

Deep root workshop

Welcome and introduction

DeepFrontier project

KØBENHAVNS UNIVERSITET



Welcome to the workshop

DEEP ROOTED CROPS FOR FUTURE FOOD PRODUCTION

- Can we use subsoil resources and deep-rooted crops to produce more food in a sustainable way?
- To provide inputs to an international research agenda for research in deep rooting and deep rooted crops (2-5 meters depth)
- To facilitate collaboration between deep root researchers and research environments
- To discuss, learn and get inspired for deep root research

Organizing group: DeepFrontier PIs – and Lise!



Dorte Dresbøll
Univ. Copenhagen

Root growth and
function
Root methods



Mette Nicolaisen
Univ. Copenhagen

Root microbiology



Jørgen Olesen
Aarhus Univ.

Roots and soil
C



Niels Halberg
Aarhus
Univ./ICROFS

Project
management



Lise Andreasen
Aarhus
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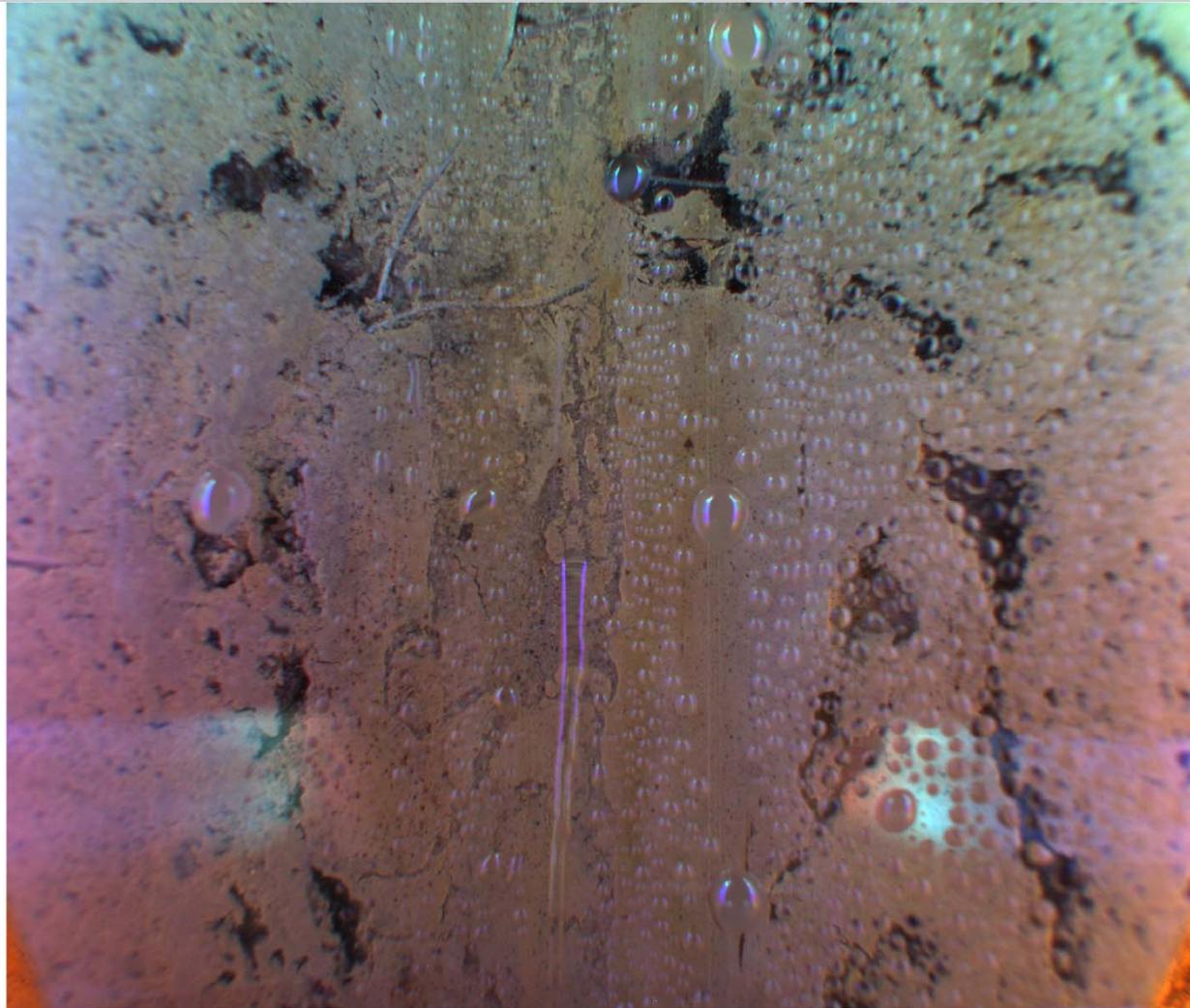
Organizing!!

