Understanding physiological responses to dry conditions: Preparing for drought

Paul Petrie
Tim Pitt
Dane Thomas

Australian Almonds R&D Forum 21 to 22 October 2025

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Department of Primary Industries and Regions

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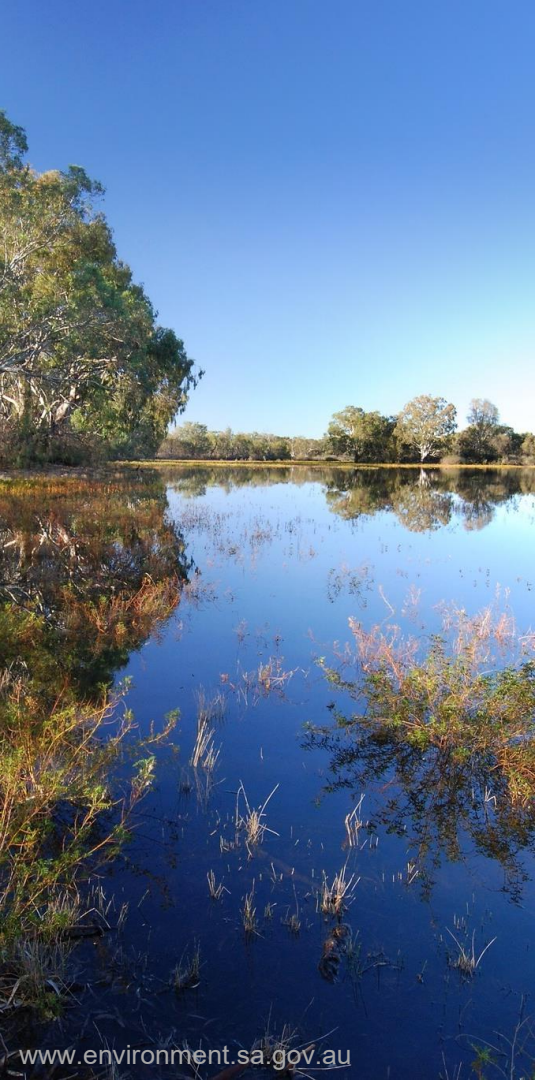

Overview

- Drought in an irrigated crop
- Climate change impacts on irrigation
- Response to reduced irrigation
- Transient water stress
- Canopy size and productivity improvement

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Water supply & demand

60,000 ha of almonds in the Murray Darling Basin

14 ML/ha (1400 mm) irrigation in a mature orchard

>10% of available MDB irrigation water in a full allocation season, more during low water seasons

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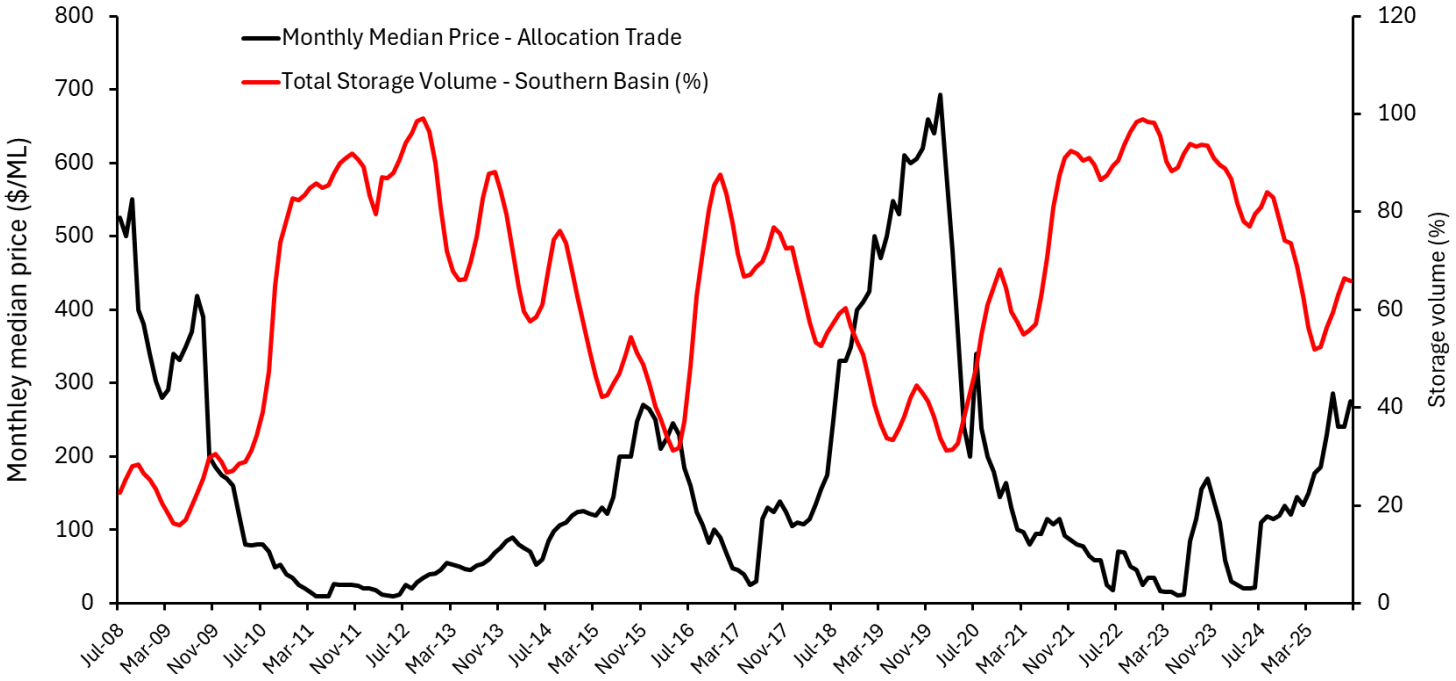
Water market



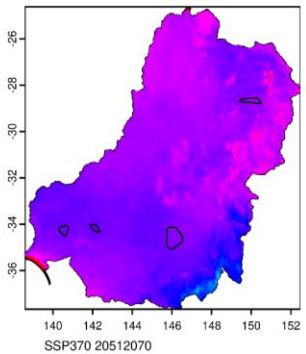
Median allocation price and storage volume southern MDB

https://mdbwip.bom.gov.au/southern-basin/
https://www.bom.gov.au/water/dashboards/#/water-markets/mdb/at

