

# Root phenotyping

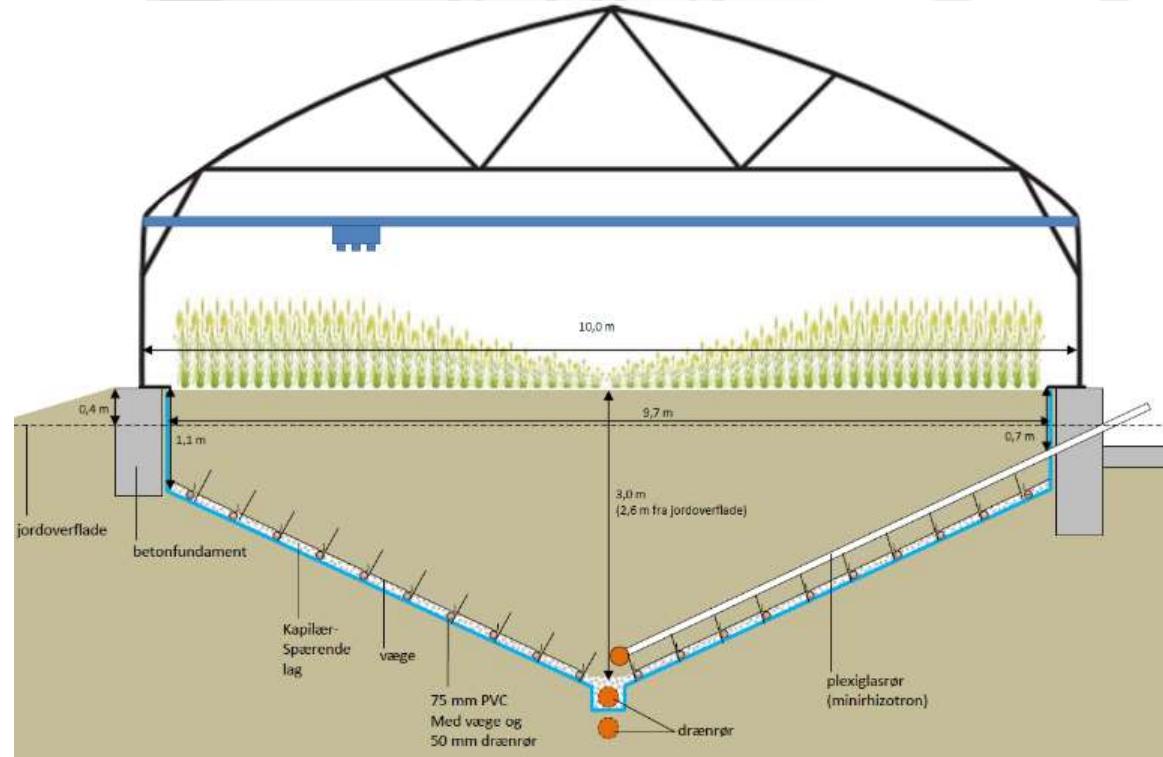
## Deep root growth and function

RadiMax

Kristian Thorup-Kristensen

Dept. Plant and  
Environmental Sciences

UNIVERSITY OF COPENHAGEN



# Deep roots – why?

- Water and nutrients applied to topsoil
- ...and often 90% of roots in top 0.1 to 0.4m
- **Sustainable intensification of crop production**
- Deeper roots – more soil volume exploited
- Stored soil water
- Nitrogen
- Different and more stable conditions
  - humidity, pH, redox, temperature

