



Department of
Primary Industries and
Regional Development

Protect
Grow
Innovate

Managing wheat in stressful environments

Putting heat and water stress in context

Dr Dion Nicol (DPIRD Merredin)



Heat – 2023 concerns

- Numerous enquiries about impact of heat on yield
 - Some agronomists asked for formulae to estimate yield losses from hot days
 - Many publications list statistical associations
- Interrogating DPIRD variety x TOS data
 - focusing today on Mullewa and Merredin
- Other important considerations (factors that increase risk) and potential trade-offs

Critical yield phase (Temp. and radiation)

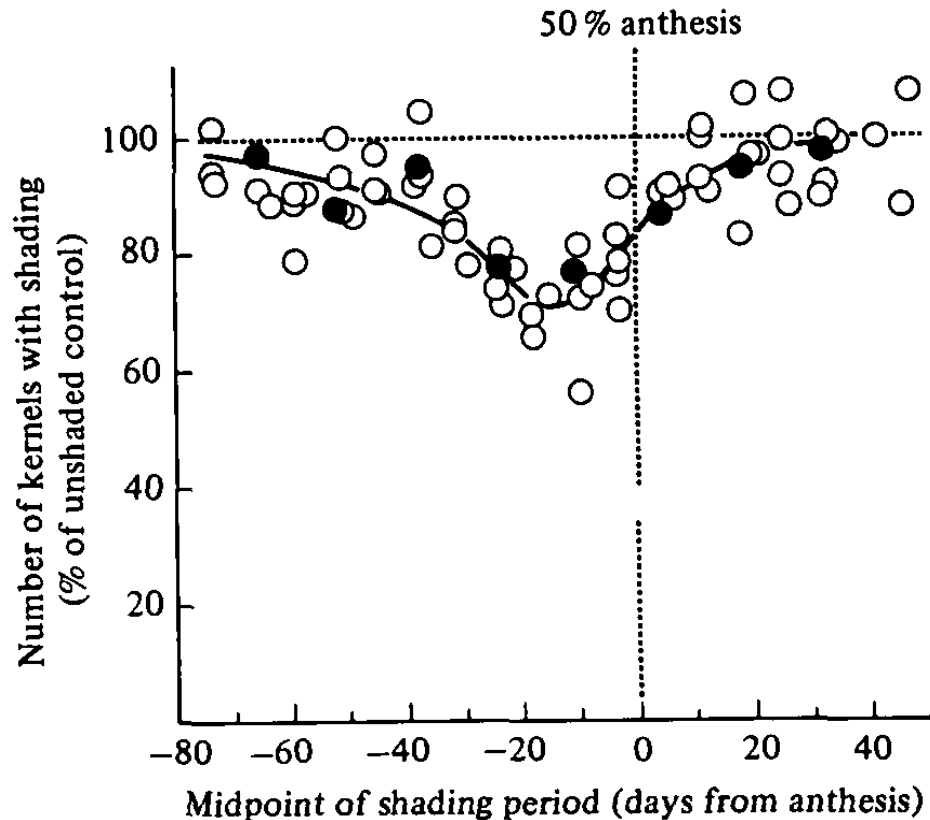


Fig. 2. The effect of single 28-day shading periods (55 % intensity) on nine semidwarf wheat cultivars at CIANO in 1974–5. Each circle represents the centre of a shading period for a particular cultivar, solid symbols refer to the cultivar Yecora 70.

- Increased temp. reduces resource capture in determinate crop (speeding up the crop)
- Increased photosynthetic rate not considered
- Drought stressed crops not radiation limited

