

# Yield and protein data from recent years can improve N-fertilization practices

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STØTTET AF

Promilleafgiftsfonden for landbrug

SEGES  
INNOVATION



# Agenda



- Motivation and background for study
- Method
- Results
  - Field experiments (mainly N, with a small remark about P)
  - Data recorded in MarkOnline
- Recommendations and future perspectives

## Motivation for study

In the years with supoptimal N-norm a lower protein percent was observed

### Excising grain samples:

- When farmers sell a batch of grain
- However, if not for bread or malt barley, protein commonly not measured

### Aim:

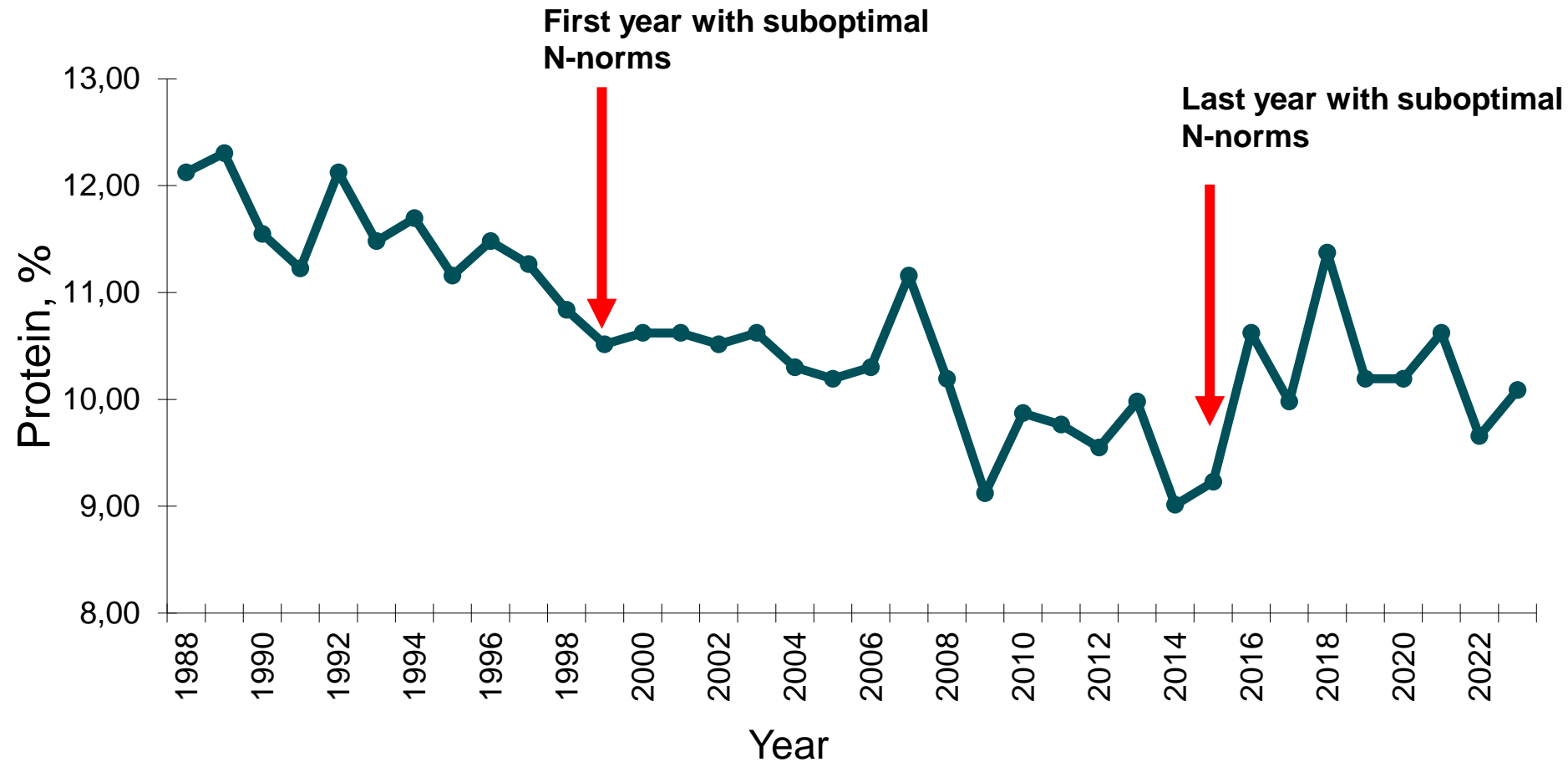
- Explore the relationship between protein percentage, yield, and nitrogen application and identify threshold values
- Improve future nitrogen fertilization practices

