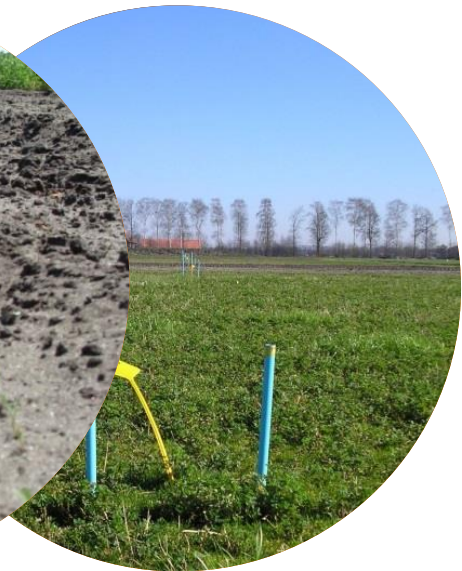


Integrated Soil Management on Sandy Soils for Sustainable Agriculture

Masterclass 11, Wageningen Soil Conference
Vredepeel, The Netherlands, 28 August 2019
Janjo de Haan



28 augustus
2019



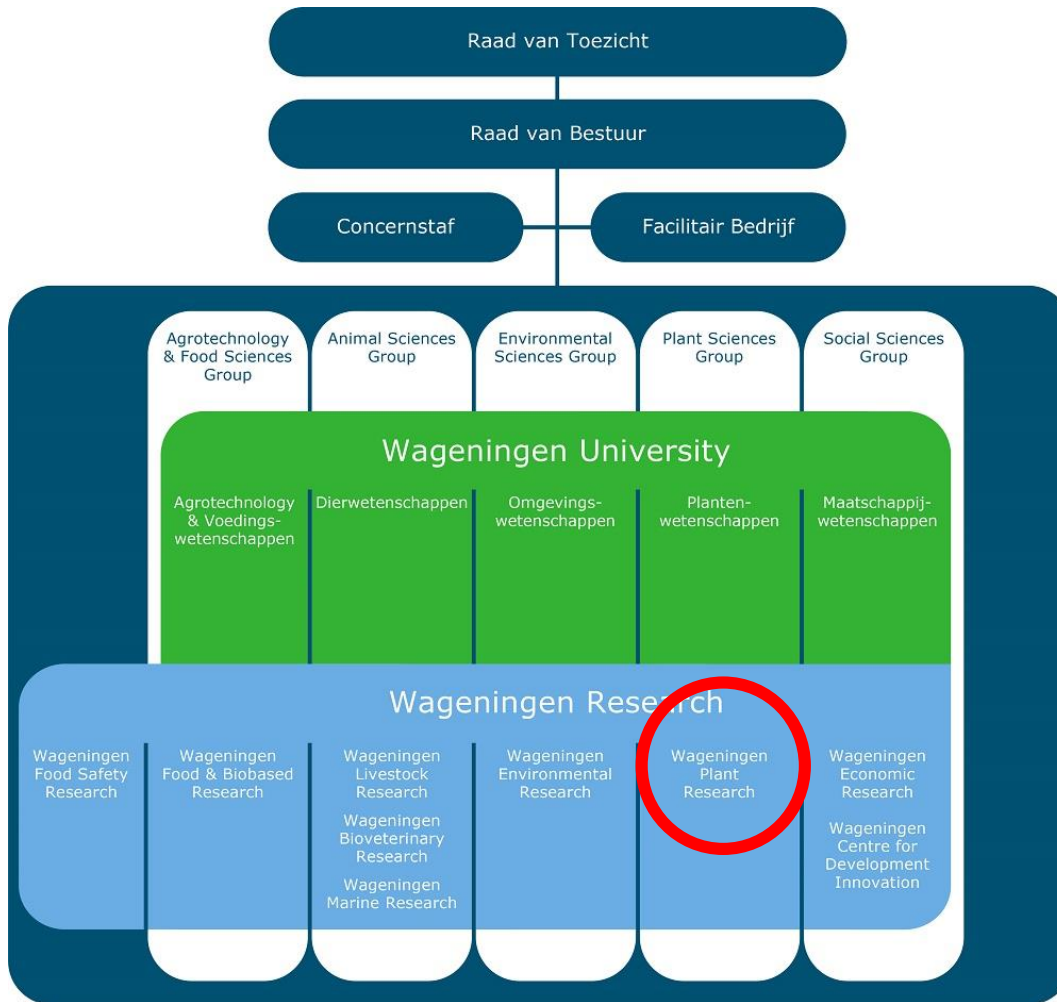
DE GROEN BEMESTER DAG

Kennis binnen handbereik



WAGENINGEN
UNIVERSITY & RESEARCH

WUR → WUR Field Crops and locations



Activities WUR Field Crops

Disciplinary
research

Field trials

Lab trials

Desk studies



Systems research

*Comparing
strategies*

*Development of
cropping and
farming systems*

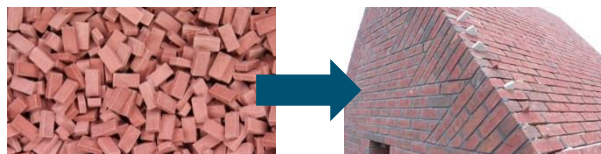


Tool
Development

DSS's

Handbooks

Schemes



Knowledge
circulation

*Farmers
networks*

Communication

Field days



An aerial photograph of the Wageningen University & Research Field Crops Experimental Farm Vredepeel. The image shows a vast agricultural landscape with various crop fields, including corn, soybeans, and wheat. A central cluster of farm buildings, including a large white barn and several smaller houses, is surrounded by trees. The sky is blue with scattered white clouds.

