

# Tilpasning af gødningsstrategier til reduceret jordbearbejdning

FRDK, Vissenbjerg, DK, 24.02.2016

15 års erfaringer med minimal jordbearbejdning og Cultan gødsning (ammonium gødning) .

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# Structure

- Introduction
- Fundamentals of  $\text{NH}_4$ -based Crop Nutrition
- Field Trial Results from 2001 to 2007
- Practical application (til 2015)

# Begin

- Since 1993 Advisory/ Contracting service/Sewage slurry recycling/Nitrate Vulnerable Zones
- Soil sample based
- Indicators pH and P-level
- Open question: N delivery

# Fertilizer savings in a mintill system – CULTAN minimum tillage

Timing and manners of  
application are the key  
to sustainable savings

# Fundamentals of $\text{NH}_4$ -based Crop Nutrition

- CULTAN
- Controlled
- Uptake
- Long-Term
- Ammonium
- Nutrition

# Fundamentals of $\text{NH}_4$ -based Crop Nutrition

- Sustainable N-Supply
- Reduced Total- N-amount (20 % less!)
- One pass fits all!
- Root dominant N-Nutrition vs. Stem-dominant N-Nutrition

# Root aspects

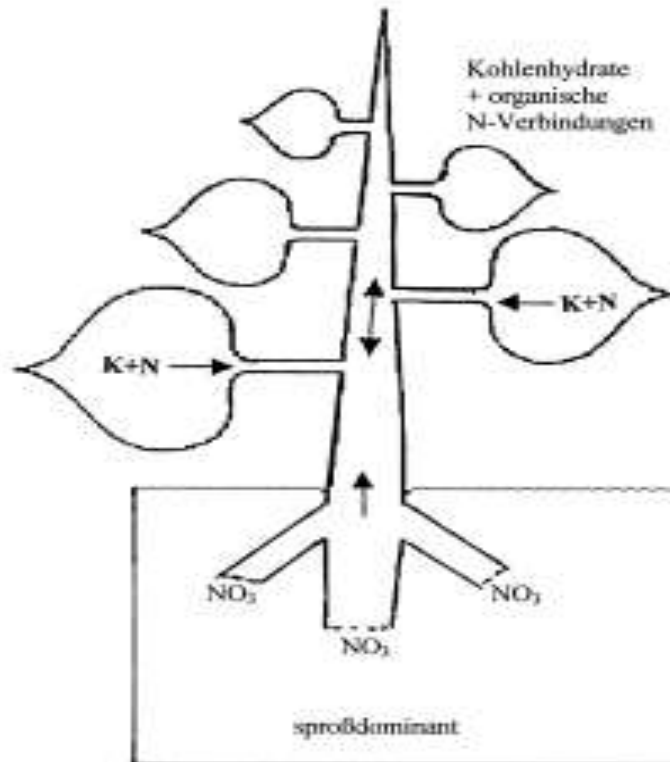


- Root development differs with type of N-Nutrition

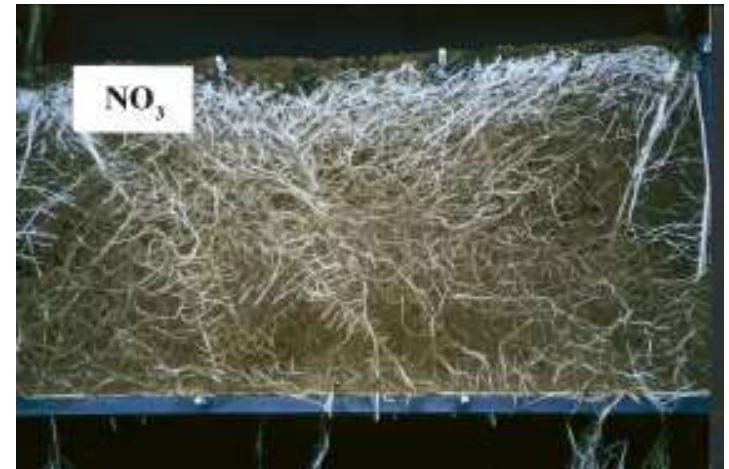
# Physiology of plant nutrition

Nitrat oder Harnstoff

Nitrate or Urea



Carbohydrates and organic N-compounds

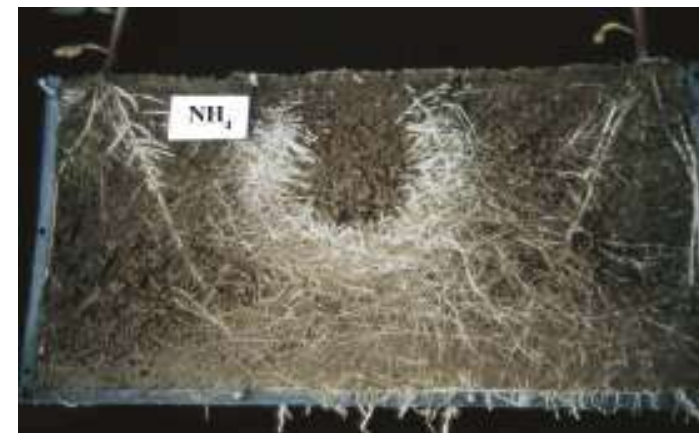
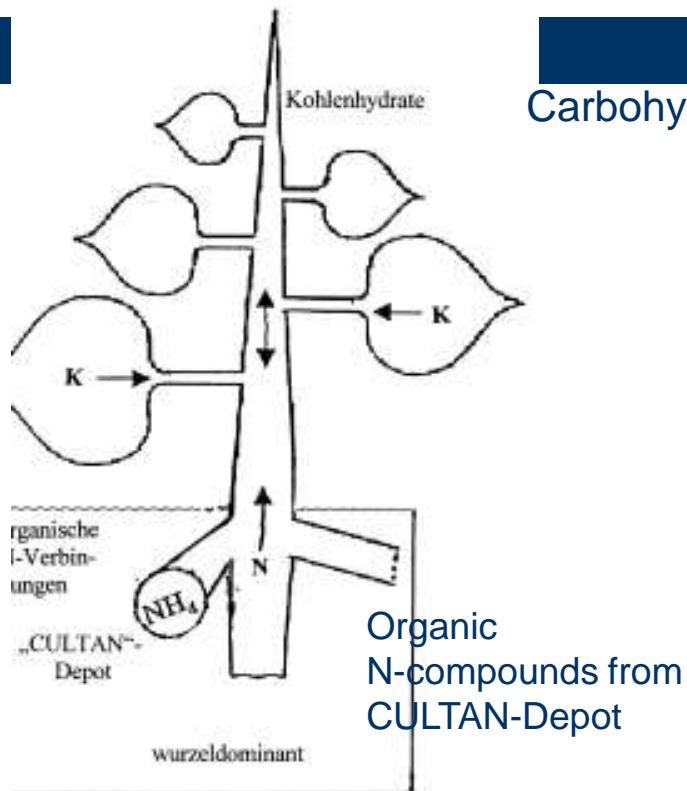


