Growing sorghum under water stress conditions in Australia

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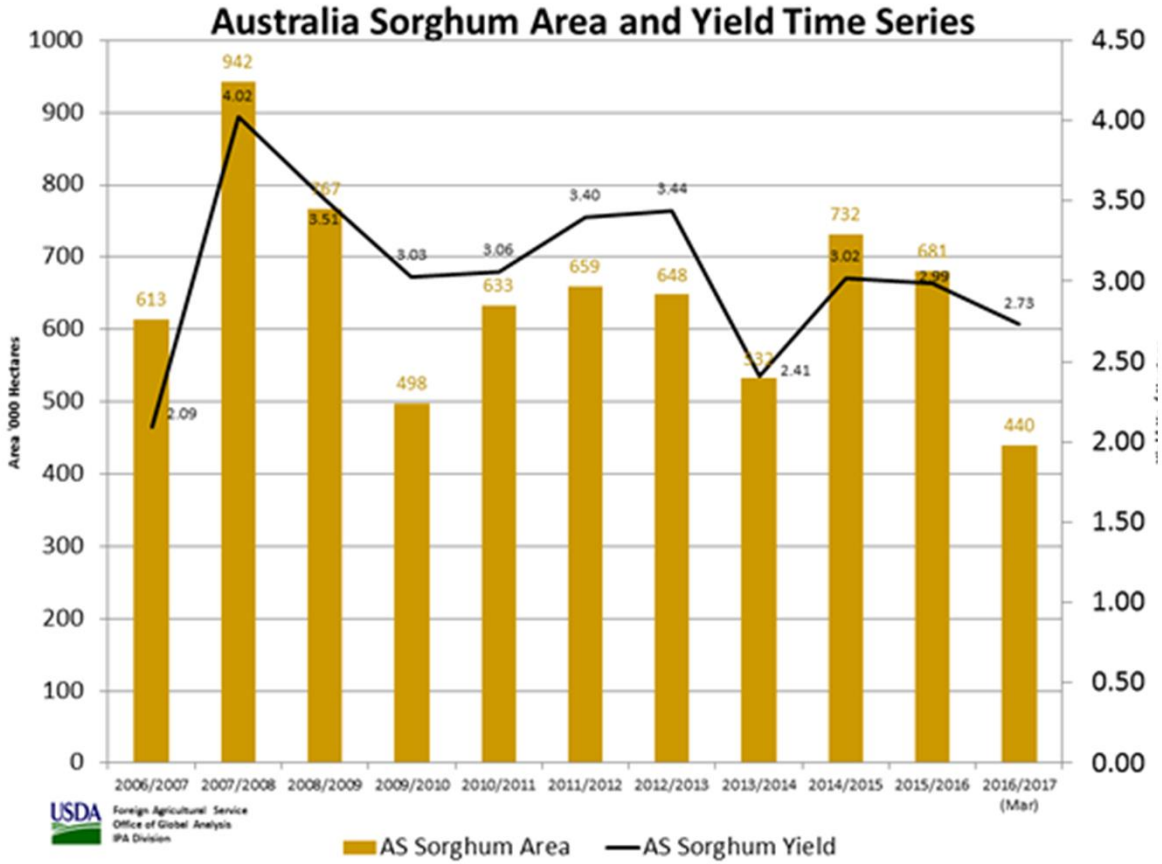
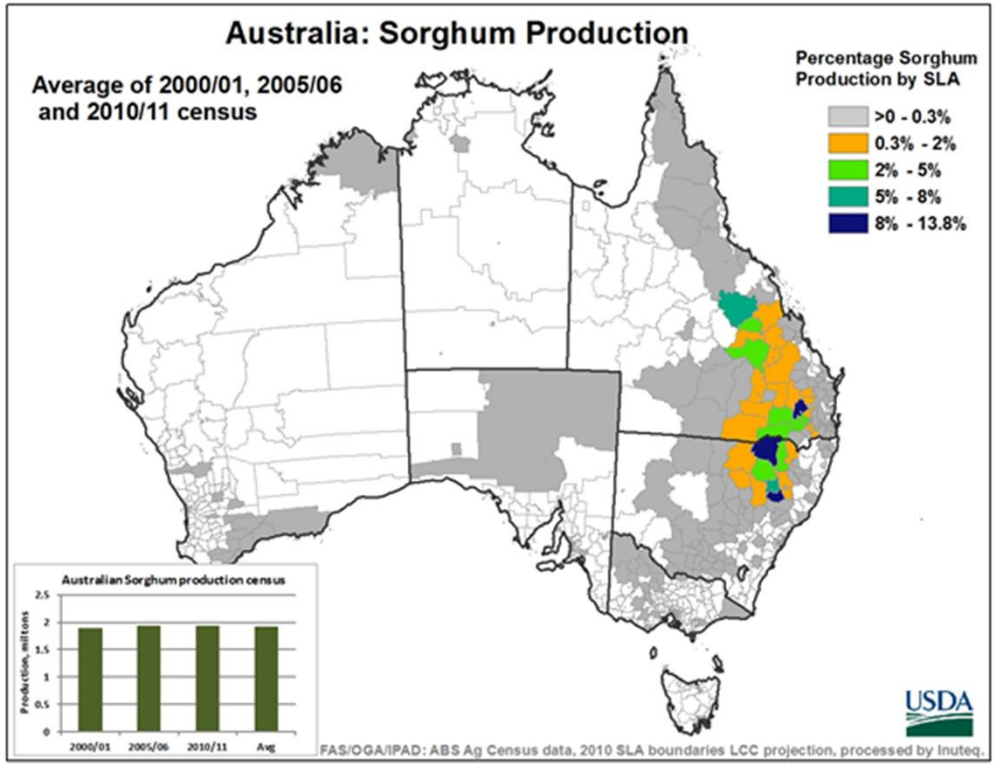
AUSTRALIAN SORGHUM INDUSTRY

