

Controlled Drainage As Measure to Reduce Nitrate Leaching in a Wheat Cropping System.



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Introduction

Subsurface drainage of soil to avoid water logging is a prerequisite for crop cultivation for a large proportion of the agricultural land, and approximately 50% of the Danish agricultural area is artificially drained. Multifunctional drain systems, such as Controlled Drainage (CD), can be effective measures to reduce losses of nutrients.

Objectives of this poster

To present a newly field study on CD in a winter cereal cropping system under northern European field and weather condition.

Material and Methods

Field sites selection based on:

- Slope (<2)
- Systematic pipe drain systems that are possible to locate and to adjust for drainage depth.
- Soil type (sandy loam, or loamy sand) with a minimum of heterogeneity.
- Farmers willingness to cooperate.

Soil characterization:

- Soil profiles described (total 6 profiles, 26 horizons), hydraulic properties, soil chemical analysis. (Bredkjaer and Hedemark)
- Soil heterogeneity mapped using DUALEM measurements. (All sites)
- Soil texture and soil chemical properties in grid points (41 points). (Bredkjaer and Hedemark)

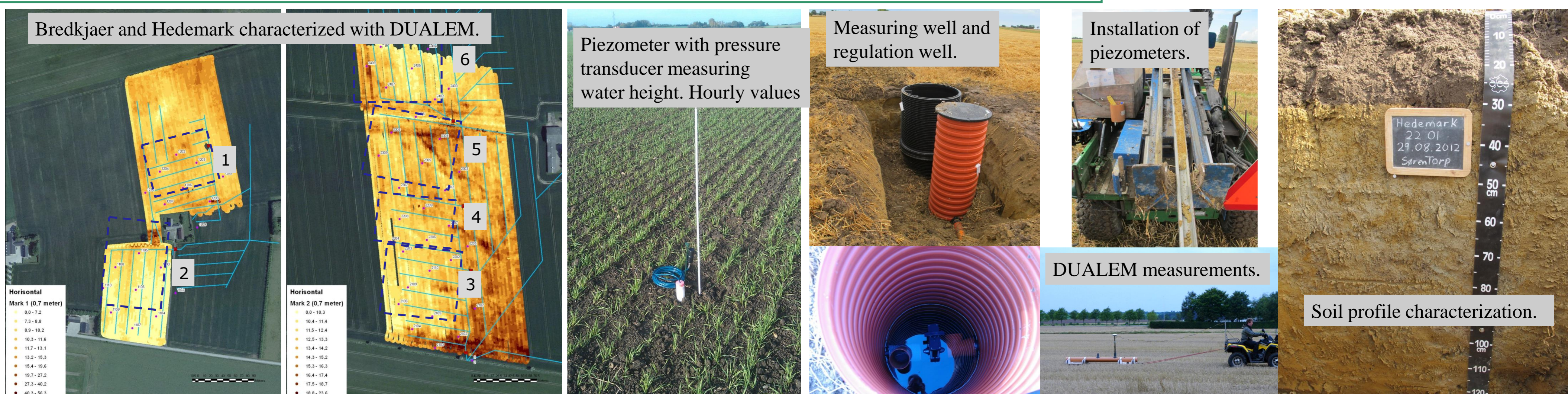
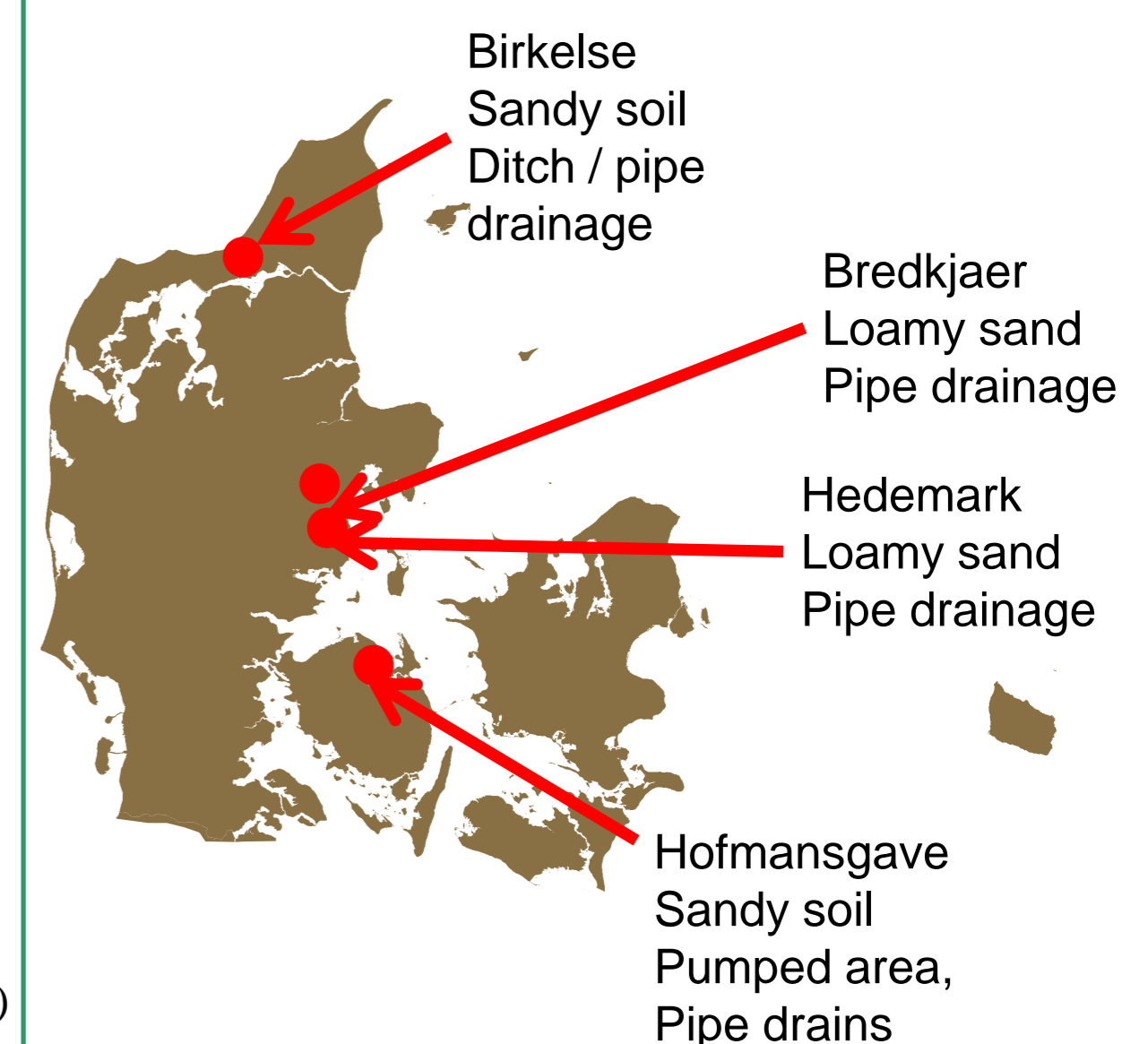
Treatment plan (2012-2015):