# RadiMax and other deep root facilities

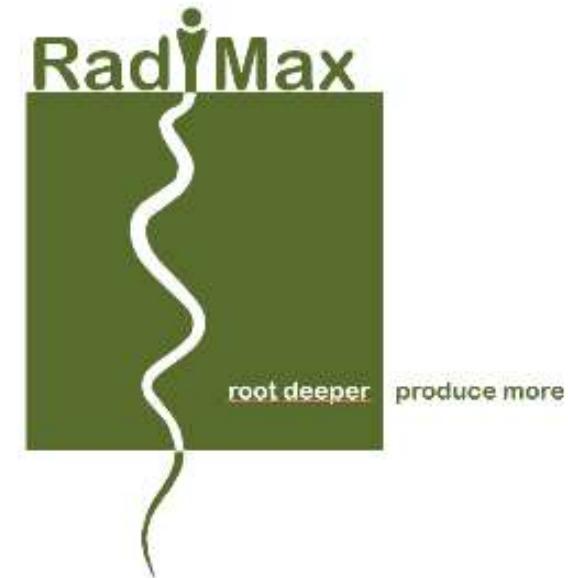
- Simultaneous study of root growth and function
- Size and scale for “real life” root growth and repeated experiments
- Test and develop methodology for deep root study
- Permanent access to deep soil
  - Observe roots
  - Measure resource use
  - Apply tracers
- Breeding – phenotyping of many lines

## Other deep facilities

### Root Towers and Field facility



# RadiMax facility for deep root phenotyping



*LKF Vandel*



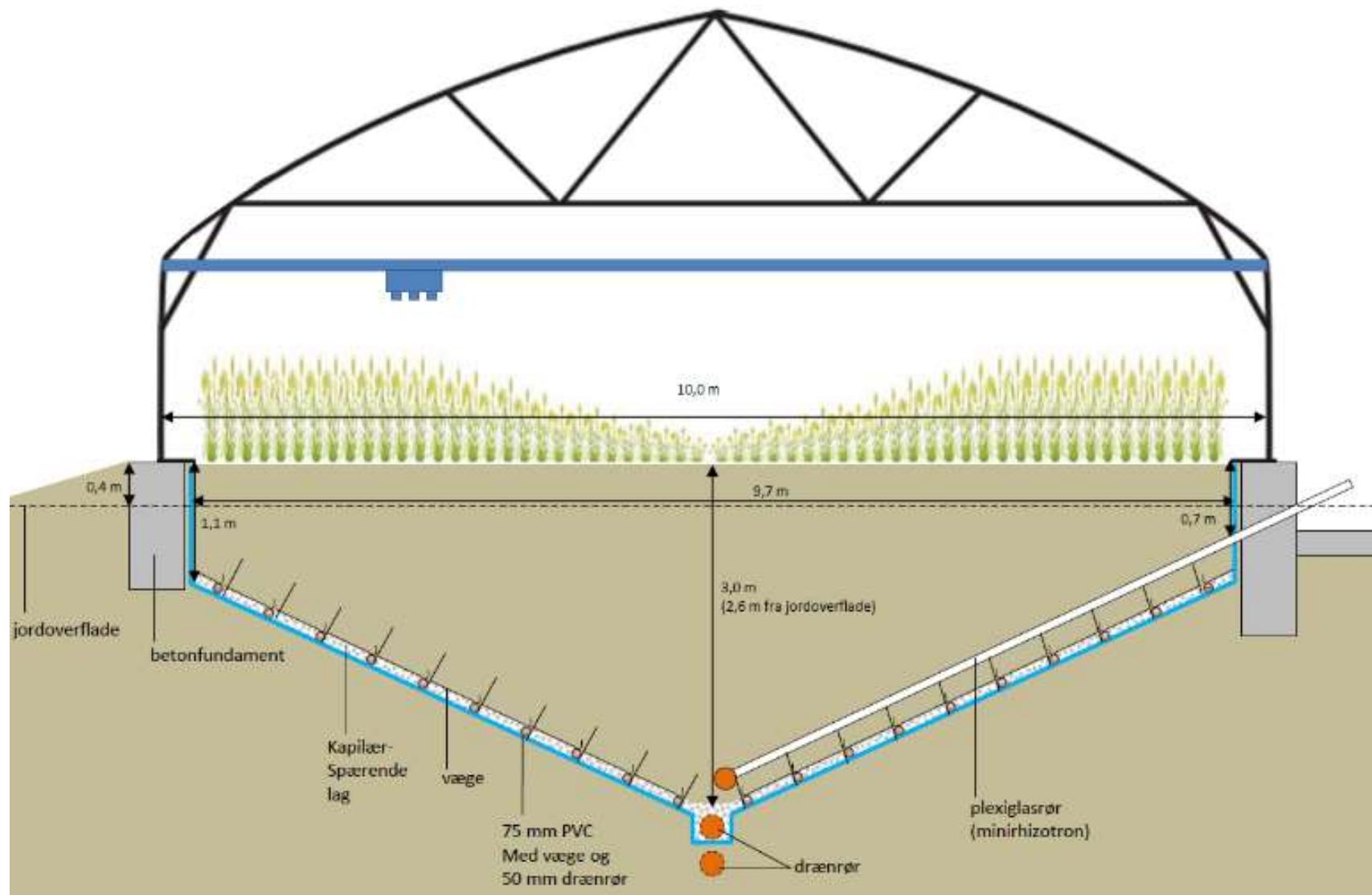
# Phenotyping for root growth and function

