Phenotypic analysis of abiotic stress tolerance in Australian oat

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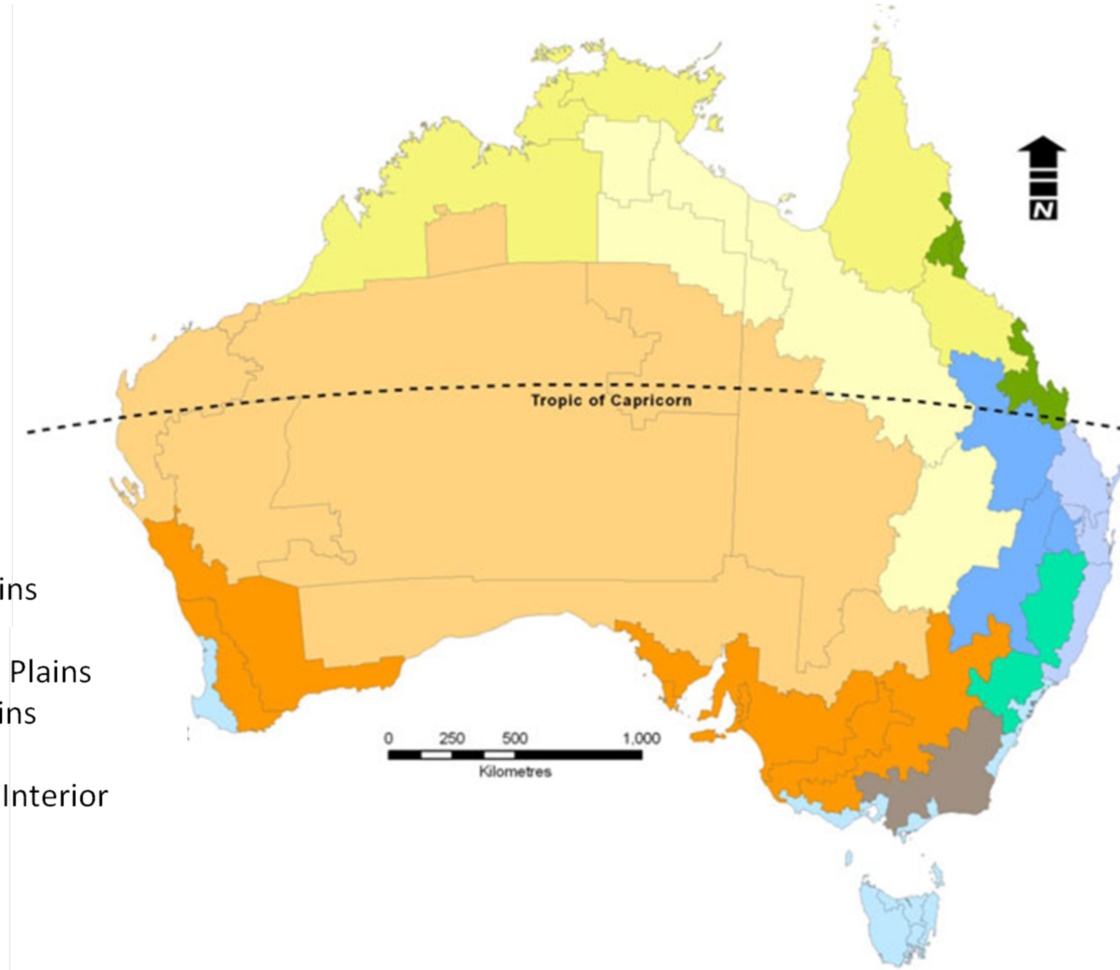
Agro-Ecological Regions of Australia