stængel udvikling



# Physiology of plant nutrition

## Ammonium as CULTAN



# Root dominance off-site



# Root dominance on-site!

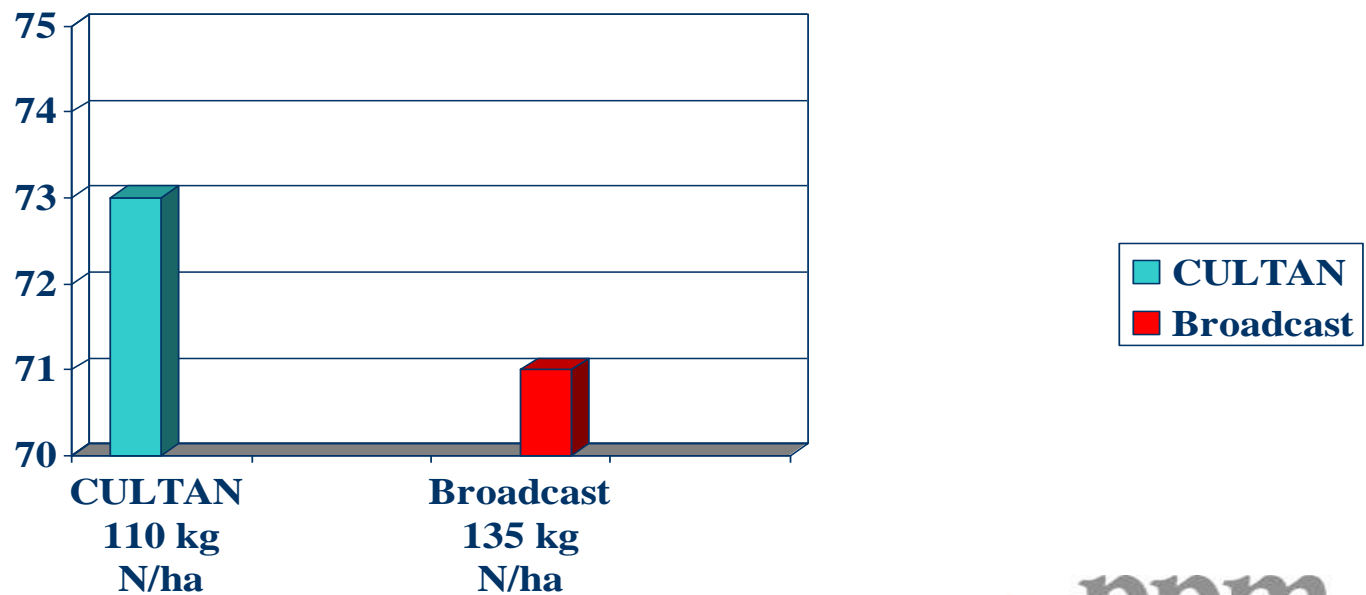


# Intensive Fieldtrials since 2001

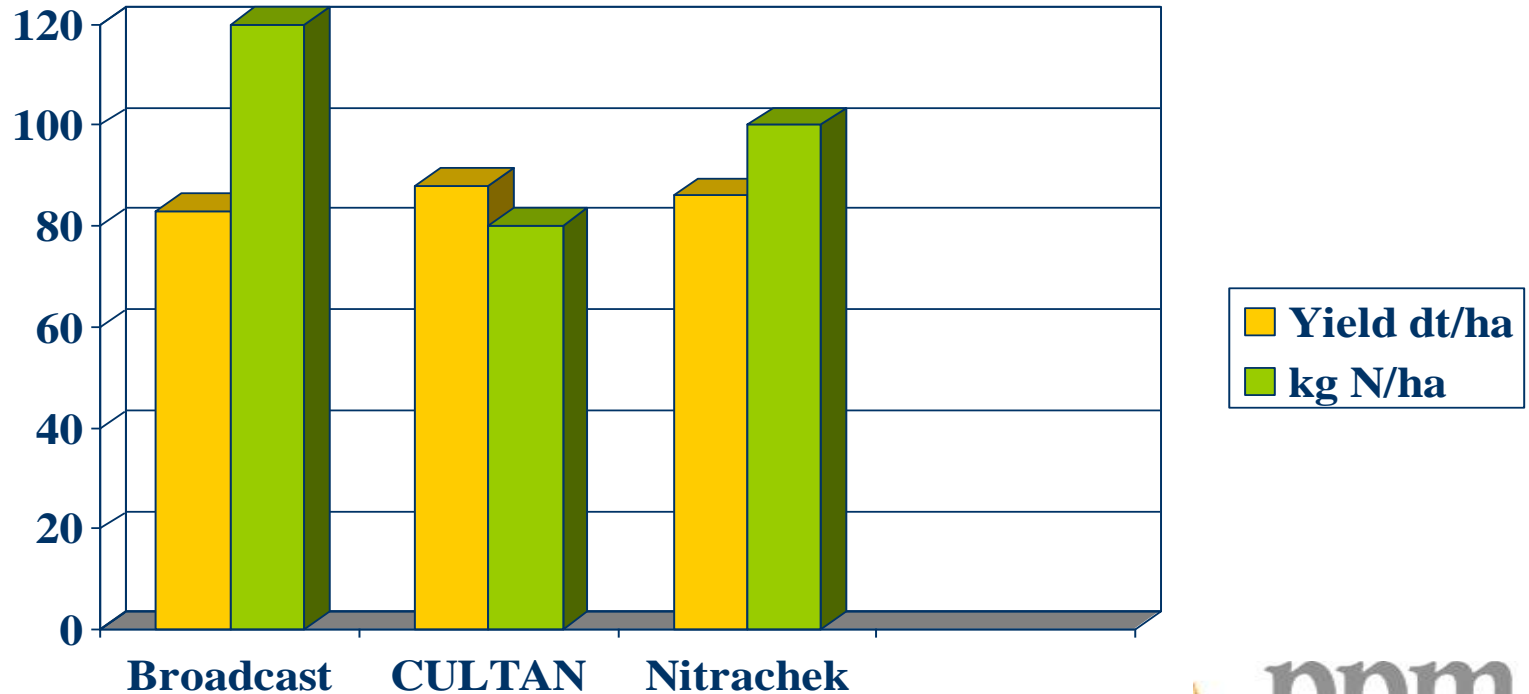


20 03 2006