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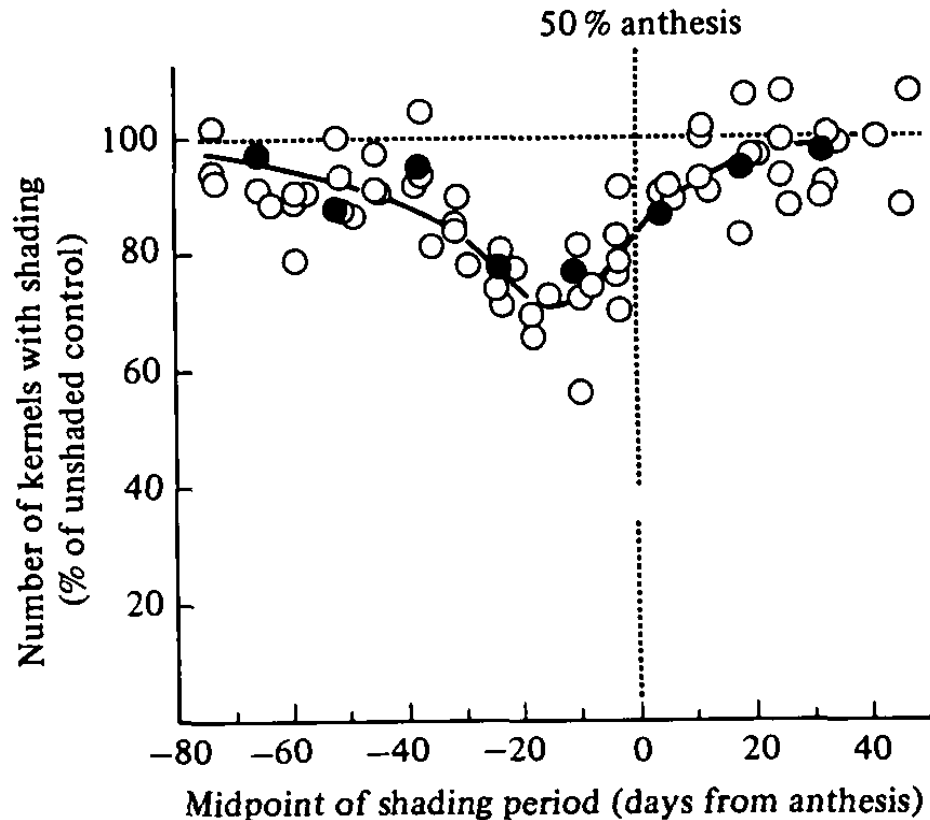
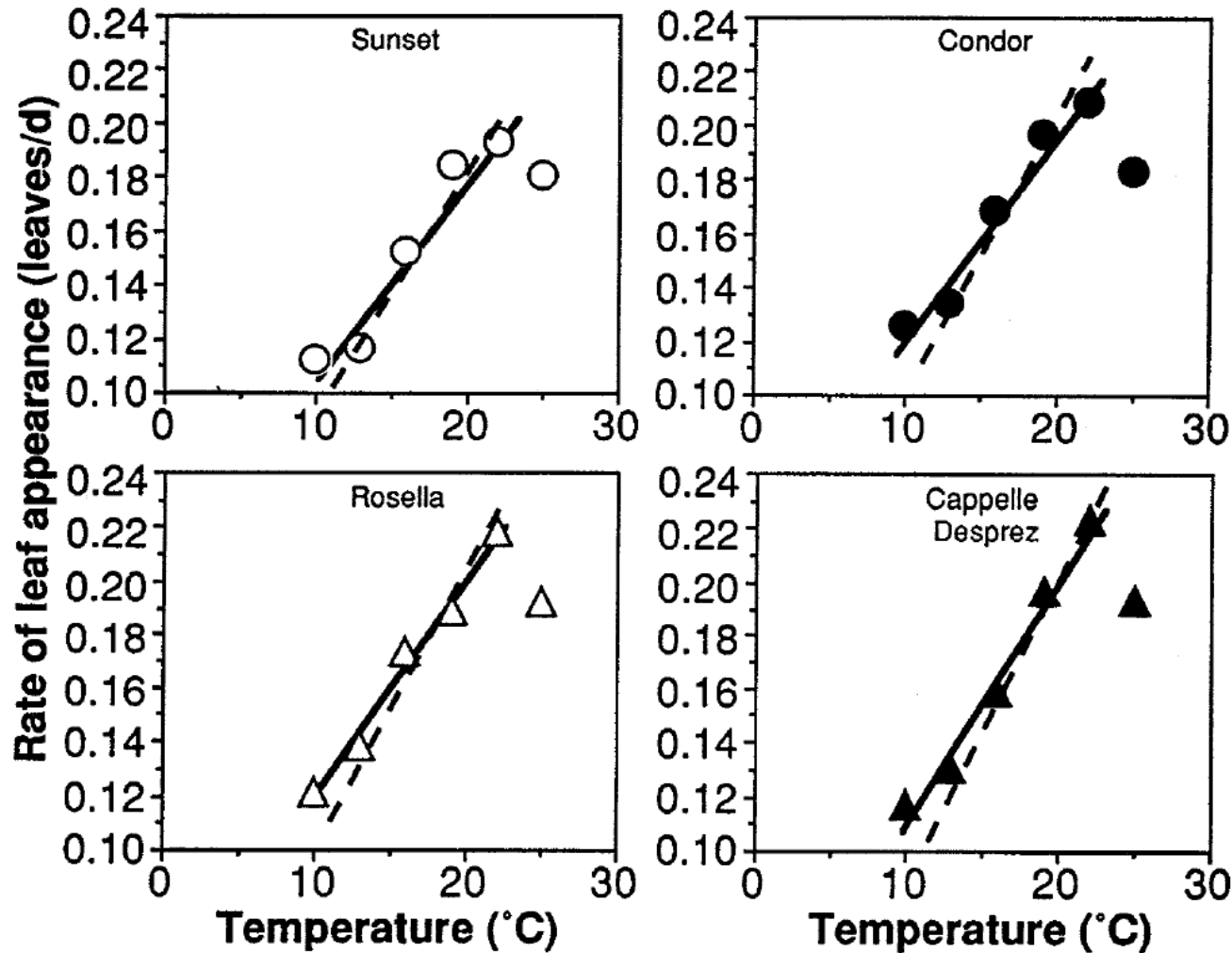