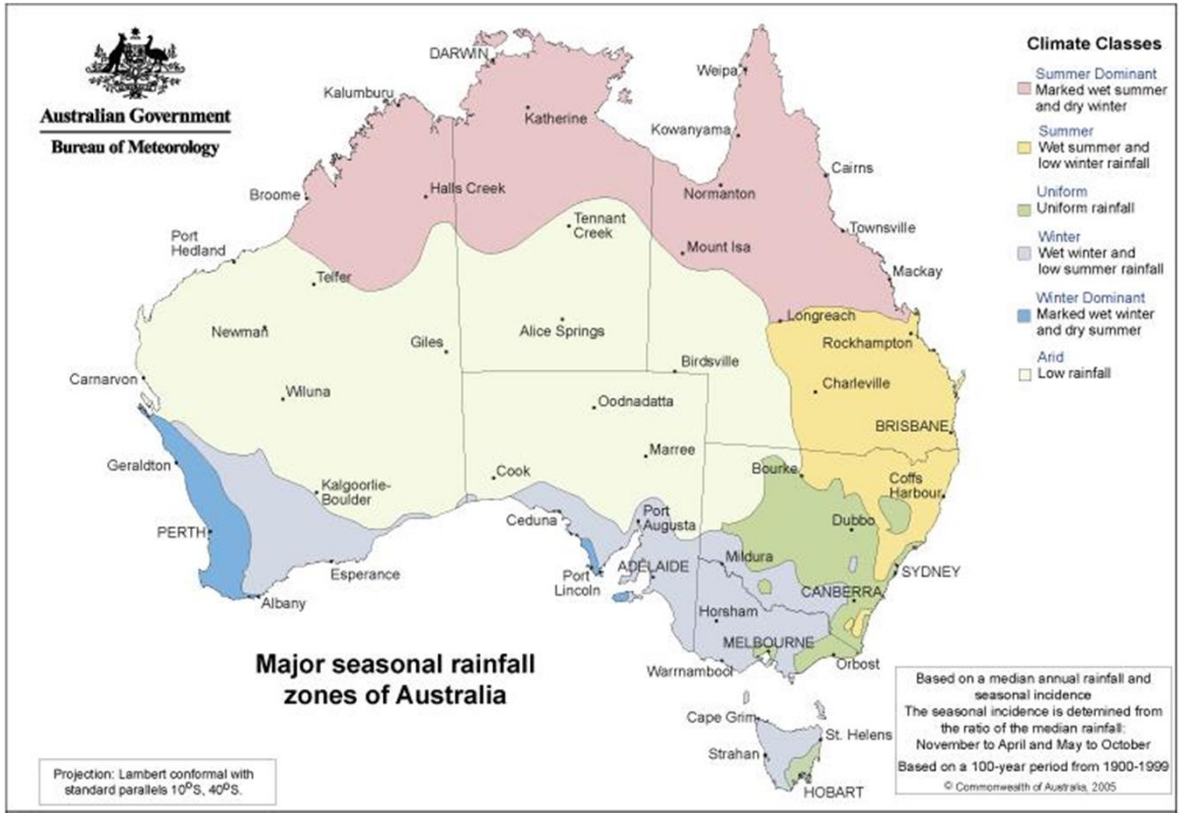




Source: https://ipad.fas.usda.gov/highlights/2017/03/australia/images/fig6.htm

SORGHUM GROWING IN AUSTRALIA

- Average sorghum production area is 470,000 ha
- Producing 1.4 million tonnes per annum
- Primary use is livestock feed domestically, also exporting to Asia
- Australia's most significant summer grain crop and is widely grown across a range of environments.
- Summer dominant rainfall zone



Crop rotations

Wheat
(April-June)

Long
fallow

Sorghum
(Sept-Jan)

Double
crop

Chickpea
(April-June)

Short fallow

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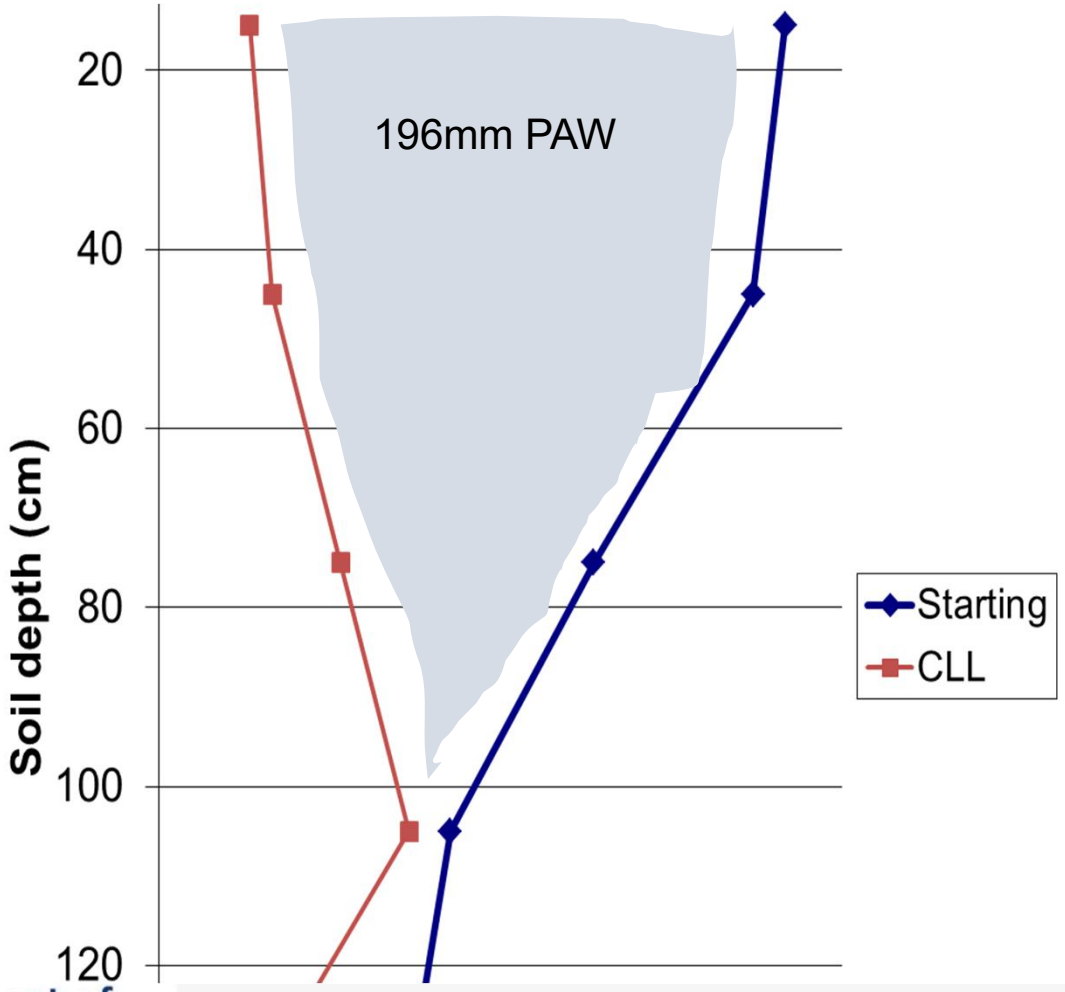
THE GROWING ENVIRONMENT

- Soil type:
  - deep vertosol soils (grey - black)
  - heavy cracking clays (50-70% clay content)
  - High water holding capacity
- Planting time:
  - September through to January
- Climate:
  - High intensity, storm events
  - High day and night time temperatures