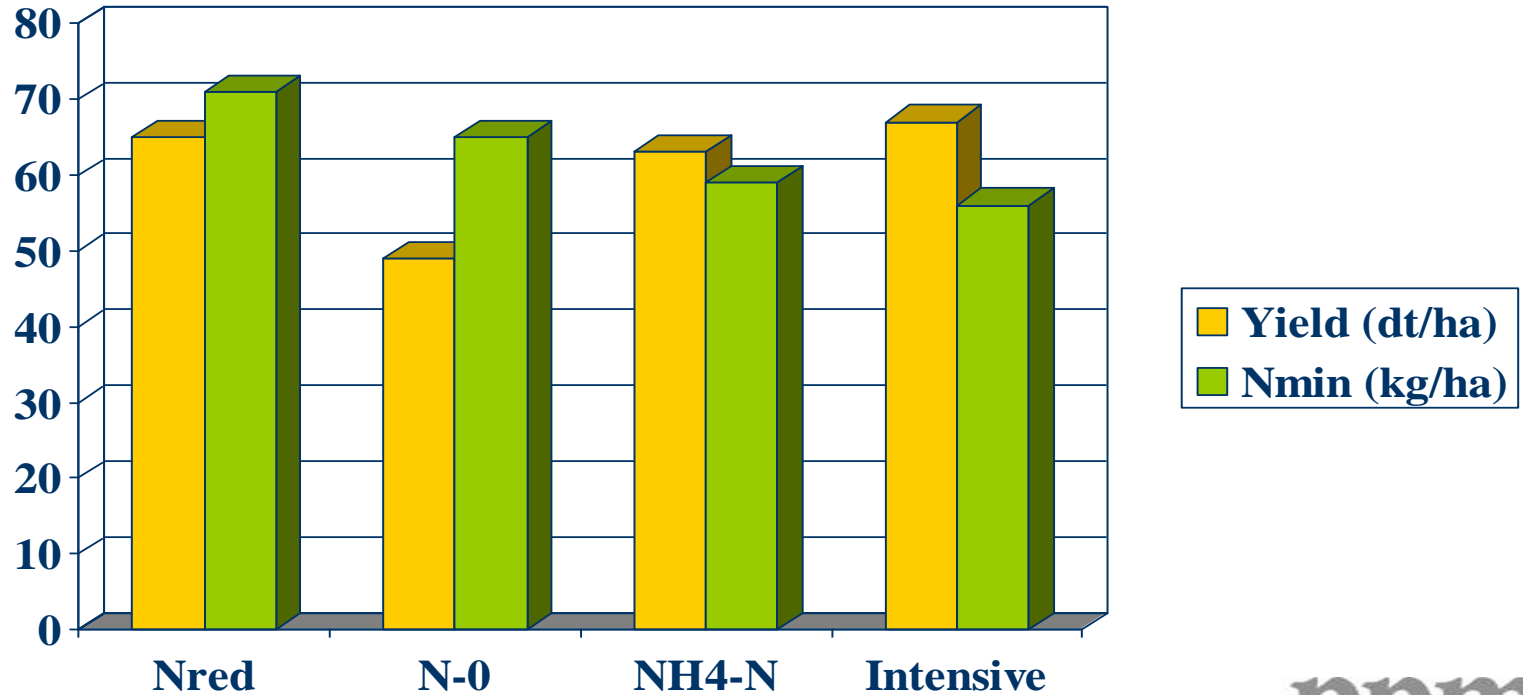
## Average Cereal yields in dt/ha as a function of N-intensity (2001 - 2004, Elbe-Weser, Lower Saxony)



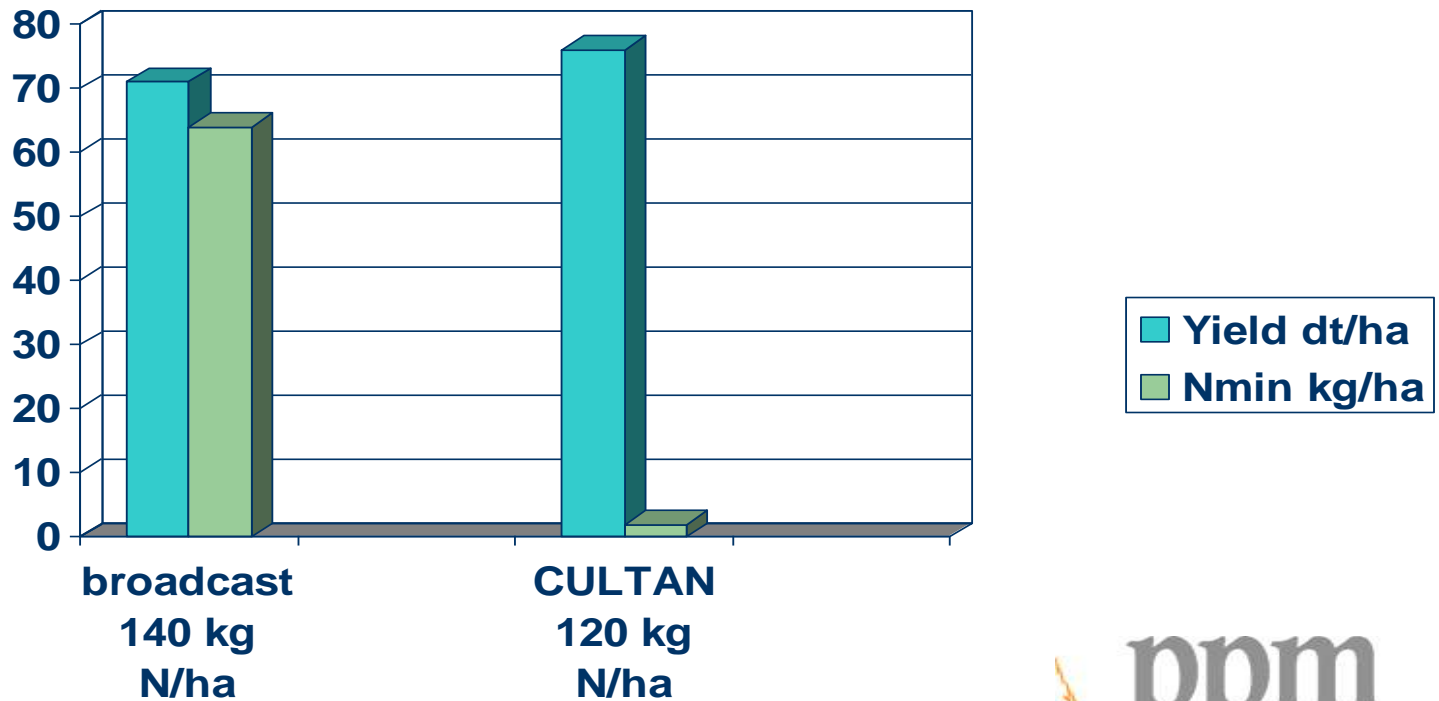
# Winter Ryeyields (dt/ha) and N-intensity, Worpsswede 2001, Lower Saxony



