

**Welcome to the workshop:**

**USE OF SATELLITE OR SENSOR DATA TO DETERMINE  
OPTIMAL N-RATE OF WINTER WHEAT ON FIELD LEVEL  
OR POSITION LEVEL FOR VARIABLE RATE APPLICATION**



STØTTET AF

**Promille**afgiftsfonden for landbrug



## 9.00 – 10.15: Introductory talks

- 9.00-9.30: **Leif Knudsen** - Introduction to the workshop
- 9.30-10.15: **Stefan Reusch** – Use of sensor technologies to determine nitrogen demand on field level and for variable rate application

## 10.30-11.45: New results and experiences from Denmark

- Setting the nitrogen demand – general description
- Results from trials in 2019, including satellite data in an N-decision model
- Results from big scale trials in 2019 with variable rate application in winter wheat
- How to achieve the protein level in malting barley to optimize the price

## 11.45 – 12.30: Already working IT-models for farmers to decide the absolute nitrogen demand or rest demand from sensor data

- **Dimitri Goffart** - The BELCAM platform: a tool for a better nitrogen management through the use of Sentinel-2 data in Belgium.
- **Mats Söderström** – Determination of N-demand by drones in combination with satellites.
- **Jörg Jasper** – N-sensor and Atfarm – practical VRN solutions combining

## **13.15-14.00 Presentation of actual activities, results from trials and modelling to determine the nitrogen demand in crops at field level and variable rate application**

- **CG Petterson** – Protein control in Malting barley
- **Ingemar Gruveaus** – Use of Yara-N-sensor in practice in Sweden to determine N-demand in winter wheat in Sweden
- **Daniel Kindred** – Actual activities on Nitrogen fertilization in UK



## The aim of the workshop:

- To discuss how to include sensor data in finding the nitrogen demand on field level and position level
- To use the experience from the different countries and researchers

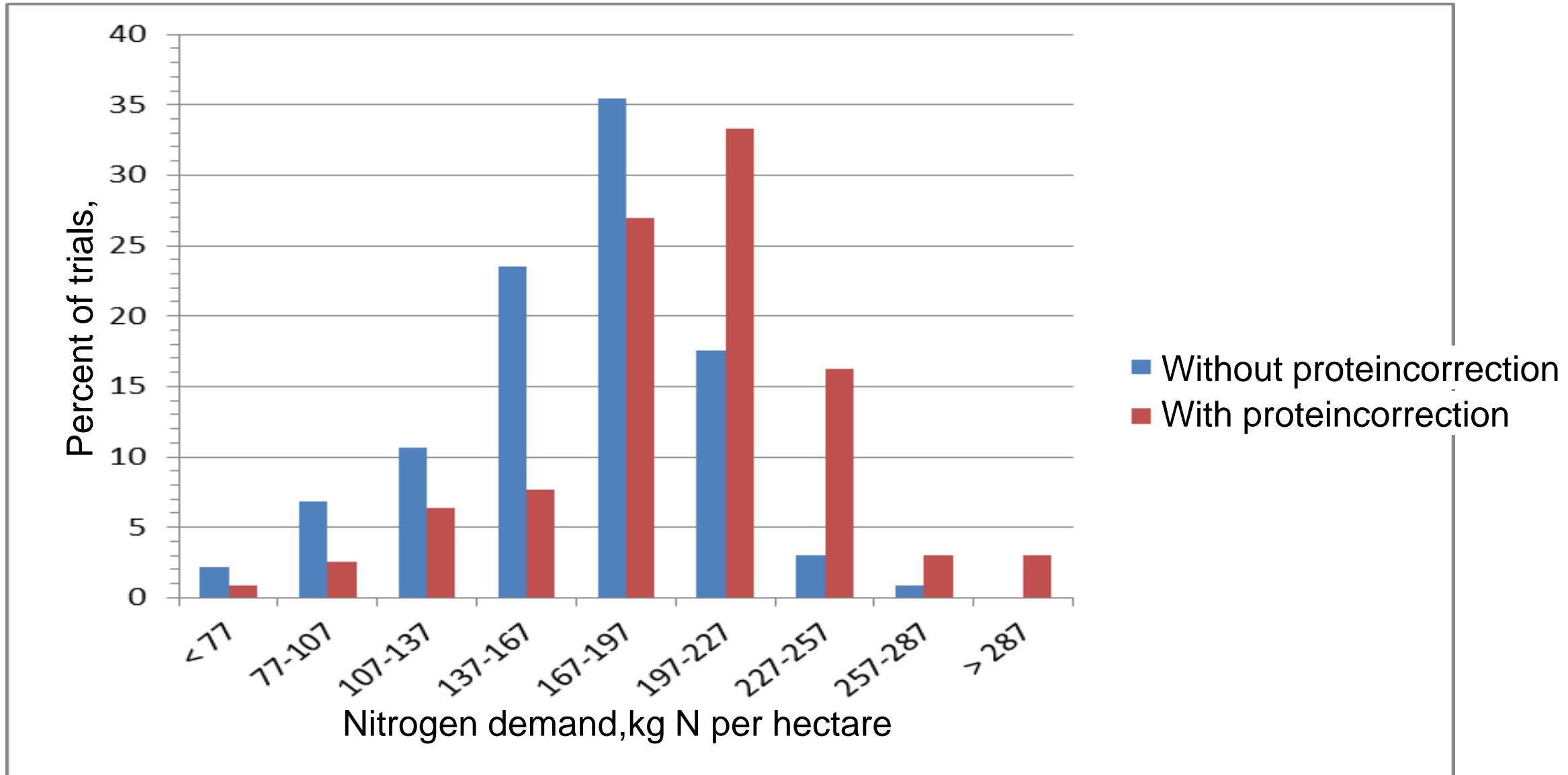
Our objective at SEGES is to create a system in DK, that will be used at least at 50 percent of the danish agricultural area when deciding nitrogen fertilization!