What do we mean by “deep rooting”? - definitions?

- In the DeepFrontier project
 - Roots below 2 meters
 - Study of roots between 2 and 5 meters
- More generally?
 - Typical definition: Roots below 1 m
- In our work more broadly: **Increases of deep rooting of crops**
 - Whether from 2 to 3 meters or from 80 cm to 100 cm
 - The view behind this workshop – any increase in deep rooting may be of value



Root image from 4m depth



About the workshop

- Workshop organized by DeepFrontier project, but broader scope
- Giving you short time to present – we hope for discussions
 - 20 minutes keynote
 - 4*5 minutes pitch deck presentation
 - Then discussions
- Very different disciplines, - all on roots, and deeper rooting
- Maybe paper on research agenda from this workshop?
 - Discuss Tuesday
- Small and dedicated workshops, hopefully great discussions

DeepFrontier project – focus on deep rooting

- There is a continuous need to increase crop and food production
- And to limit the use of land and resource inputs for doing so
- Where can we find the resources for this?

- Beneath the root zone on every hectare where we grow crops
 - Further resources of water and nutrients exist
 - The amounts, and the chance to reach them will vary widely
 - Common annual crops are limited in rooting depth
 - So, clearly on many soils, substantial opportunities!

- So we want to “Challenge the depth frontier of crop root systems”

The DeepFrontier project

- Developing facilities
- Developing methods
- Plant species and cropping systems
- Deep resource use
- Interactions with soil microbiology
- Roots and deep C deposition



Inspiration from previous research

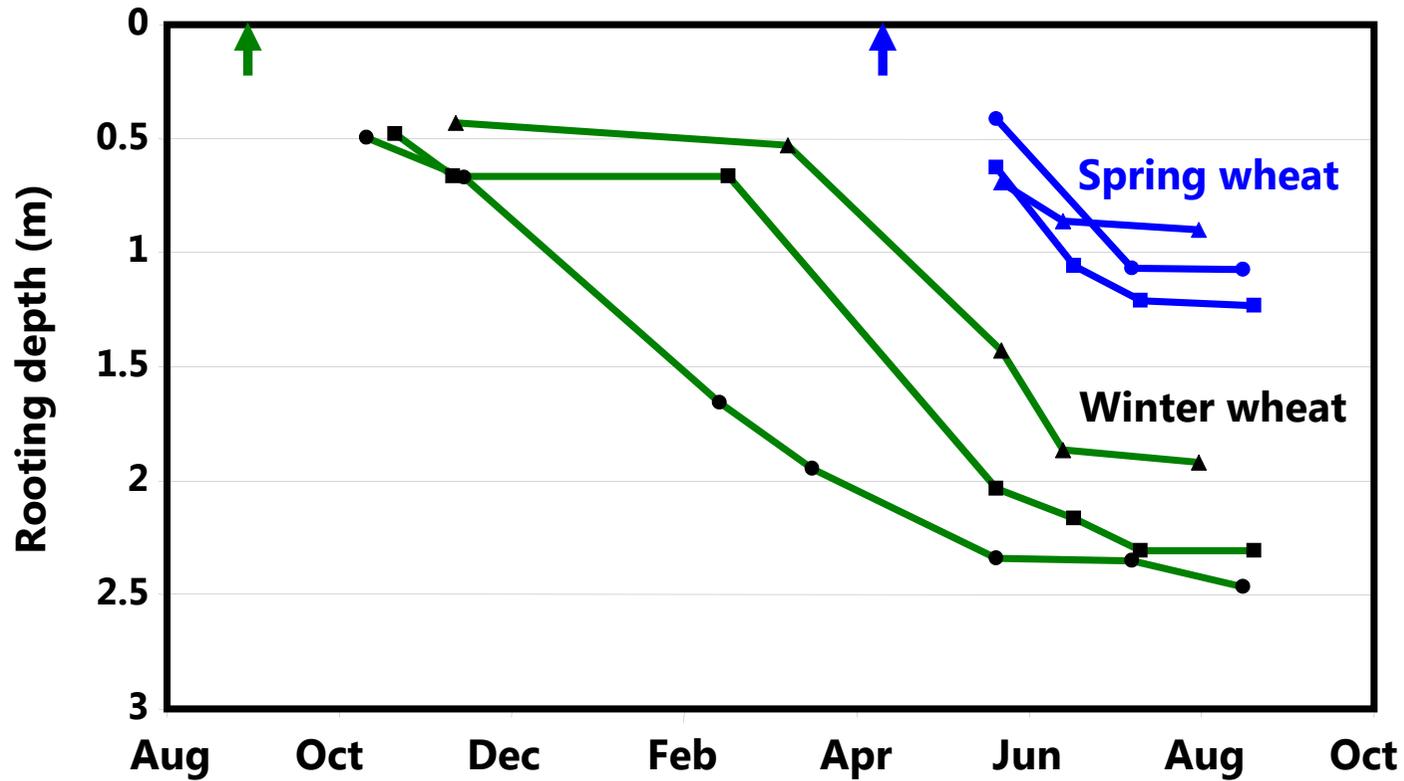
- Started by working on cover crop for reducing nitrate leaching
 - Including root studies
- Already first study showed that:
 - Root depth development of common cover crop species differed dramatically
 - One species reached 1m depth in less than 6 weeks
 - Root development mattered, affected deep soil nitrate (75-100 cm)
- Conclusions
 - Root development could be “deep”
 - Root depth development vary strongly among species
 - Differences mattered for nitrate