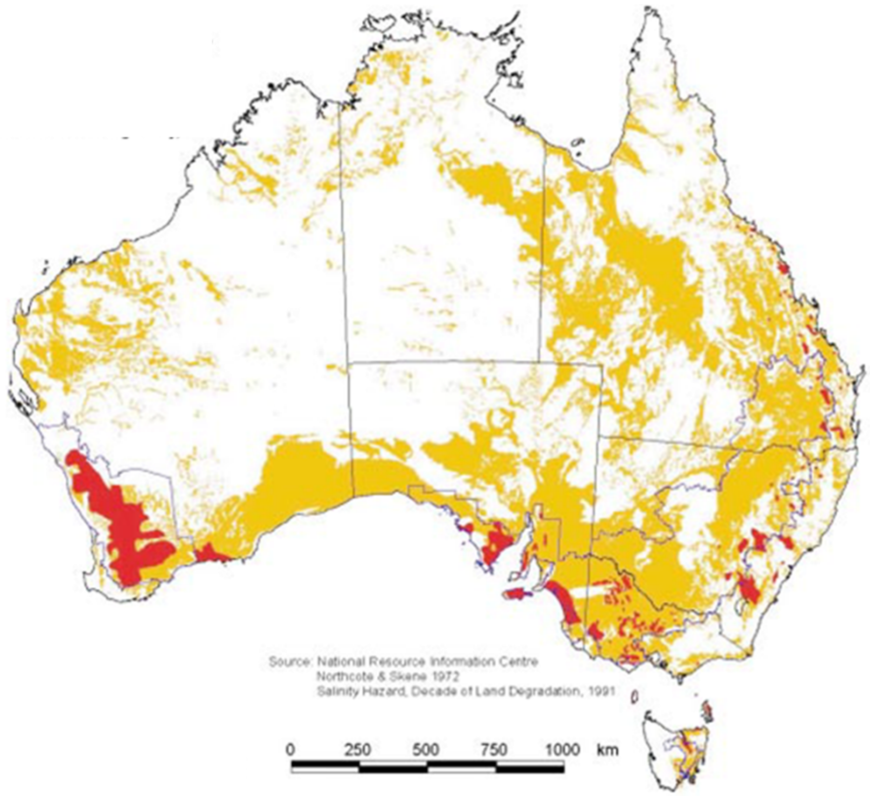
Agro-ecological Regions

- 1. Wet Temperate Coast
- 2. Wet Subtropical Coast
- 3. Wet Tropical Coast and Tableland
- 4., 9. Wet/Dry Tropics
- 5. Subhumid Subtropical Slopes and Plains
- 6. Subtropical Highlands
- 7. Temperate Seasonally Dry Slopes and Plains
- 8. Semiarid Tropical and Subtropical Plains
- 10. Wet Temperate Highlands
- 11. Temperate Semiarid Plains and Arid Interior



Agro-Ecological Regions of Australia – Methodology for their derivation and key issues in resource management.
CSIRO: John Williams, Rosemary Hook, and Ann Hamblin (Feb 2002).

