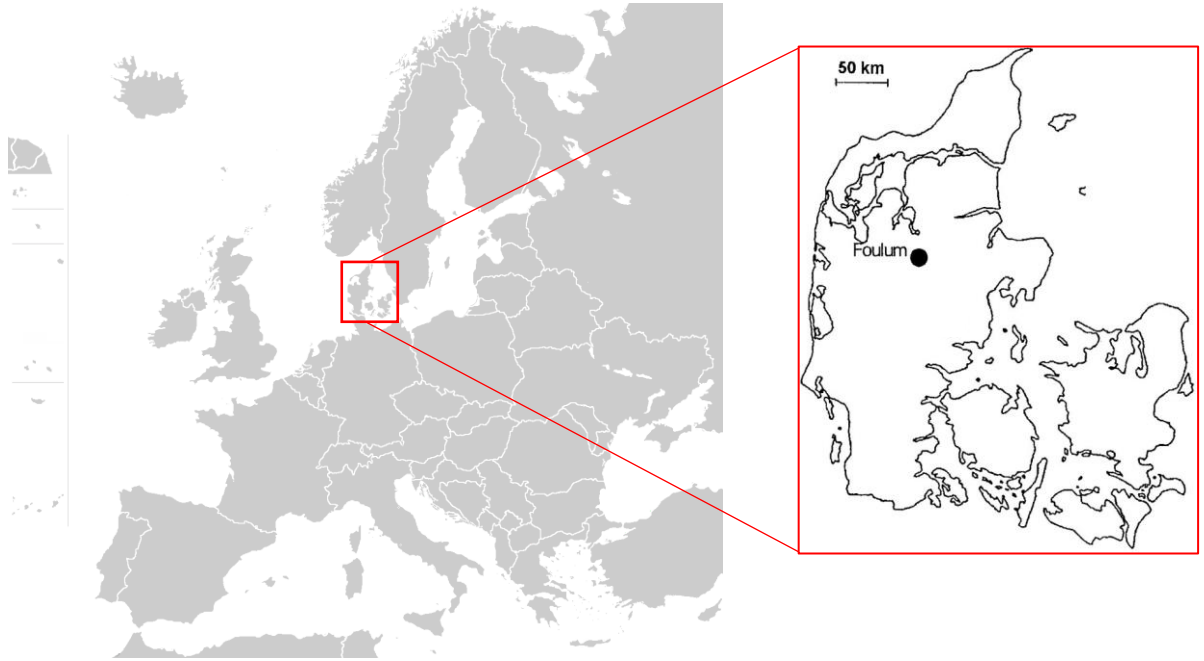
The CropSys long term experiment

Agroecology Research Infrastructure

AARHUS
UNIVERSITY
DEPARTMENT OF AGROECOLOGY

Context



Temperate oceanic climate
Average annual temperature: 8.3˚C
Average cumulative annual precipitation: 746 mm (1981-2010)

Crop rotation experiment started in 1997

→ Cereal production in organic farming (initially 4 locations); feed

→ Traditional crop rotations include grass/clover leys (ruminants)

→ Increasing production of pork and poultry = increasing demand for grain cereals and legumes

→ Is this going to decrease the stability of the crop rotation?

Aim of the experiment

"Investigating the possibilities for increasing the grain production in organic farming in the short and long term"

Fixed measurements: yield, nitrate leaching, weed pressure, nutrients

Extra measurements on the side (e.g., biological N_2 fixation, N_2O emissions, vegetation indices)

Crop sequences and treatments

	Organic – ley (O2)	Organic – grain legume (O4)	Conventional (C4)
4th cycle 2010-14	S.barley:ley Lucerne Lucerne S.wheat^{CC} Potato^{CC}	S.barley^{CC} Hemp Pea/s.barley^{CC} S.wheat^{CC} Potato^{CC}	S.barley^{CC} Hemp Pea/s.barley^{CC} S.wheat^{CC} Potato^{CC}
5th cycle 2015-18	S.barley:ley Grass-clover S.wheat^{CC} Oat^{CC}	S. barley^{CC} Faba bean^{CC} S.wheat^{CC} Oat^{CC}	S.barley^{CC} Faba bean^{CC} S.wheat^{CC} Oat^{CC}
6th cycle 2019-22	S.barley:ley Grass-clover S.wheat W.rye^{CC}	S.barley^{CC} Lupin/s.barley^{CC} S.wheat W.rye^{CC}	S.barley^{CC} Lupin/s.barley^{CC} S.wheat W.rye^{CC}