**Can yield and protein data from recent years improve N-fertilization practices?**

# Background

- Nitrogen application rates highly affects protein content
  - Higher N rates = higher protein content
- From 1999 to 2015 nitrogen fertilization norms were below optimum
  - Decreasing protein content in harvested grain
- There has been conducted over 1,000 field experiments in winter wheat with increasing nitrogen application: time to step back and have a look

# Development in protein content in harvested winter wheat



# Method

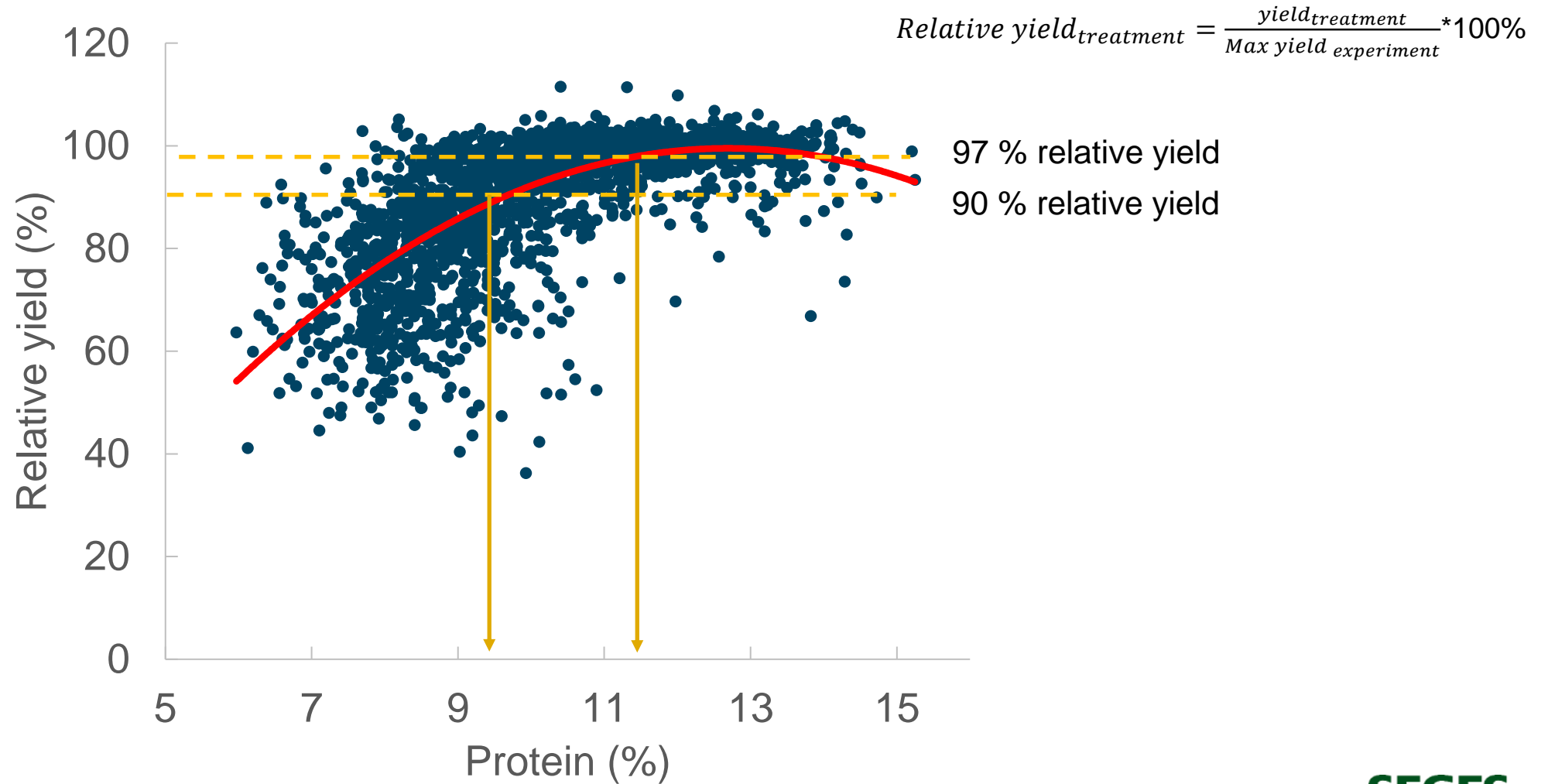
## **Comprehensive dataset:**

- Time period: 1987-2020
- 1,090 N rate experiments in winter wheat
- Yield and protein percentage

## **Data cleaning:**

- Experiments with missing data/ errors removed
- Only treatment with N-rates between 50 and 250 kg N/ha used
- A total of 3757 observations in a total of 752 experiments

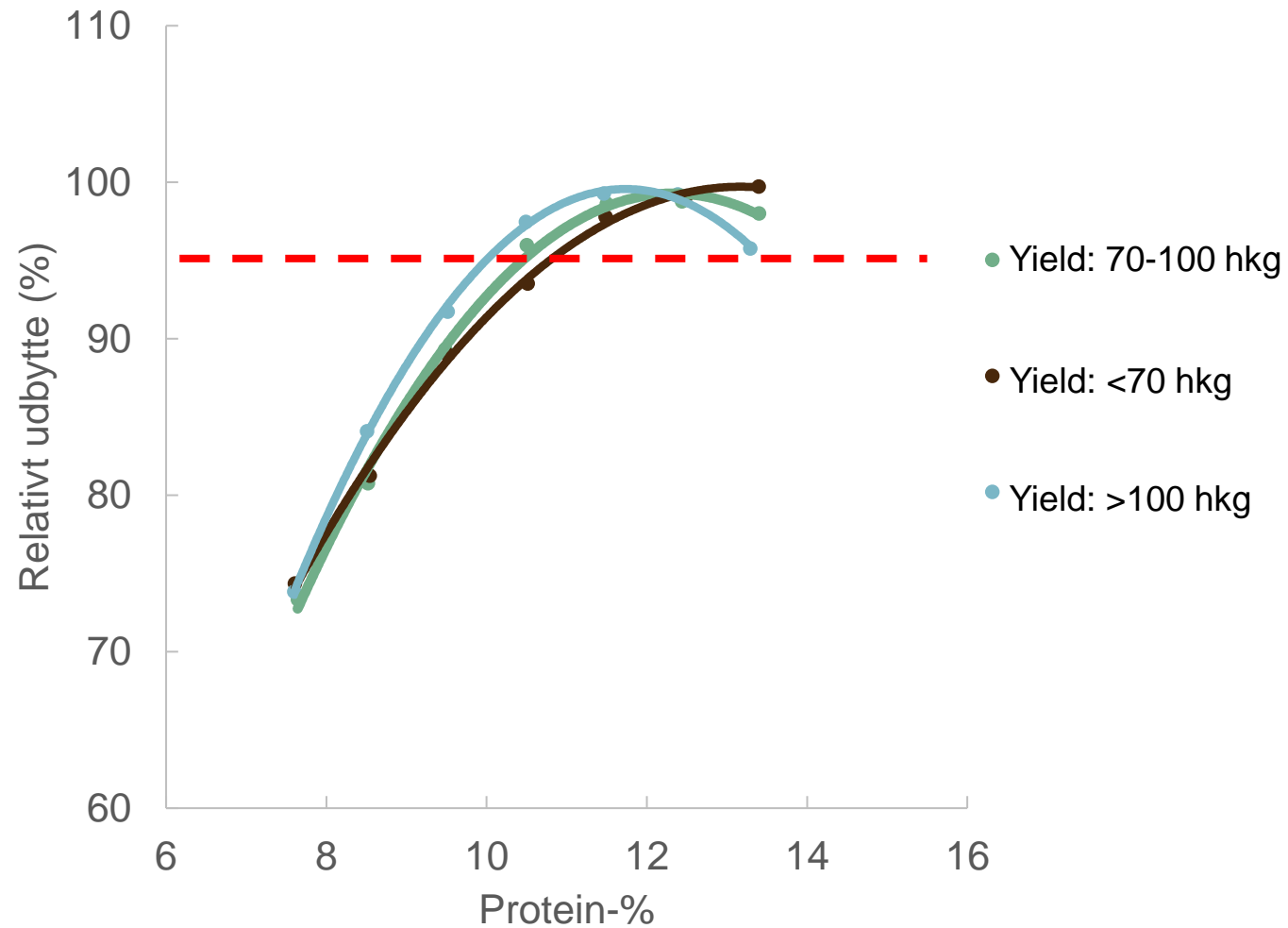
# Correlation between relative yield and protein