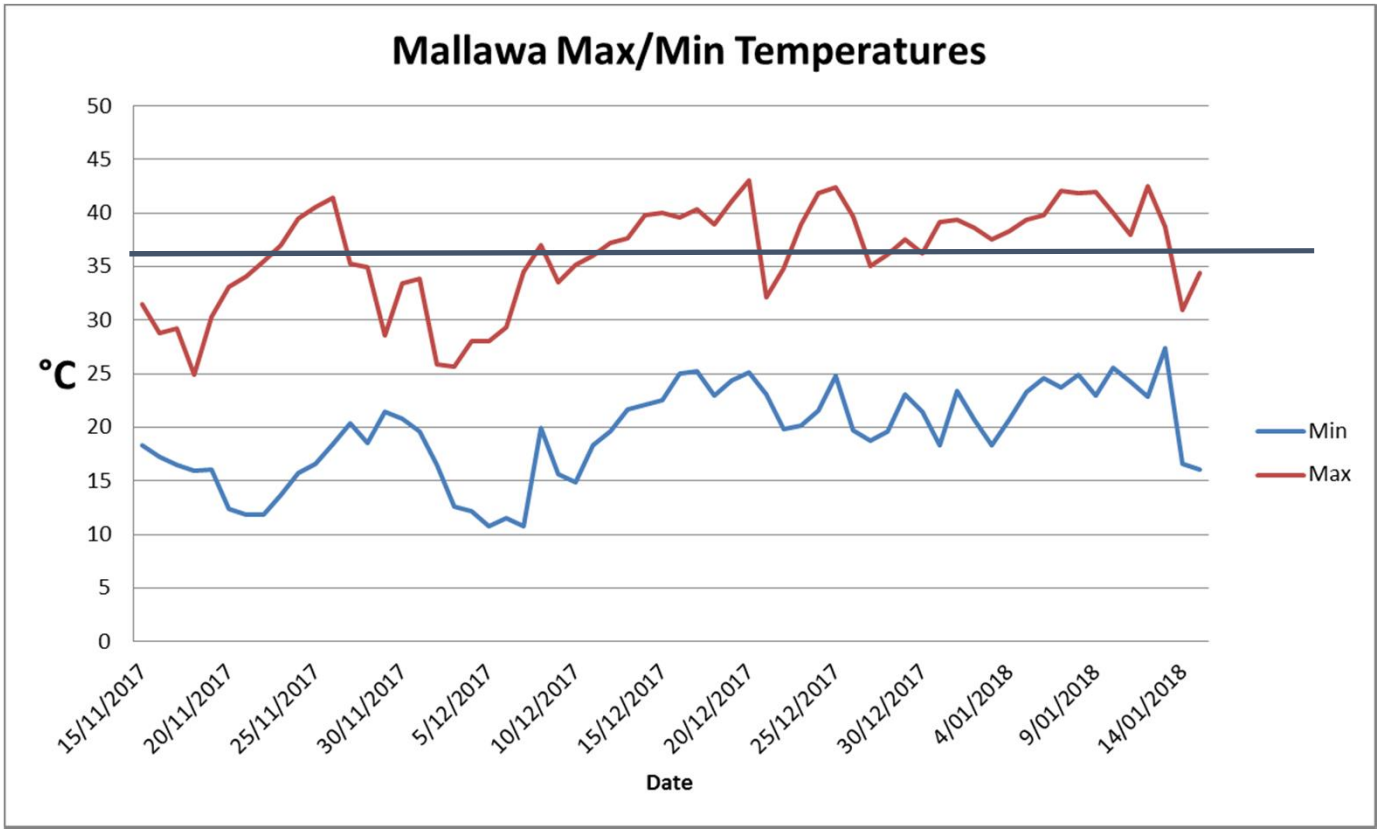


Double skip sorghum
End November

Double skip sorghum
Mid December

Extreme heat during pre and post anthesis

- Major limiting factor to production is water stress post anthesis =
  - Reduced yield,
  - Reduced grain size,
  - Reduced grain number
  - Lodging



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Methods to mitigate the impact of heat and moisture stress

- Plant into a full soil moisture profile
- Plant into no tillage, retained winter cereal stubble
- Hybrid selection
    - Planting more than 1 hybrid
    - Use hybrids with some level of stay-green
    - Select hybrids with tillers
- Spread planting time – early versus late planting
- Sow on wide or “skip” row configurations
- Plant lower plant populations

No tillage, stubble retention

- Utilising controlled traffic and 2 cm accuracy precision planting
- Planting crop between stubble rows
- Precision planters, with some air seeders
- Between 70-80% of growers were using no tillage in 2008 (Llewellyn et al, 2009) and this has continued to increase

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Hybrid selection

Source: David Jordan, QPI&F

COMPANY	MATURITY	HEIGHT	STANDABILITY
NUSEED			
Tiger	MQ	MS	4
Dominator	M	M	5
Liberty White	M	MT	4
Enforcer	MS	MT	3
PACIFIC SEEDS			
MR Bazley	MQ	S-M	5
MR Taurus	MQ	M	5
MR Eclipse	M	M	4
Pacific MR 43	M	M	4.5
MR Buster	M	S-M	5
MR Scorpio	M	M	4.5
MR Apollo	MS	M	5
PIONEER			
84G99	M	S-M	5
84G22	M	M	5
85G33	M/Q	S-M	5
HERITAGE SEEDS			
HGS 102	M	M	4
HGS 114	M	M-S	5

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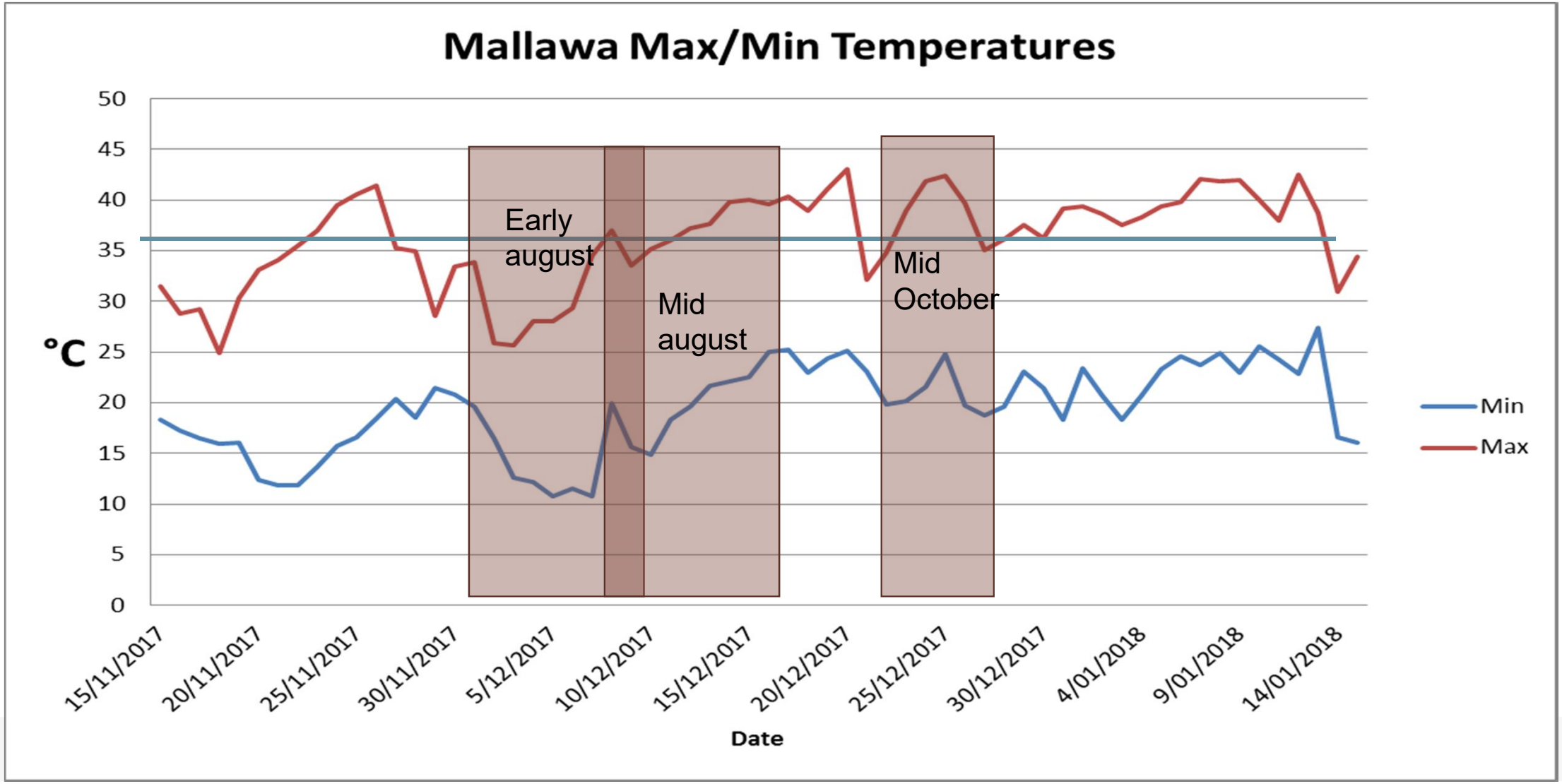
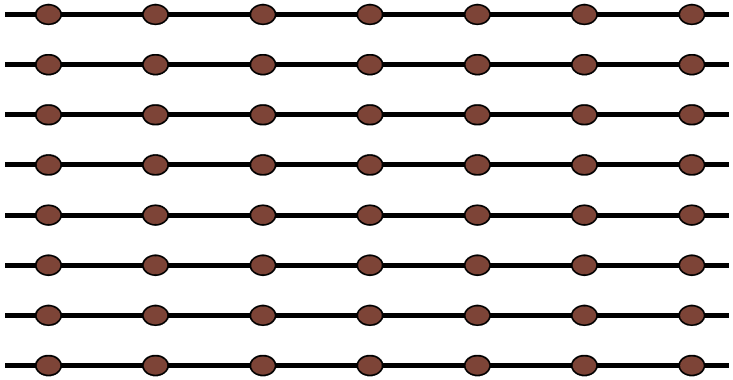
MOVE SOWING TIME EARLIER TO SHIFT THE PERIOD OF ANTHESIS