Welcome at

Wageningen University & Research Field Crops
Experimental Farm Vredepeel
Since 1959

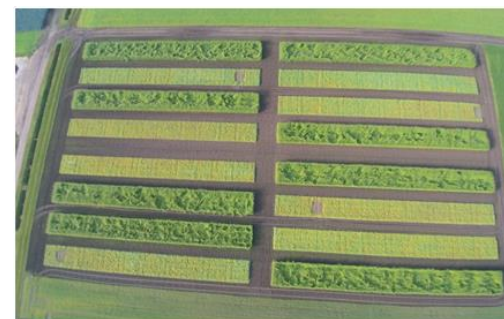
Soil Profile

- Coarse sandy soil
- Organic matter 4-5%
- Rooting depth 50-60 cm
- Susceptible for drought & wind erosion
- Groundwater level \pm 1m
- Water management: drainage and irrigation



Crops

<i>Total area</i>	<i>170 ha</i>
■ Potato	40 ha
■ Sugar beet	25 ha
■ Maize	40 ha
■ Triticale + Barley	25 ha
■ Pea and bean	12 ha
■ Carrots	6 ha
■ Black Salsify	7 ha
■ Leek	4 ha
■ Onions	2 ha
■ Grass	5 ha





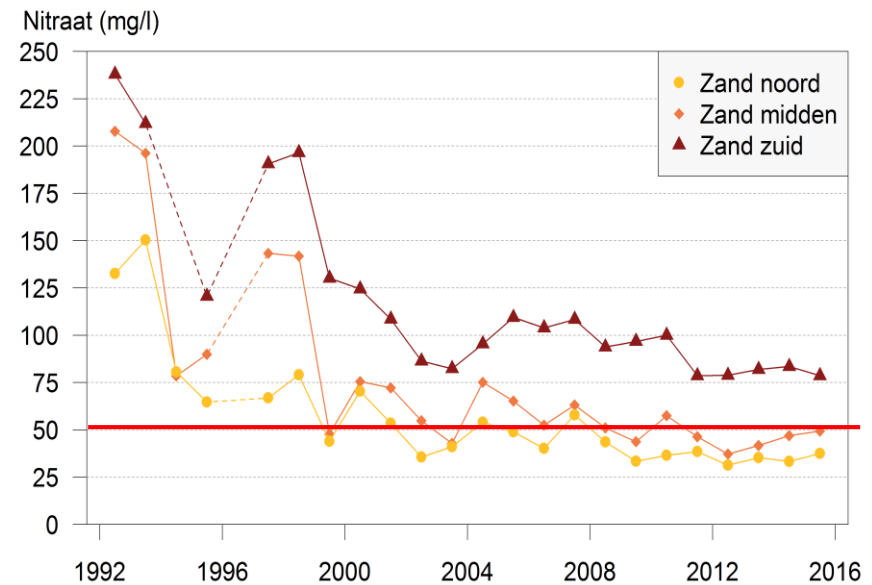
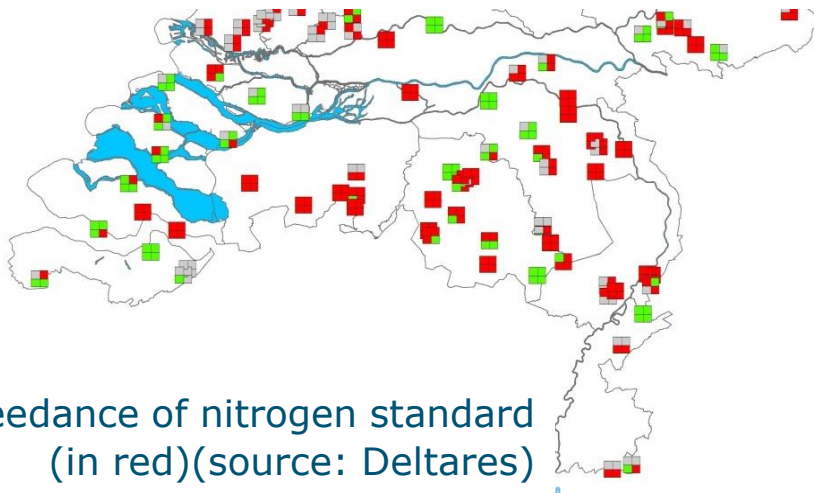
South East Netherlands: Intensive, productive but vulnerable



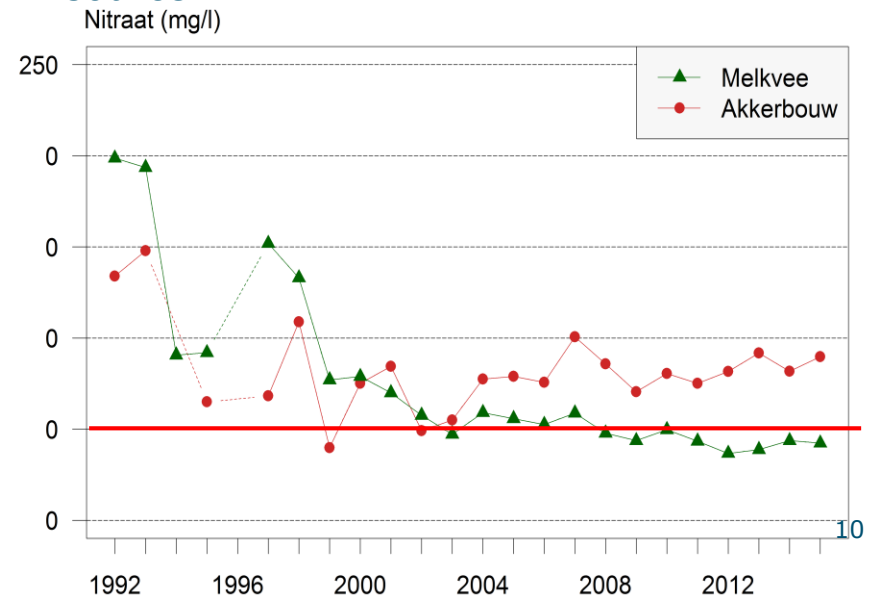
South East Netherlands

Poor water quality

- RIVM: Nitrate in groundwater above 50 mg/l, especially arable farming in SE-NL
- Deltares: 30-50% exceedance of nitrogen standards surface water in NL