# Small differences in optimum for different yield intervals

## Optimum:

<70 hkg/ha:	10,8 %
70-100 hkg/ha:	10,4 %
>100 hkg/ha:	10,0 %



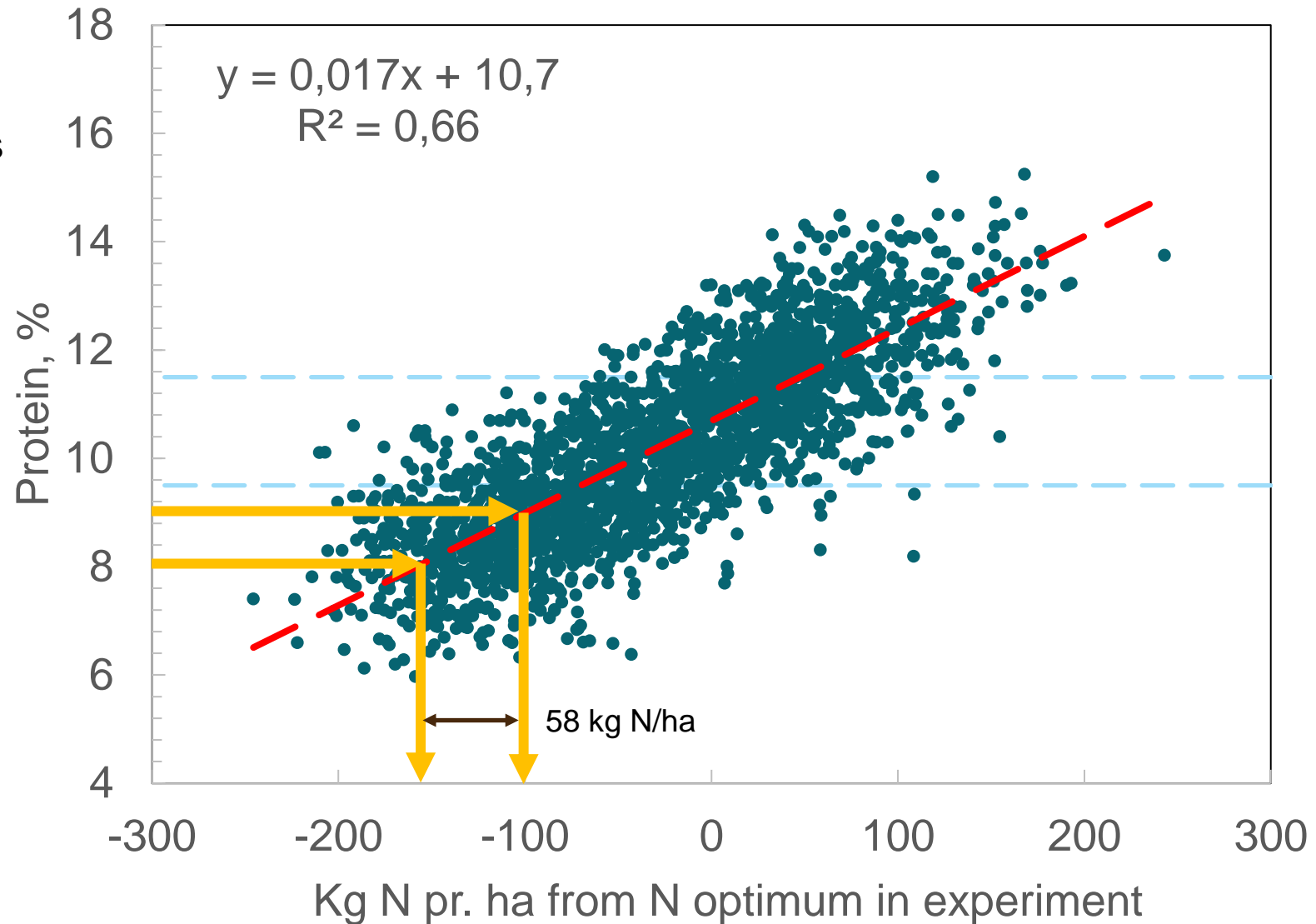


# Recommendations for winter wheat

Protein %	
Below 9.5 %	High likelihood that the crop has been undersupplied with nitrogen Risk of yield loss
9.5 % to 11.5 %	The nitrogen application has likely been sufficient
Above 11.5 %	Highly likely that the crop has received an excess of nitrogen

# Using protein percent: How far away from optimum N?

- In each N-rate experiment optimum is calculated
- In each N-treatment the distance measured in kg N/ha is calculated
- For every 10 kg N/ha extra the protein percent will increase 0,17 %