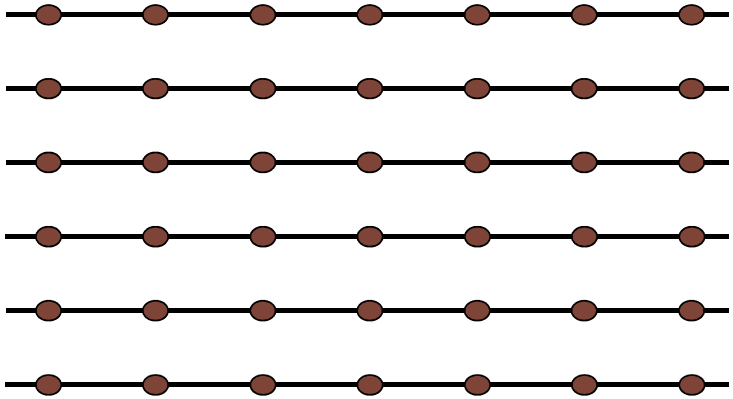


Row Configurations

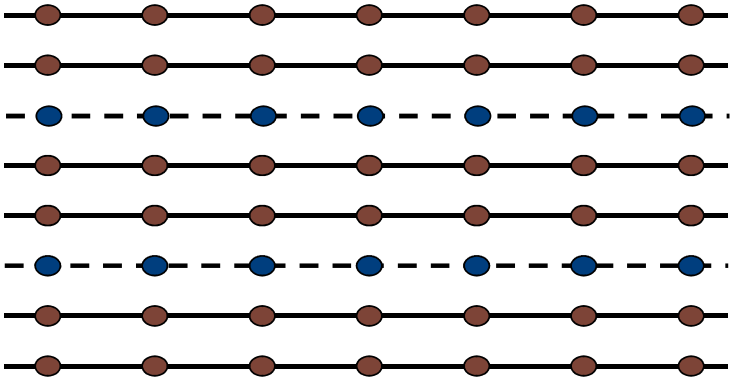
Solid Plant (1 m)



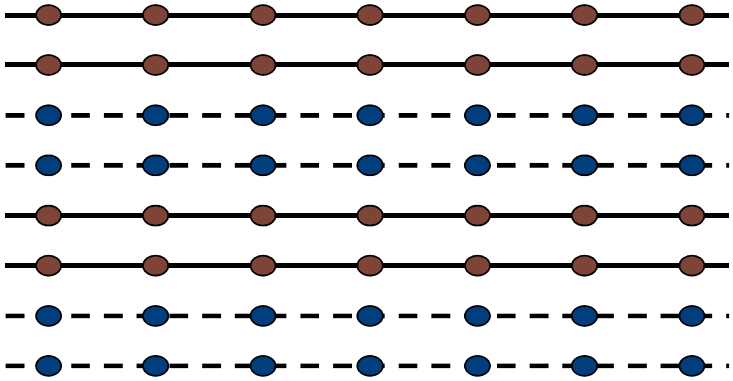
Super-wide (1.5 m)