Nitrate in upper ground water in three sand areas in NL (upper) and for dairy and arable farming on sandy soils (lower)
source: RIVM



Other sustainability problems

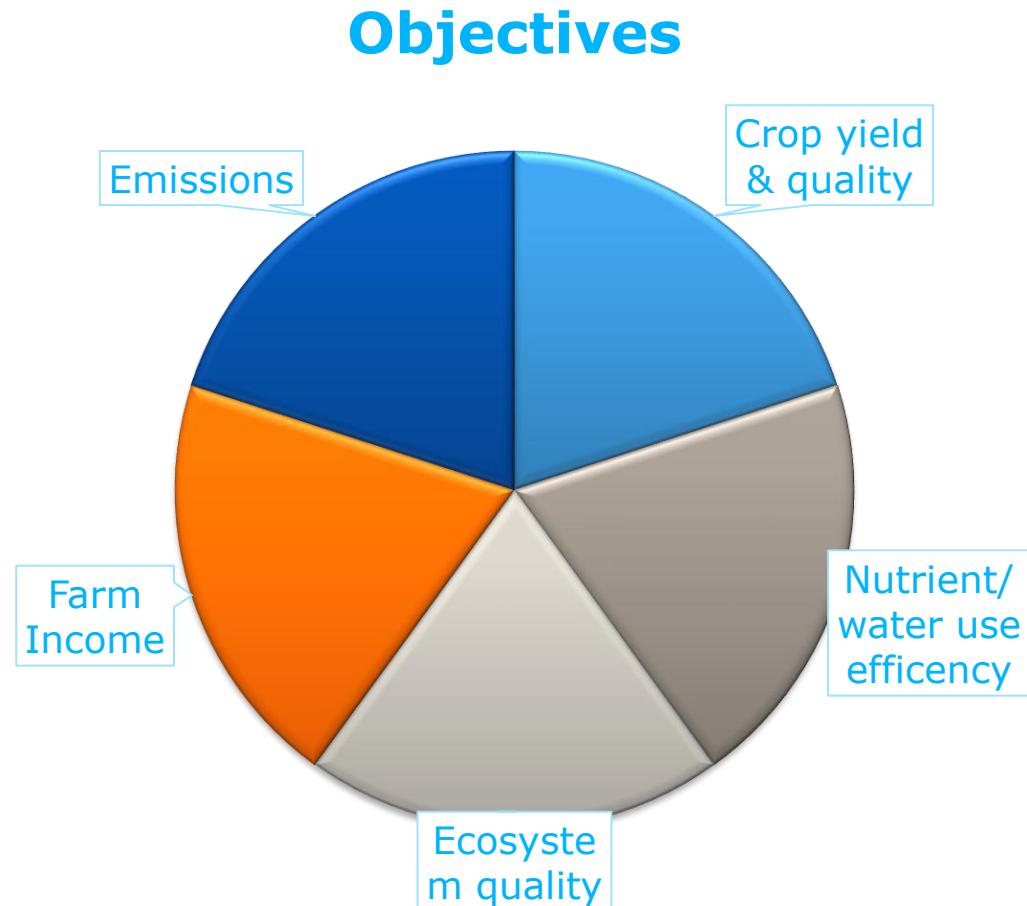
- Soil born pests and diseases
 - Various plant parasitic nematodes
 - *Sclerotinia*, *Rhizoctonia* etc.
- High use of crop protection agents
- Low biodiversity
- GHG emissions and carbon losses
- High costs for land and labour
- Low margins

How do we achieve cost-effective, sustainable cropping systems within environmental limits?



Farming systems research

- How can a farmer optimize his goals
 - Given context
 - Multi objective
 - Tool box of farming methods



Farming systems research methodology

Prototyping methodology

Analysis & Diagnosis

Design

- Objectives & parameters
- Farming methods
- Theoretical prototype

Testing & Improving

- In practice
- Monitoring and evaluation

Dissemination

Farming methods

- Coherent strategies
- Packages of techniques

Multi
Functional
Crop Rotation

Integrated/
Ecological
Nutrient
Management

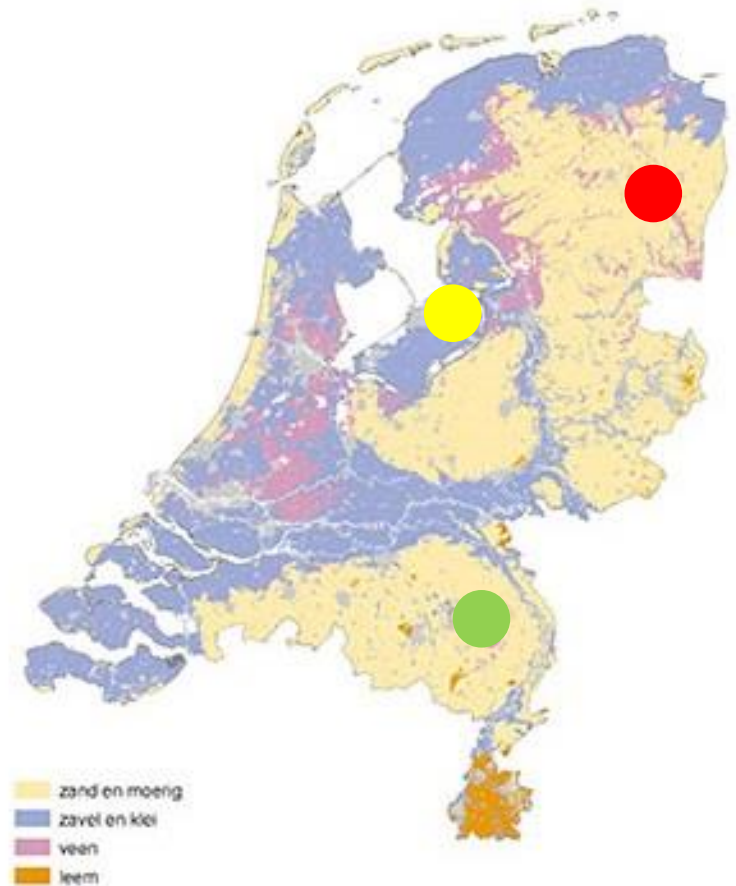
Integrated/
Ecological Crop
Protection

Minimum Soil
Cultivation

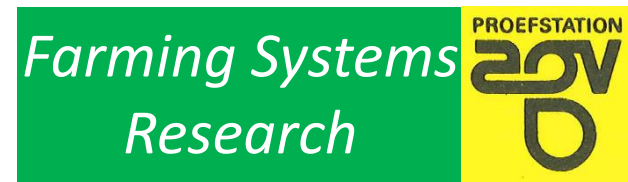
Farm Structure
Optimization

Testing soil management strategies in Long Term System Experiments (LTSE)

