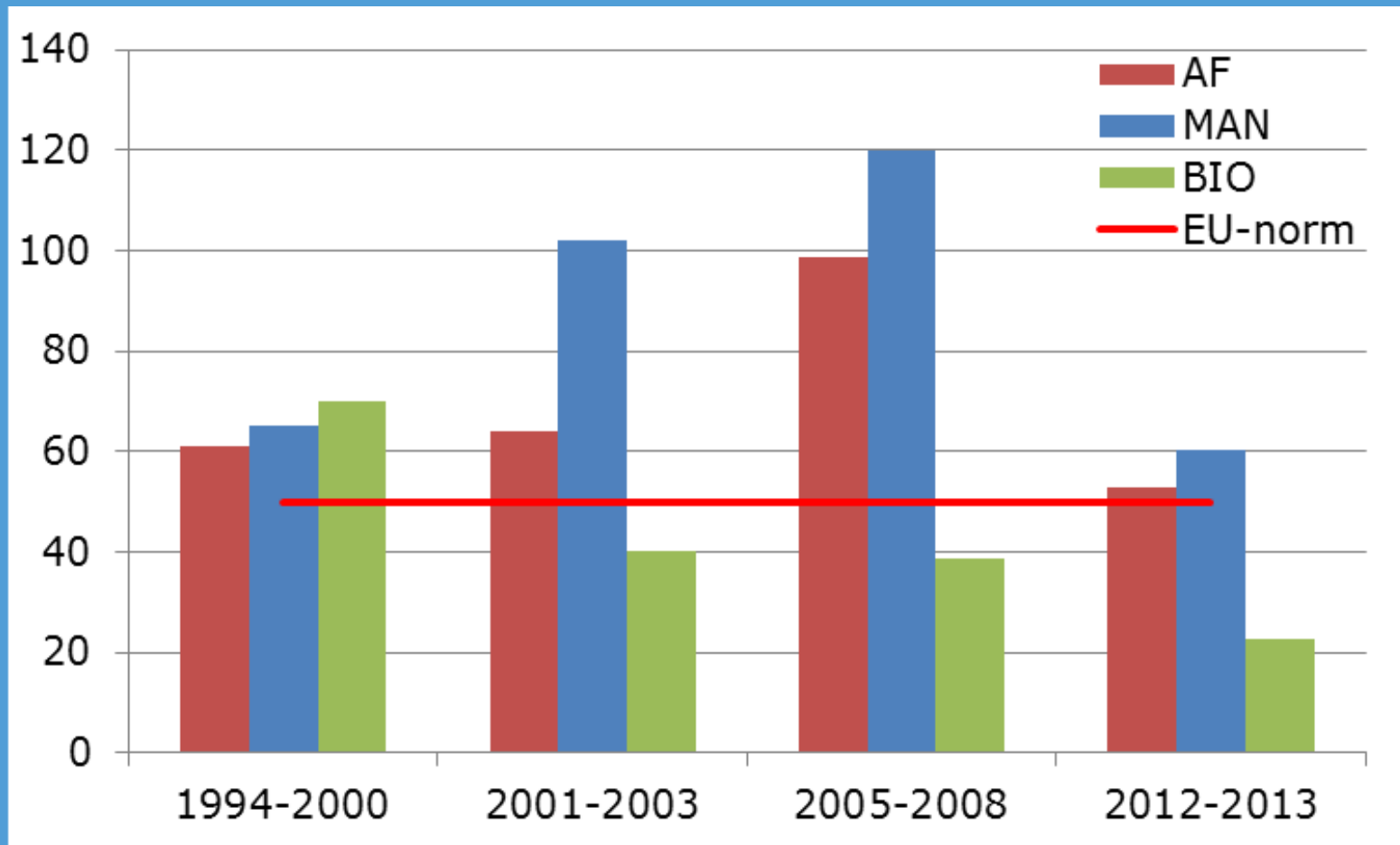


Available nitrogen input

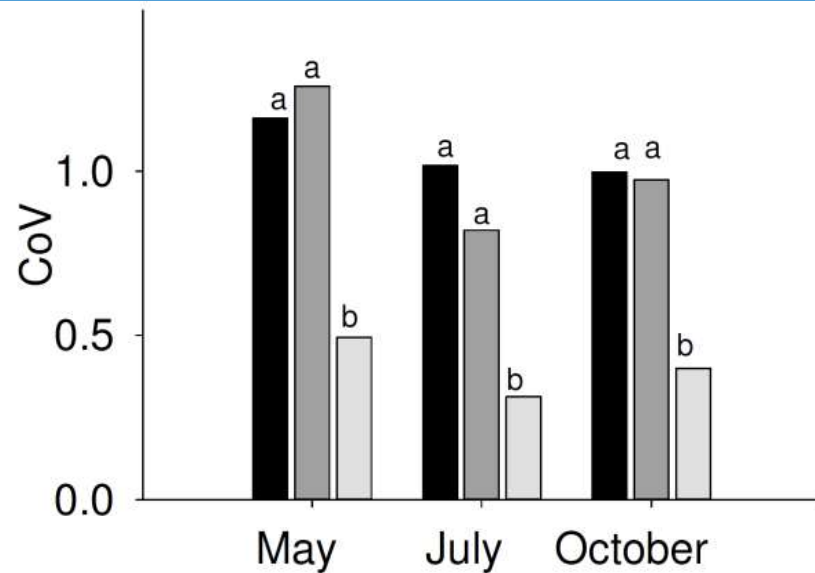
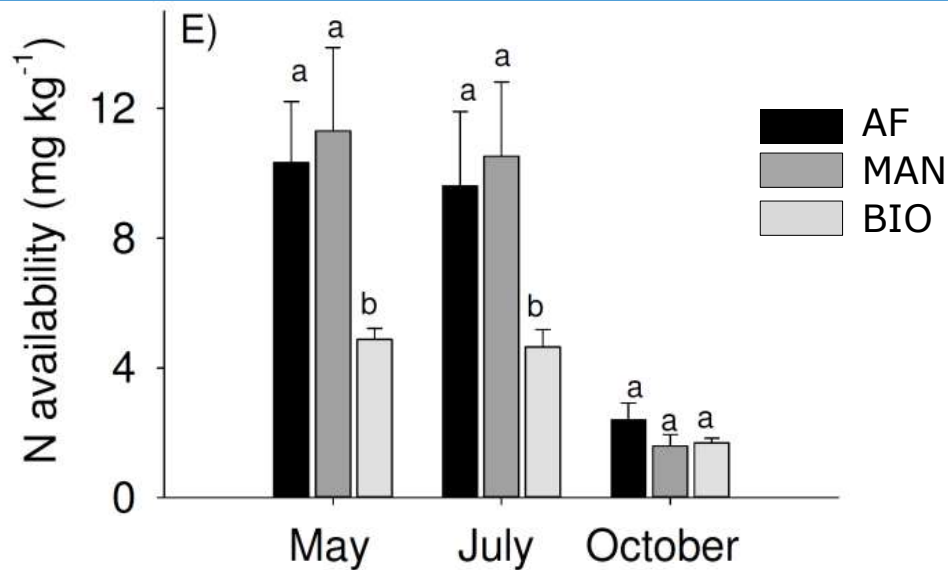


Nitrate concentrations in grondwater

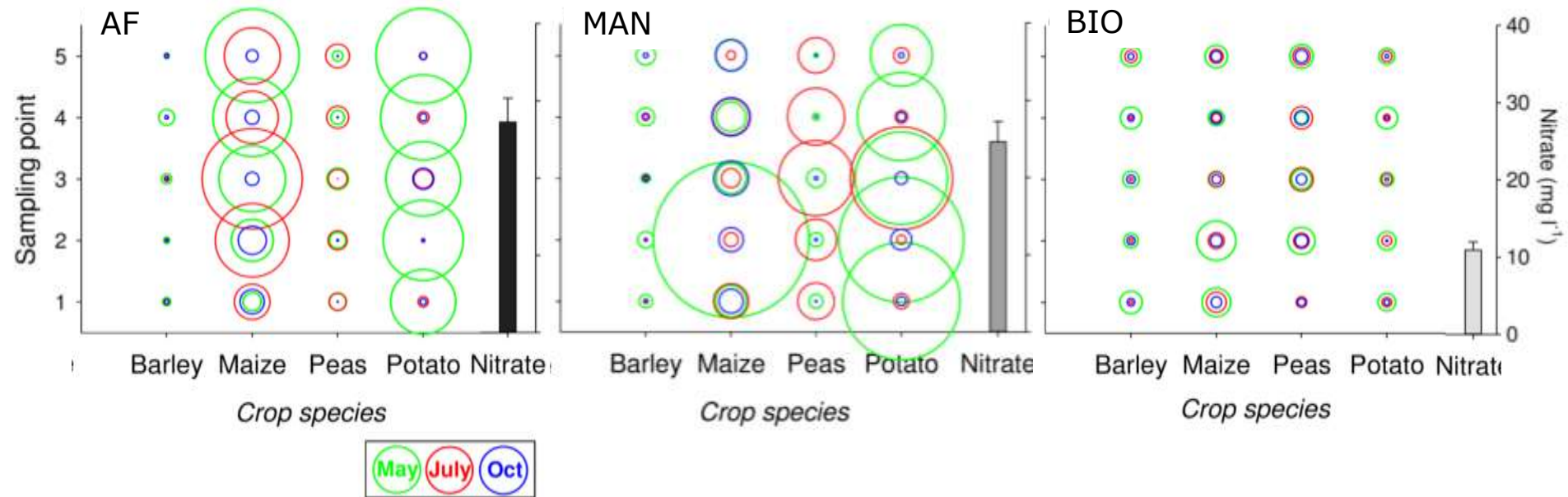
mg NO₃⁻/l



Spatial variation of mineral nitrogen



Spatial variation of mineral nitrogen



Conclusions AF/Low organic matter input

AF has compared to MAN:

- Decreasing yields (ns)
- Relative small decrease in nitrate leaching
- Similar fertilization level
- Higher costs and lower returns
- Decreasing soil quality?

→ *No feasible solution to reduce nitrate leaching*



Conclusions BIO/High organic matter input

BIO has compared to MAN:

- Increasing yield level
- Low nitrogen fertilization
- Low nitrate leaching
- Higher potential C- and N-mineralization
- Low spatial and temporal variability: higher stability

→ *What is the cause: organic matter input or no chemicals*

→ *From 2011 plots in MAN and AF with additional compost*

Thank you for your attention



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