Potential Transient Salinity and Subsoil Constraints

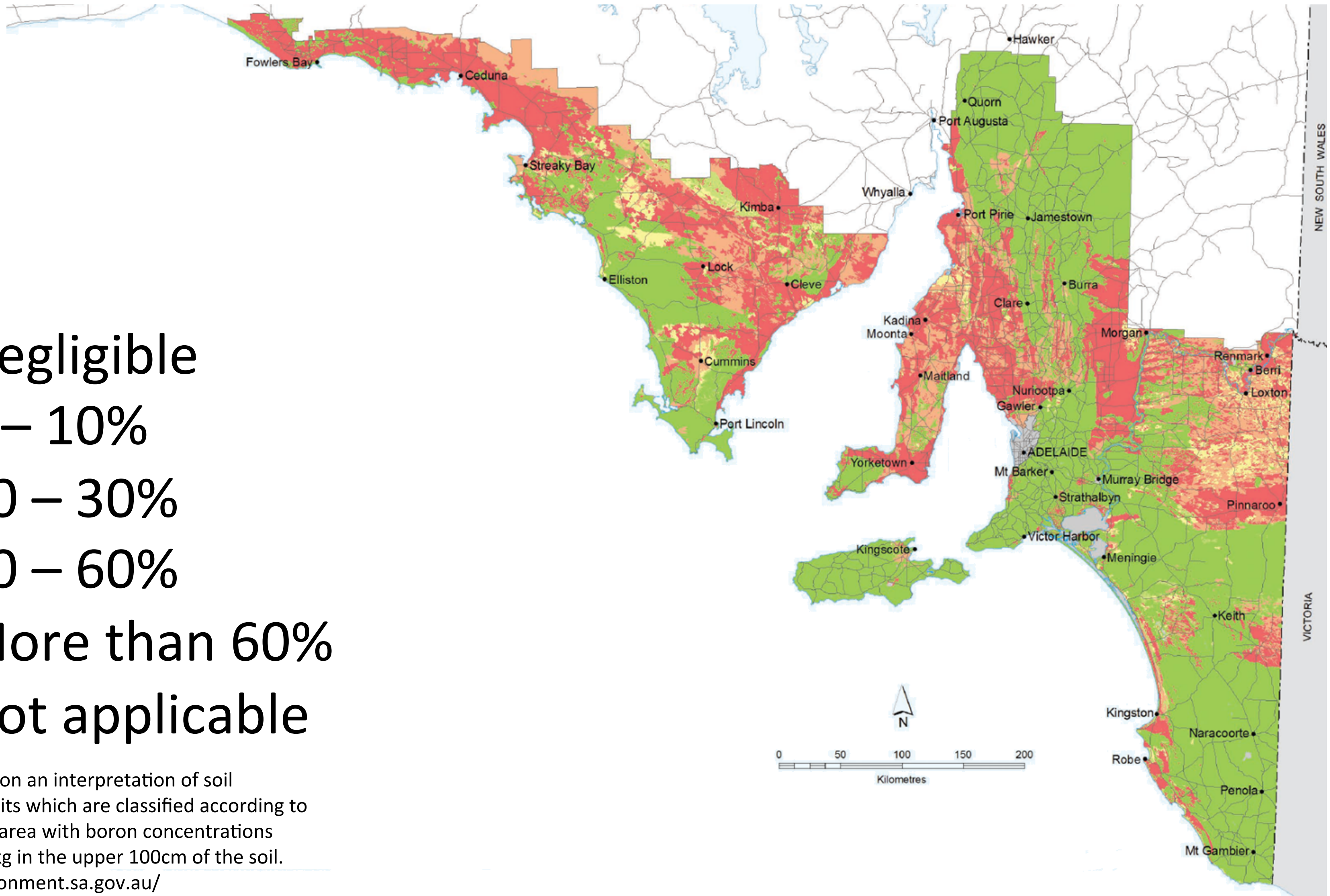


Dryland areas that have or are likely to have between about 1% and 10% of land affected by seepage salting

Areas where there is a a potential for transient salinity and subsoil constraints such as sodicity, alkalinity and toxicity due to aluminium, boron, carbonate and bicarbonate

Rengasamy, P. (2002). "Transient salinity and subsoil constraints to dryland farming in Australian sodic soils: an overview." Australian Journal of Experimental Agriculture 42(3): 351-361.

Proportion of Land in Southern South Australia with Toxic Boron Levels in the Upper 100cm of Soil



- Negligible
- 1 – 10%
- 10 – 30%
- 30 – 60%
- More than 60%
- Not applicable

Classes are based on an interpretation of soil landscape map units which are classified according to the proportion of area with boron concentrations exceeding 15mg/kg in the upper 100cm of the soil.
http://www.environment.sa.gov.au/

Impact of Salinity and Boron Toxicity

An analysis has been made of yield in 52 wheat varieties from 233 field trials over 12 years performed in Australia to quantify the importance of subsoil constraints such as Boron and salinity to yield in wheat (McDonald *et al*. 2012). The authors stated that,

"In WA, SA and Victoria, the traits with the greatest influence on yield were B toxicity (14–16% yield improvement) and soil salinity (based on Na+ exclusion data; 13–17% yield improvement)".