- Soil Quality on peaty soils:
Valthermond (SQP)
- BASIS:
Lelystad
- Soil Quality on sandy soils &
Soil Health Experiment:
Vredepeel (SQS)



Farming systems research Vredepeel from 1989



1989
2000 Development of integrated and organic farming systems



2001
2003 Farming with Future: How to comply with the nitrate directive in arable farming



2005
2008 Nutrients Waterproof: How to comply with the nitrate directive and WFD in arable farming and outdoor horticulture

Soil Quality on
sandy soils



2011
2020 Effects of soil management (input of organic matter, soil tillage) on ecosystem services (yield, nitrate leaching) in arable farming and vegetables

Soil Quality on Sandy soils: Farming systems in research (since 2001)

LOW

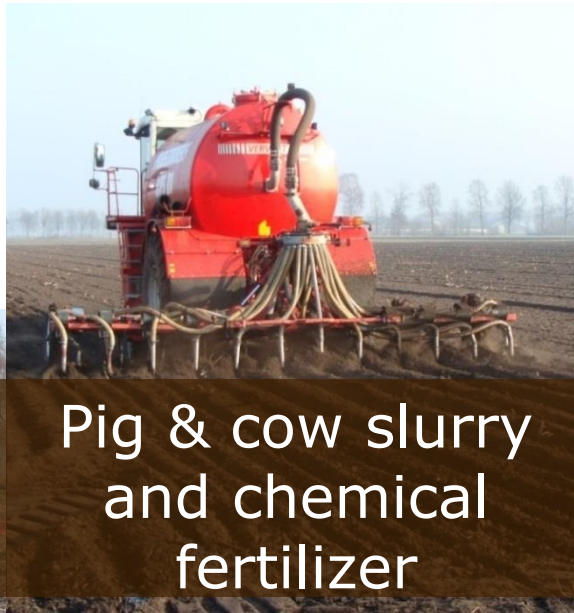
1000 kg EOM/ha/year



Mineral
concentrates &
chemical fertilizer