Climate change - ETo

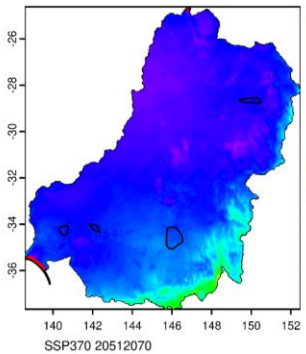
2051-2070

Ensemble Minimum



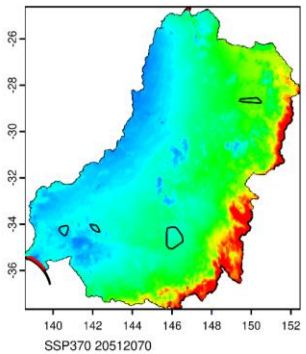
Mildura

Ensemble Median

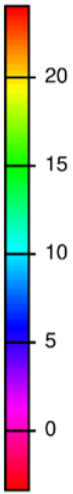


Murrumbidgee

Ensemble Maximum



Riverland

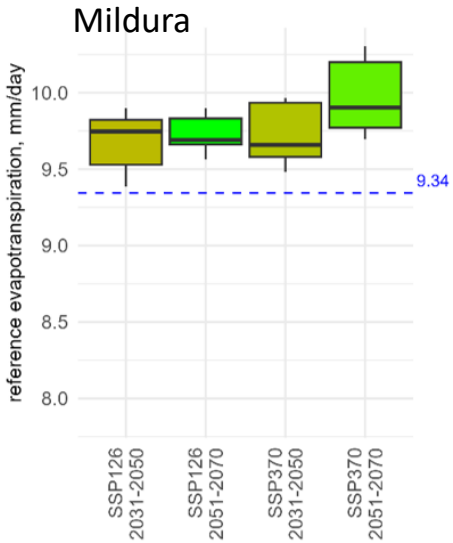


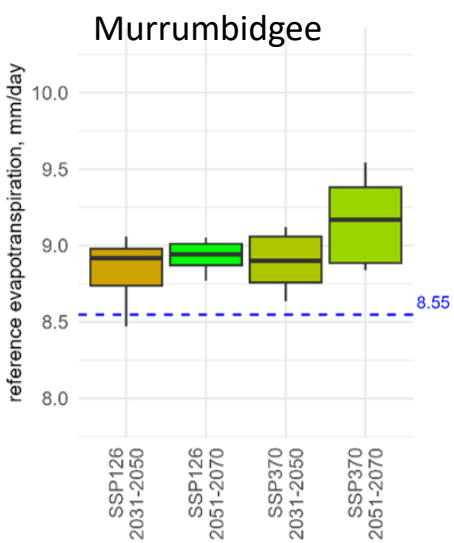
High Emissions scenario – SSP370

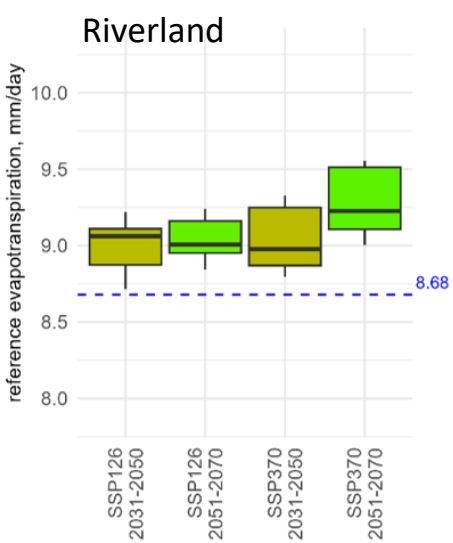
Summer ETo

Andrew Hall – Charles Sturt University

Climate change - ETo







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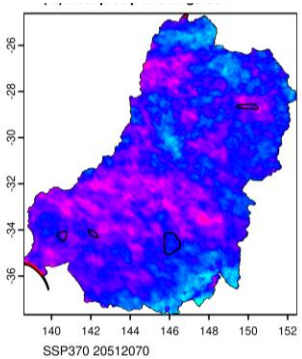
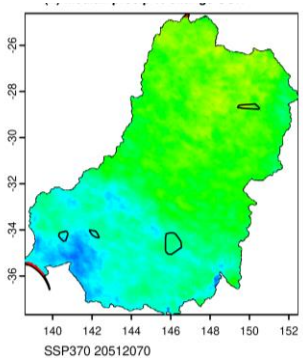
Climate change - Rain

2051-2070

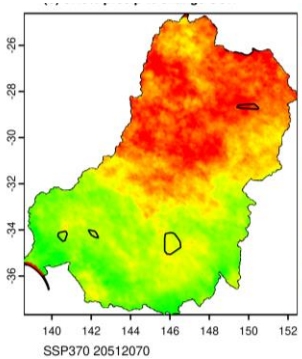
Ensemble Minimum

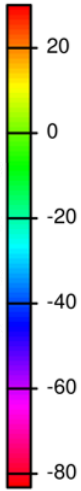


Ensemble Median



Ensemble Maximum





High Emissions scenario – SSP370

Summer ETo

High uncertainty

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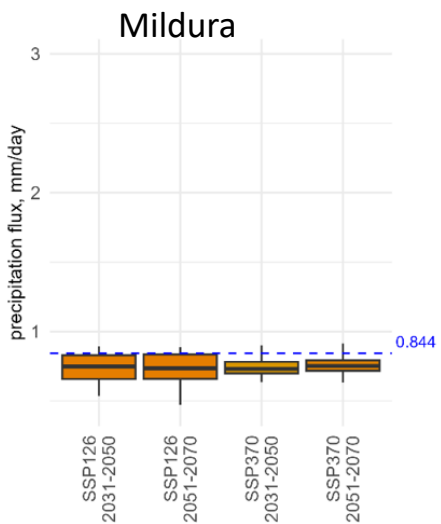
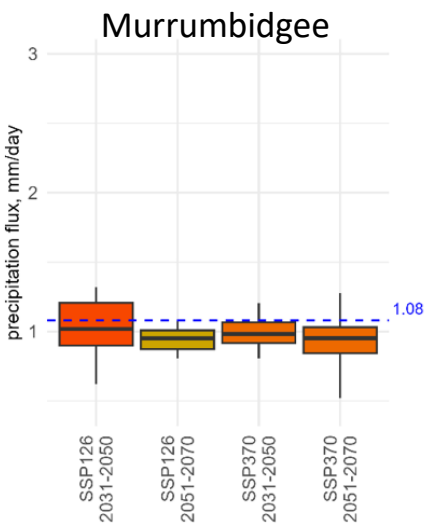
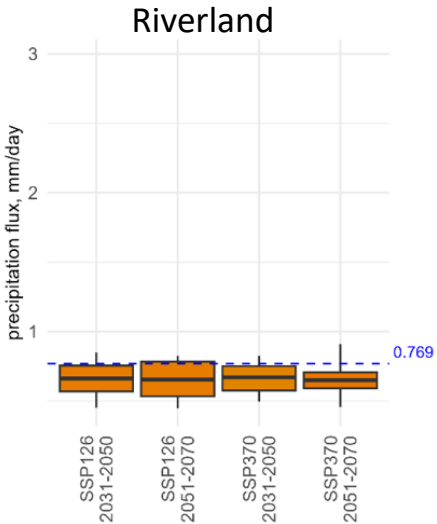
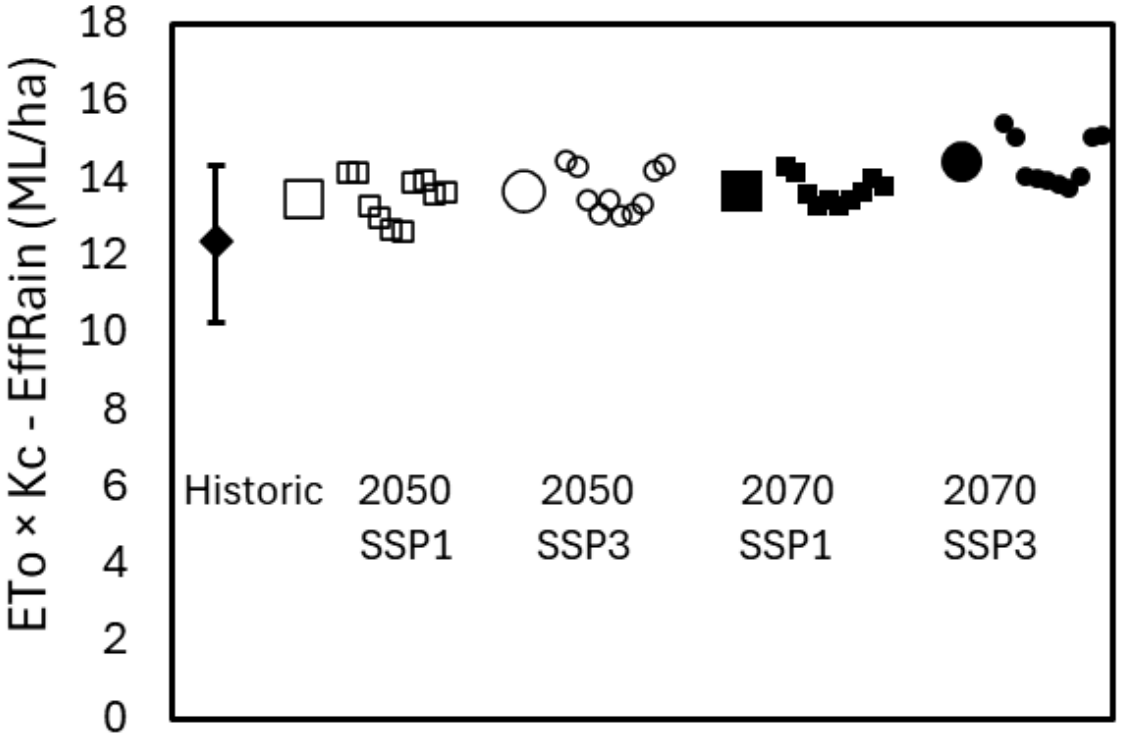
Climate change - Rain







Climate change - Irrigation



- Murrumbidgee
- 1.1-2.1 ML/ha increase (9-17%)