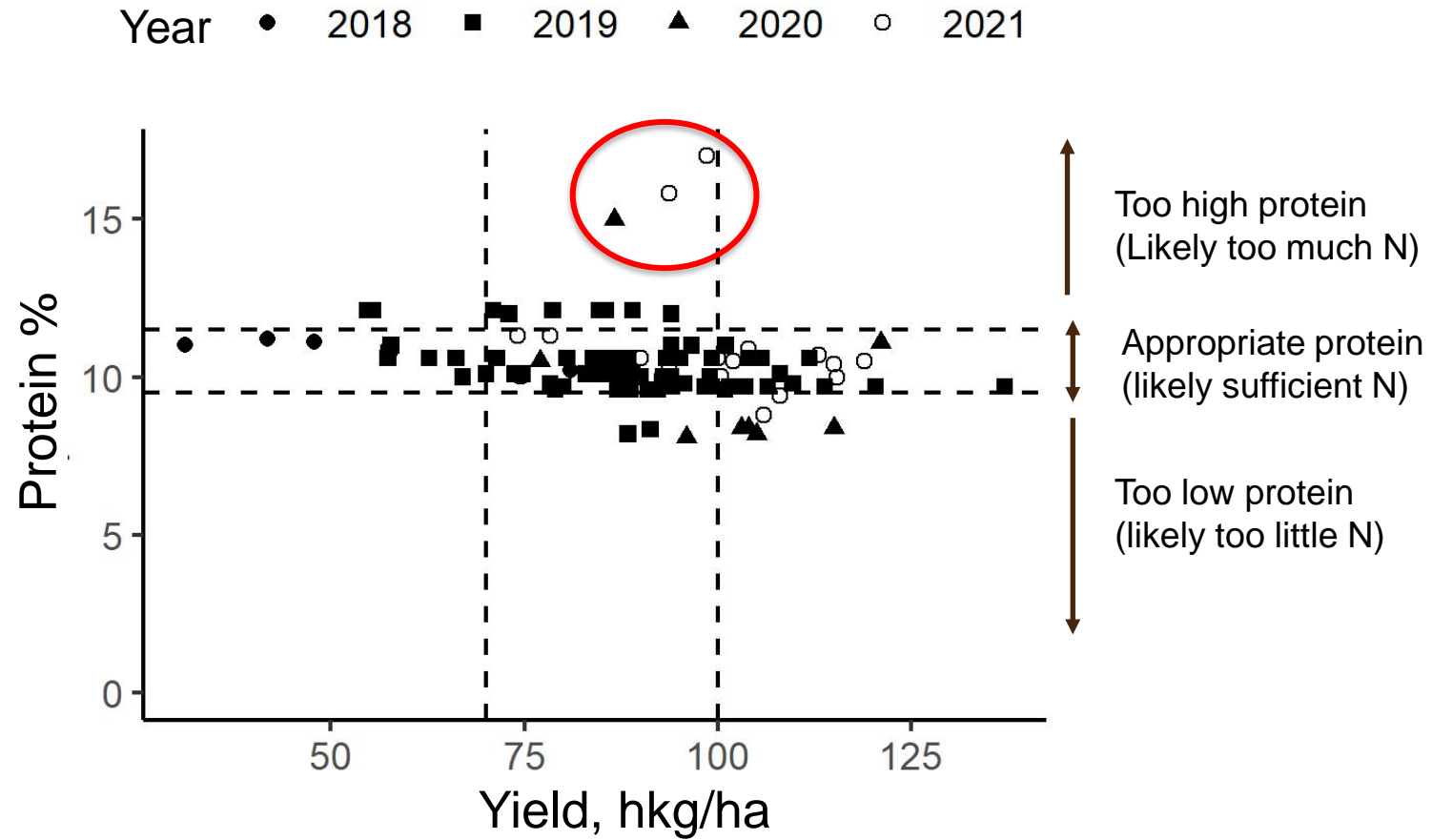


# Yield and protein registered at field level

## Data:

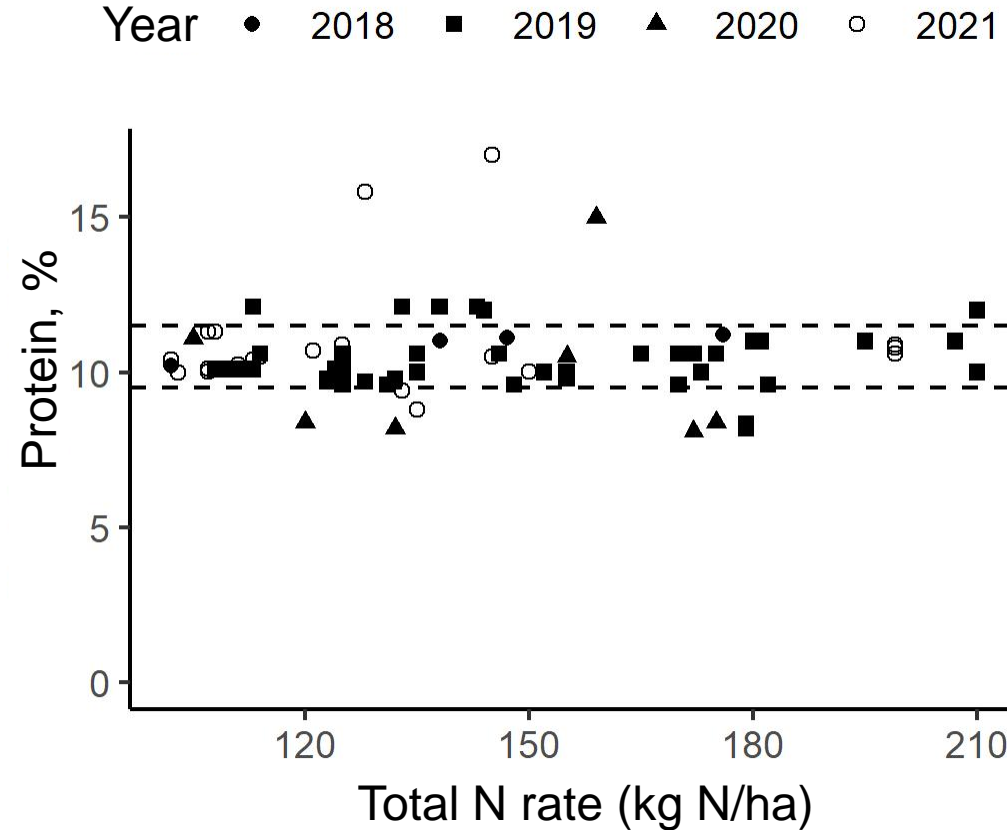
- Yield and protein content registered at field level for winter wheat
- Data registered in MarkOnline
- From 2018-2021
- A total of 282 field with registered yield data
  - Only 121 fields left after cleaning of data
- Nitrogen source: both mineral fertilizers and animal manure