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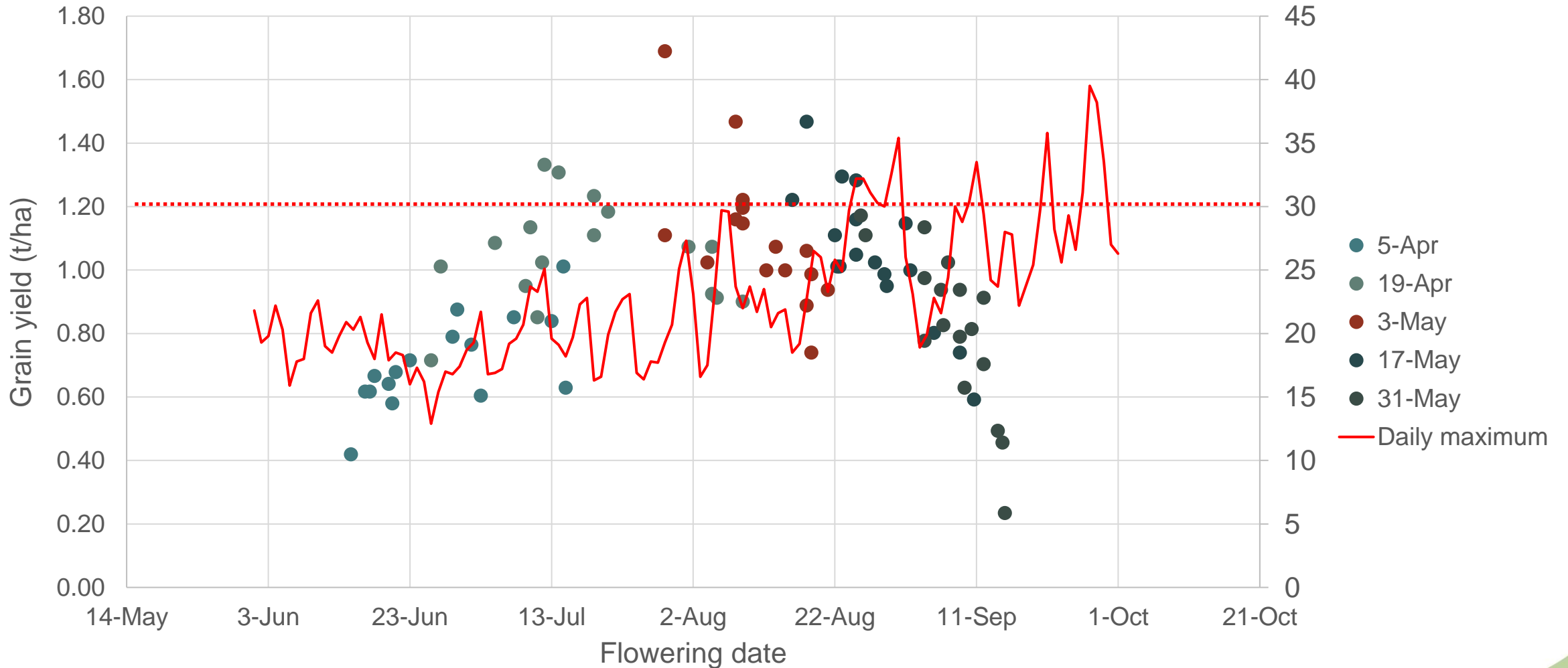
Temperature response in wheat not intrinsic



- Response is not linear beyond certain temperatures
- High temperatures have varied impact on crop development
- High temperature tolerance improves with high temperature acclimation
- Response changes with age of wheat plant