Inspiration from previous research

- Developed root studies
 - To reach 2.5 m
 - To study roots and nitrogen in cover crops, main crops and crop rotations
- Root study to 2.5 m
 - Deeper than max rooting depth of most annual crops, - but not all!
 - N uptake and large effects on soil nitrate to 2.5 m
 - Important for increasing NUE of crops and cropping systems

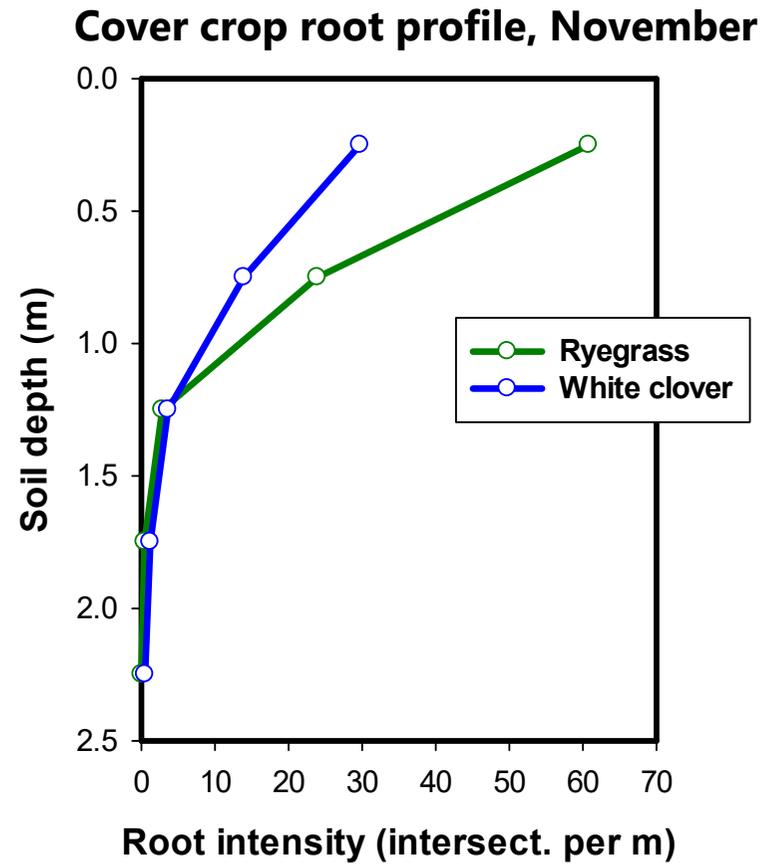
Rooting depth of winter and spring wheat