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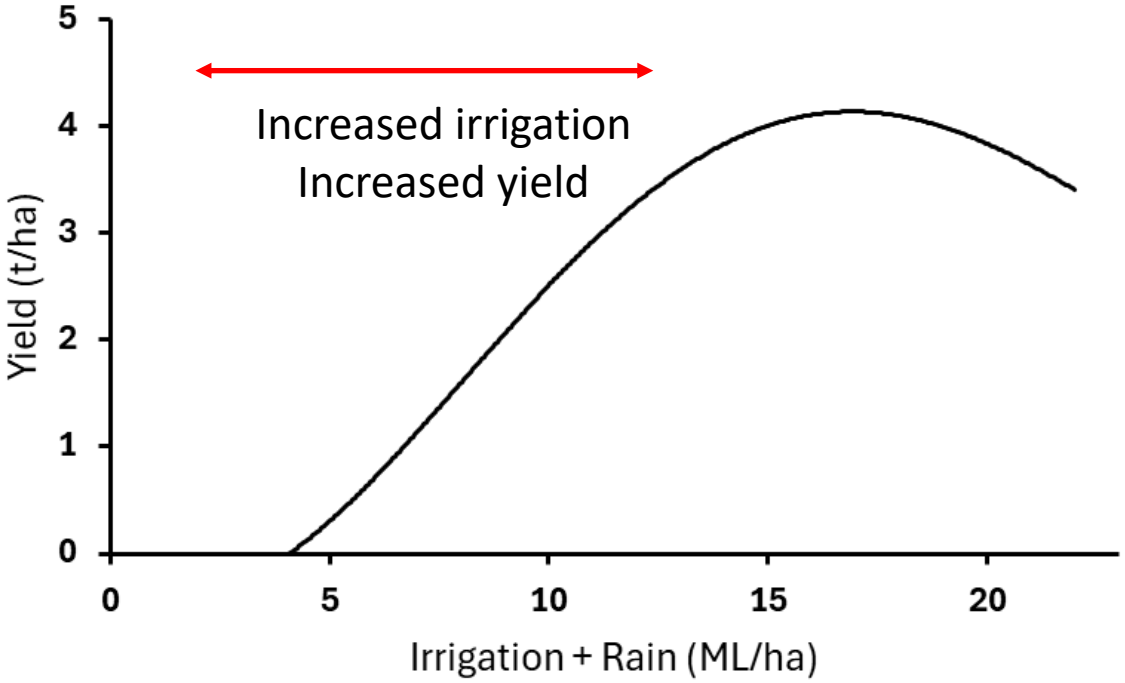
Irrigation and Yield



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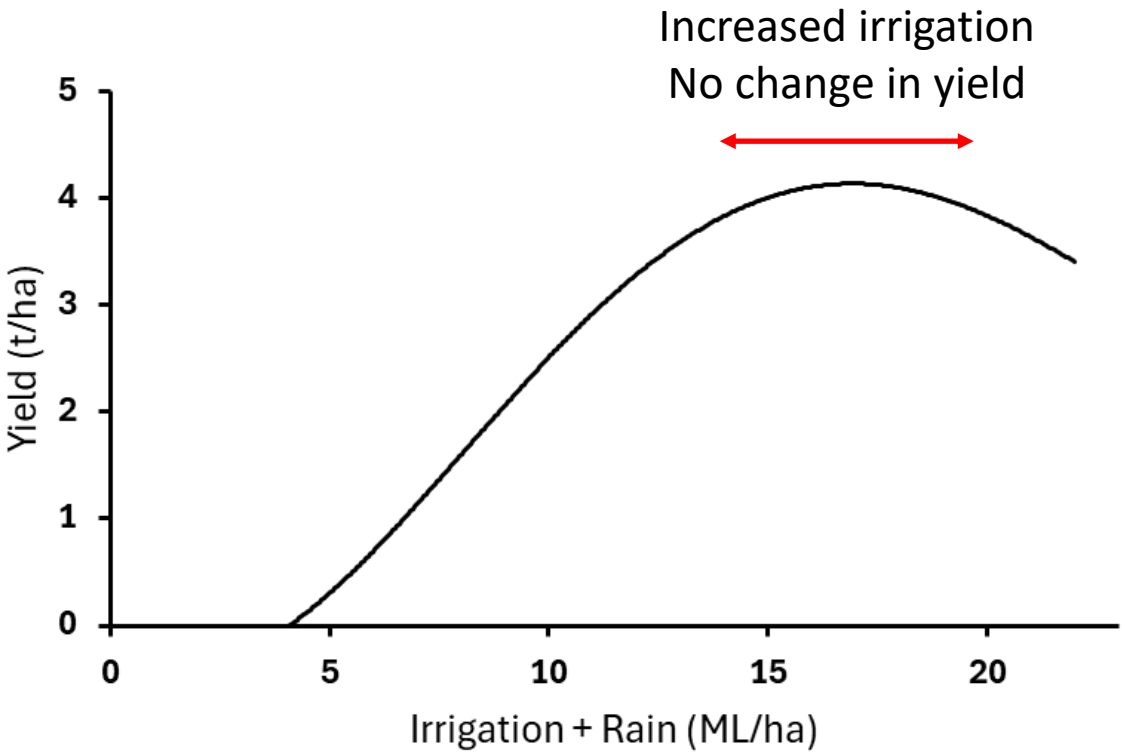
Irrigation and Yield



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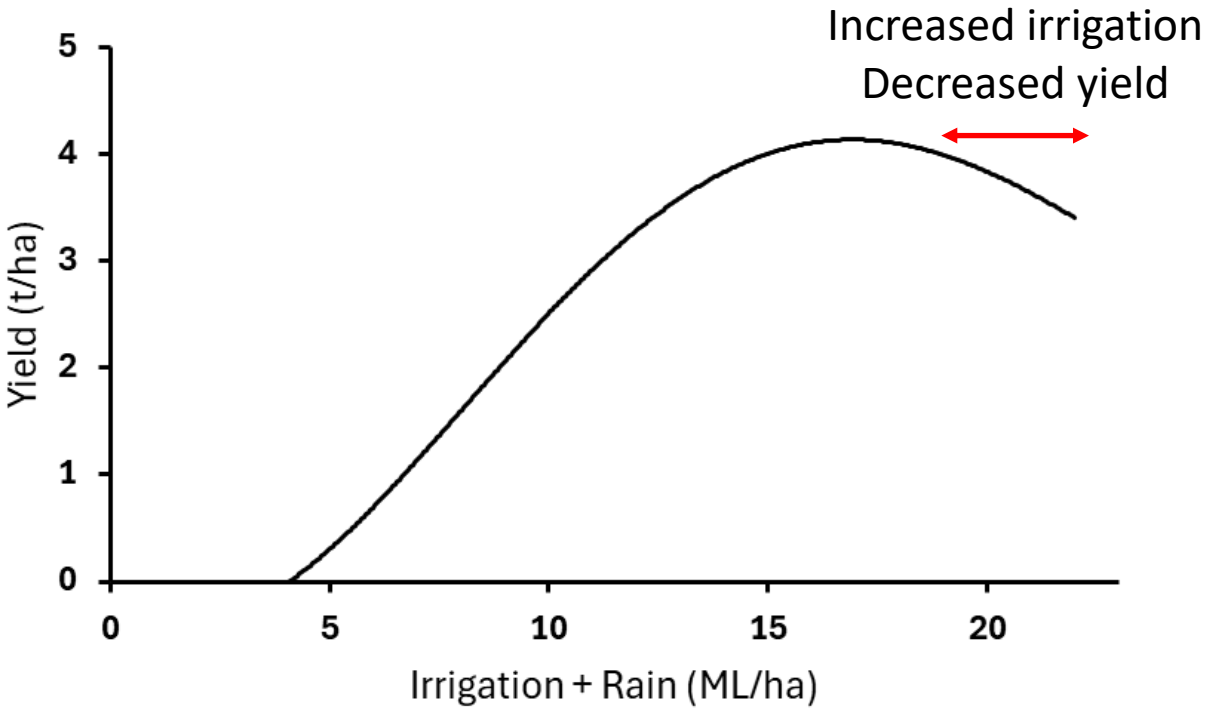