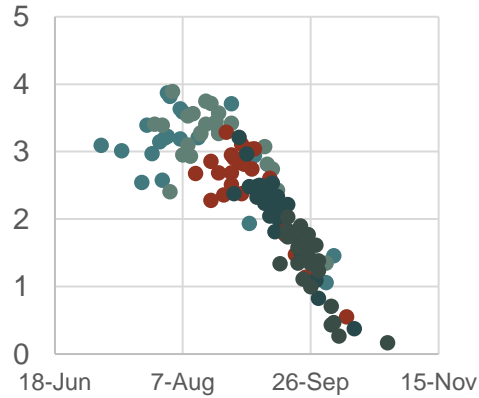
Slafer & Rawson, 1995. Aust. J. Plant Physiol. 22, 913-926

Mullewa 2023

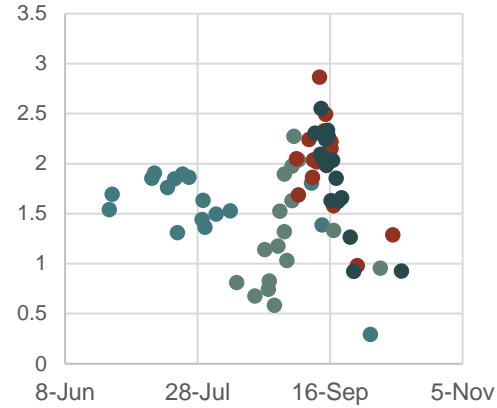


Multiple sites – grain yield × flowering date

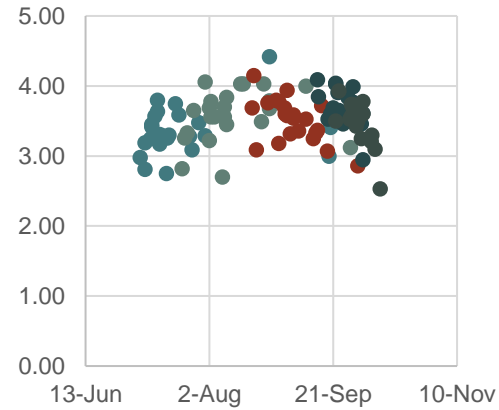
Merredin 2020



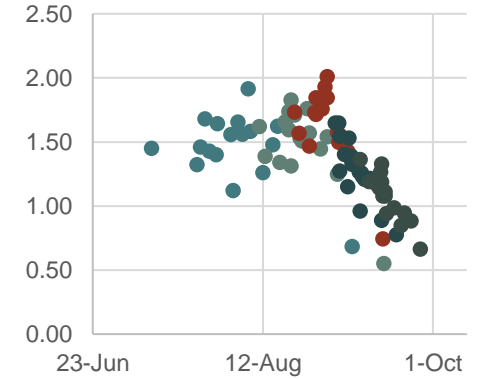
Merredin 2021



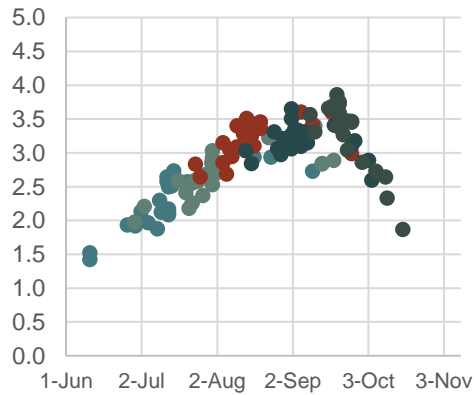
Merredin 2022



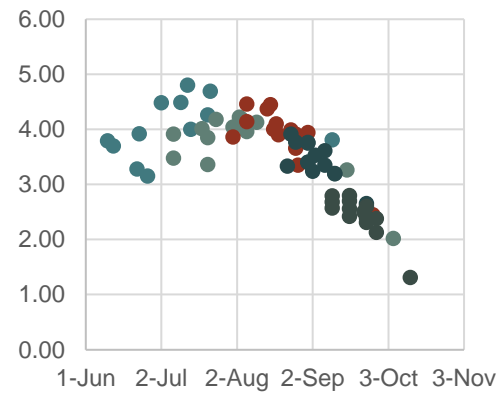
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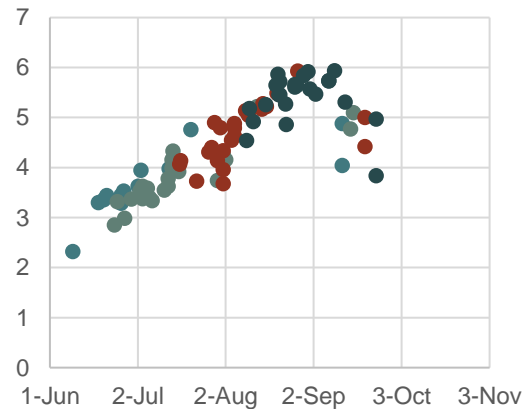
Mullewa 2017



