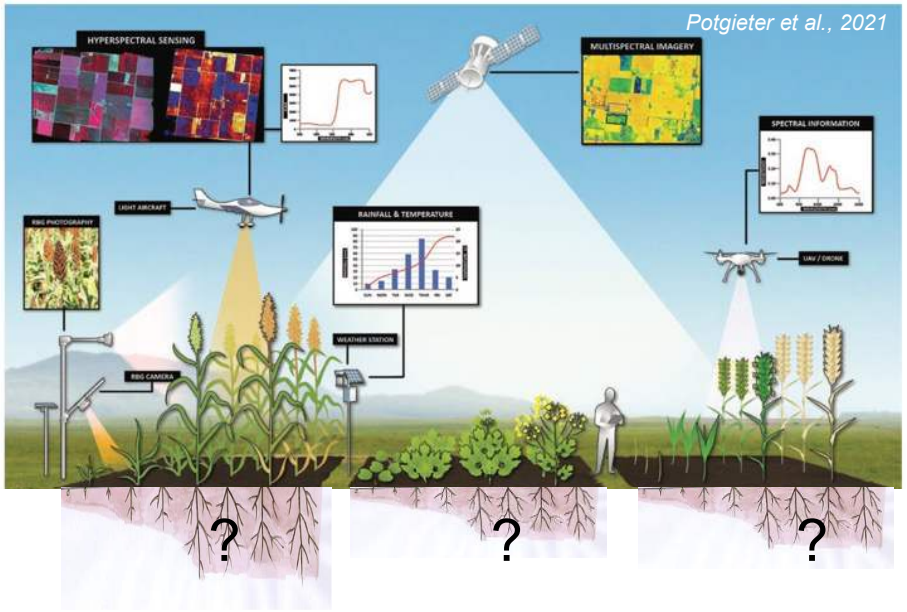
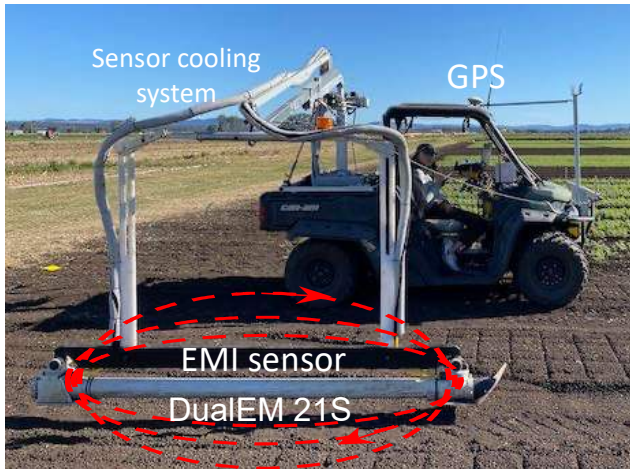
Overcoming the root phenotyping bottleneck in cereals: Opportunities for breeding and agronomy

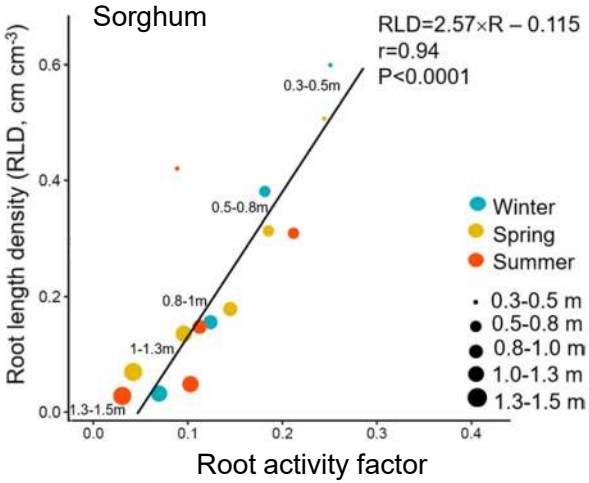
Sensing for breeding & agronomy

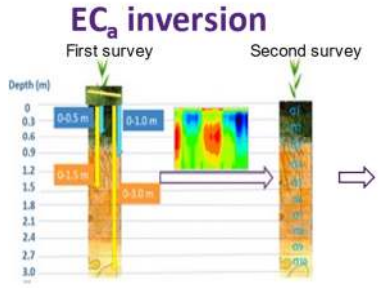


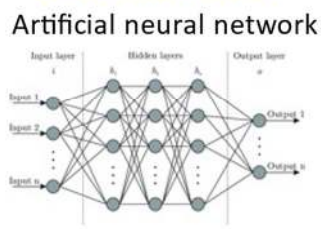
- How does the root system influence yield and yield quality?
- Do all cultivars have the same type of root system?
- Does the root system of different cultivars respond the same to drought?
- How can agronomic practice modify the growth and function of the root system?