8 Treatments:

O2	+M	-M
+CC	✓	✓
-CC	✓	

O4	+M	-M
+CC	✓	✓
-CC	✓	

C4	+F	-F
+CC	✓	
-CC	✓	

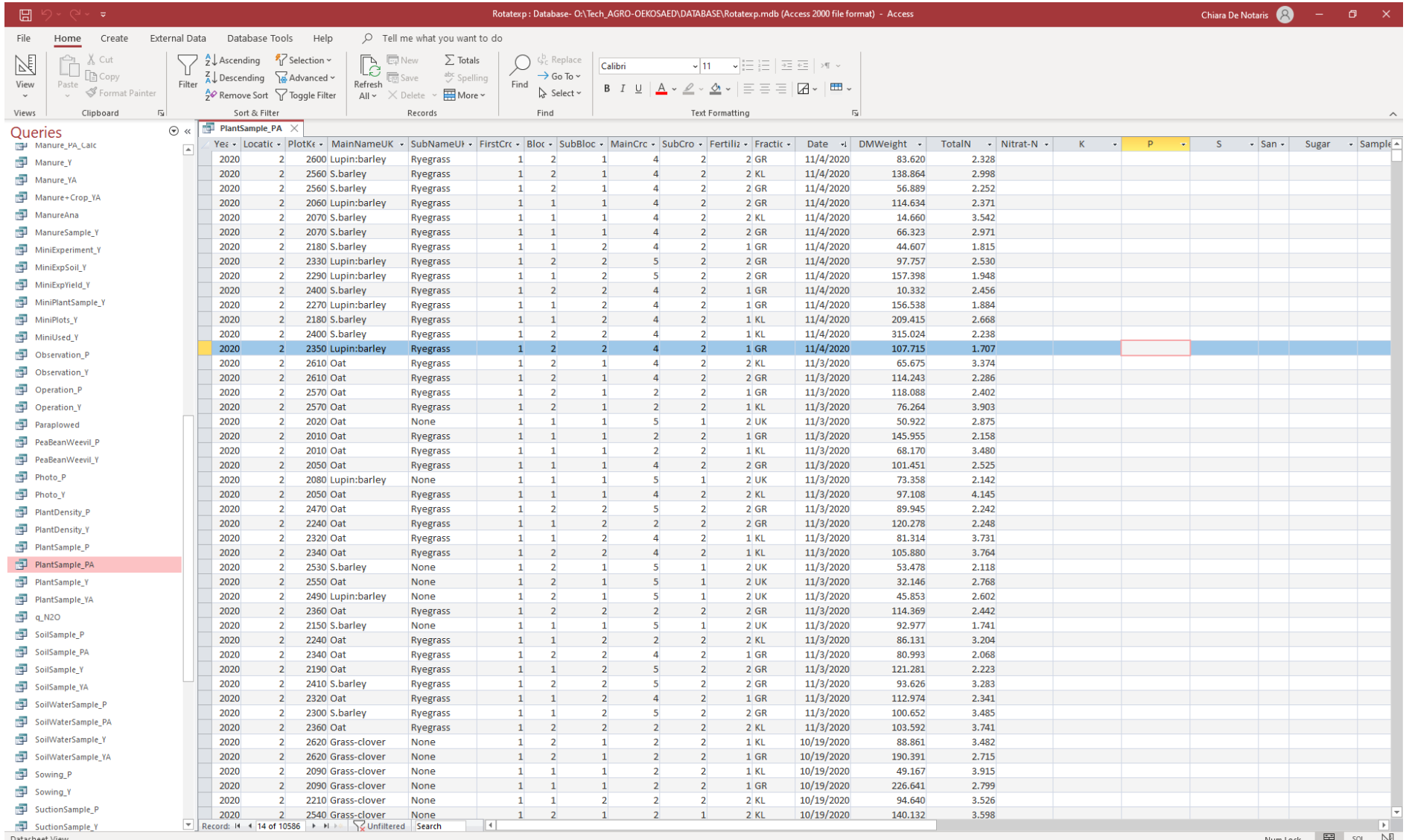
M=animal manure; F=mineral fertilizer.