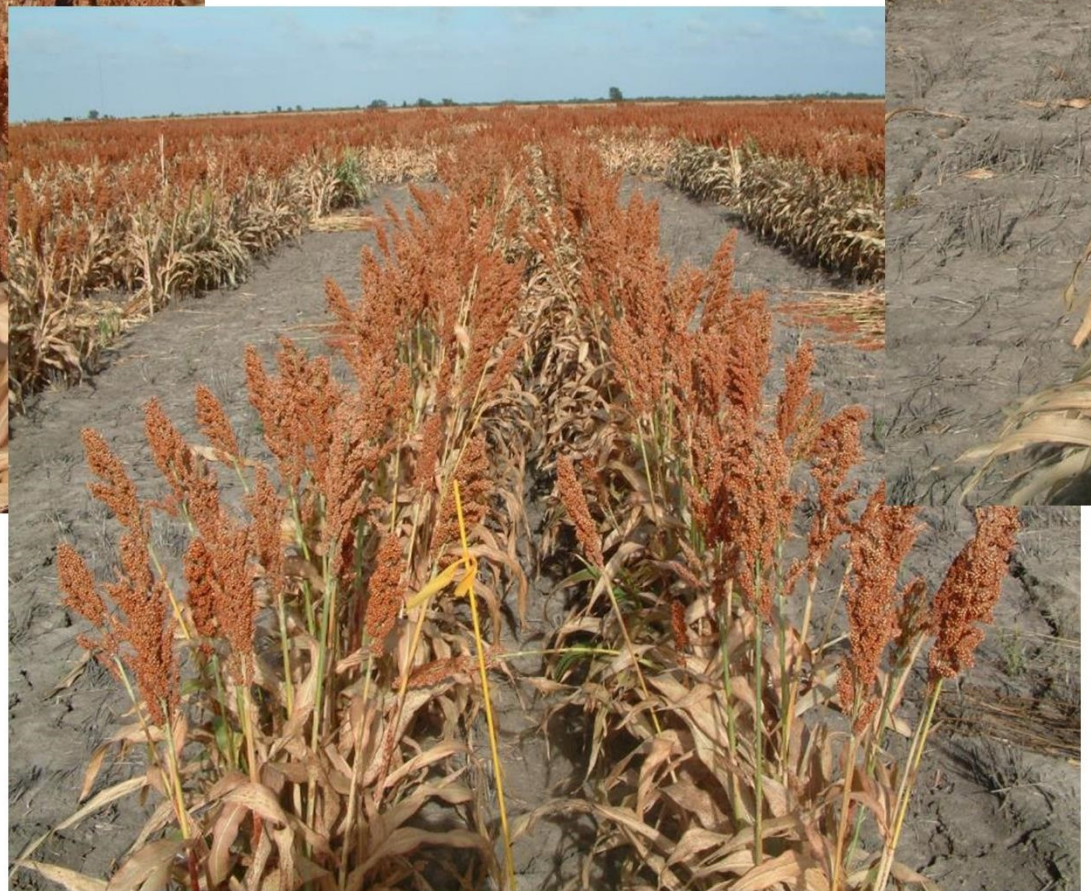


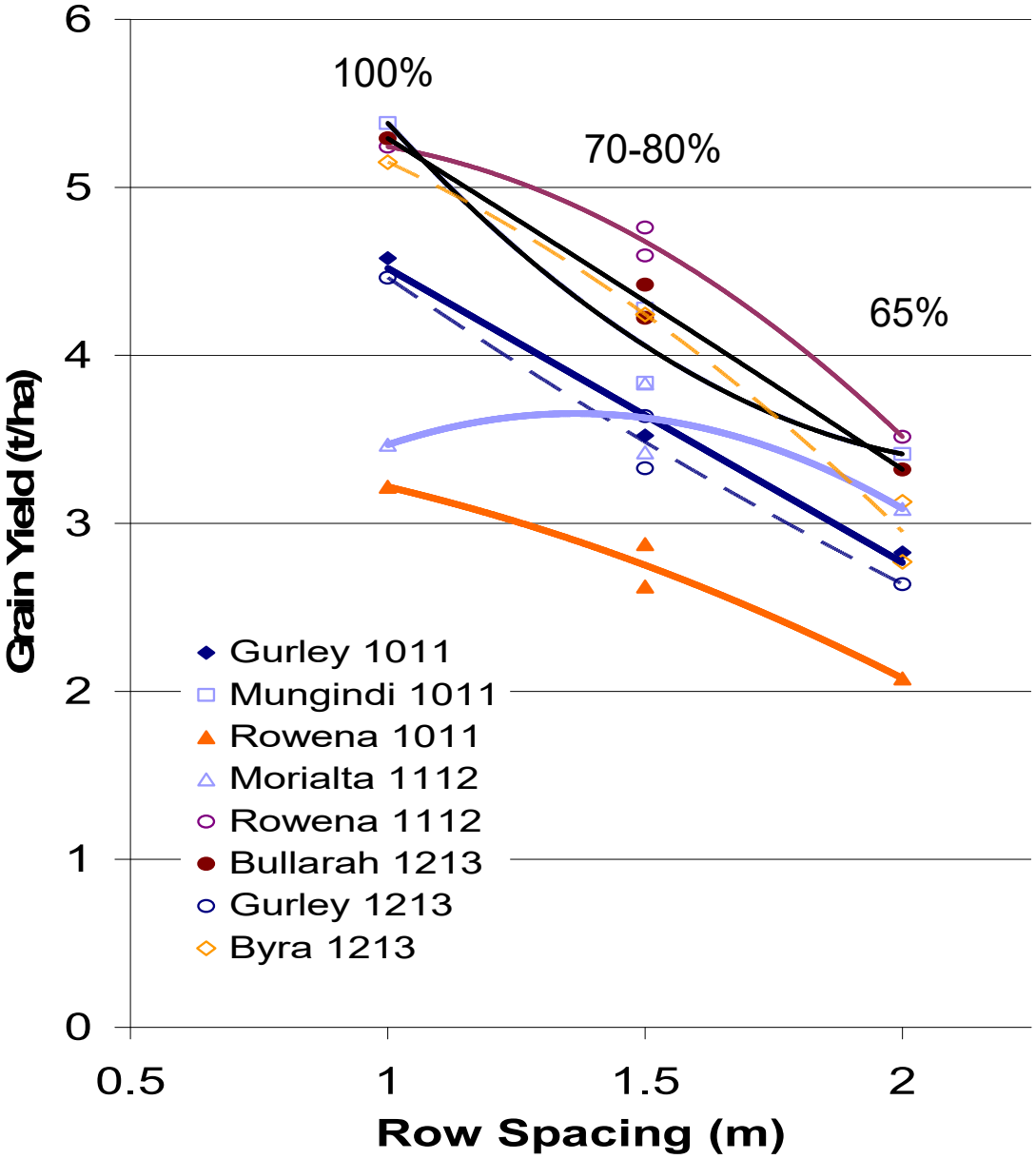
Single Skip (1.5 m)



Double Skip (2 m)







Yield loss in favourable years

- There are significant yield penalties with skip rows: Single Skip, Super Wide and Double Skip
- The penalty gets larger as the row spacing widens

Planting rules for farmers

1. Plant on at least 1 metre of wet soil

2. Plant into long fallow, no tillage i.e. following wheat or barley (stubble retained)

3. Select a row spacing and configuration to suit environment and seasonal outlook

4. Target plant populations of ~ 50,000 plants/ha

5. Select hybrids based on company and independent data – choose at least 2 hybrids

6. Fertilise to match environmental yield potential

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Researchers working with farmers

Developing simple agronomic packages which can be readily adopted using existing technology