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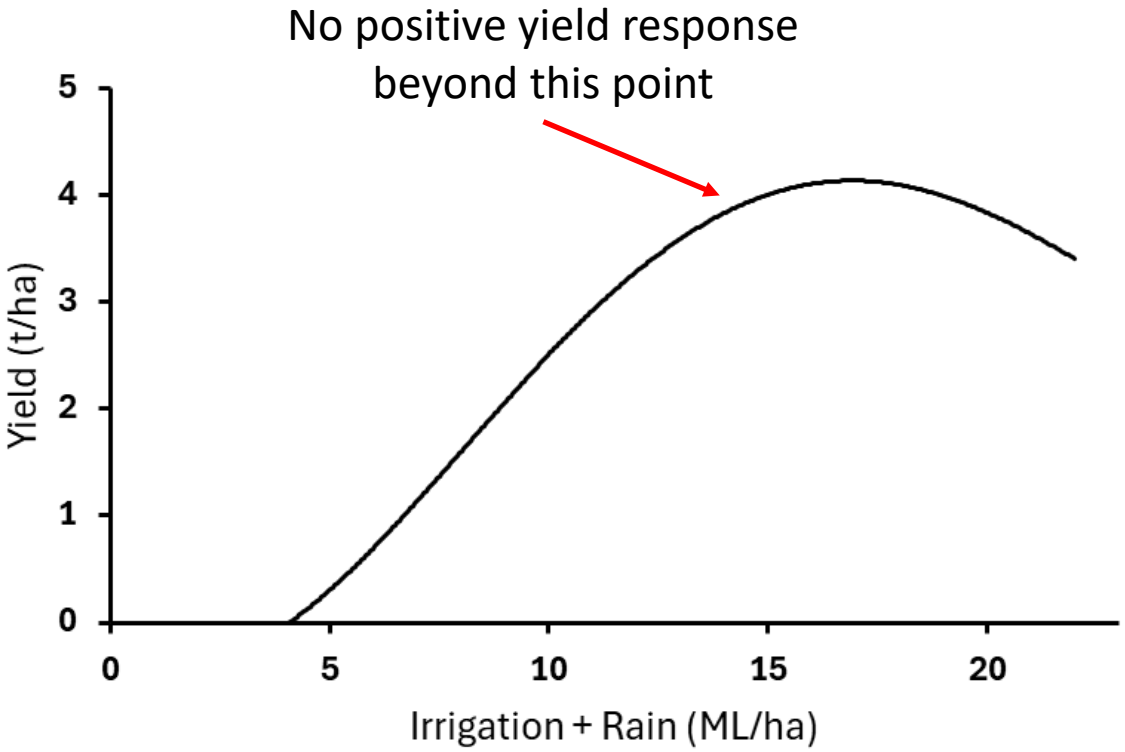

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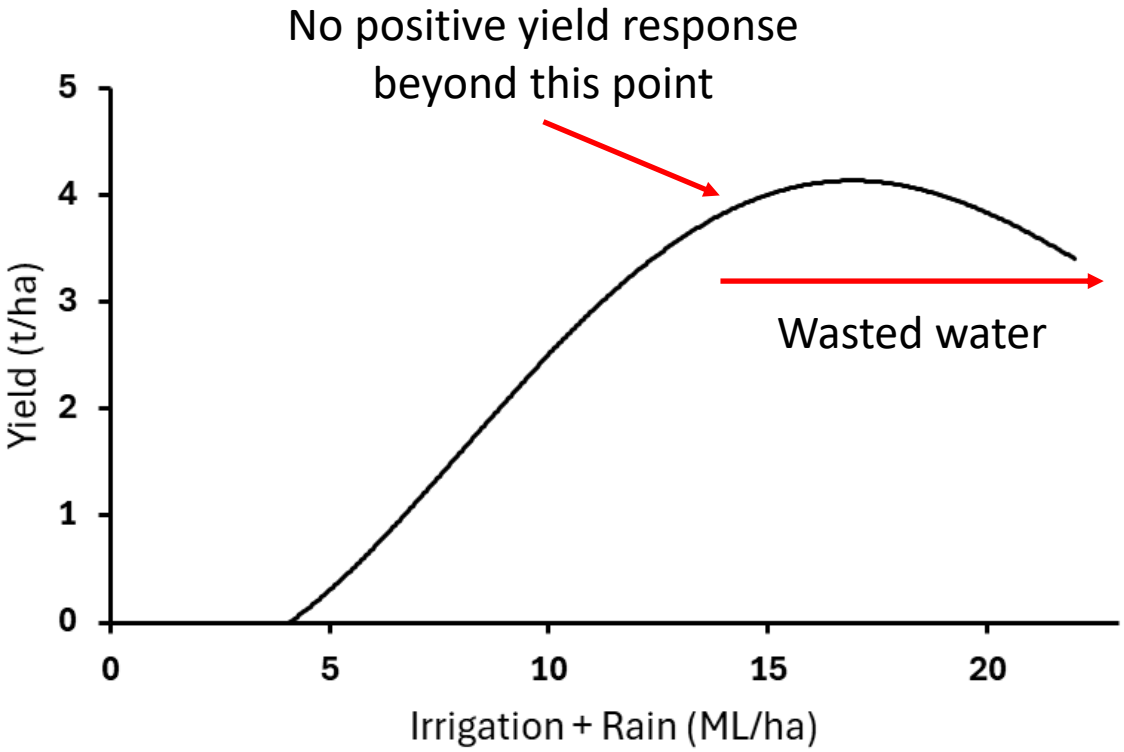

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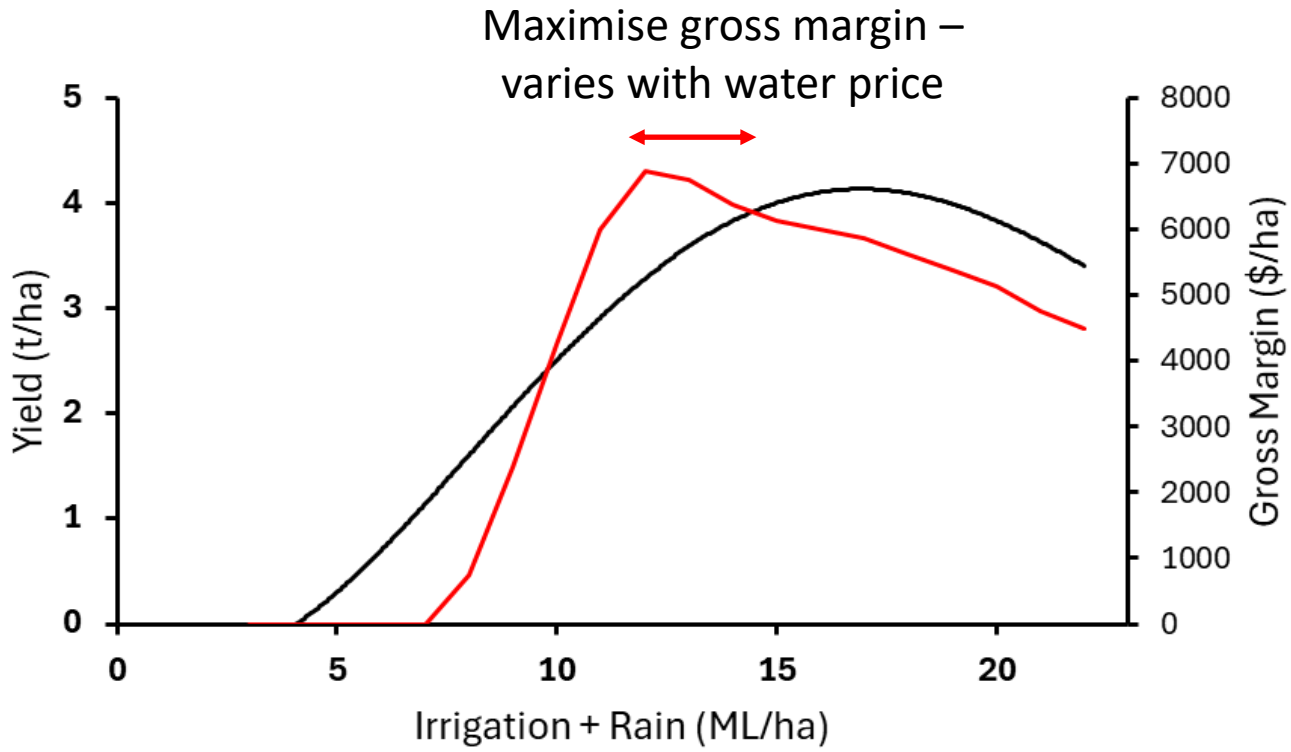