## Yields and N<sub>min</sub>-residues under different fertilizer regime in W-Wheat, Meyenburg 2002, L.S.

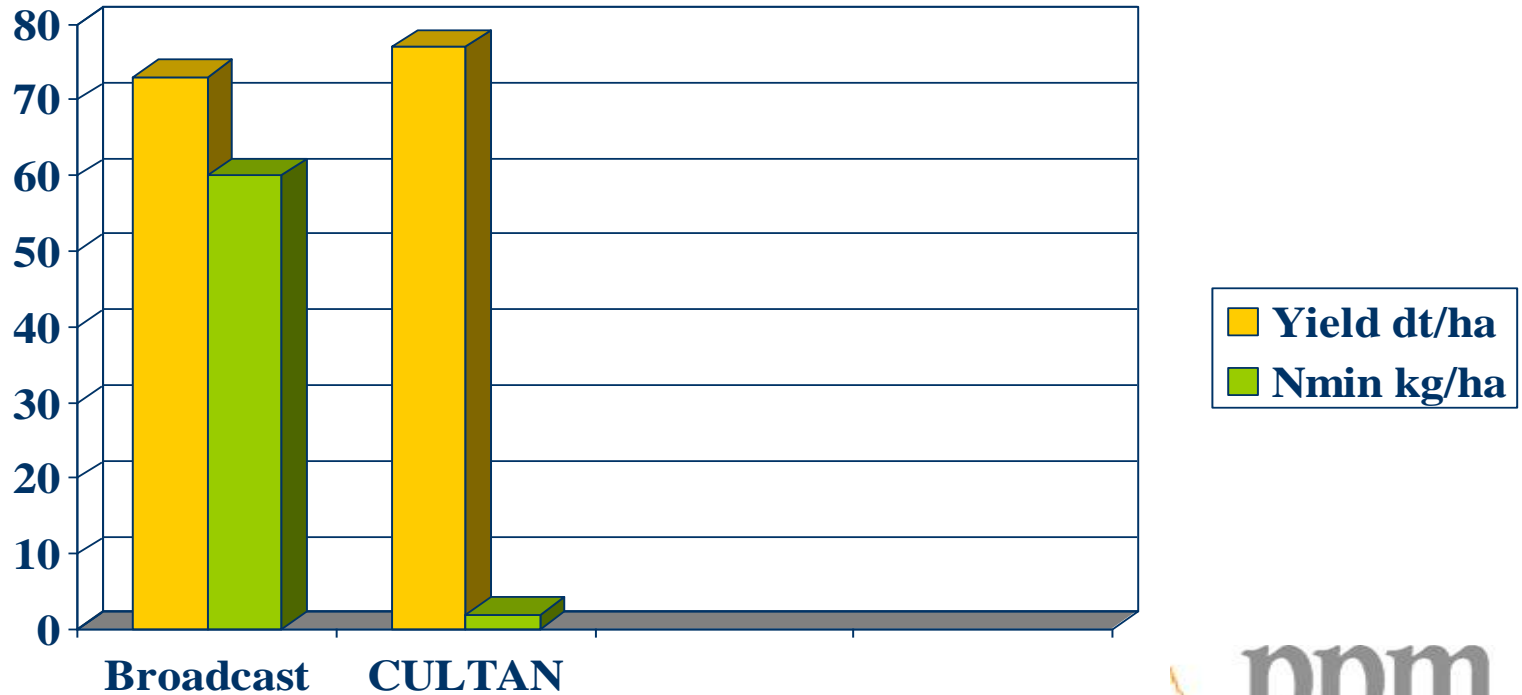


# Winter Barley yield 2003 im WSG