Na^+ and Cl^- Ion Content in Barley and Wheat under Salinity Stress

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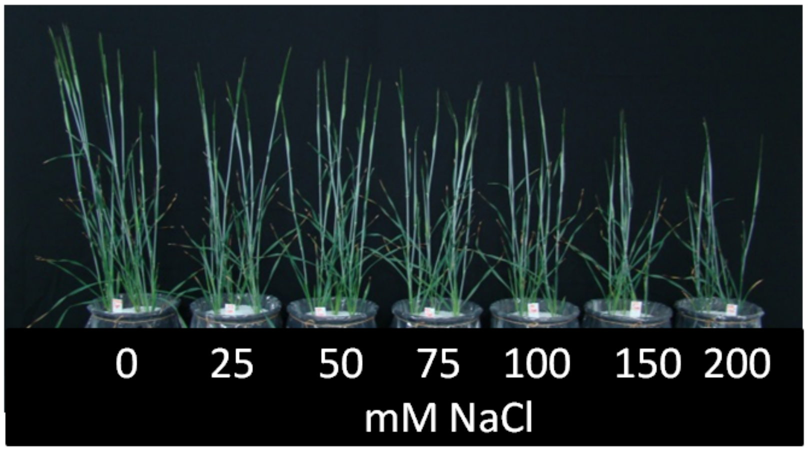
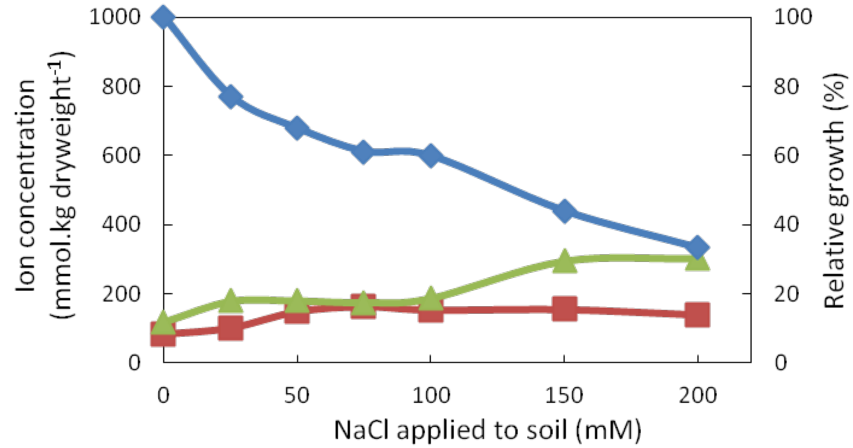
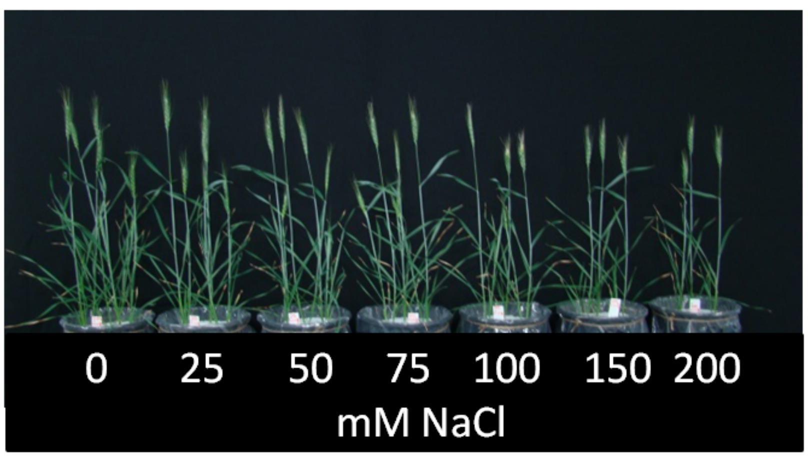
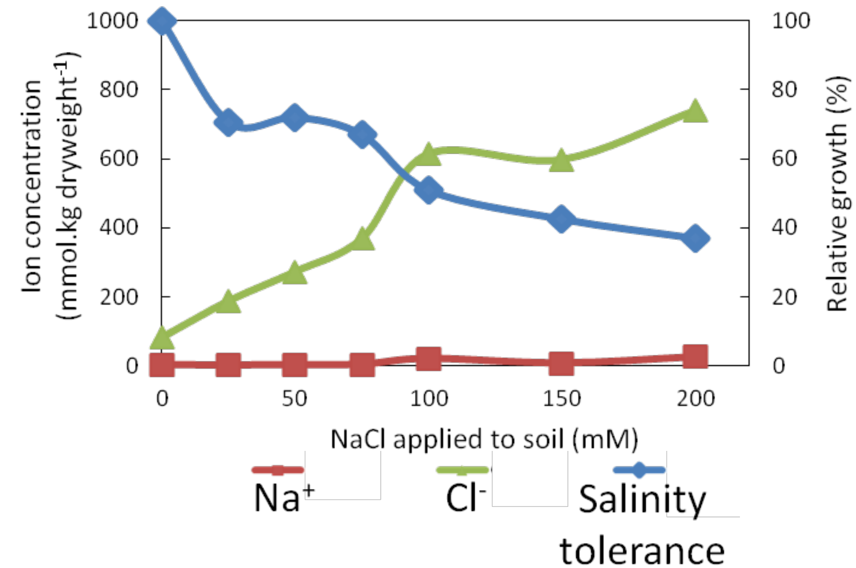
Barley