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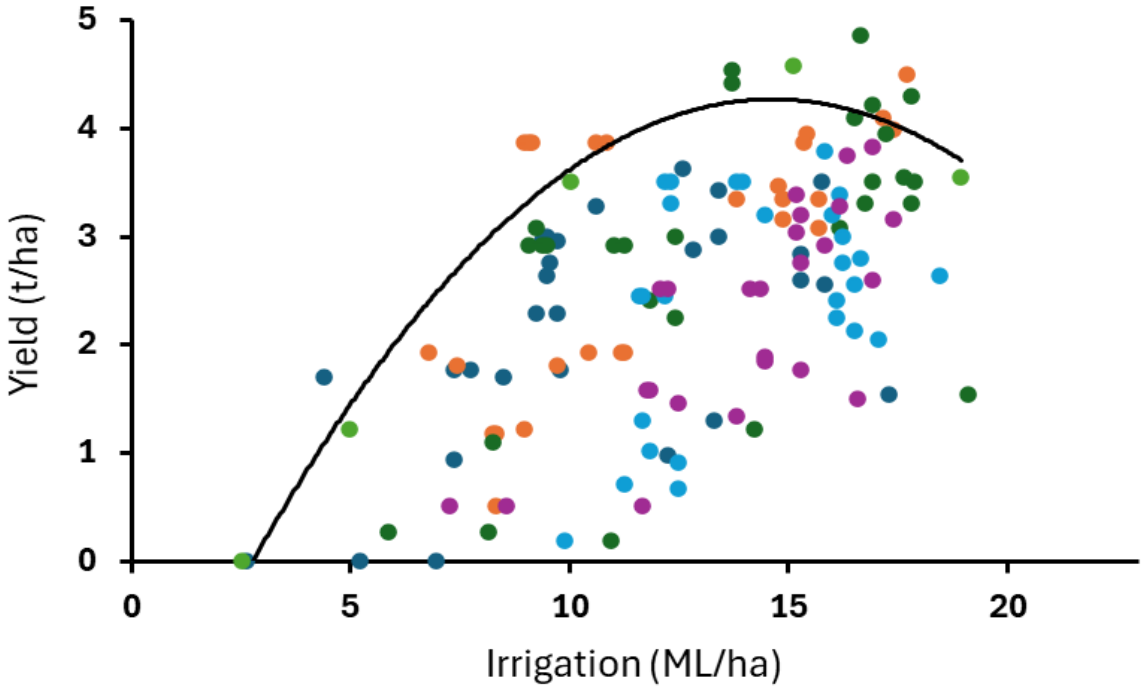
Irrigation and Yield



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Shasta


Nonpareil


Vela


Control Drought

Transient Water Stress: Genotype Response

Water stress experiment overlaid across rootstock compatibility screen:

- Nonpareil, Shasta & Vela
- 14 x rootstocks
- 2023/24 & 2024/25

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Transient Water Stress

Shasta

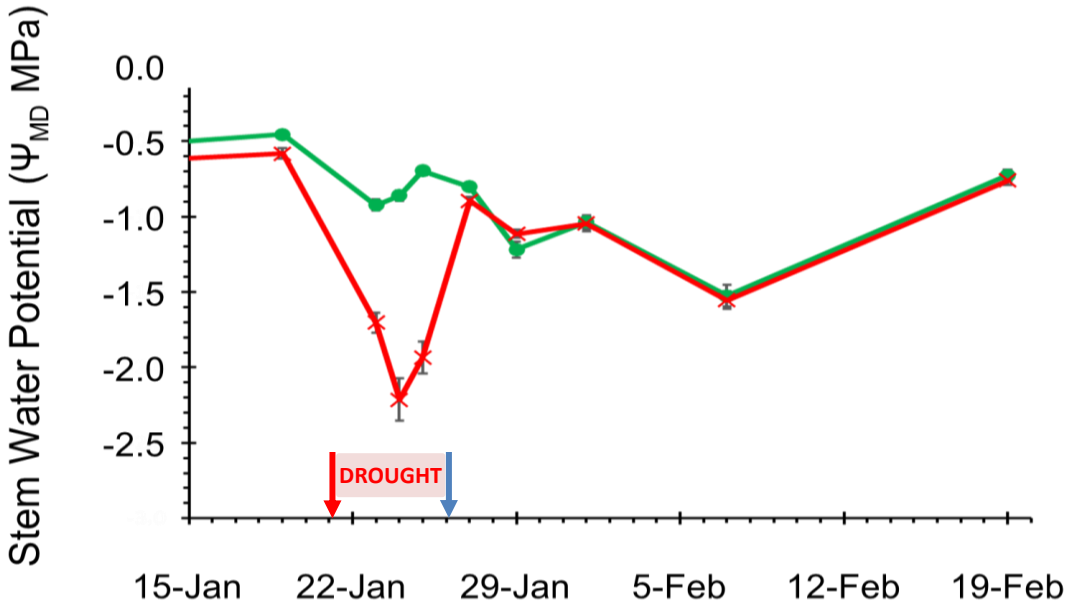

Nonpareil


Vela


Control Drought

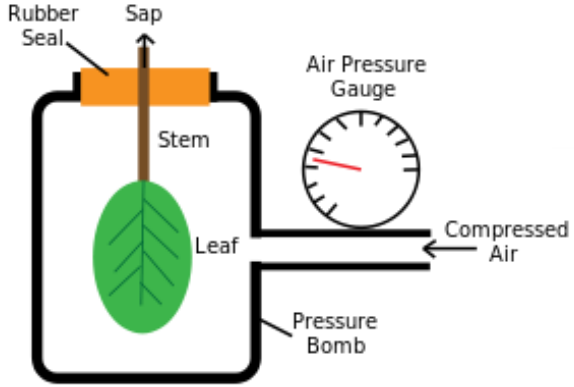
Yr1 (2023/24) four-day drought treatment

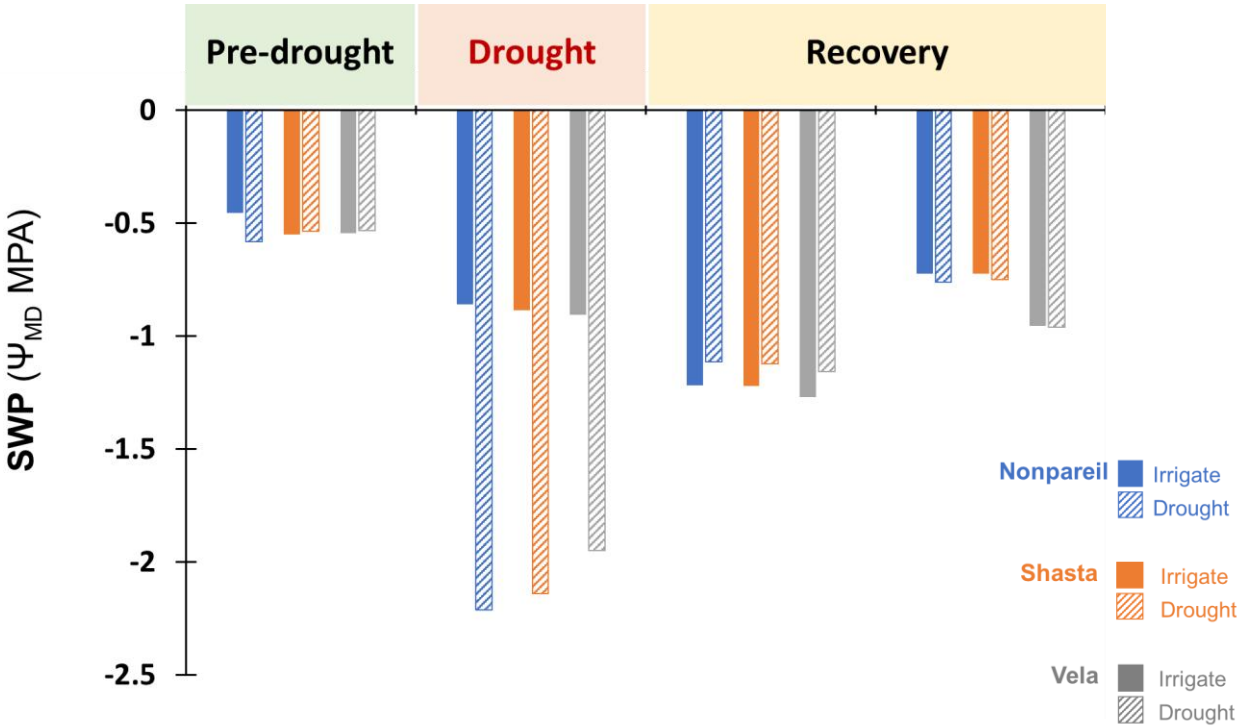
(Avg >33°C and >10mm/day ET)



Cultivar Response to Drought

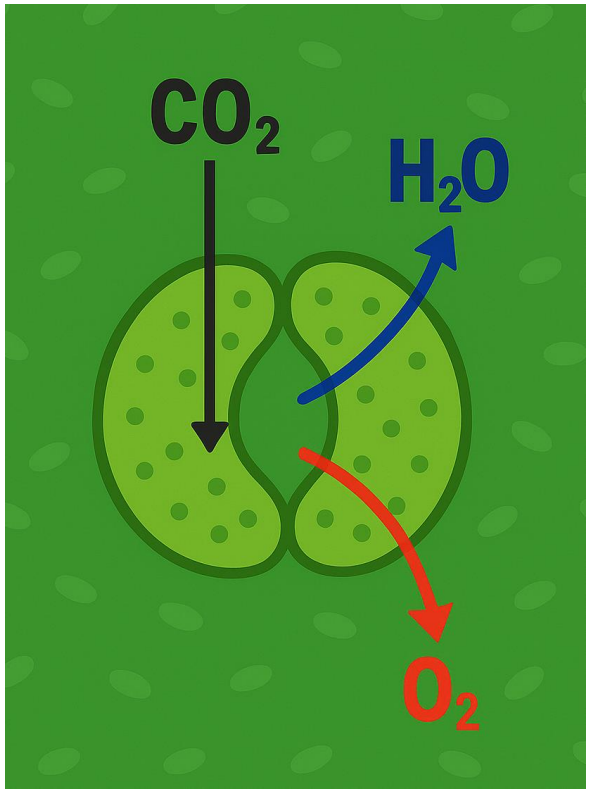
(Stem Water Potential)