Cover crops:

O2/O4: mix of legumes and non-legumes

C4: non-legumes

Database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Tell me what you want to do
Queries
PlantSample_PA
Manure_PA_Calc
Manure_Y
Manure_YA
Manure+Crop_YA
ManureAna
ManureSample_Y
MiniExperiment_Y
MiniExpSoil_Y
MiniExpYield_Y
MiniPlantSample_Y
MiniPlots_Y
MiniUsed_Y
Observation_P
Observation_Y
Operation_P
Operation_Y
Paraplowed
PeaBeanWeevil_P
PeaBeanWeevil_Y
Photo_P
Photo_Y
PlantDensity_P
PlantDensity_Y
PlantSample_P
PlantSample_PA
PlantSample_Y
PlantSample_YA
q_N2O
SoilSample_P
SoilSample_PA
SoilSample_Y
SoilSample_YA
SoilWaterSample_P
SoilWaterSample_PA
SoilWaterSample_Y
SoilWaterSample_YA
Sowing_P
Sowing_Y
SuctionSample_P
SuctionSample_Y
Yea Locatic PlotKe MainNameUK SubNameUk FirstCrc Bloc SubBloc MainCrc SubCro Fertiliz Fractic Date DMWeight TotalN Nitrat-N K P S San Sugar Sample
2020 2 2600 Lupin:barley Ryegrass 1 2 1 4 2 2 GR 11/4/2020 83.620 2.328
2020 2 2560 S.barley Ryegrass 1 2 1 4 2 2 KL 11/4/2020 138.864 2.998
2020 2 2560 S.barley Ryegrass 1 2 1 4 2 2 GR 11/4/2020 56.889 2.252
2020 2 2060 Lupin:barley Ryegrass 1 1 1 4 2 2 GR 11/4/2020 114.634 2.371
2020 2 2070 S.barley Ryegrass 1 1 1 4 2 2 KL 11/4/2020 14.660 3.542
2020 2 2070 S.barley Ryegrass 1 1 1 4 2 2 GR 11/4/2020 66.323 2.971
2020 2 2180 S.barley Ryegrass 1 1 2 4 2 1 GR 11/4/2020 44.607 1.815
2020 2 2330 Lupin:barley Ryegrass 1 2 2 5 2 2 GR 11/4/2020 97.757 2.530
2020 2 2290 Lupin:barley Ryegrass 1 1 2 5 2 2 GR 11/4/2020 157.398 1.948
2020 2 2400 S.barley Ryegrass 1 2 2 4 2 1 GR 11/4/2020 10.332 2.456
2020 2 2270 Lupin:barley Ryegrass 1 1 2 4 2 1 GR 11/4/2020 156.538 1.884
2020 2 2180 S.barley Ryegrass 1 1 2 4 2 1 KL 11/4/2020 209.415 2.668
2020 2 2400 S.barley Ryegrass 1 2 2 4 2 1 KL 11/4/2020 315.024 2.238
2020 2 2350 Lupin:barley Ryegrass 1 2 2 4 2 1 GR 11/4/2020 107.715 1.707
2020 2 2610 Oat Ryegrass 1 2 1 4 2 2 KL 11/3/2020 65.675 3.374
2020 2 2610 Oat Ryegrass 1 2 1 4 2 2 GR 11/3/2020 114.243 2.286
2020 2 2570 Oat Ryegrass 1 2 1 2 2 1 GR 11/3/2020 118.088 2.402
2020 2 2570 Oat Ryegrass 1 2 1 2 2 1 KL 11/3/2020 76.264 3.903
2020 2 2020 Oat None 1 1 1 5 1 2 UK 11/3/2020 50.922 2.875
2020 2 2010 Oat Ryegrass 1 1 1 2 2 1 GR 11/3/2020 145.955 2.158
2020 2 2010 Oat Ryegrass 1 1 1 2 2 1 KL 11/3/2020 68.170 3.480
2020 2 2050 Oat Ryegrass 1 1 1 4 2 2 GR 11/3/2020 101.451 2.525
2020 2 2080 Lupin:barley None 1 1 1 5 1 2 UK 11/3/2020 73.358 2.142
2020 2 2050 Oat Ryegrass 1 1 1 4 2 2 KL 11/3/2020 97.108 4.145
2020 2 2470 Oat Ryegrass 1 2 2 5 2 2 GR 11/3/2020 89.945 2.242
2020 2 2240 Oat Ryegrass 1 1 2 2 2 2 GR 11/3/2020 120.278 2.248
2020 2 2320 Oat Ryegrass 1 1 2 4 2 1 KL 11/3/2020 81.314 3.731
2020 2 2340 Oat Ryegrass 1 2 2 4 2 1 KL 11/3/2020 105.880 3.764
2020 2 2530 S.barley None 1 2 1 5 1 2 UK 11/3/2020 53.478 2.118
2020 2 2550 Oat None 1 2 1 5 1 2 UK 11/3/2020 32.146 2.768
2020 2 2490 Lupin:barley None 1 2 1 5 1 2 UK 11/3/2020 45.853 2.602
2020 2 2360 Oat Ryegrass 1 2 2 2 2 2 GR 11/3/2020 114.369 2.442
2020 2 2150 S.barley None 1 1 1 5 1 2 UK 11/3/2020 92.977 1.741
2020 2 2240 Oat Ryegrass 1 1 2 2 2 2 KL 11/3/2020 86.131 3.204
2020 2 2340 Oat Ryegrass 1 2 2 4 2 1 GR 11/3/2020 80.993 2.068
2020 2 2190 Oat Ryegrass 1 1 2 5 2 2 GR 11/3/2020 121.281 2.223
2020 2 2410 S.barley Ryegrass 1 2 2 5 2 2 GR 11/3/2020 93.626 3.283
2020 2 2320 Oat Ryegrass 1 1 2 4 2 1 GR 11/3/2020 112.974 2.341
2020 2 2300 S.barley Ryegrass 1 1 2 5 2 2 GR 11/3/2020 100.652 3.485
2020 2 2360 Oat Ryegrass 1 2 2 2 2 2 KL 11/3/2020 103.592 3.741
2020 2 2620 Grass-clover None 1 2 1 2 2 1 KL 10/19/2020 88.861 3.482
2020 2 2620 Grass-clover None 1 2 1 2 2 1 GR 10/19/2020 190.391 2.715
2020 2 2090 Grass-clover None 1 1 1 2 2 1 KL 10/19/2020 49.167 3.915
2020 2 2090 Grass-clover None 1 1 1 2 2 1 GR 10/19/2020 226.641 2.799
2020 2 2210 Grass-clover None 1 1 2 2 2 2 KL 10/19/2020 94.640 3.526
2020 2 2540 Grass-clover None 1 2 1 2 1 2 KL 10/19/2020 140.132 3.598
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High sense of ownership and many possibilities