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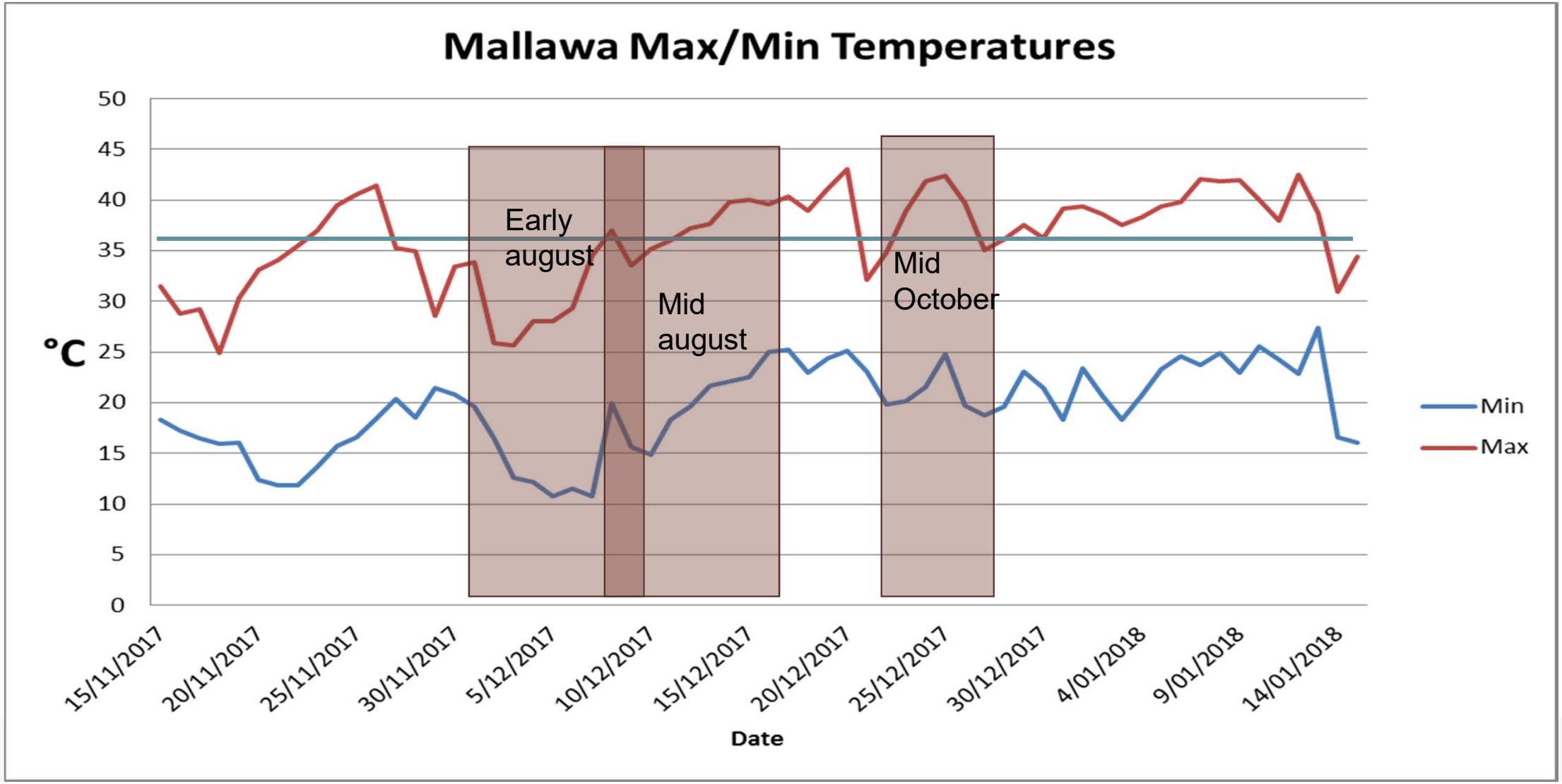
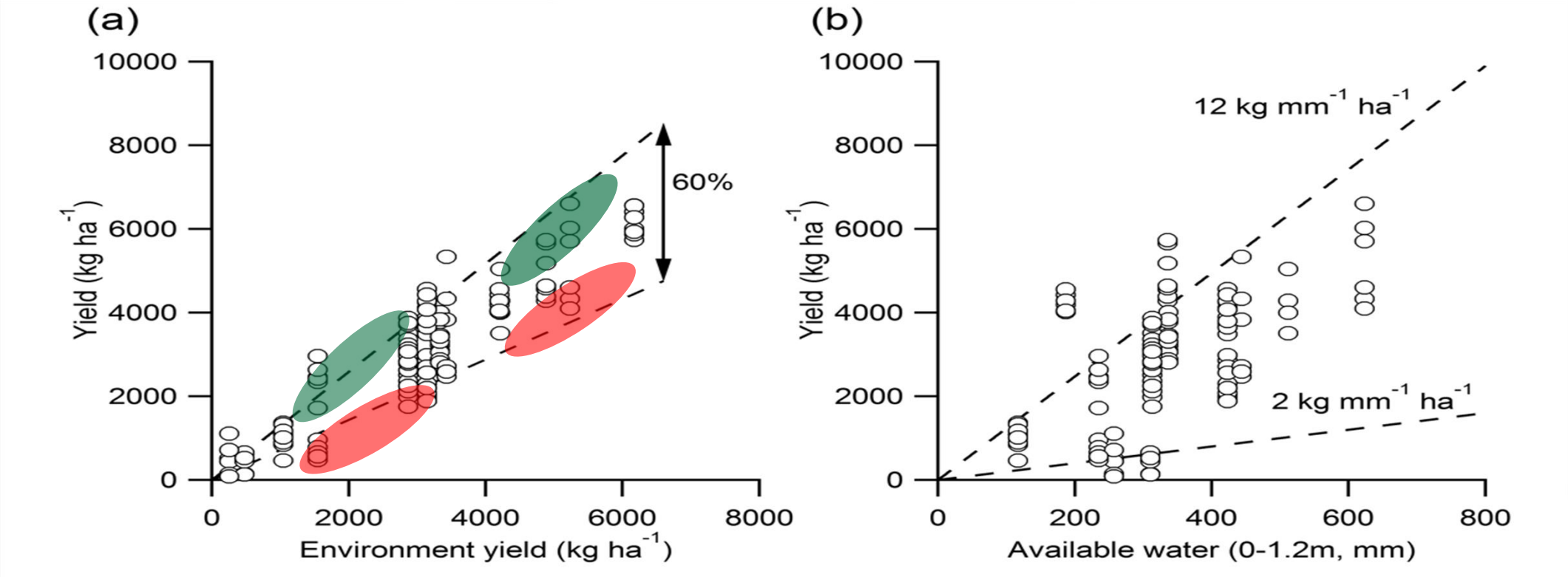
MOVE SOWING TIME EARLIER



Sorghum



- The different combinations of hybrids and management created up to 60% difference in yield
- Yield differences translated into a six fold difference in water use efficiency