Meyenburg

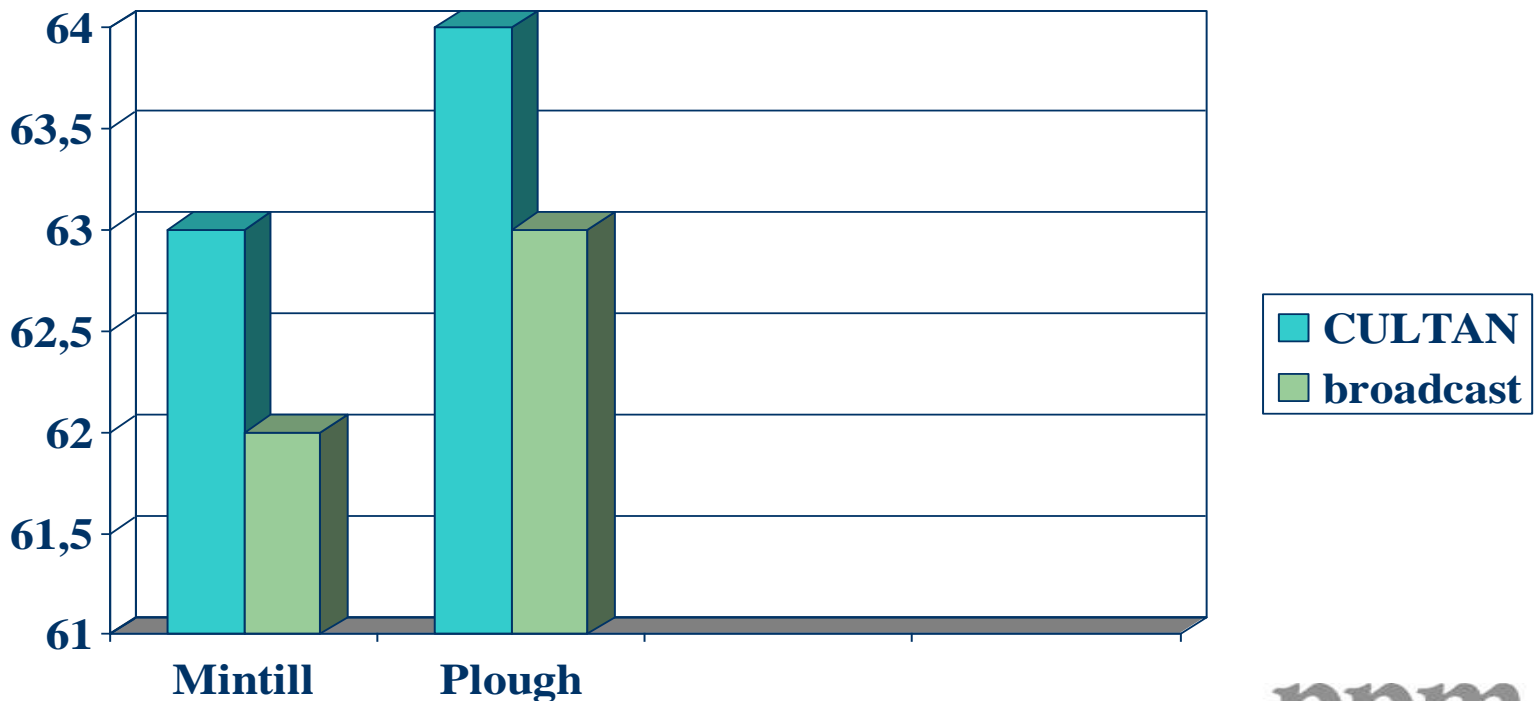




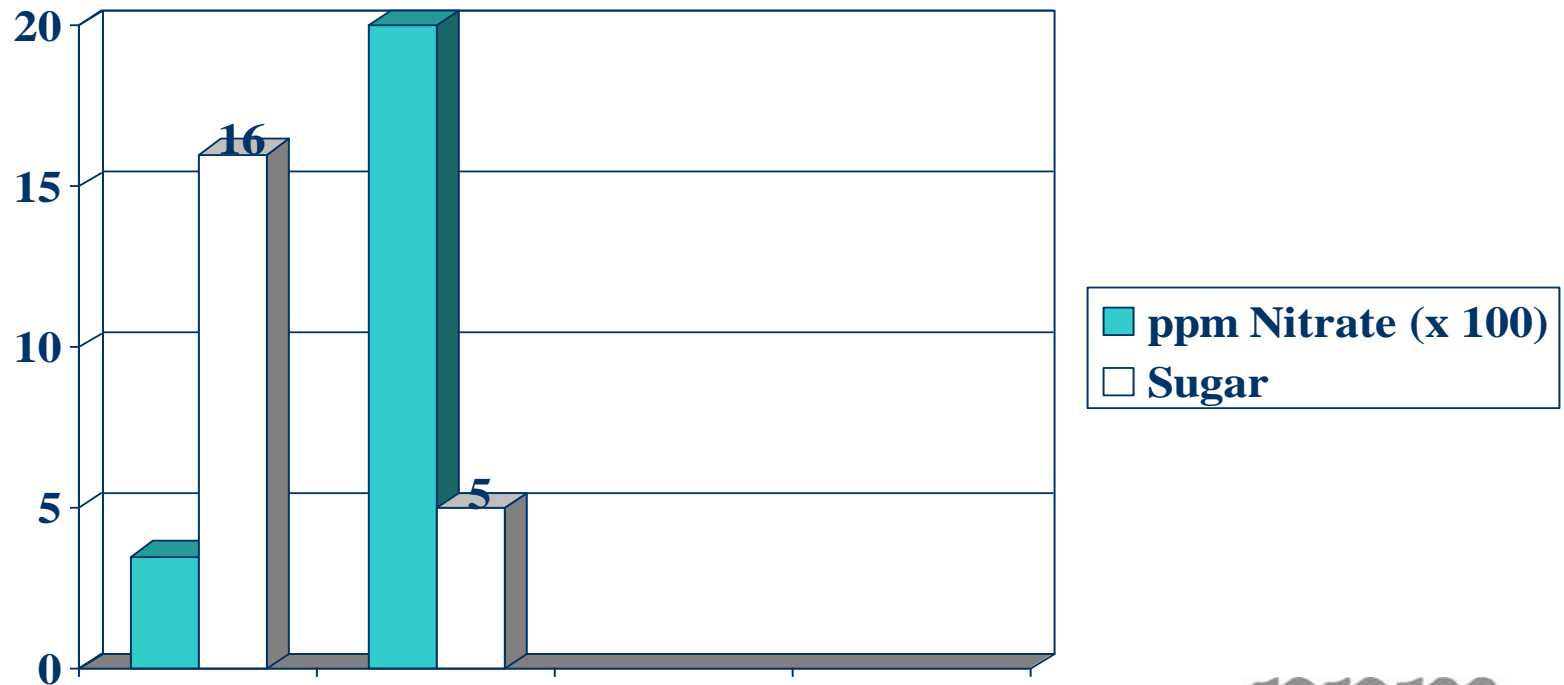
# Yields und Autumn-N<sub>min</sub>-residues after Winter Barley, Meyenburg 2003