We have in 2019 started a project – N-Tool-Precise - together with Aarhus University to make such a system and include it in SEGES electronical fertilizer planning program, which are used at 85 percent of the agricultural land.

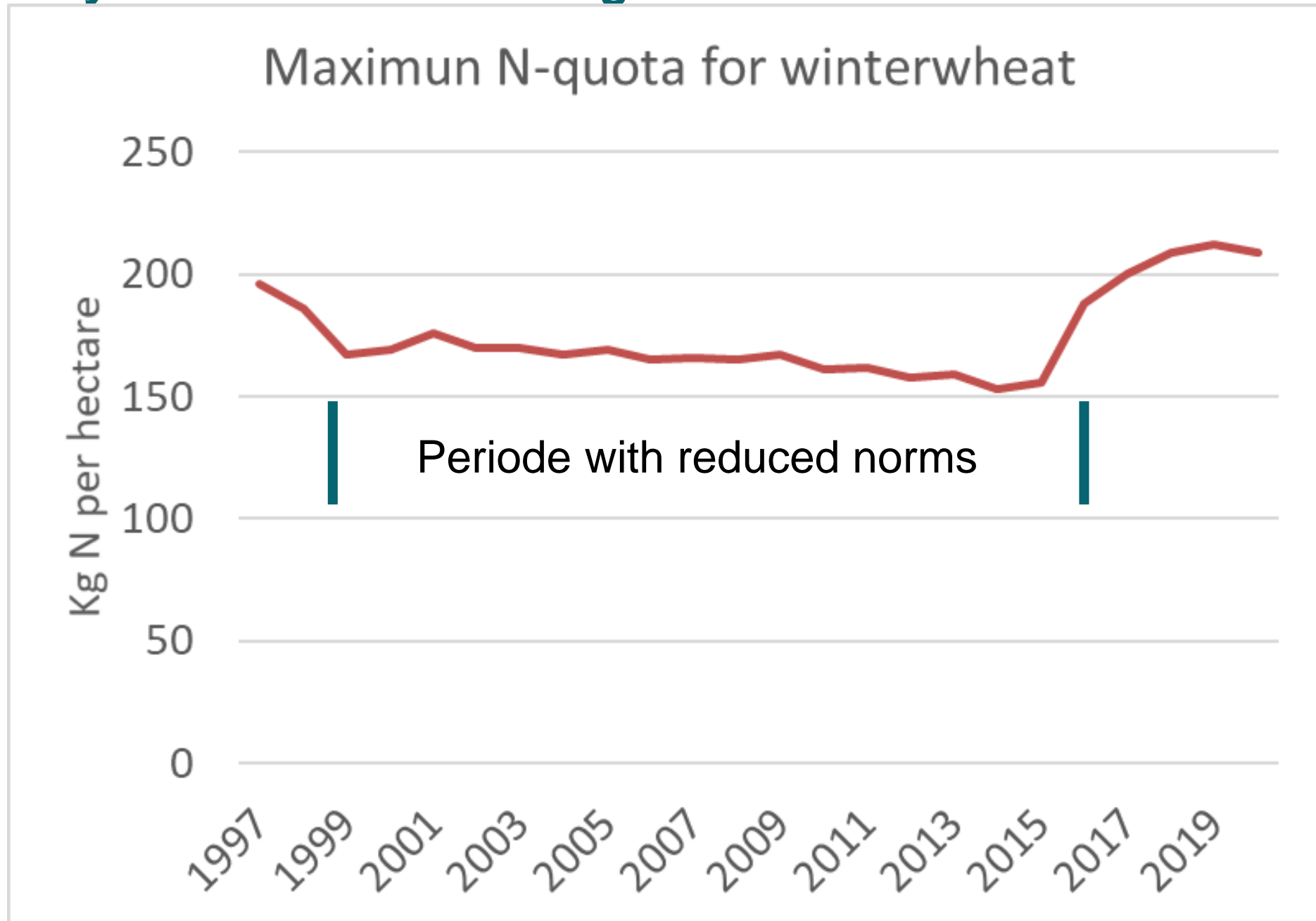
**SEGES**



# Variation in nitrogen demand in trials in winter wheat from 2006-2015

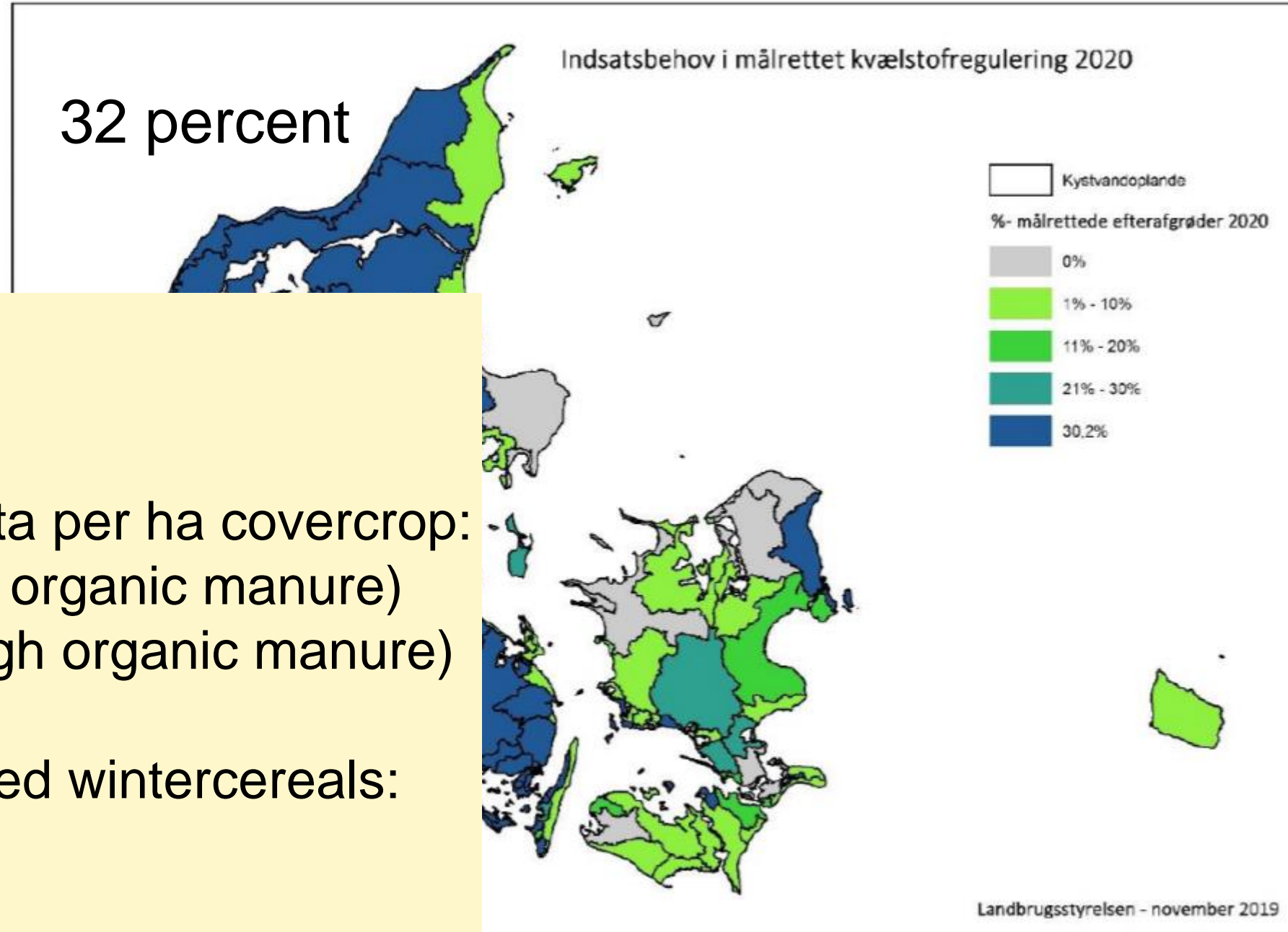


## Very much focus on Nitrogen and N-fertilization in Denmark





# Mandatory cover crops 2020



Cover crops can be replaced by:

Reduction of N-quota per ha covercrop:  
93 kg N per ha (low organic manure)  
150 kg N per ha (high organic manure)

2 ha early established wintercereals:  
1 ha set-a-side

# How is N-demand decided today

## Quota system

- Soil type
- Previous crop
- Long term effect of organic manure
- Residual effects of catch crop
- Yield average (documented for 5 years)

**SEGES**

## Electronic fertilizer planning system

- Soil type
- Previous crop
- Soil pools of organic N (Keeps track of plant and manure organic N)
- Yield expectation



