SoilCare
SOILCARE FOR PROFITABLE AND SUSTAINABLE CROP PRODUCTION IN EUROPE

STUDY SITE 5: Western Denmark

Responsible partner: 13, Aarhus University, Department of Agroecology

The study site in general

(Tommy Dalgaard, Gitte H. Rubæk, Chris Kjeldsen et al.)

- *Center of activities:* Western Denmark where Aarhus University, our main Agricultural Research Centre in Foulum and the Department of Agroecology with related fields stations are centered. In particular, the Island of Samsø is used for demonstration and visualization of Soil Care impacts.
- We can draw on extensive long-term data from our field stations (see below), and nearby agricultural landscape study sites; e.g. from the dNmark.org Research Alliance (2012-2018), the NitroEurope EU project (2007-2011), and other research projects; e.g. Velux funded activities in relation to Samsø.
- The study represents the most agriculture and livestock intensive western parts of Denmark, including significant organic production.
- The area is dominated by loamy moraines (about 40-70 m above sea level), with agriculture and rotation cropping systems as the dominating land use.
- The climate is temporal coastal with significant surplus rainfall, especially outside the main growth season.
- *Cropping systems: About 75 %* winter cereals in rotation with winter rape at pig and cash crop farms, and in rotation with forage crops at dairy and cattle farms. About 10-20% permanent grasslands, mainly in river valleys.
- *Cropping intensity: C*onventional farming about 90% of the farm area, and organic farming about 10%.
- Intensive use of livestock manure, with precision fertlisation of slurry and fertilisers and precision farming.
- *Management of soil, water, nutrients and pests:* Strict norms on fertilizer application and documentation of nutrient efficient crop rotations.
- Irrigation widespread on the most sandy soils, and cropping systems with for e.g. potatoes or forage crops.
- Most soils are ploughed but reduced tillage are practiced. The studies include conservation agriculture, both conventional and organic.

- Examples: successful minimum tillage, and soil incorporation of straw and cover crops (maybe strip harvest). Row /alley cropping, new organic farming practices, including mobile green manure. More use of grasslands to prevent nutrient losses and erosion. Examples on Short Rotation Coppice energy crops.
- *Problems that cause yield loss or increased costs*
  - Loss in organic Matter
  - Soil Compaction
  - Stone separation
  - Erosion (especially a problem in cereals and maize)
  - Severe nutrient losses (N and P) to the environment (especially from livestock farms)
- The yield gaps are up to 40% for irrigated winter cereals and about 20% for non-irrigated.

www.dNmark.org

The National Soil Sampling grid (KVADRATNETTET)

(SEGES with input from AU scientists for soil analyses at the big campaigns)

- 7 km Grid of 50 by 50 m squares
- 830 squares, hereof 590 on agricultural land
- Four depths (0-25, 25-50, 50-75, 75-100 cm) are sampled (16 cores per square)
- Full sampling campaign in 1986 for full soil classification
- Large sampling campaigns in
  - 1997 (for C, P, Zn and Cu)
  - 2007 (for C).
  - Next large campaign is scheduled
- Smaller subset is sampled every year or Soil N prognosis
- Database with information on fertilisation, fertiliser source, crop yields, soil and crop management are hosted and maintained at SEGES.

The **SOILCARE** project is a 5 year project aimed at identifying and evaluating promising soil improving cropping systems and agronomic techniques increasing profitability and sustainability across scales in Europe.

The SOILCARE project consortium consist of 28 partner institutes from 18 European countries
The SOILCARE project is coordinated by ALTERRA, Wageningen UR, The Netherlands.

• Starting date: March 1st 2016. • Ending date: February 28th 2020. • EU contract number: 677407

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This project is funded by the European Commission under the H2020 program

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The Askov Long-Term Experiments on Animal Manure and Mineral Fertilisers

(Bent T. Christensen, Ingrid K. Thomsen and Gitte H. Rubæk)

- Initiated in 1894
- Nutrient source, mineral fertiliser (NPK) or animal manure (AM)
- Different rates of N, P and K applied, similar doses for each source
- Soil pH kept between 5.5 and 6.5
- Soil sampled and archieved since 1923 (every 4 yr)

Core treatments and year of establishment

0	(unmanured)	1893
½	AM	1894
1	AM	1894
1½	AM	1894
2	AM	1923
½	NPK	1923
1	NPK	1894
1½	NPK	1923
2	NPK	1923

Gross plots 110 m² (net plots 36 m²)

B2: Gross plots 69 m² (net plots 24 m²)

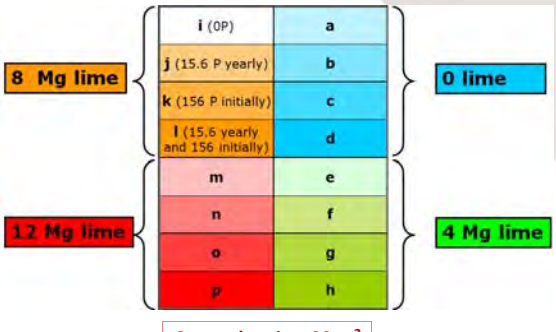
Nutrients in 1 AM and 1 NPK since 1973

Period	Crop	Kg ha^{-1} in 1 AM and 1 NPK		
		Total-N	P	K
1973-2005	Wheat	100	19	88
	Root crops	225	44	196
	Spring barley	75	14	65
	Grass-clover	0	0	0
Annual mean		100	19	87
2006-	Wheat	150	30	120
	Maize	150	30	120
	Spring barley	100	20	80
	Grass-clover	0	0	0
Annual mean		100	20	80

The St. Jyndevad Long-Term Experiments on liming and phosphate fertilisation

(Gitte Rubæk, Bent T. Christensen and Ingrid K. Thomsen)

- Initiated in 1942 on a coarse sandy acid soil
- Four P levels (0P, 15,6 kg P y^{-1}, initial dose of 156 kg P and 15,6 kg P y^{-1} + 156 kg initially)
- Four levels of lime applied with 5-8 years intervals
- Three replicates in each field,
- Two fields grown with spring barley
- One field fallow since 1994, one with threes in the 1970es



Gross plot size: 90 m²

Soil pH 1994, before liming

Depth, Cm	Treatment			
	a "0 lime, 0P"	d "0 lime, max P"	m "max lime, 0P"	p "max lime max P"
0-20	3.5^{a}	3.6^{a}	5.2^{b}	5.3^{b}
30-40	4.2^{a}	4.3^{a}	5.5^{b}	5.7^{b}
50-70	4.4^{a}	4.4^{a}	4.7^{b}	5.4^{c}
85-95	4.3^{ab}	4.3^{a}	4.6^{b}	5.2^{c}

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