- Each site is split up in two to four blocks (separate drain systems app. 1 ha).
- First year (2012-2013): control year, normal drainage.
- Second and third year (2013-2015): one unmanaged block, the other managed to a winter drain depth of app. 40 cm below surface.

Measurements all years (2012-2015):

- N₂O fluxes during autumn, winter and early spring (campaign measurements). (Hedemark)
- NO₃, NH₄, total N, P, concentration measurements in drain water (daily water sampling). Mineral N in soil autumn and spring. (All sites)
- Crop biomass and N uptake in fertilized and unfertilized micro-plots. (Bredkjaer and Hedemark)
- Grain yield with combine harvester (yield meter). (all sites)

Eksperimental sites in Denmark



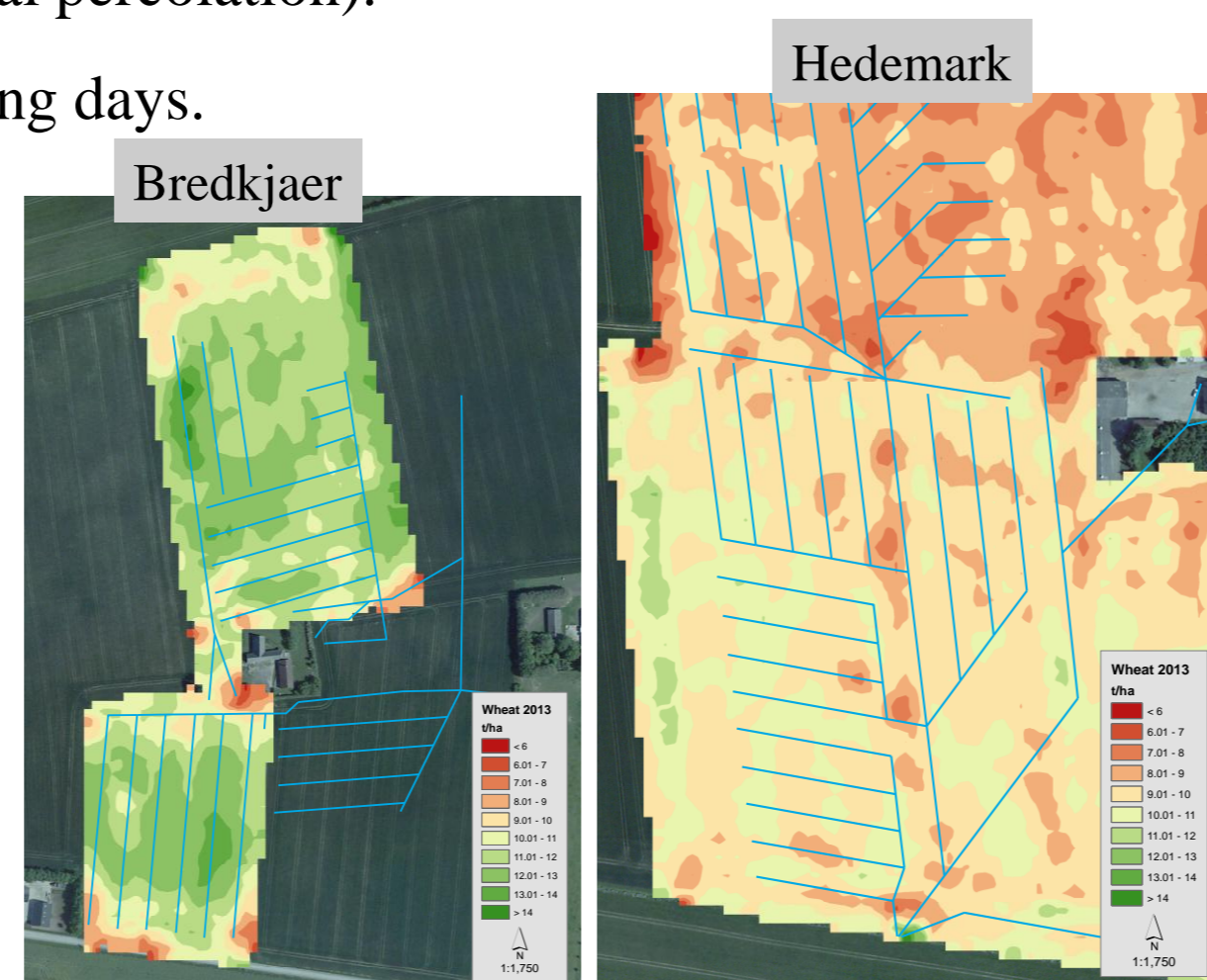
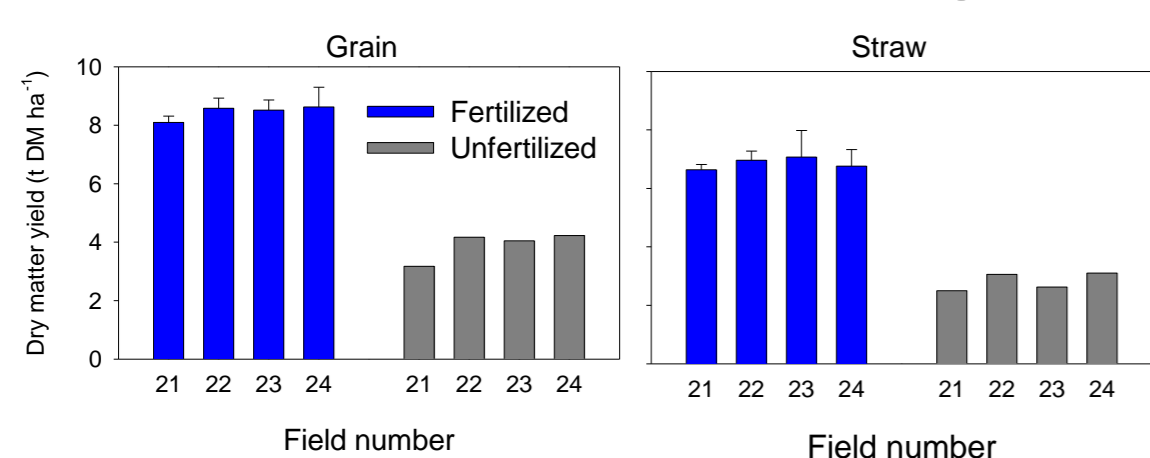
Results 2012-2013 (control year) Examples from Hedemark and Bredkjaer