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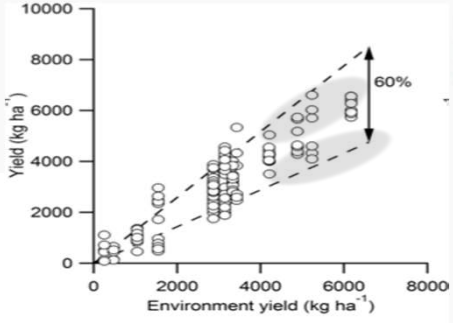
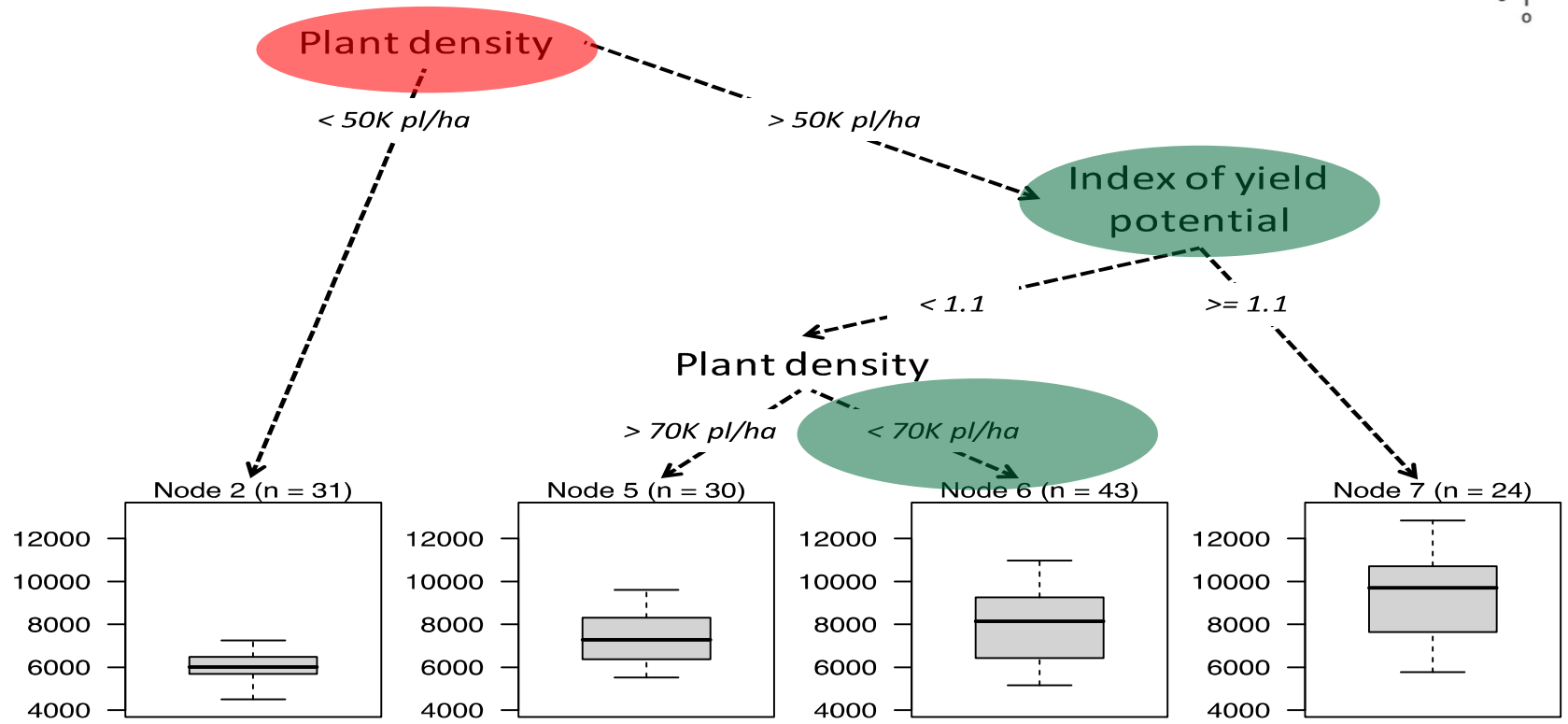
Sorghum: Simple rules of thumb



Above median yield environments (>5.3t/ha)



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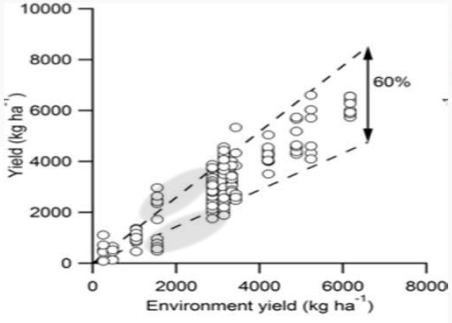

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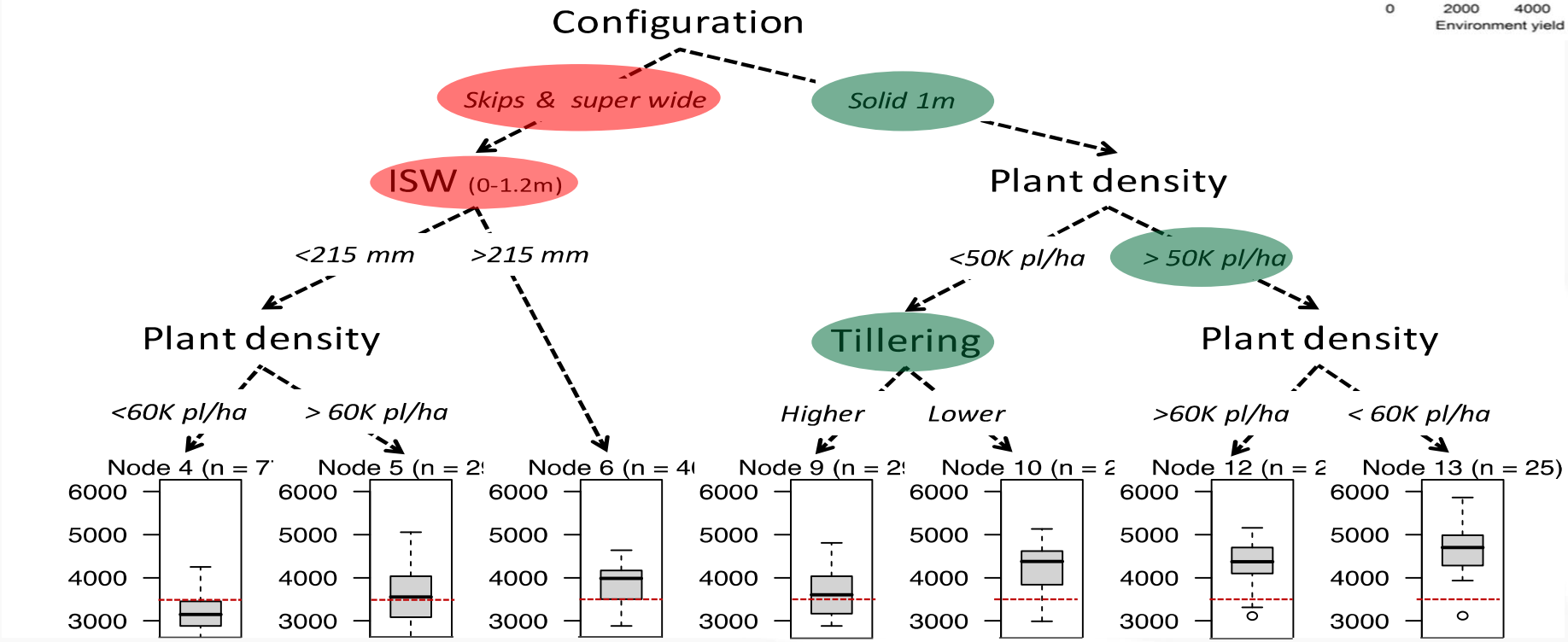