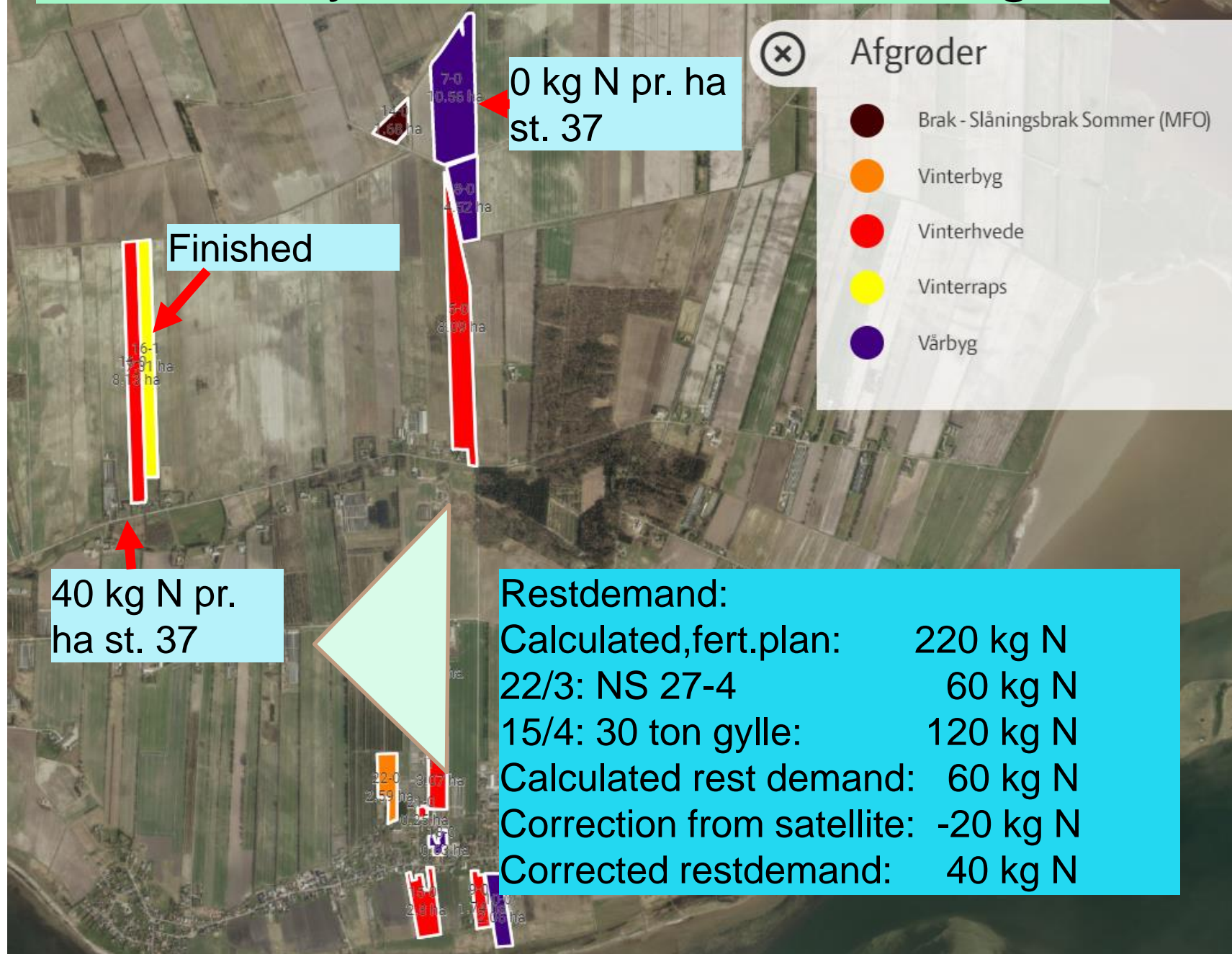
**Improvement by adding  
Satellite Data**



## GUDP – Project N-Tool-Precise

- New tool for determination of N-Demand
- Supplement to the "Soil-model" in MarkOnline
- Focus on winter wheat and spring barley for Malt
- Running from 2019-2022 (Trial 2019-2021)
- Participants: SEGES and Aarhus University
- Many field trials

# 17th of May, Rest Demand for Nitrogen



## Challenges in the project:

- Yield forecast, Can it be improved in the growing season?
- How precise can satellites/drones measure N-uptake
- Relation between N-uptake and N-demand
- Determination of grow stage
- Utilization of all ready added fertizer – Dependent of the time from spreading to measurement
- How to present data for the farmer
- Relation to N-quota

## Trial program

- 30 trials in winter wheat per year 2019-2021
- 10 trials in spring barley per year 2019-2021
- 2 big scale trials in malting barley per year
- 2-6 measurements by drone in each trial