- Root growth, 600 minirhizotrons
  - 5m long
  - Reaching 2m or 3m depth
- Root function
  - Subsoil irrigation with depth gradient along rows
    - Aboveground growth, drought stress and thermal imaging
  - Injection of tracers
    - $^{15}\text{N}$  and  $^2\text{H}_2\text{O}$

# RadiMax construction

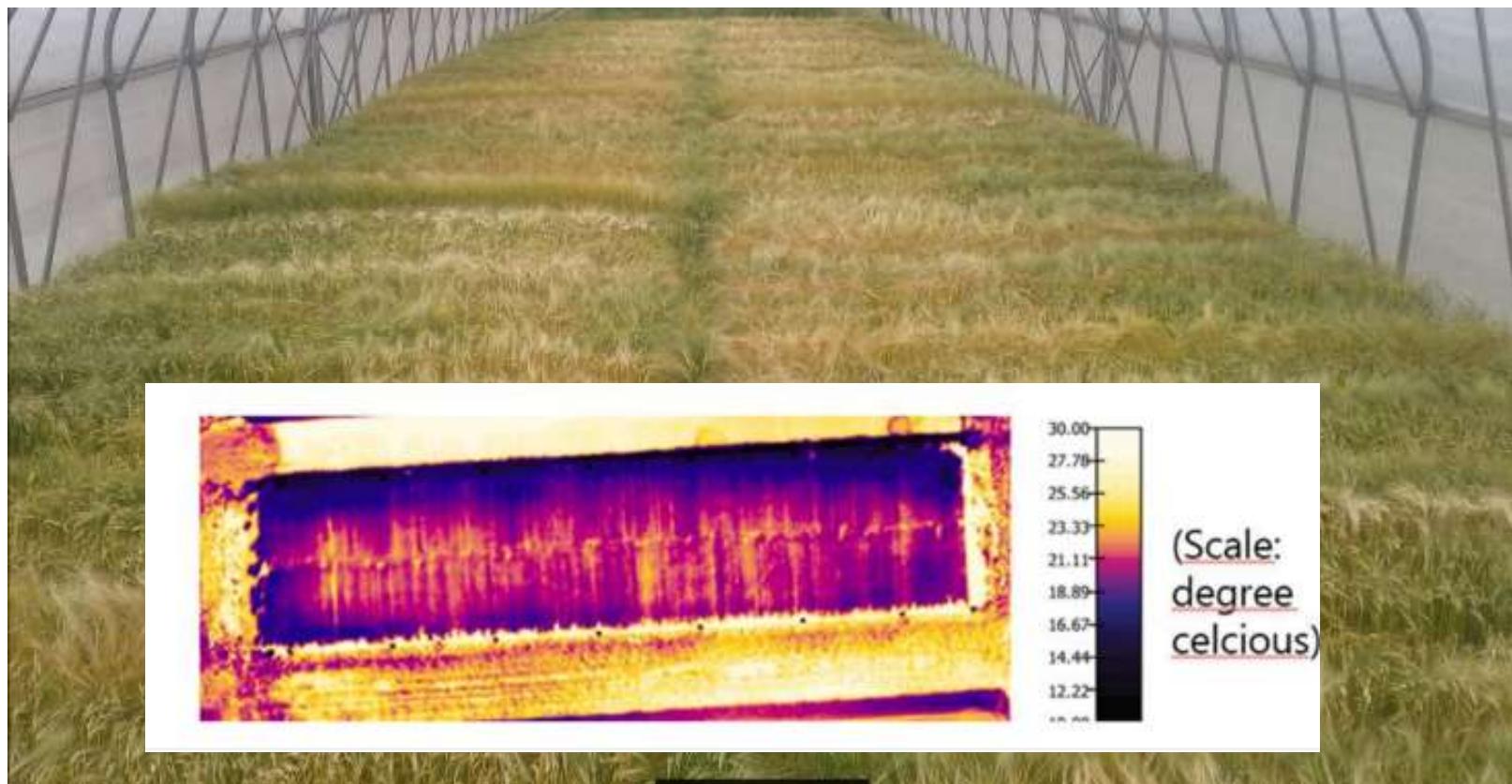