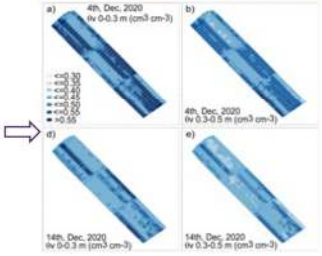
Functional root phenotyping

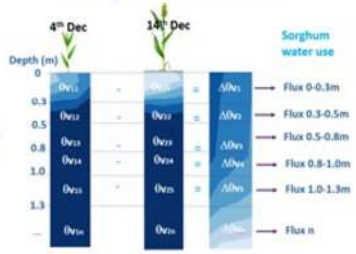




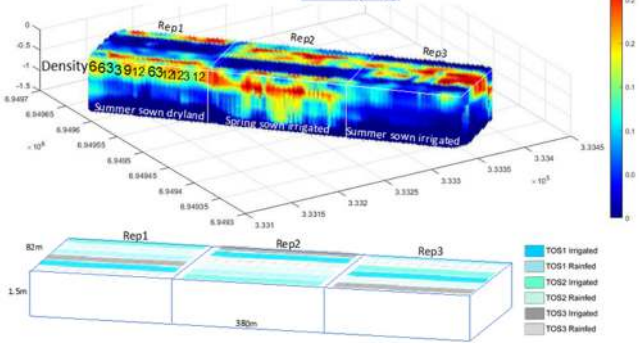








$$Root\ activity\ factor_i = \frac{Water\ use_i}{PAW_{(t1,i)} \times Crop\ demand}$$



High throughput functional phenotyping of rooting systems in the field

Computers and Electronics in Agriculture 202 (2022) 107409

Contents lists available at ScienceDirect

Computers and Electronics in Agriculture

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Original papers

3D characterization of crop water use and the rooting system in field agronomic research

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Plant Soil
https://doi.org/10.1007/s11104-024-06648-0

RESEARCH ARTICLE

Sowing summer grain crops early in late winter or spring: effects on root growth, water use, and yield

Dongxue Zhao · Peter deVoil · Bethany G. Rognoni · Erin Wilkus · Joseph X. Eyre · Ian Broad · Daniel Rodriguez

Root phenotypic plasticity: agronomic, breeding and modelling implications

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Victor Sadras
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Root structure and function traits: Overcoming the root phenotyping bottleneck in cereals (UOQ2312-009RTX)

Daniel Rodriguez
Raul Gimenez
Dongxue Zhao
Lee Hickey
David Jordan
Alison Kelly

Karine Chenu
Vijaya Singh
Emma Mace
Peter de Voil
Andries Potgieter

Anton Wasson, CSIRO
Hammad Khan, DPIRD
Bob French, DPIRD
Hannah Schneider, IPK, Germany

Expected products:

- *Accurate, fast and cost effective high-throughput phenotyping tools for impactful root traits that affect yield, and yield stability.*
- *Genetic diversity of impactful root traits on elite and non-elite panels in sorghum, and a nested-association mapping populations in wheat quantified.*
- *The value of selecting for root traits across TPEs in wheat and sorghum quantified.*
- *Root growth and function algorithms in APSIM wheat and sorghum revised.*

Take home messages

A new method for high throughput functional phenotyping of rooting systems shows opportunity to design rooting systems to fit site and seasonal conditions.

Narrower nodal root angles at 6 leaves will produce deeper rooting system at maturity, more stay green and higher yields in dry conditions.

Different hybrids have different capacity to grow roots deeper and stabilise yield when the season turns dry.

Hybrids able to stabilise yields in drier conditions might not be the best yielding hybrids in the best seasons.

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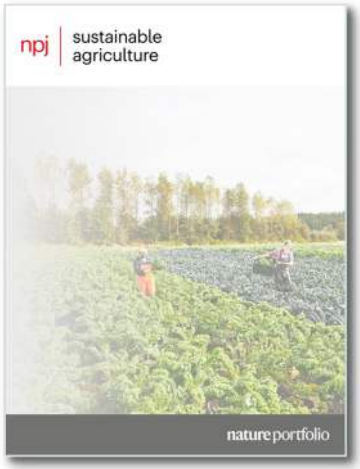
Scope: a global reference in the transition of agricultural systems towards more productive, environmentally sustainable and equitable agri-food systems.



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- Sustainable agriculture from an environmental and ecological perspective (Planetary boundary)
- Sustainable agriculture from a policy and socio-economic perspective (Interventions)
- Sustainability transitions in agricultural and food systems

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