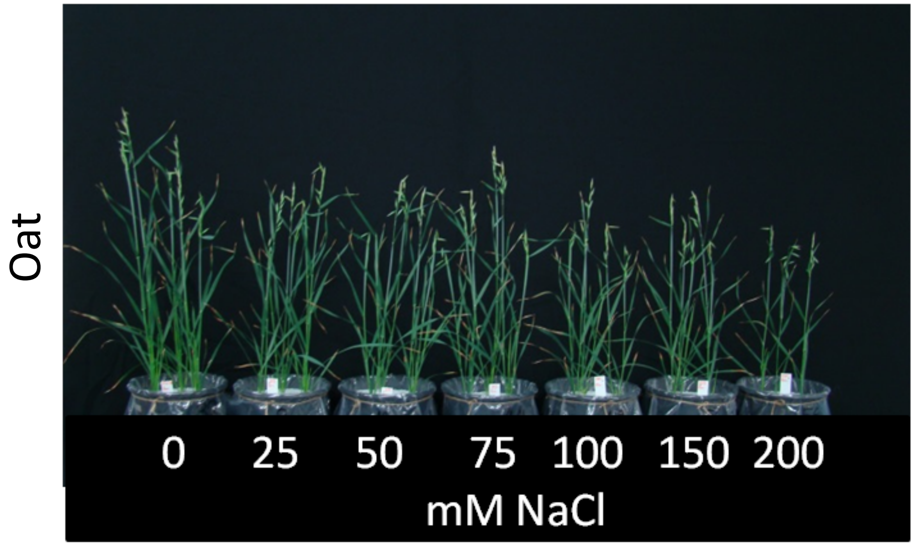


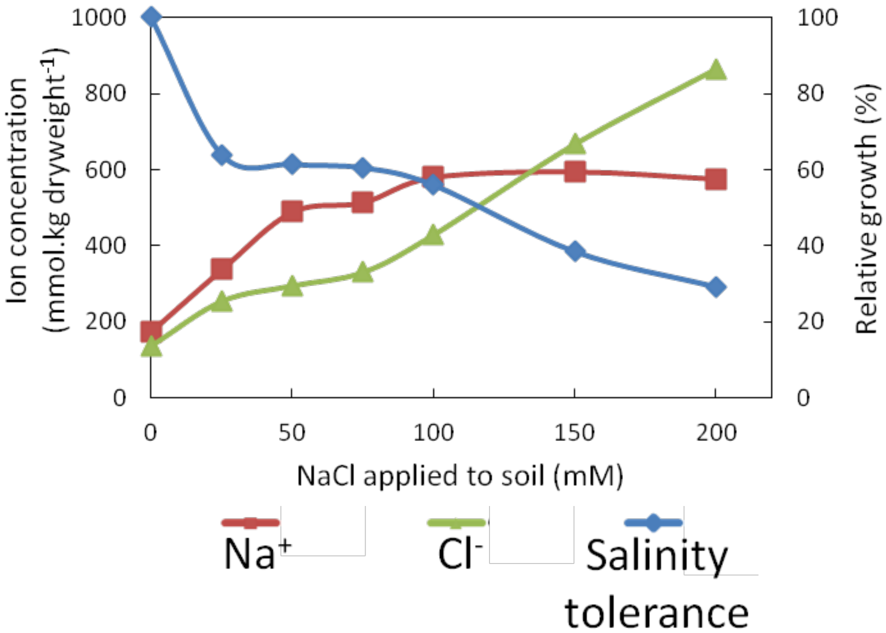
Wheat





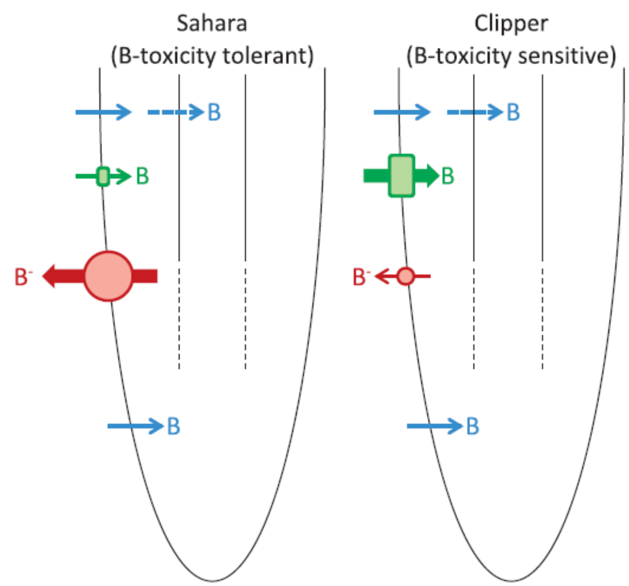
The Effect of Increasing