# Principles – minirhizotrons and water gradient



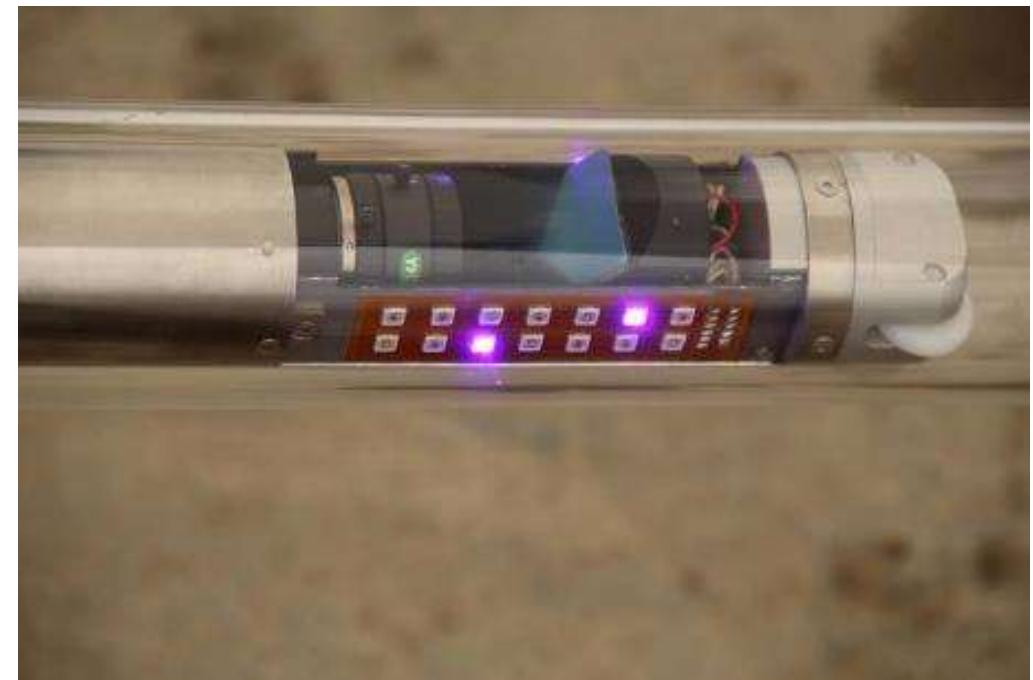
# Subsurface irrigation effect

- Clear visible effect

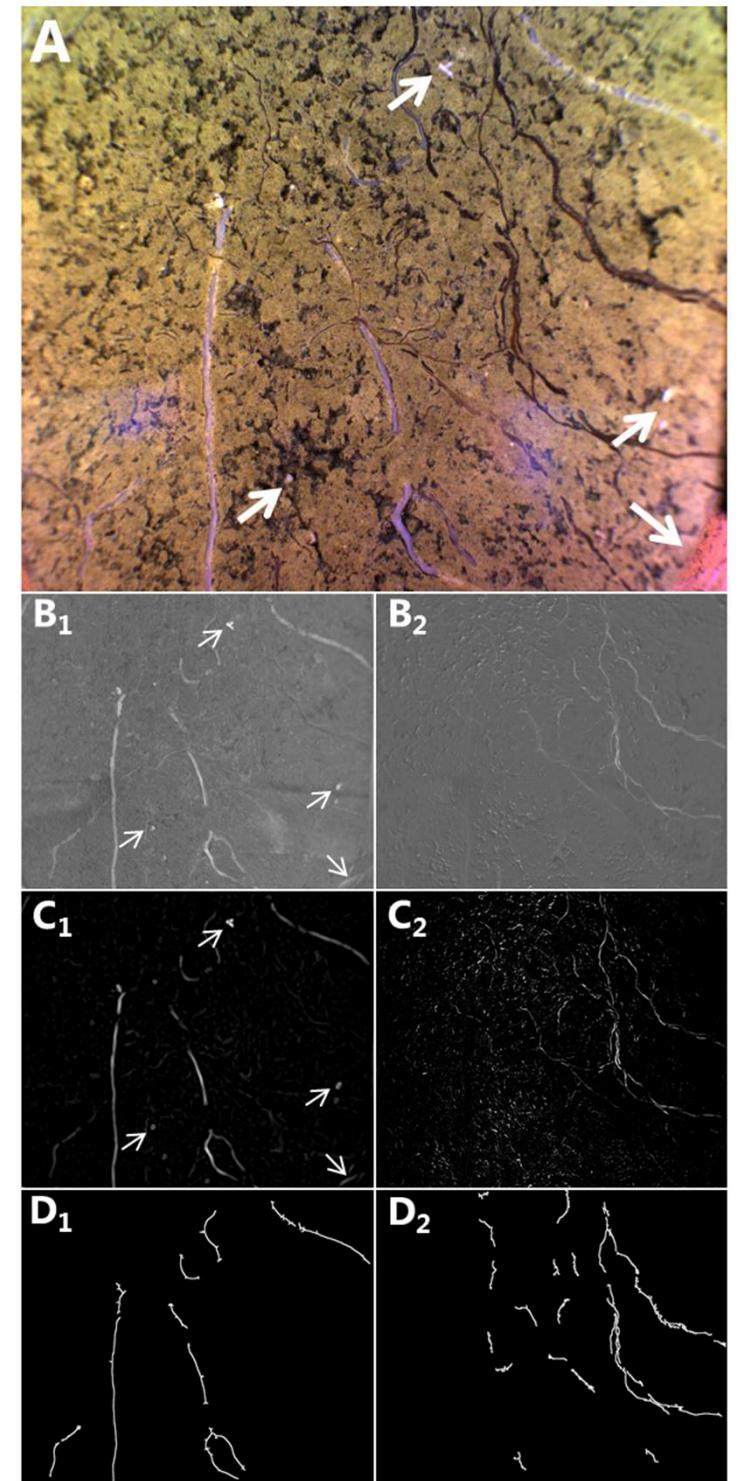


Images by: Jesper Svensgaard

# Multispectral camera system



# Image analysis for root quantification

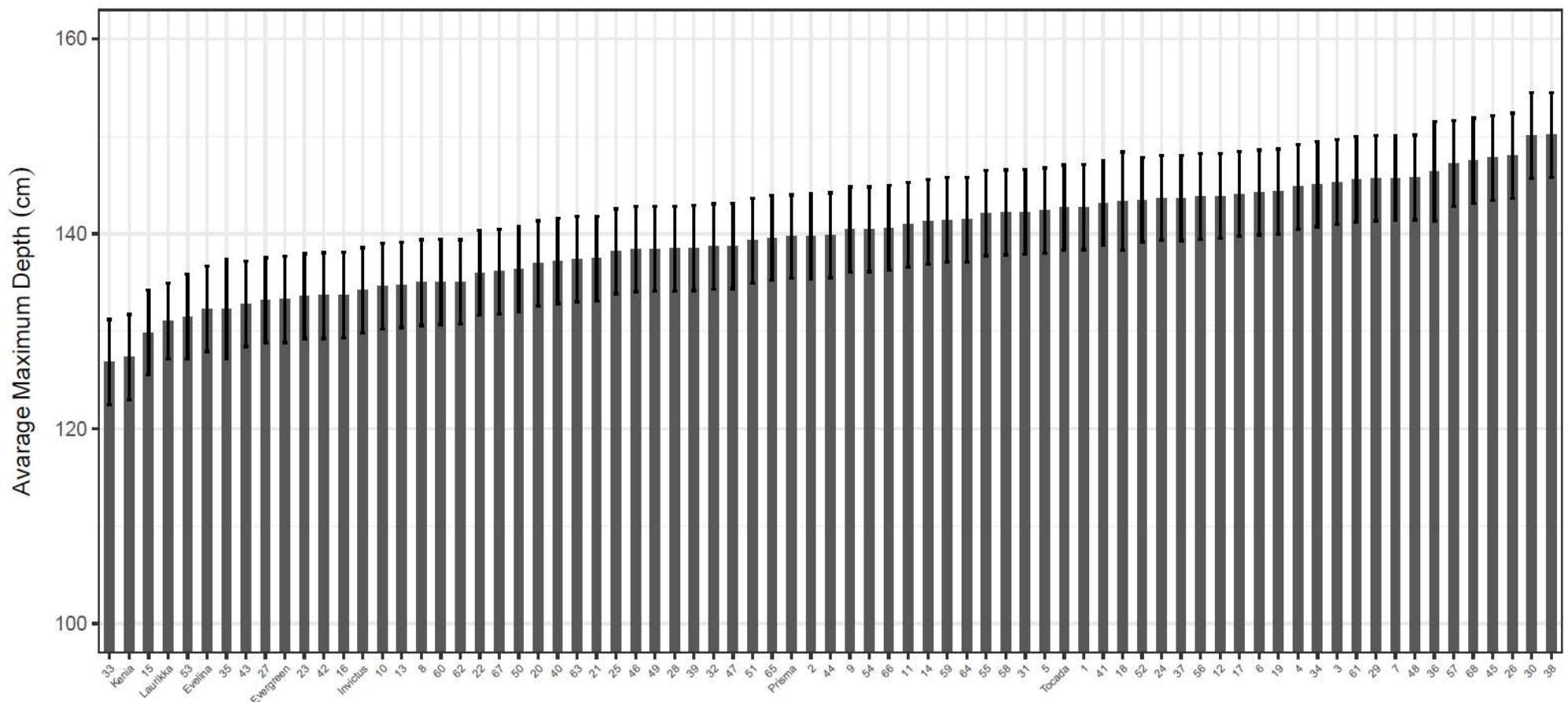


Simon Fiil Svane