## Winter barley yield mintill vs. plough (CULTAN vs. broadcast), Uthlede 2004, L.S.

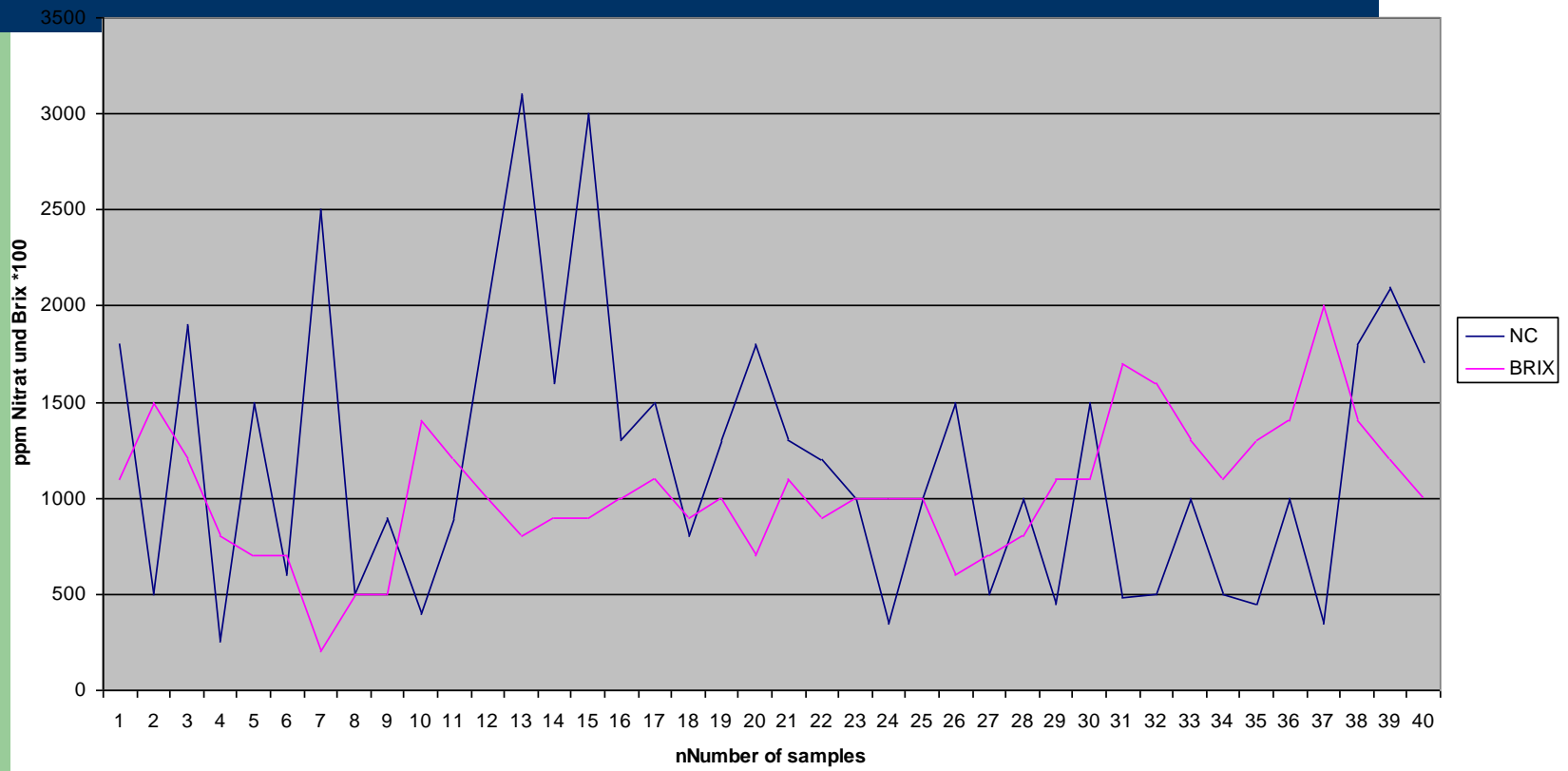


## Sugar content (%) and Nitrate content (in ppm x 100 ) of shoot stem base of cereals (n=500)

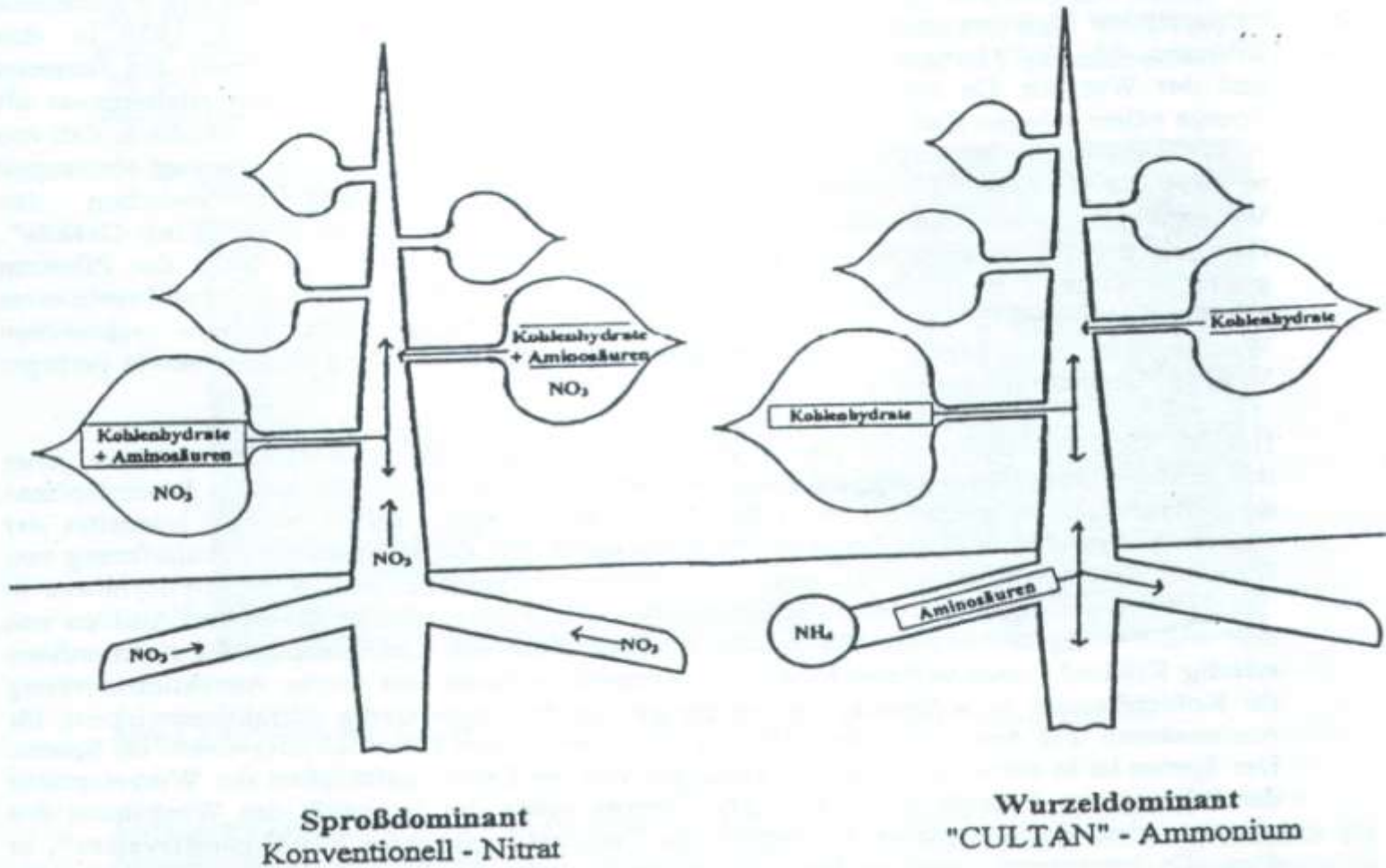


# Fieldanalytics 2005

Nitrate/Suger-Ratio in plant stem sap



# Physiology of plant nutrition



# Practical application I



# Practical application II



# N-Depot: Banding

- Universally applicable in cereals, maize and OSR: keeping your tractor on track





## Established Practice since 2008

- **Injection timings:**
  - Grassland (from 1st February when trafficable)
  - OSR (dito)
  - Winter barley until mid-tillering (BBCH 27)
  - Winter rye until the end of tillering (BBCH 29)
  - Winter wheat until stem extension (BBCH 32)
  - Maize post emerge until 4-leaves growth stage
  - Potatoes at planting

# N-Fertilizers for CULTAN minimum tillage

- **AHL (N-28)**
  - Ammoniumnitrat
  - Urea
- **NTS (N-27)**
- **HAS (N-20)**
  - Urea
  - Svovlsur ammoniak