Levels of Salinity Stress on Oat





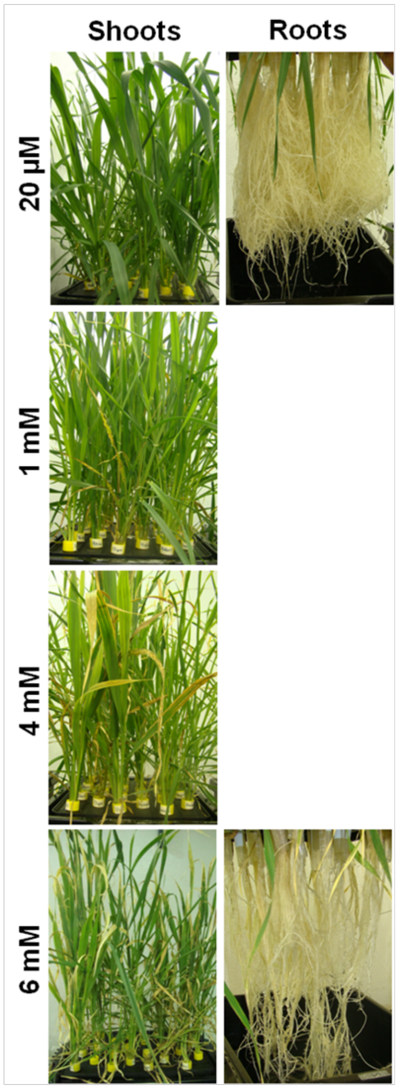
Improvement in oat may be achieved through selection for Na^+ and Cl^- ion exclusion