# UCPH Spring Barley

all lines

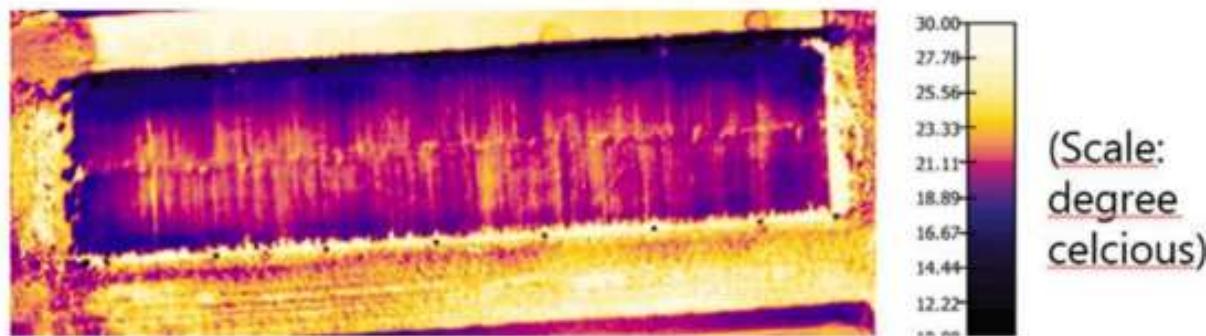
Barley Root Depth 2017



P=0.0025

# Direct and indirect measurements of deep roots

- Root observation in minirhizotrons
- Yield trends along drought gradient
- Drone imaging – thermal imaging
- Tracer uptake,  $^{15}\text{N}$  and  $^2\text{H}_2\text{O}$



# The KU RadiMax team

- Kristian Thorup-Kristensen
- Simon Fiil Svane
- Jesper Svensgaard
- Olga Popovic
- Tomke Susanne Wacker
- Niels Faircloth Olsen
- Si Chen
  
- Working closely with breeders, and especially:
  - Christian Sig Jensen DLF
- Projects on deep rooting
- Also follow:
- @Adeeplokbelowground

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