STANDARD

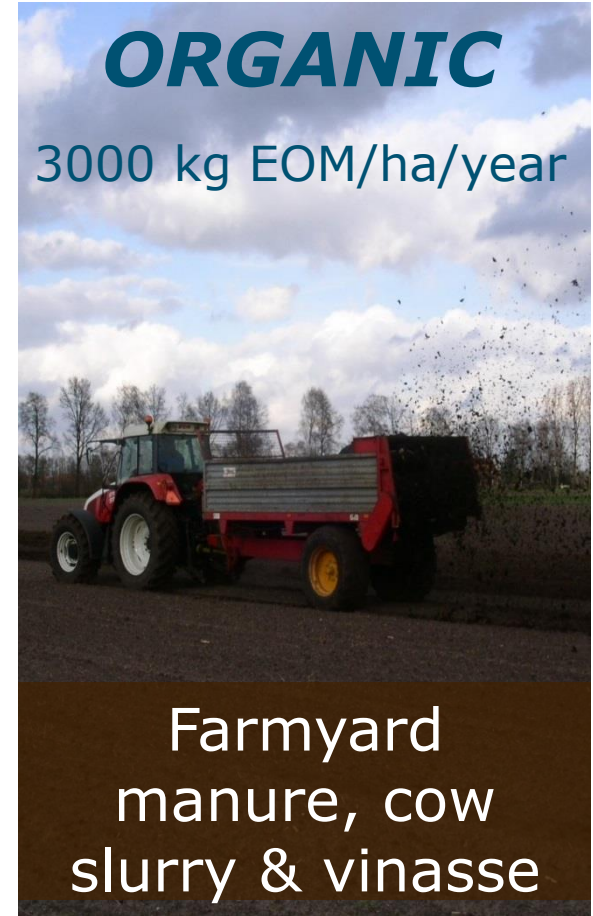
2000 kg EOM/ha/year



Pig & cow slurry
and chemical
fertilizer

ORGANIC

3000 kg EOM/ha/year



Farmyard
manure, cow
slurry & vinasse

Since 2011 Compost plots on two fields per system

Since 2011 Comparison reduced tillage - ploughing

Crop rotation

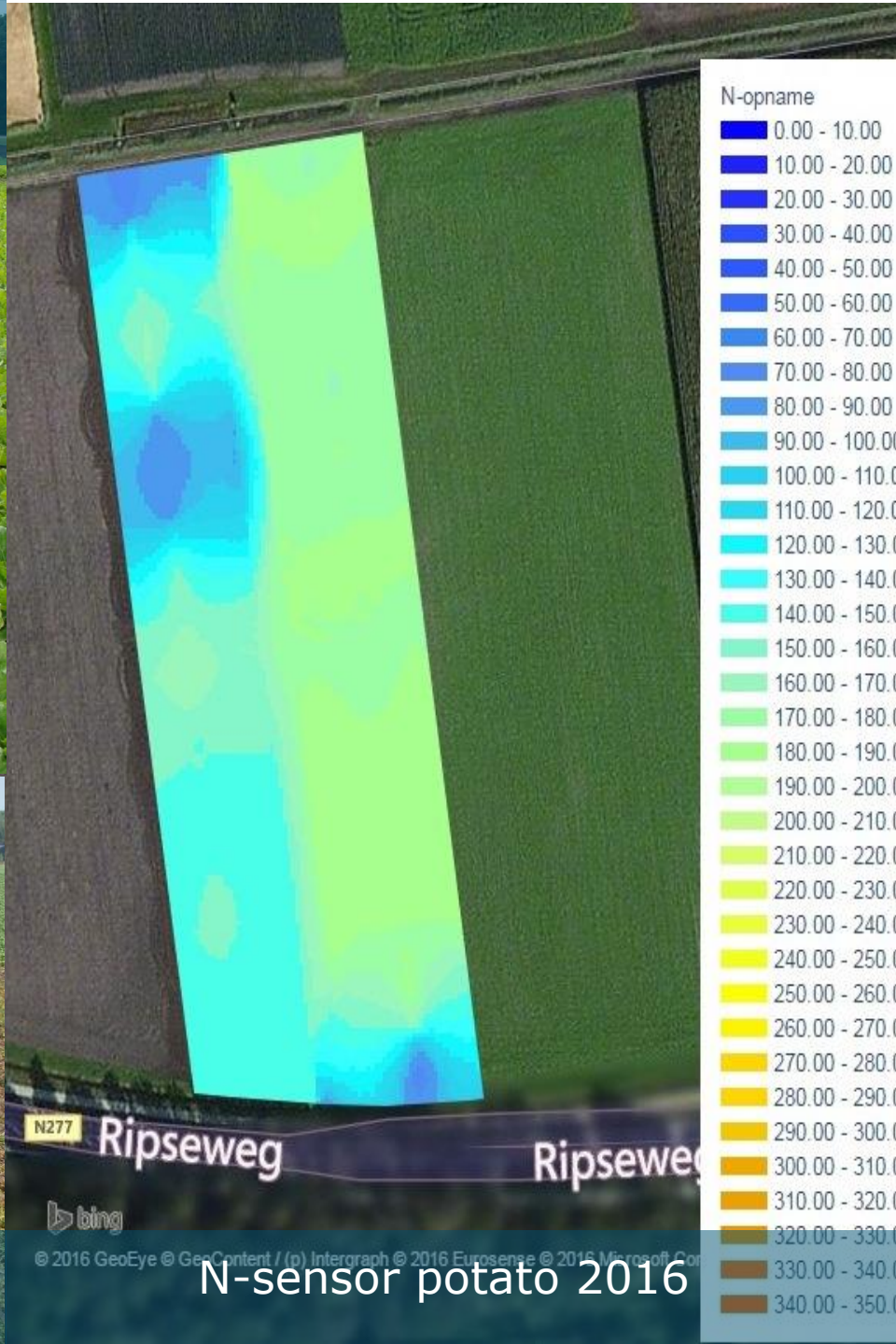
- Arable, vegetable and fodder crops
 - Grown in the region
- Relative extensive crop rotation
 - Alternation mow and root crops
- Green manure crops where possible
 - Japanese Oats and Barley
 - Grass-clover
 - Nitrogen fixation
 - Example for arable-dairy rotations



Sugarbeet 2008 STANDARD-LOW



Effect 140 ton compost in potato 2013



N277

Ripseweg

Ripseweg



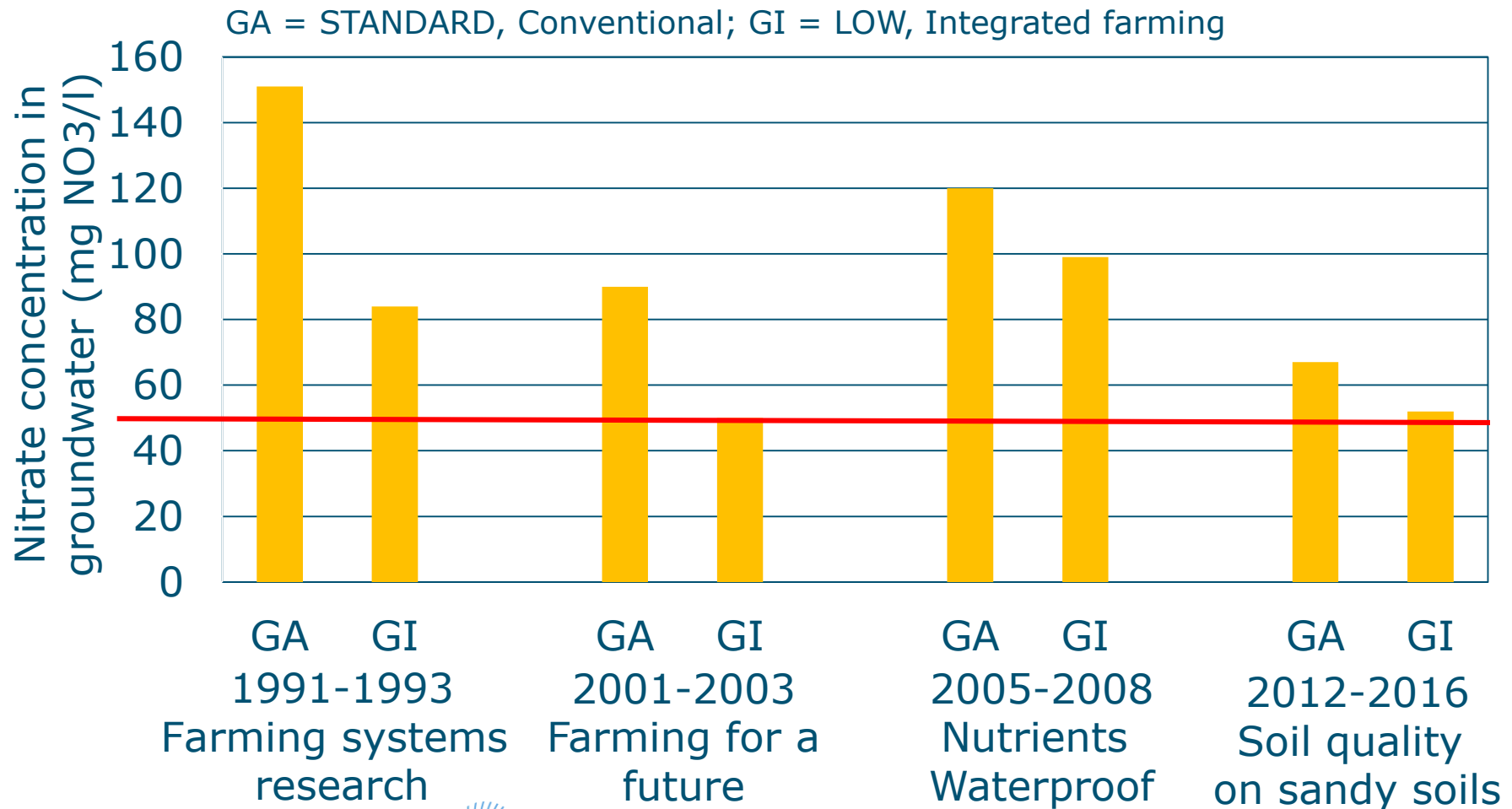
© 2016 GeoEye © GeoContent / (p) Intergraph © 2016 Eurosense © 2016 Microsoft Corp