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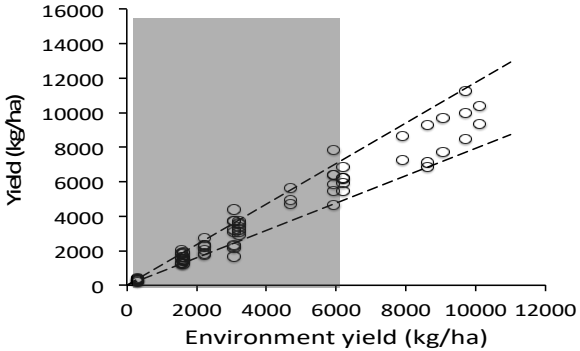
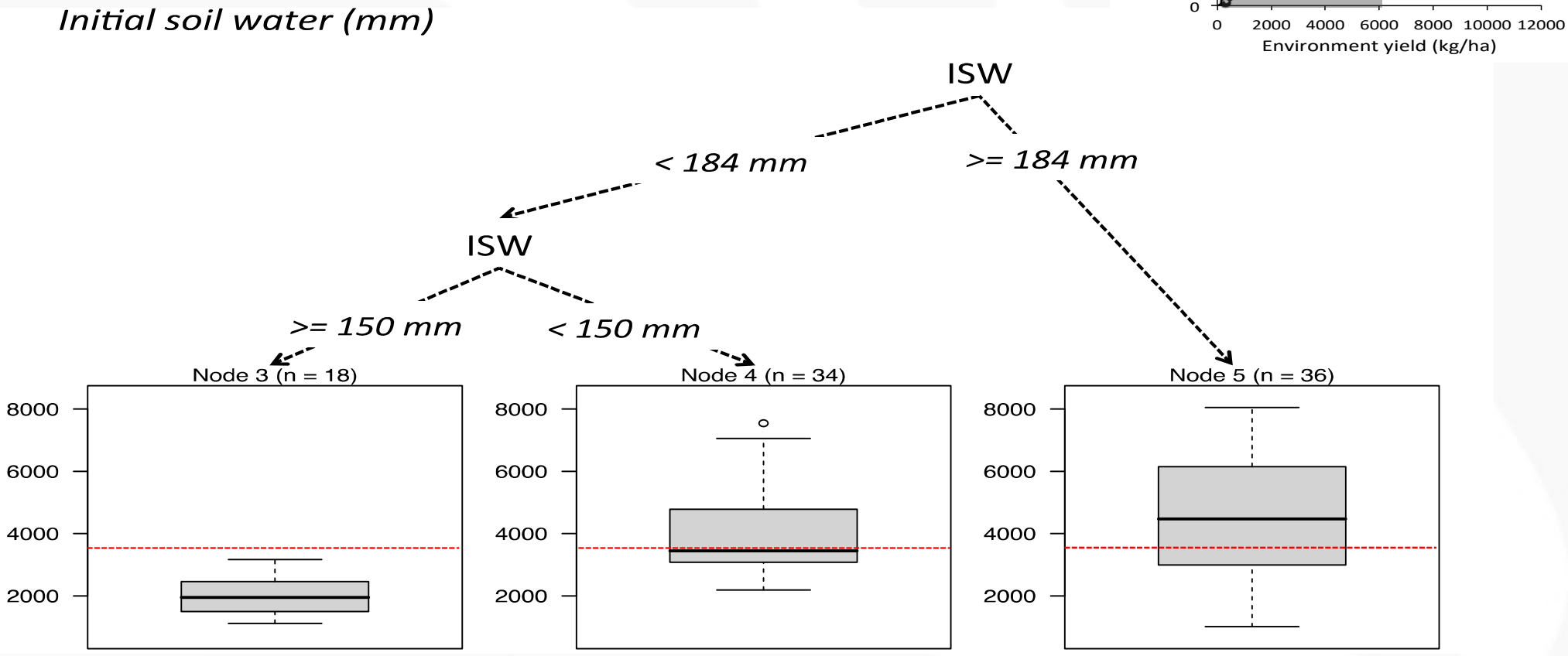
Rules for low yielding environments





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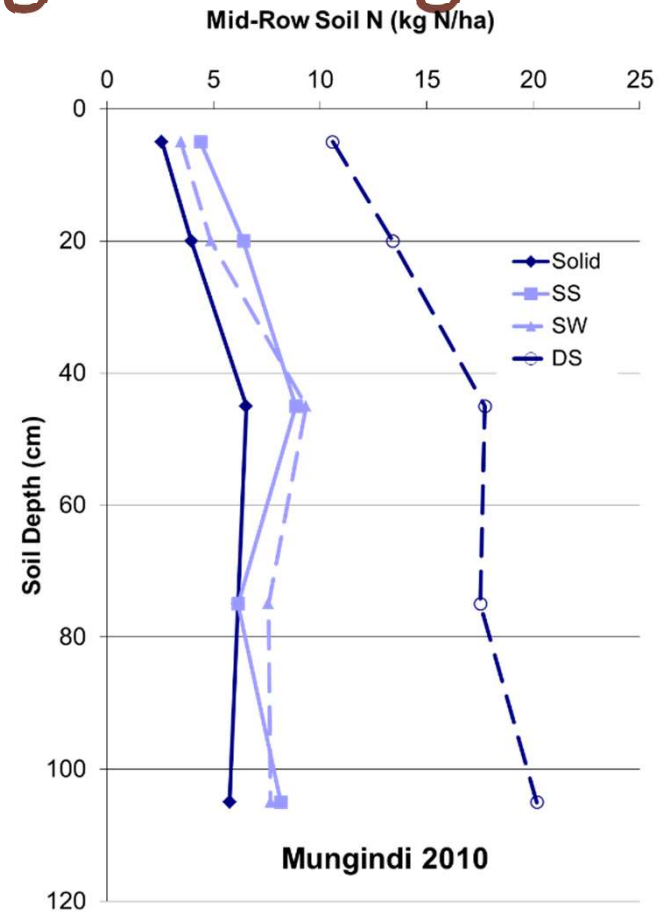
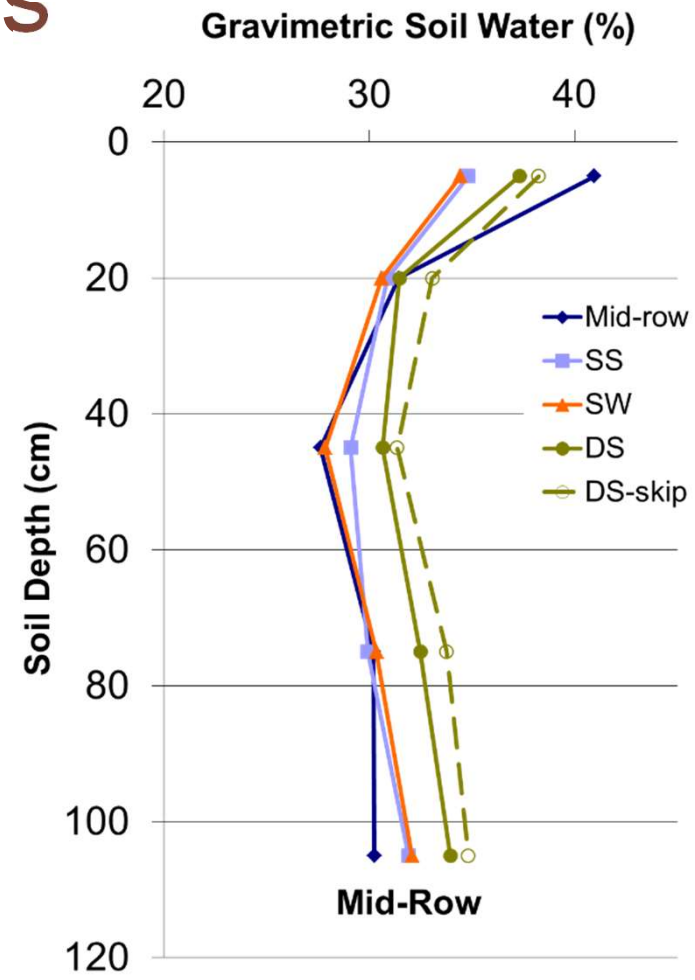
Challenges facing farmers





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Take home messages

- **Starting soil water is critical in Australia**
- Farmers use a range of methods to reduce the risk of crop failure and increase crop yields.
- Creating safe crop production systems also caps the top end yield potential.
- Target plant populations at 50,000 plants/ha.
- Select Hybrids with a level of tillering
- Increased yield = increased profit
- Rotational impacts need further consideration

Thankyou

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