- same root growth rate, but more time



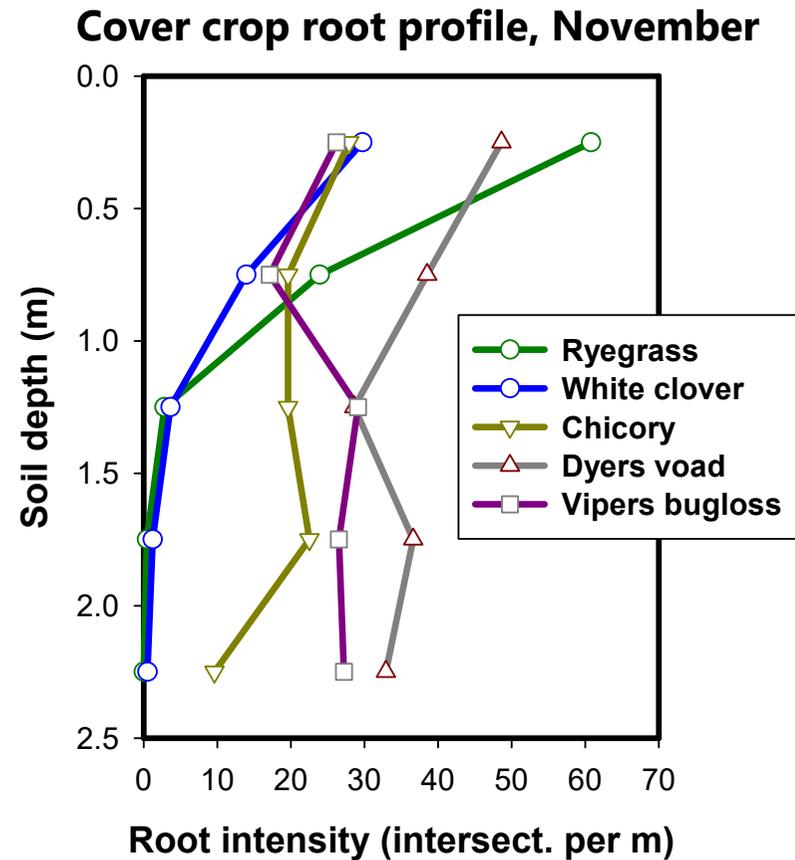
Exploiting biodiversity:

- new species as cover crops



Exploiting biodiversity:

- new species as cover crops



Inspiration from previous research

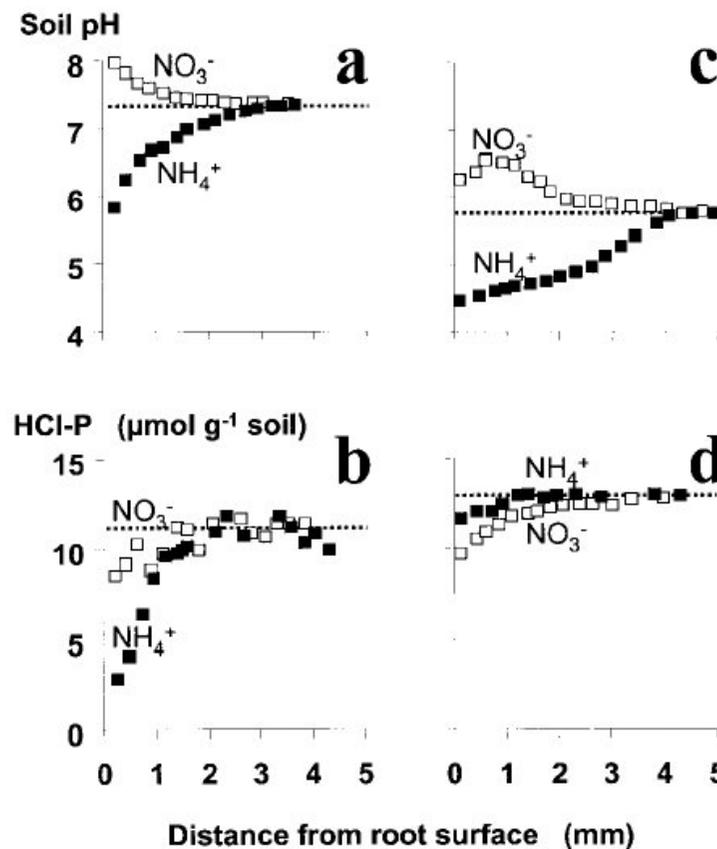
- Developed root studies
 - To reach 2.5 m
 - To study cover crops, main crops and crop rotations
- Root study to 2.5 m
 - Beneath the rooting depth of most annual crops, - but not all!
 - N uptake and large effects on soil nitrate to 2.5 m
 - Important to increase NUE of crops and cropping systems
- Must be possible to take this further - deeper
 - Other crops and cropping systems
 - Other resources and root effects than N
 - But challenging and expensive to do deep root studies

Inspiration from many others

- DeepFrontier international advisory board
- Phillipe Hinsinger
- Timothy Crews
- John Kirkegaard
- Alain Pierret