- **ASL (N-8)**
  - Svovlsur  
Ammoniumopløsning
- **Blandinger  
(AHL/ASL)**

# How crops do look like!

Betrieb Herbert Häusler, Warthmannsroth, Schlag Eidenbacherhof AZ40-70  
Weizen Tommi Saatt.25.09.2005, VF Raps, Betriebsübl. 190 N als AHL 3  
Gaben, erste Gabe am 13.04., Cultan 160 N als AHL am 22.04.06 unter  
absolut nassen Bedingungen mit Standartbereifung 600 und  
Dreipunktgerät Spuren sind noch deutlich sichtbar, der Cultaneffekt  
jedoch auch!!!!!! **Ertrag Cultan 97dt,Betr.90 dt/ha**

2006.06.08

# Open question: N demand and supply

- N supply is more than counting estimated amounts
- Soil sampling mineral N (Nmin) is not effective in results

# Excursus/Strejftog

## Nmin – bad science

- There is no evidence that mineral N samples show any correlation with plant uptake

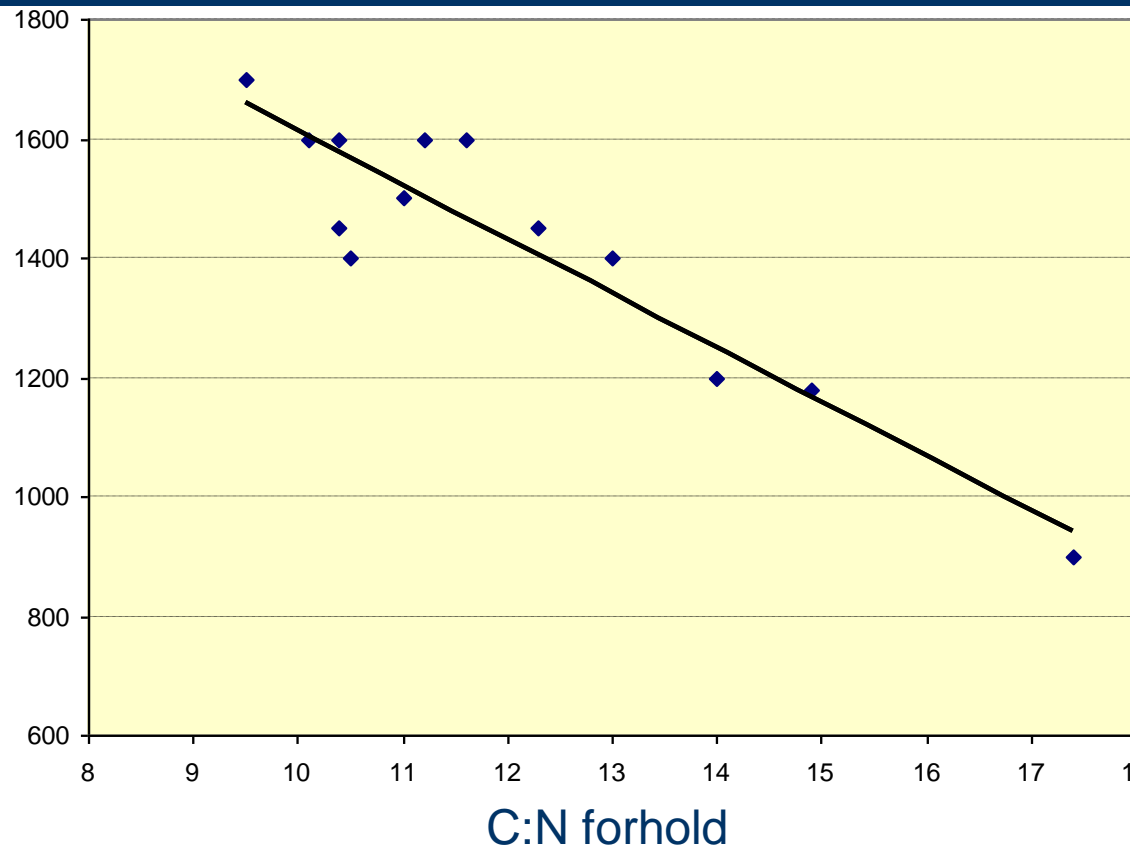
# Solution:

- Alternative to mineral N testing:  
Plant testing to reflect nutrient availability

# Plant analysis and soil fertility

Nitracheck (ppm NO<sub>3</sub><sup>-</sup>)