# Registered yield and protein content



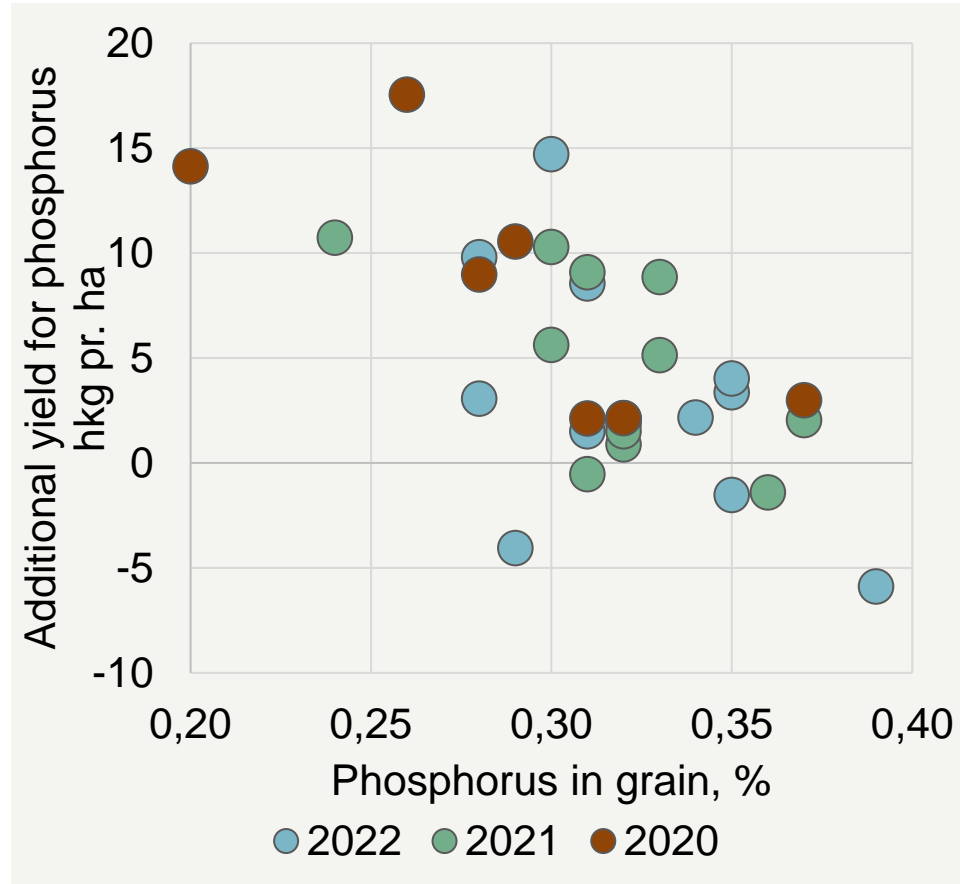
# Nitrogen rate and protein percent

- No increase in protein percent with increasing N rates
- Is the quality of the registration of N rate at field level good enough?



# Phosphorus in grain analysis

- 32 field trials in spring barley with and without phosphorus fertilization
- Years: 2020-2022
- Phosphorus content in grain analysis can reveal if the plants have lacked phosphorus during the growing season



# Conclusion

## Initial question:

Can yield and protein data from recent years improve N-fertilization practices?

## Answer:

Yes

# Conclusions

- Clear potential to make better use of excising grain samples
- Information about protein percent represents valuable knowledge to improve nitrogen fertilization planning
  - <9,5%: apply more N
  - 9,5-11,5 %: sufficient supply
  - >11,5 %: decrease N supply
- Phosphorus content in grain can reveal lack of phosphorus supply
- Can be integrated in future tools:
  - Especially if grain analysis becomes more common
  - There is still a lack in registration of yield and protein levels



# Future perspectives for using grain analyses

- Integrated part of fertilization planning
  - In future include other nutrients
- Farmer evaluation of fertilization strategy
  - Look at more years
  - Remember: other factors can affect protein and yield levels e.g. drought periods
- Visualization of fields
  - Red: Too high nitrogen application
  - Green: Optimal nitrogen application
  - Yellow: Too low nitrogen application



# ANAKORN – new projekt



- Inspired by the work done in U.K. on grain analysis and in the Field trials in DK
- Use new technology (LIBS) to make grain analysis cheaper
- Facilitate logistics and build a decision support system for grain analysis
- Goal: to improve the following years fertilization plans