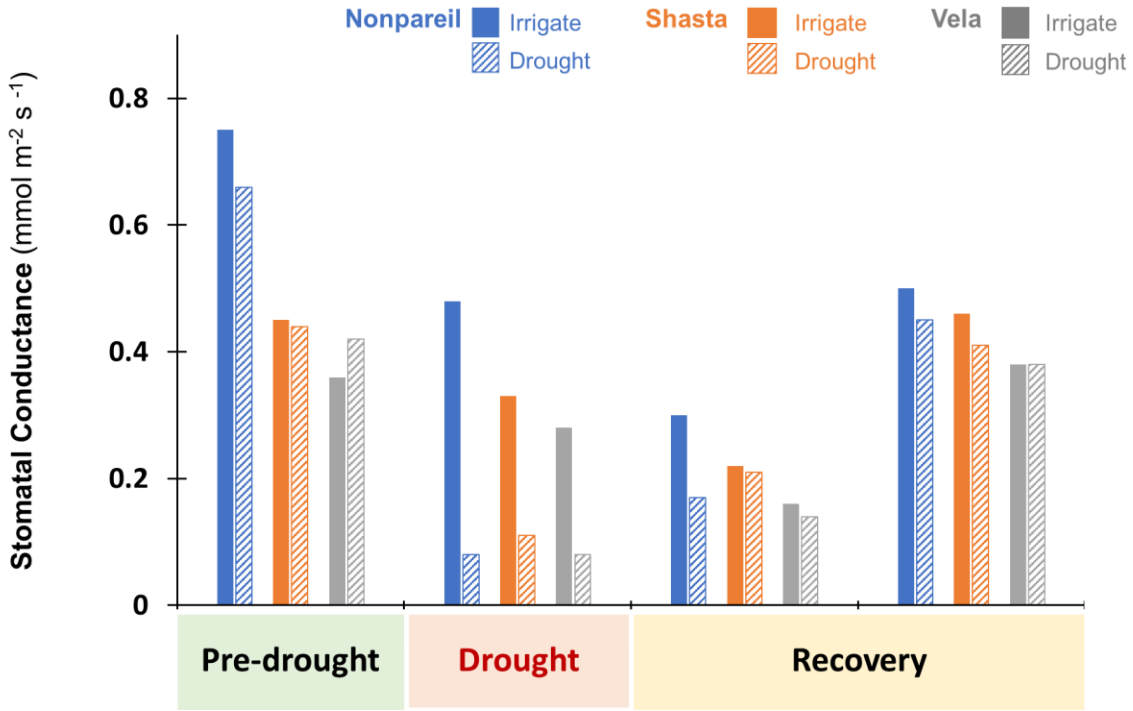




Cultivar Response to Drought

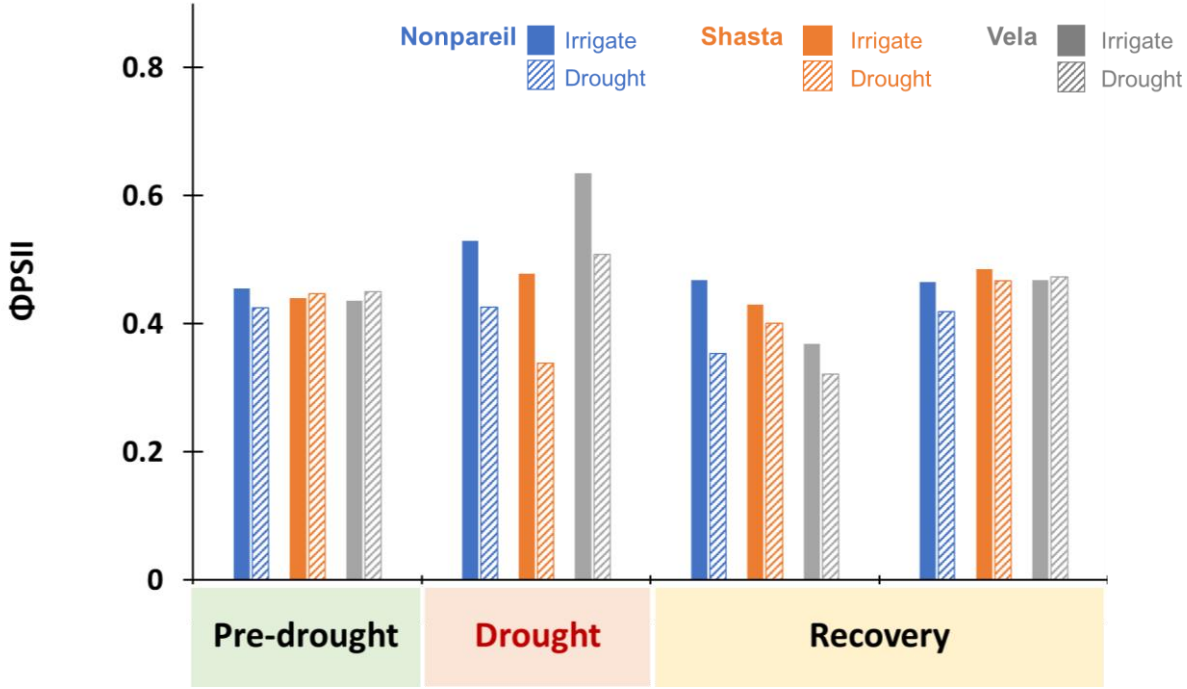
(Stomatal Conductance)





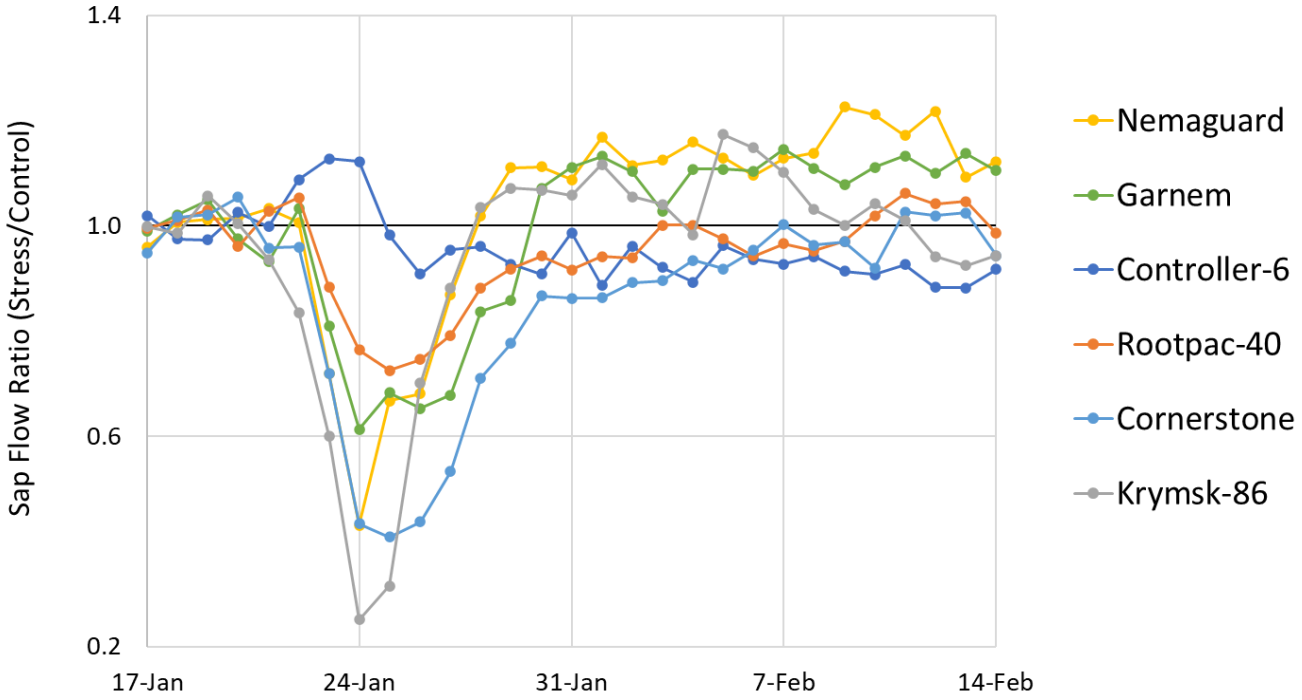
Cultivar Response to Drought

(Chlorophyll - Fluorescence)