Plantesaft  
N, ppm



# N-Dynamics

are depending on time of fertilizer application

Temperature:	Humidity:
Warm	Dry
Cold	Wet



# Corresponding combinations and N supply (mineralisation)

Temperature: Humidity:	N
Warm and Dry	High accumulation
Cold and dry	Low accumulation
Warm and Wet	High release
Cold and Wet	Great losses after warm period

# Examples and conditions of plant testing

- 5 steps

# N-Management



# N-Management



# N-Management



# CULTAN and Mintill/ Notill

- To avoid exceeding application of organic or mineral N- fertilizer

# Sustainable N-supply in a Mintill or Notill system

- **Conventional nutrition**  
stem dominant:
  - Up to +40 kg N/ha extra
  - Increasing risk of lodging
  - Increasing disease level
- **Placement nutrition**  
root dominant:
  - Reduced N amounts down to -60 kg N/ha less
  - No Lodging
  - Less mildew

# Sustainable N-supply in a Mintill or Notill system

- **plant diseases depending from N supply :**
- **Septoria**
- **Mildew**
- **Lodging**
- **Plant health in a root dominant nutrition:**
  - Reduced N amounts down to -60 kg N/ha less
  - No Lodging
  - Less mildew or septoria



# From Mintill to CTF

- A CTF System points out the necessity of root establishment

# CTF a base and a framework

- Mintill allows to yet to know the previous crop
- CTF allows to consider all aspects of previous management

# The key to a reliable farming future - Zoning

- CTF
- CULTAN
- Banded and placed slurry
- Maize under Plastic

# Zoning

- Continues the development of agricultural infrastructure

# Zoning

- Excursus Project 20 -20 -20

Sugar beet improvement Germany 2010

20 % of the best farming operations

20% more sugar per hectare

Until 2020

# Zoning

- Our Project 50 - 5

50 % less nitrogen with given yield within the next 5 years

# How to start

- No mapping available:
  - Consider slopes, tops and feet for extra sampling

# Excursus/Streiftog

## Soil Analysis and Sampling

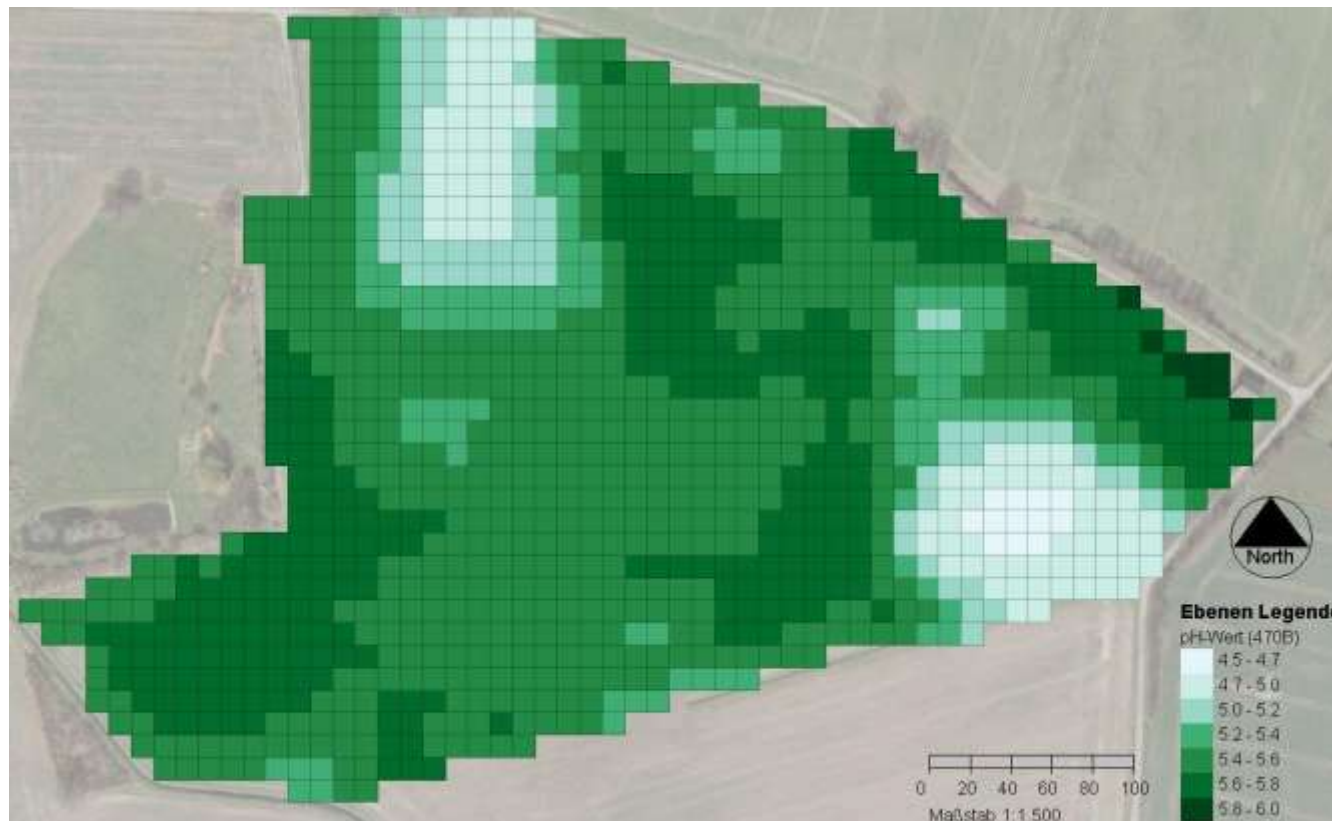
- Meet the right place
- Soil map for localizing significantly different parts of the field



# How to start

- Mapping does exist:
  - Consider GPS sampling

# Excursus/Streiftog Soil Sampling



# Excursus/ Strejftog Soil Sampling



- Bring the correct fertilizer to right place

# Excursus/Streiftog: Calibration

- N-Sensors promise

will only be kept with a reliable testing to calibrate the sensor

# Excursus/Streiftog: Sure N

- **NH<sub>4</sub><sup>+</sup> bredspredd:**
  - Forsuring af jord pga frigivelse af H<sup>+</sup>
- **CULTAN - NH<sub>4</sub><sup>+</sup> nedfældning:**
  - ingen forsuring da NH<sub>4</sub><sup>+</sup> optages af planter