- Field technicians
- Students

How do we keep it running?

Continuous effort to attract funding → use it as a platform within different projects.

RowCrop

The main challenges for achieving higher and more stable yields in stockless organic farming relate to providing sufficient N supply and controlling competitive weeds. RowCrop will develop, evaluate and demonstrate a new row cropping that takes advantage of the latest developments in vision and GPS guided row cultivation systems by effectively integrating traditional arable crops with row cultivated legume-based catch crops and targeted weed control.

RowCrop will develop the scientific foundation for improved control of aggressive annual and perennial weeds in a row cropping system and for cultivating more productive N fixing catch crops to enhance crop N supply. It will document the effects of the row cropping system on productivity, weed infestation, N cycling, N
leaching and soil carbon in a long-term crop rotation experiment representing different organic crop rotation systems and different fertility and weed infestation levels. It will further demonstrate and disseminate results to advisors and farmers using field trials, open field days, workshops etc. The expected annual effects are: Economy: Yield increase of organic cereals of 1.2 ton/ha (100 million DKK).

Environment:
Reduced nitrate leaching of 10 kg N/ha (500 ton N). Climate:
Enhanced soil carbon storage of 200 kg C/ha (37,000 ton CO_2). In addition the results are expected to pave the way for phasing out import of conventional manure in organic farming and for an enhanced conversion from conventional to organic farming.

Project leader

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Photos from the project

CCRotate

Context of the project:

Long term organic field trials with cover crops show that problems with diseases after repetitive use of the same cover crop species can occur. Thus, there is a need to explore the possibilities to design new cover crop rotation systems to secure the growth of the cover crops without affecting the health of the main crop. There is also a need to examine whether optimal design of such systems can inhibit weed to an extent that reduces the need for tillage in the fall. Furthermore, the fertilization effect of cover crops for the following crop is poorly estimated which means that e.g. the nitrogen derived from cover crops is not utilized to its full extent.

Purpose

In a long-term crop rotation experiment and new field trials, the CCRotate project investigates the effect of cover crop mixtures on productivity, weed pressure and climate footprint. CCRotate is developing a camera-artificial intelligence based system for determining the cover crop biomass, in order to determine the fertilizer effect of the cover crops and include this in the fertilizer planning for the subsequent main crop. The results of the project are incorporated into the advisory tools for organic farmers, so that both optimization of cover crop mixtures, effects on weeds and soil fertility become available to the farmer. Together with the new camera tool for determining the fertilizer effect, it is expected that CCRotate will optimize the use of cover crops in organic farming systems.

CCRotate step-by-step

- Mapping of farmers' current use of cover crops
- Trials with cover crops mixtures

Project manager

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Next year we celebrate 25 years anniversary

Two/three days event

→What have we learnt?

→ Shift towards production of food? Balance between different products

- Expert workshop (international)
- Living lab (different actors)