N-sensor potato 2016

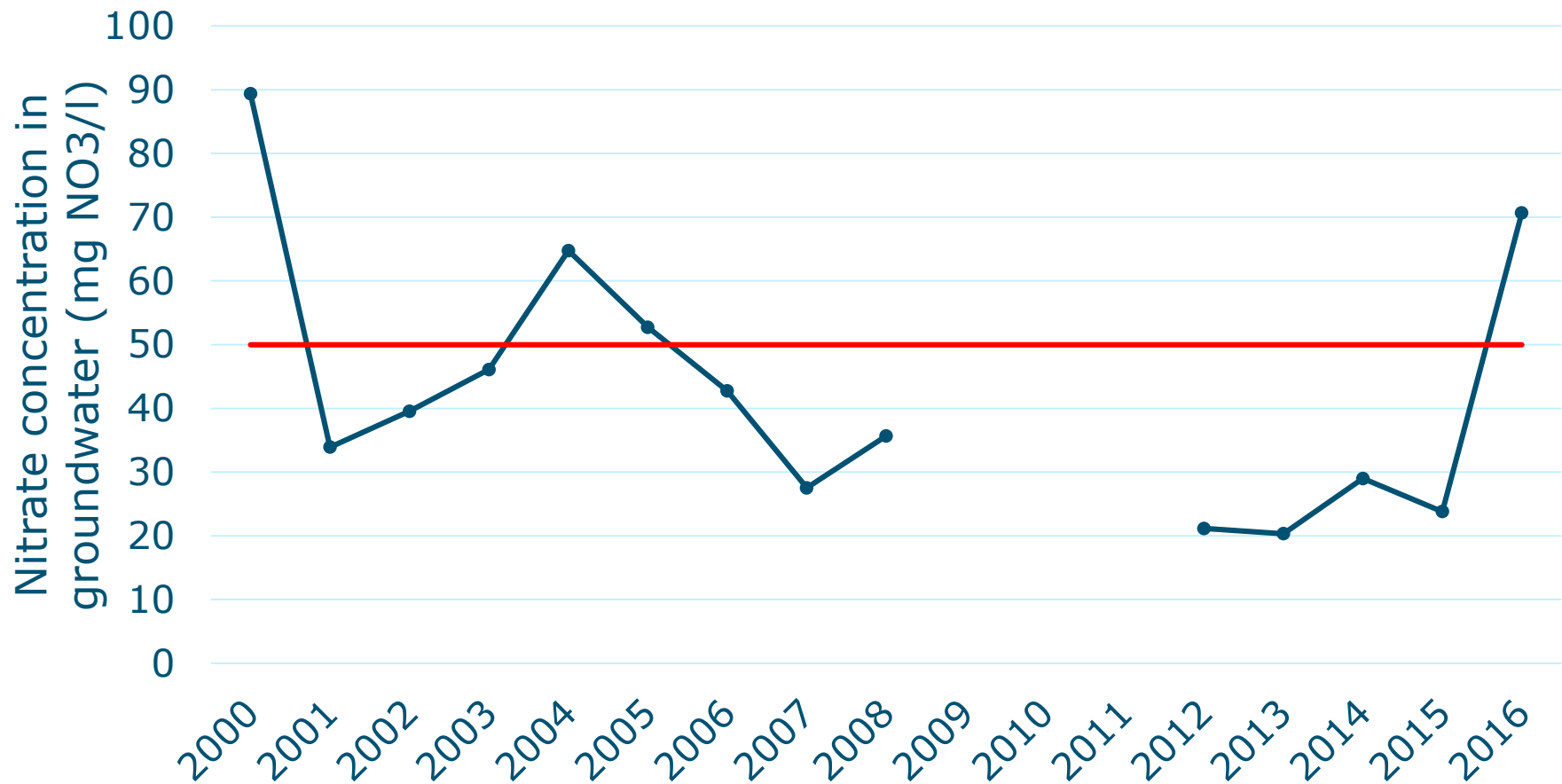
N-opname

0.00 - 10.00
10.00 - 20.00
20.00 - 30.00
30.00 - 40.00
40.00 - 50.00
50.00 - 60.00
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320.00 - 330.00
330.00 - 340.00
340.00 - 350.00