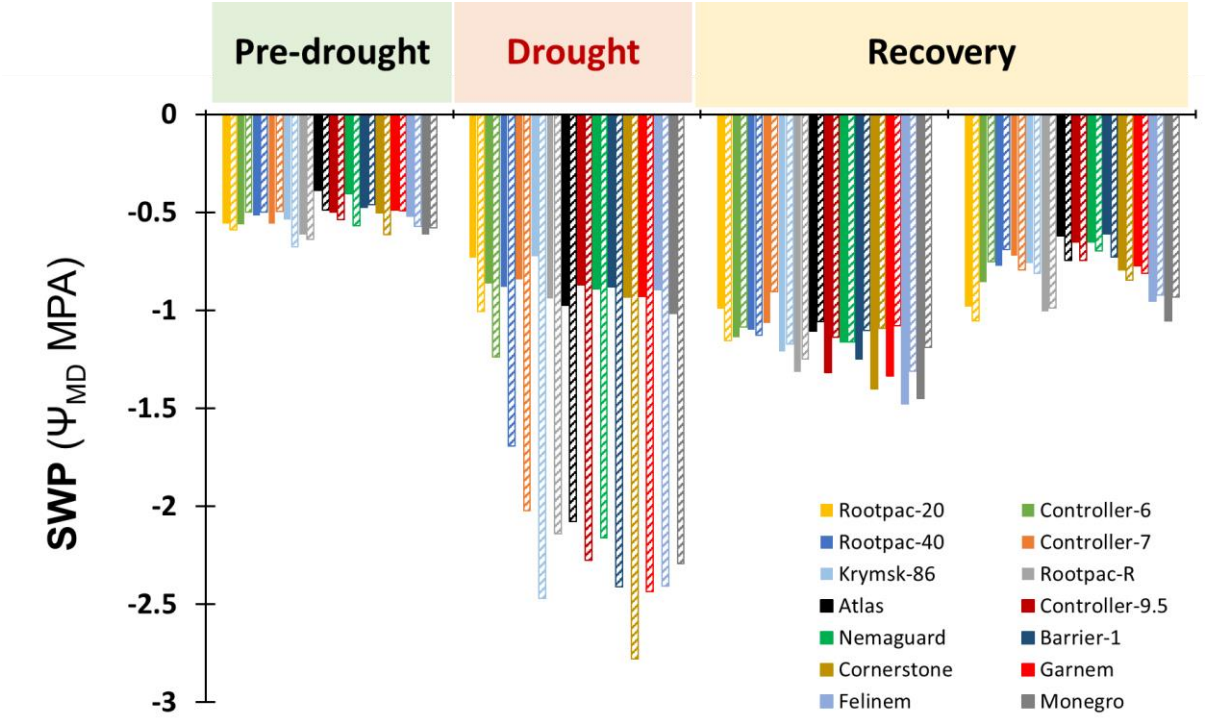
Rootstock Response to Drought

(Sap Flow)



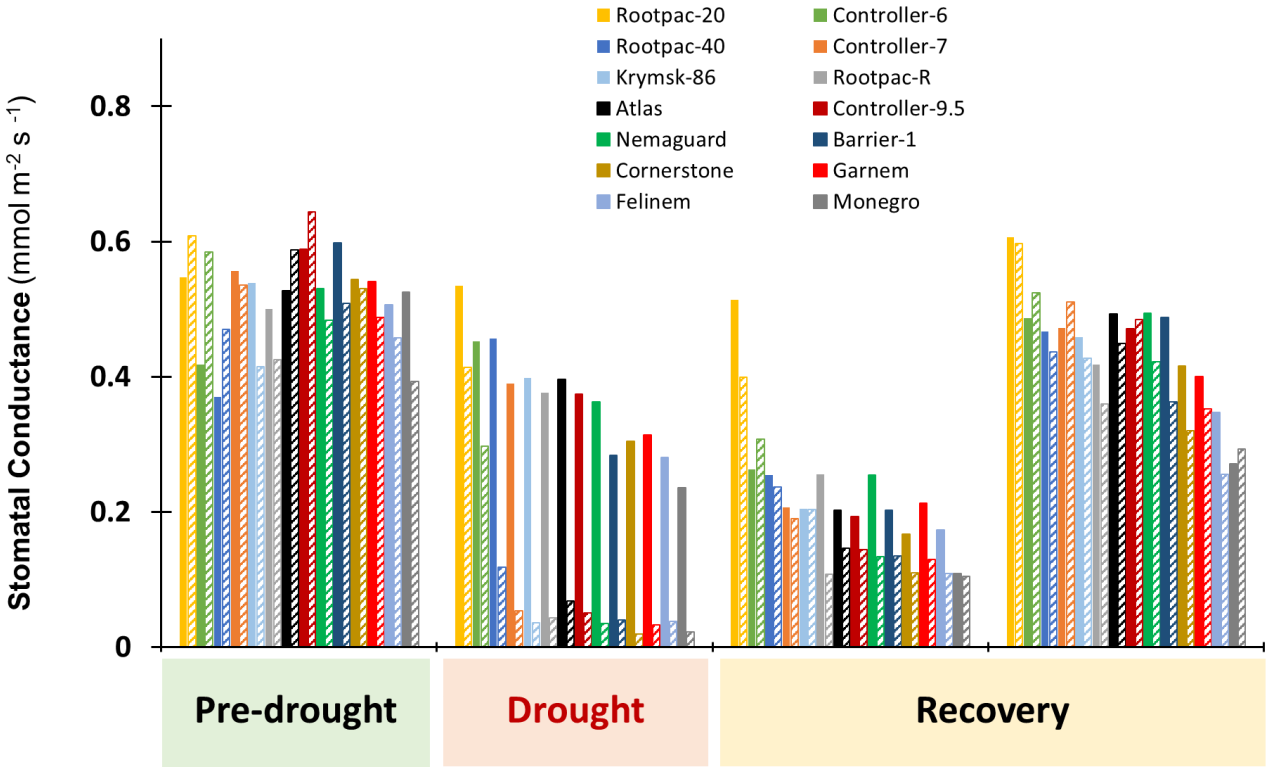
Rootstock Response to Drought

(Stem Water Potential)



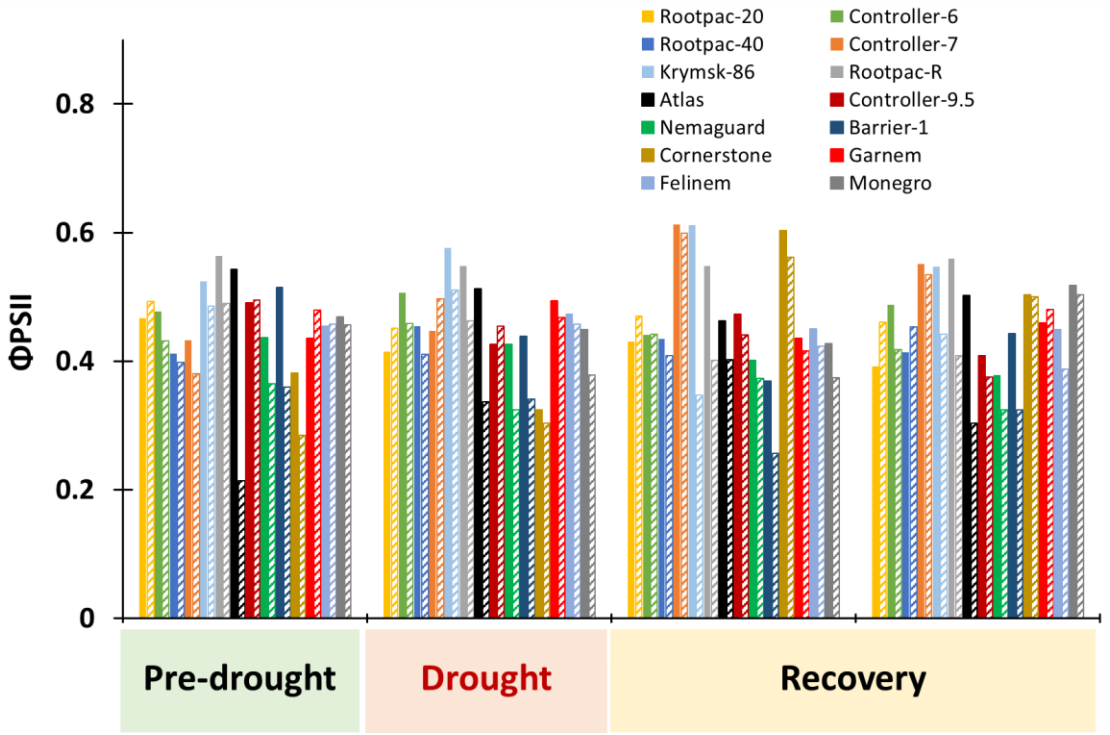
Rootstock Response to Drought

(Stomatal Conductance)