# The basic idea by including satellite in setting N-demand in winter wheat

Winter: fertilizer -  
plan calc.  
N-Demand

40-80  
Kg N

Rest  
- 50  
kg N

Rest N  
SAT- deci-  
ded



Decimalskala

10 12 14 16 20 30 31 32 37 41 45 53 59 75-90

Buskning

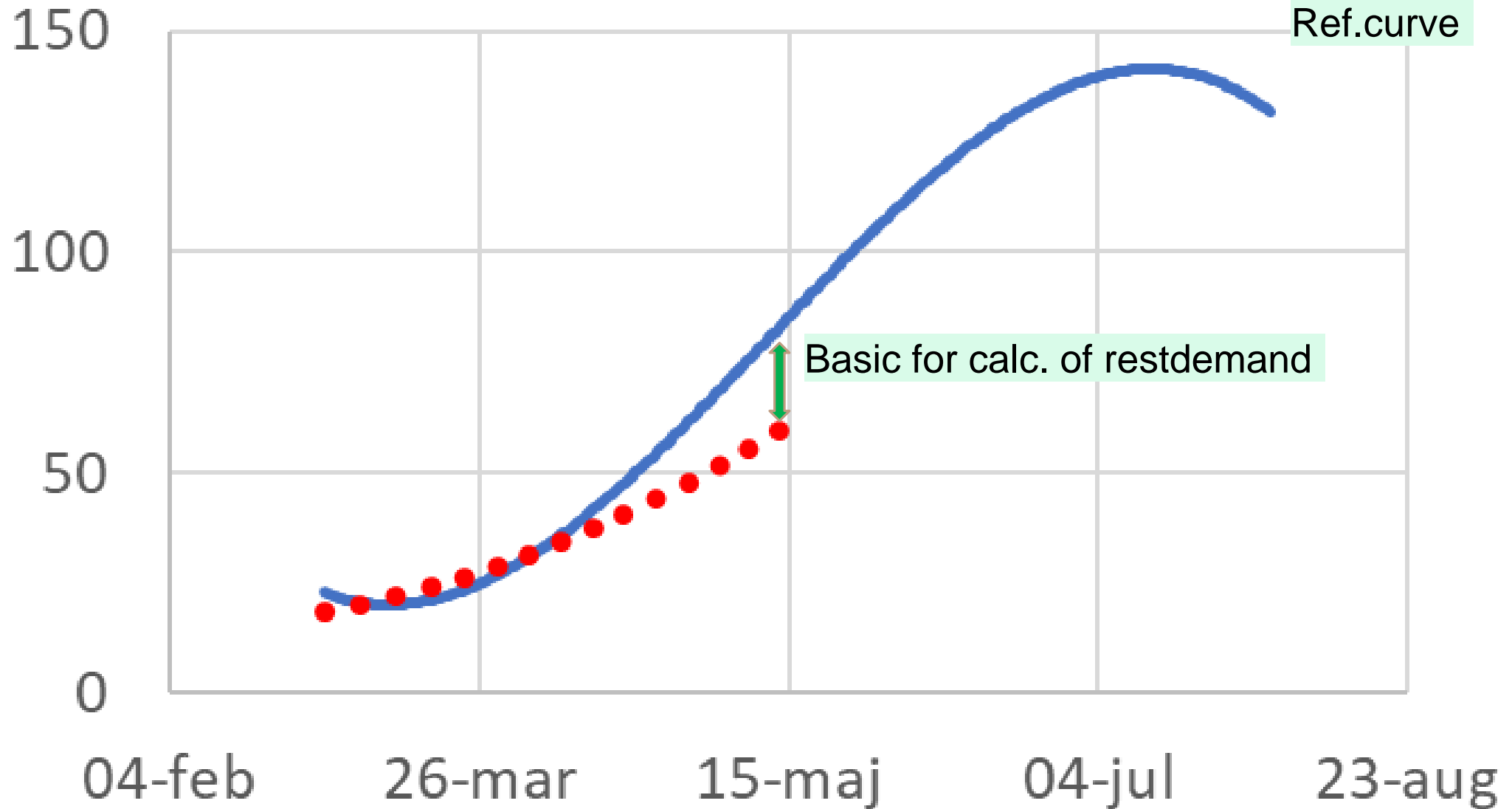
Strækning

Skridning

Modning

# Calculation of rest demand for N from satellite

Crop uptake of N, from satellite



## The focus at the workshop must be:

- Determination of absolute or rest demand of nitrogen from satellite – on field and position level
- Do information of soils, cropping history and climate improve the calculation of N-demand
- Do we need to include growth models?
- Machine learning?
- What is the environmental effect?