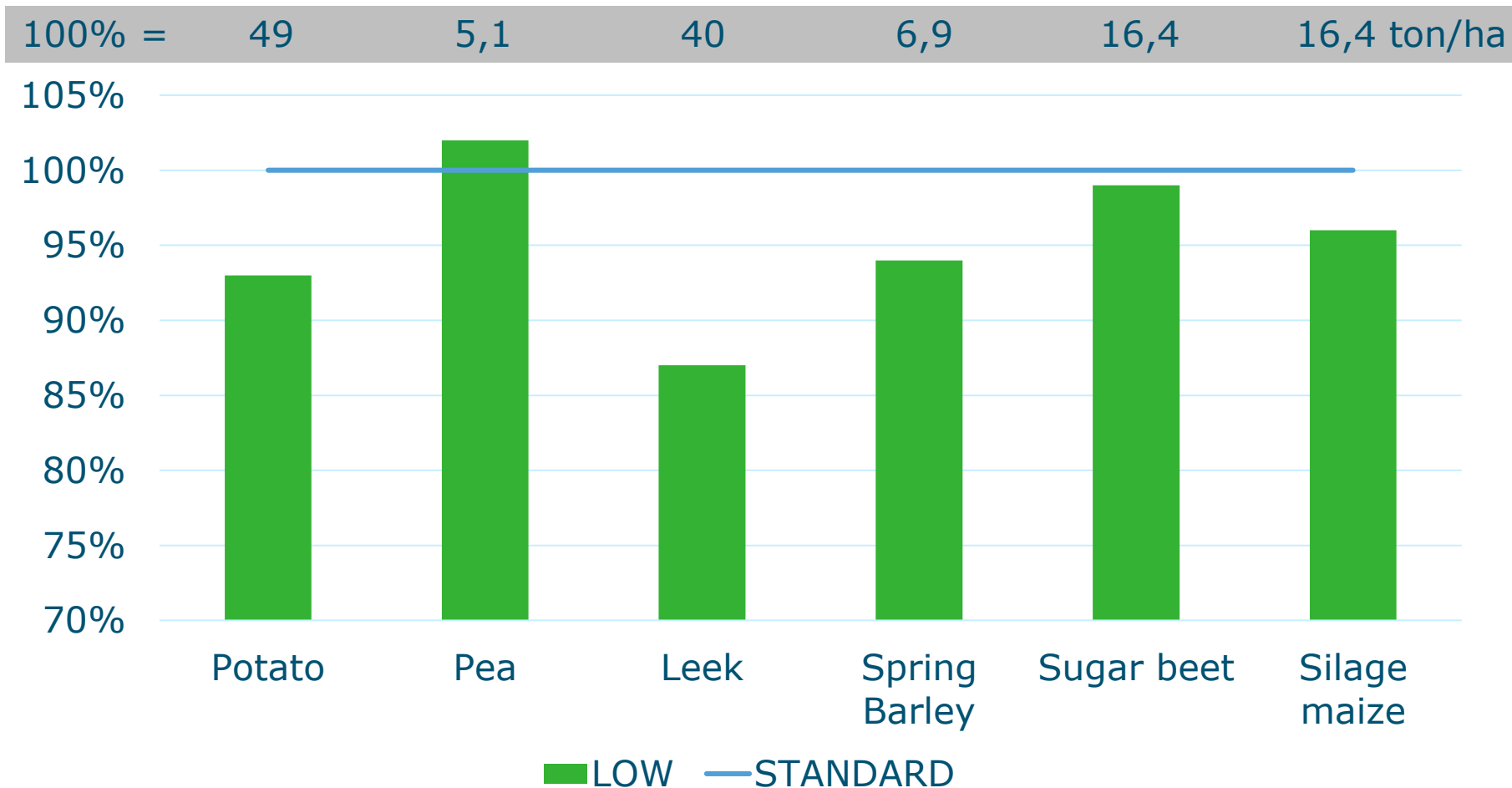
Nitrate concentrations in groundwater in various project periods (mg NO₃/l)



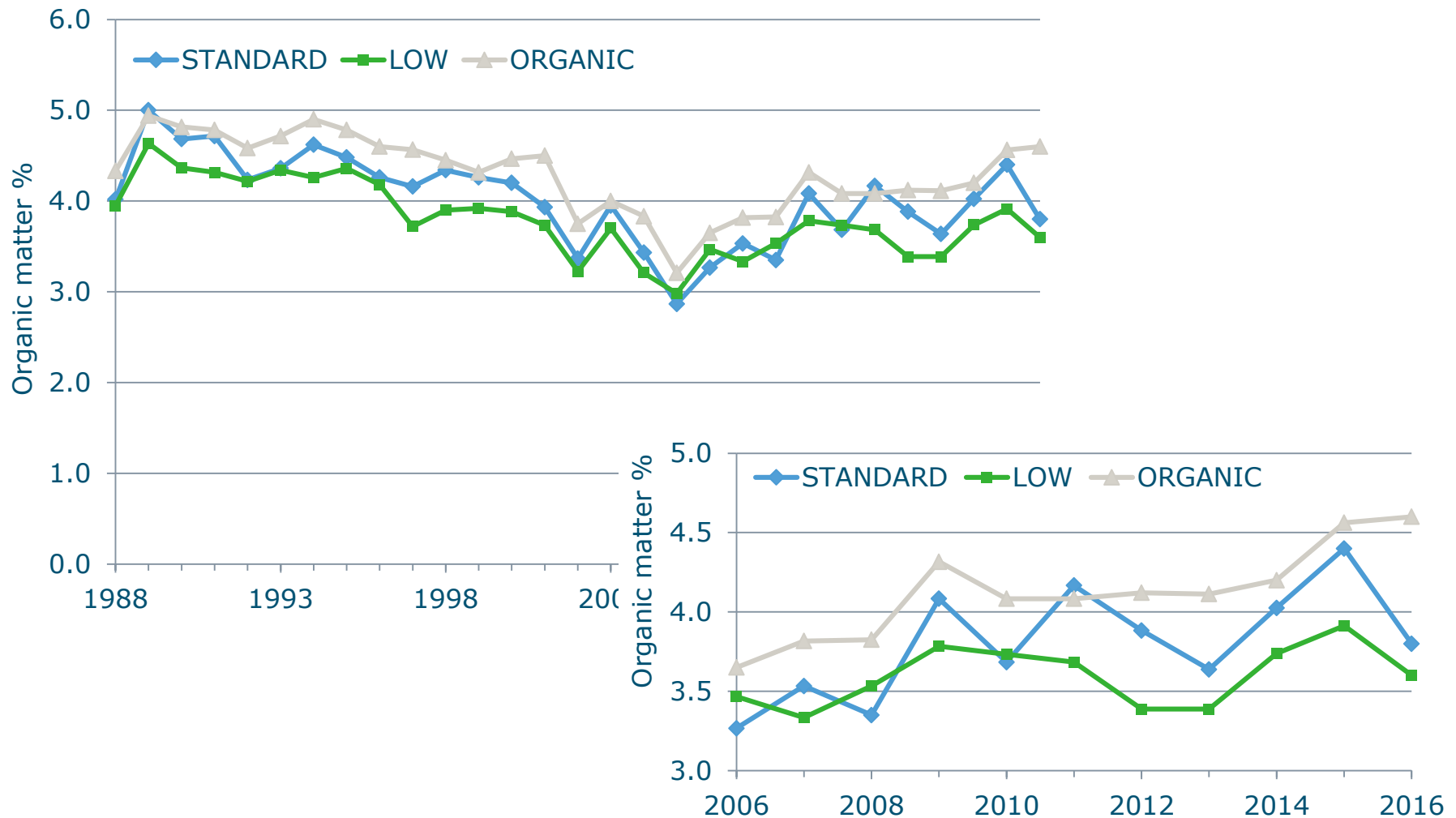
Nitrate concentrations in groundwater organic system (mg NO₃/l)