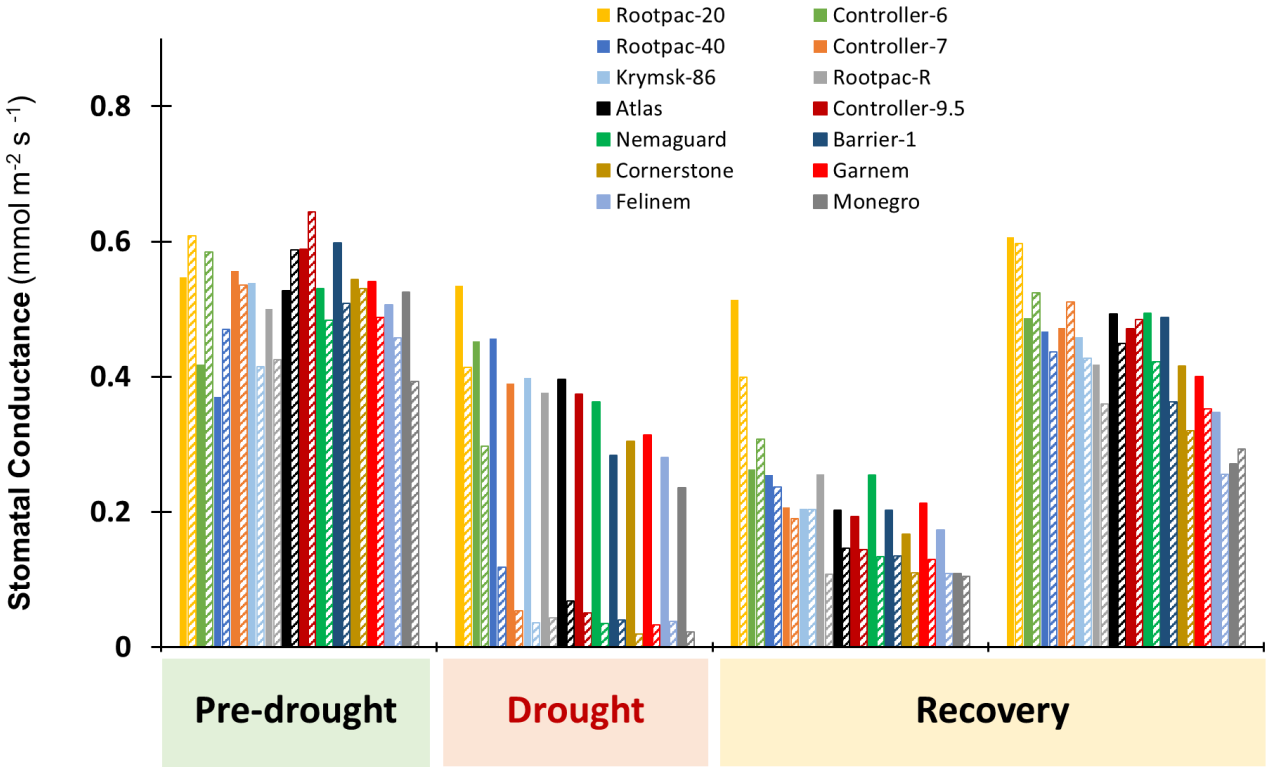
Rootstock Response to Drought

(Chlorophyll - Fluorescence)

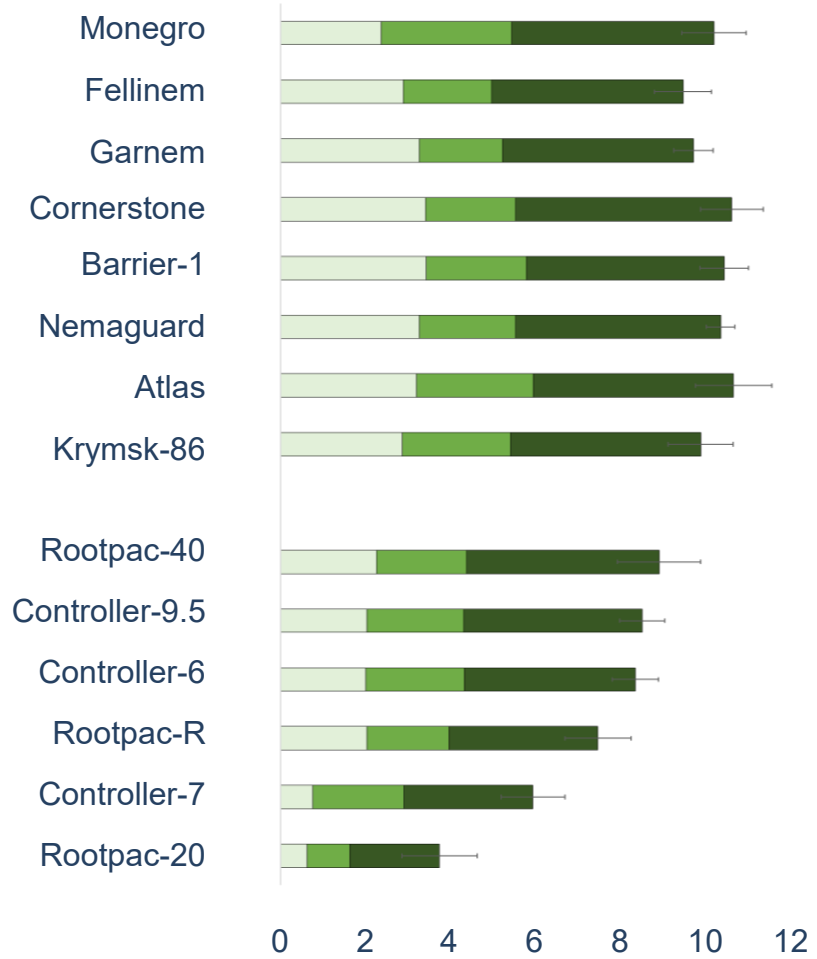


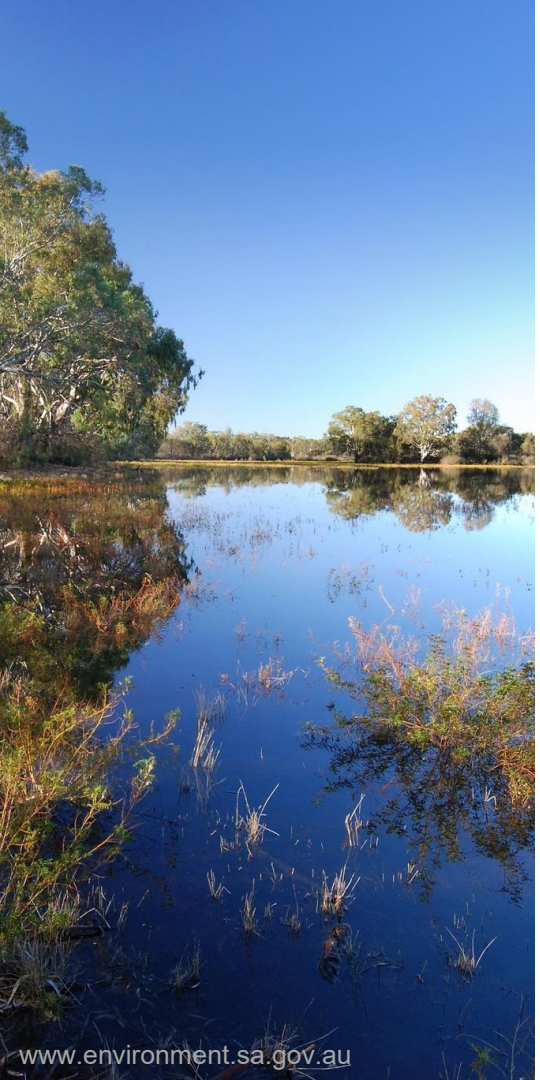
Rootstock Response to Drought

(Stomatal Conductance)



Vigour & Yield





Conclusions

- Climate change impacts on irrigation demand
- Understand yield penalty with reduced irrigation
- Tree vigour drove transient stress responses
- Higher yield on a smaller canopy

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Thank You

Almond Centre of Excellence

Mark Skewes, Nigel Fleming, Kavitha Shanmugam,
Vinod Phogat, Shahin Solgi and Darren Graetz

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