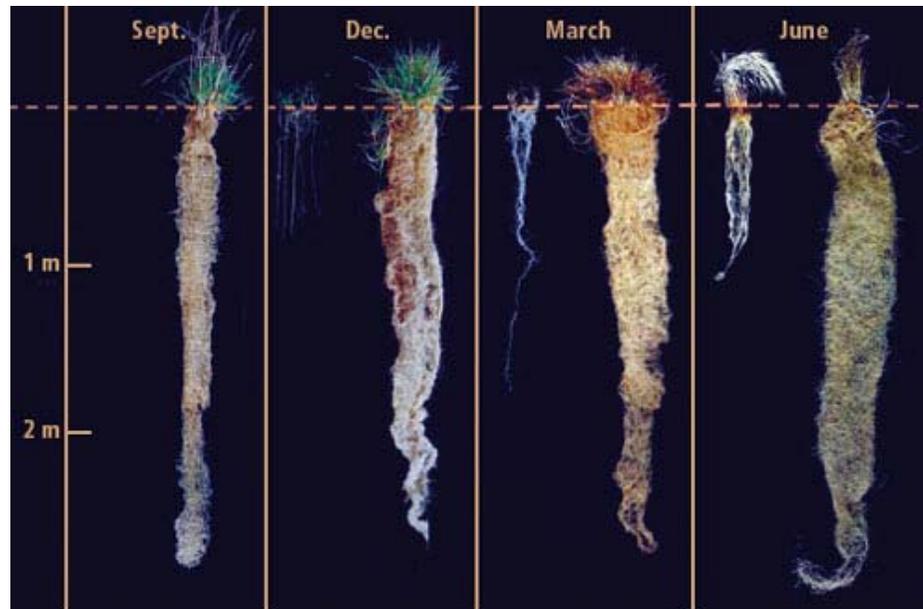
Philippe Hinsinger, Eco&Sols, Montpellier, France

- Deep root rhizosphere
- Interactions with soil minerals
- Mineral weathering
- Rhizosphere biology



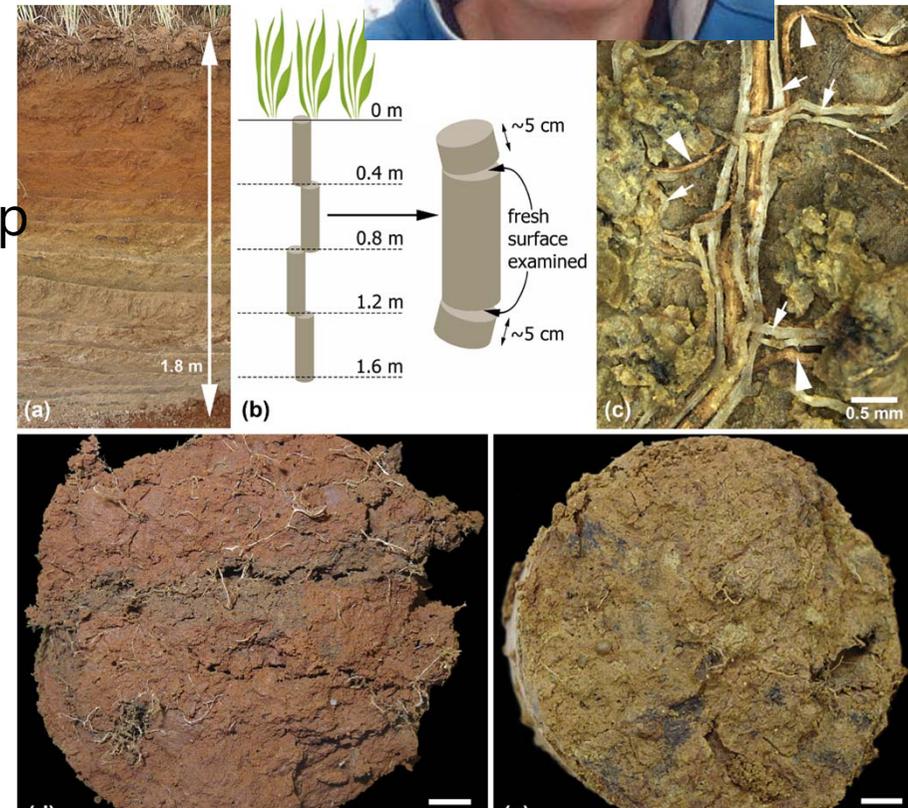
Tim Crews, Land Institute, Kansas, USA

- Perennial crops for deeper rooting
- System disruption



John Kirkegaard, CSIRO, Australia

- Deep roots and water use
- Can we increase crop water use in dry areas by deep rooting?
- Agronomist
- Translate deep root research directly for crop production



Alain Pierret, UMPC, Viangchan, Laos

- Very deep rooting
- Methods for deep root study
- Deep root system effects