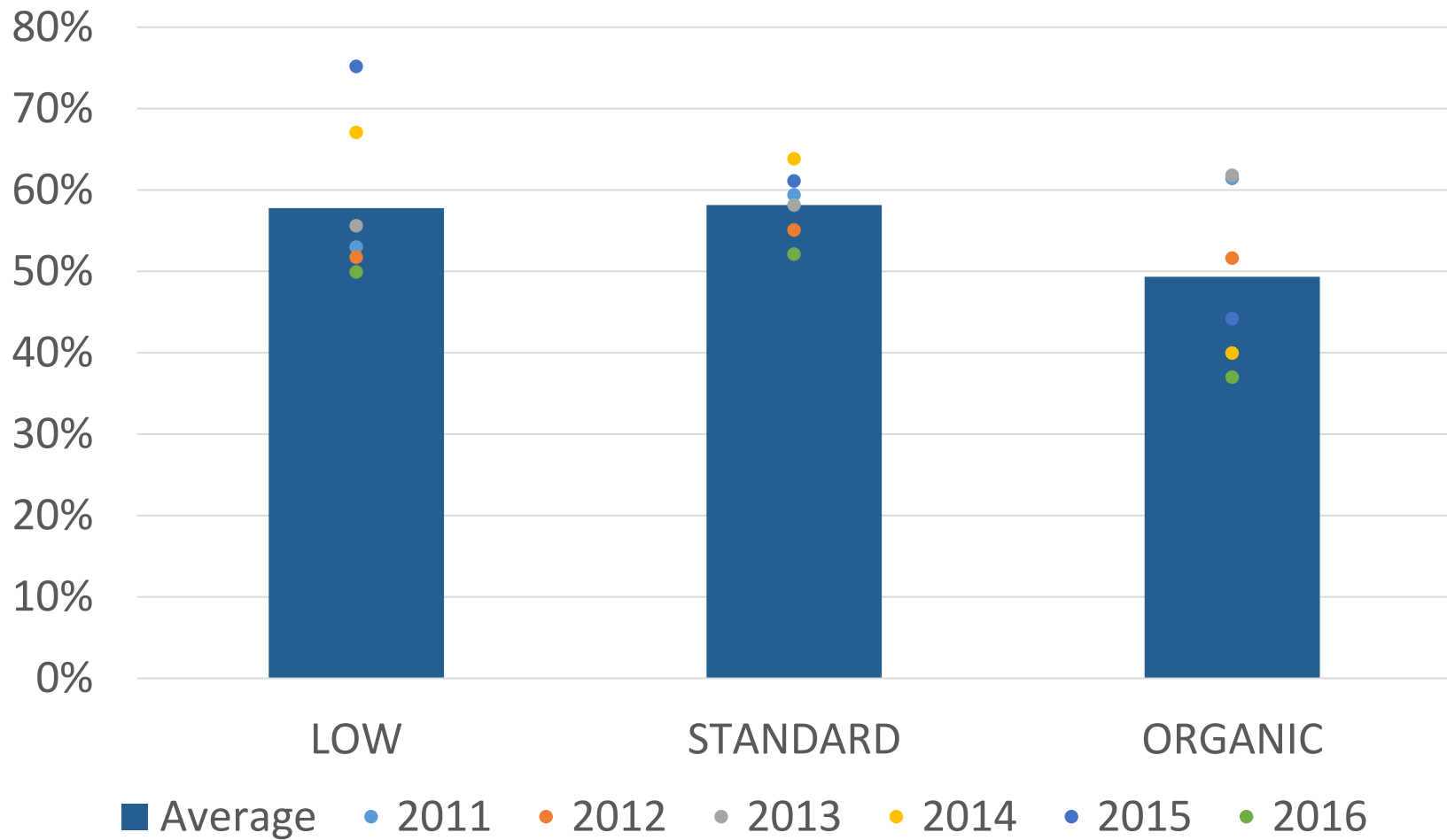
Relative yield LOW compared to STANDARD 2011-2016



Trends in soil organic matter 1998-2016



Nitrogen Use Efficiency



Value of organic matter (2011-2016)

- $Value\ EOM = \frac{\Delta\ Financial\ yield\ (STANDARD-LOW)}{\Delta\ EOM\ input\ (STANDARD-LOW)}$
- Average 0,54 €/kg EOM
 - Pea -0,05 €/kg EOM
 - Leek 2,24 €/kg EOM
- Value of organic matter in NL
 - Slurry negative
 - Compost 10 €/ton = ca 0,06 €/kg EOM
 - Green manure crop 1000 kg EOS/ha, 100 €/ha → ca. 0,10 €/kg EOS

*And now to
the field!*



WAGENINGEN
UNIVERSITY & RESEARCH



100years
1918 — 2018