- N leaching through drains = 10-16 kg N/ha.
- Total N leaching from the root zone between 20-30 kg N/ha.
- Water surplus 355 mm (water balance model).
- Drainage runoff 176-200 mm (app. 50-56% of total percolation).
- Yield variation at Hedemark due to different sowing days.
- Low variation in yield at Bredkjaer.

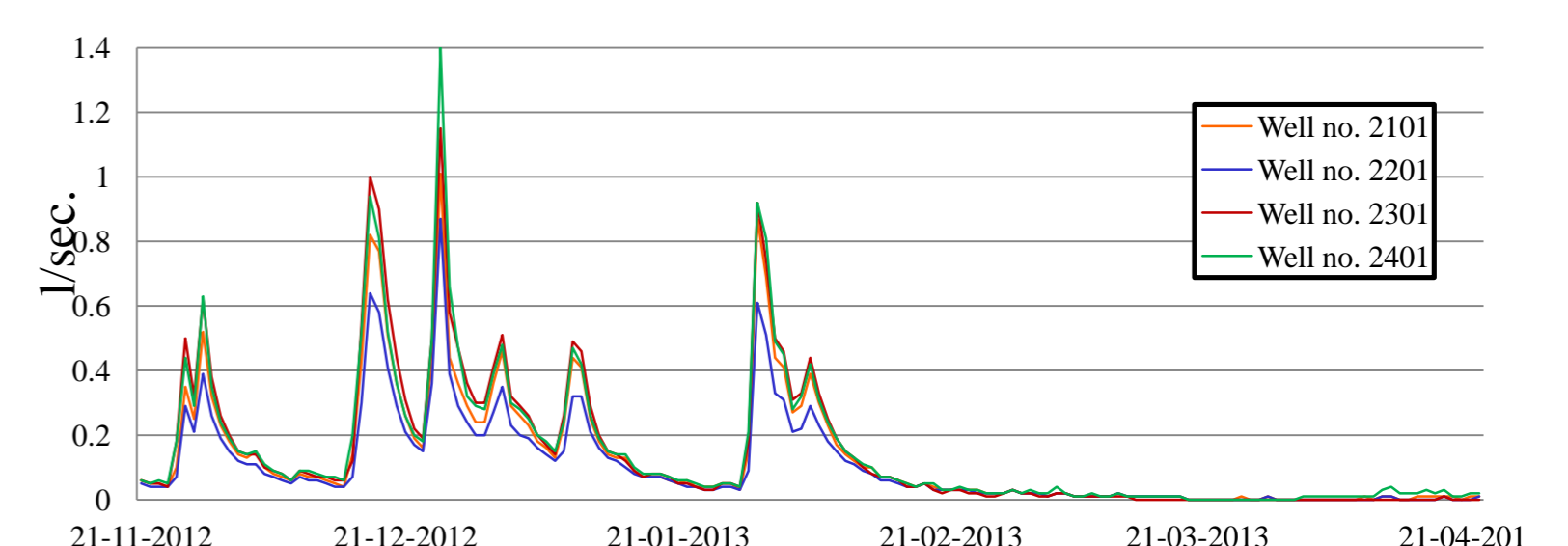
Nutrient leaching in drain and runoff

Field block	Area ha	Total N kg N/ha	Total P kg P/ha	Total reactive P kg P/ha	Percolation mm
3	1.2	10.6	11	0.04	190
4	1.2	16.1	16.2	0.032	184
5	0.9	13	13	0.021	176
6	1	15.4	15.4	0.054	201

Yield in micro-plots (below, (Hedemark)) and from combine harvester (right)



Drainage is measured on daily basis



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