Benchmarking Boron

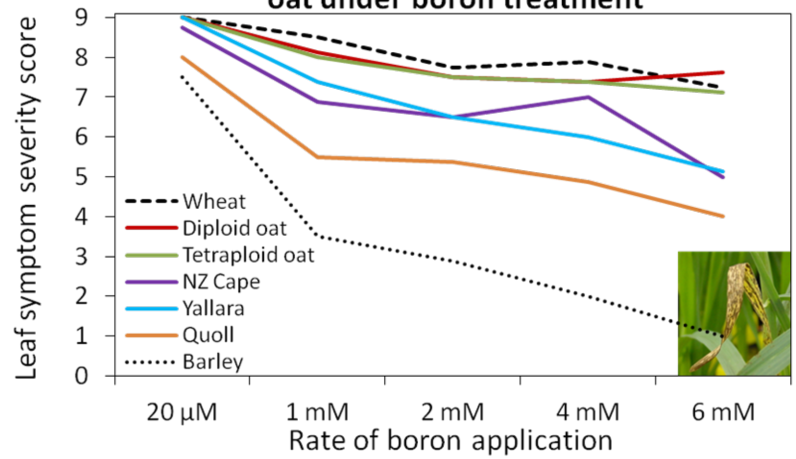


Schnurbusch, T., J. Hayes, et al. (2010). "Boron toxicity tolerance in wheat and barley: Australian perspectives." Breeding Science 60(4): 297-304.

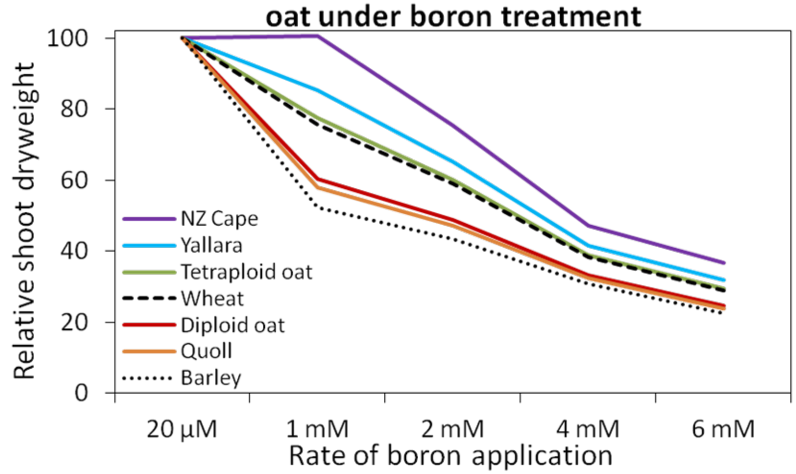
Effect of Increasing Boron Concentrations



Leaf symptom severity in barley, wheat, and oat under boron treatment



Biomass accumulation in barley, wheat, and oat under boron treatment



Future work

•We have found that there is genetic diversity for Na+, Cl-, and boron exclusion

•Further assessment of a wider range of germplam is needed to identify material with Na^+, Cl^-, and boron exclusion mechanisms

Improved Resistance to Oat Pathogens and Abiotic Stress Management

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- Leaf and stem rusts
- Cereal cyst nematode
- Septoria
- Red leather leaf disease
- Drought tolerance

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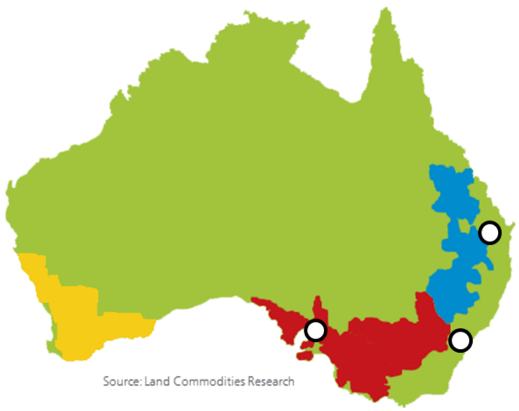
Improved Resistance to Oat Pathogens and Abiotic Stress Management



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Thank You

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