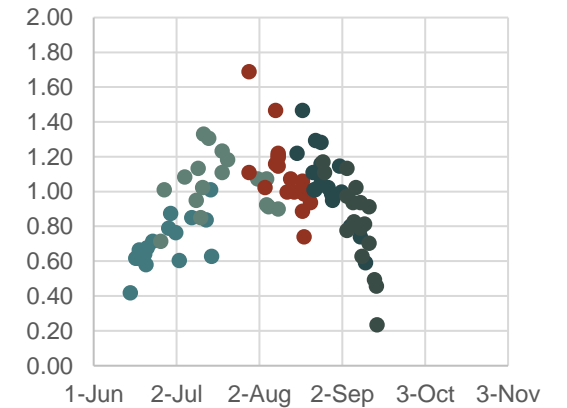
Mullewa 2021



Mullewa 2022



Mullewa 2023

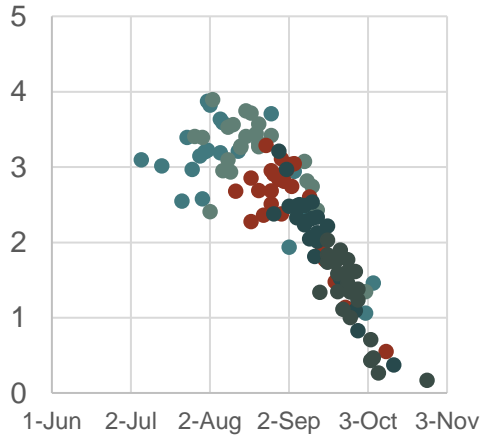


Flowering date

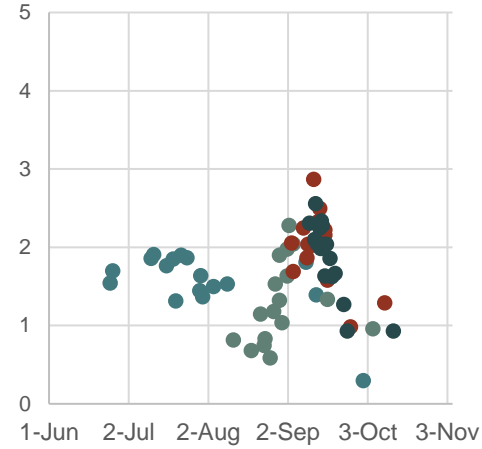
Multiple sites – grain yield × flowering date

Grain yield (t/ha)

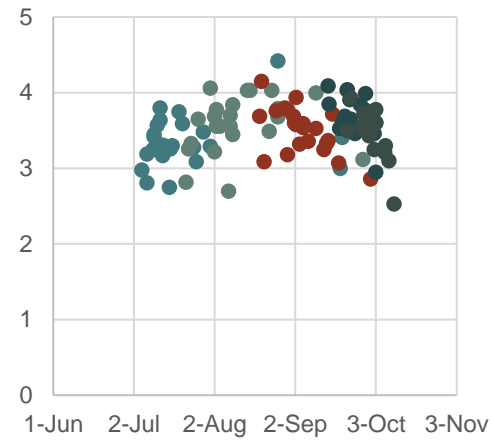
Merredin 2020



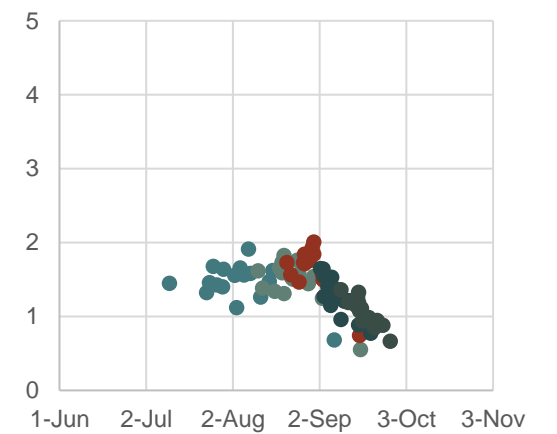
Merredin 2021



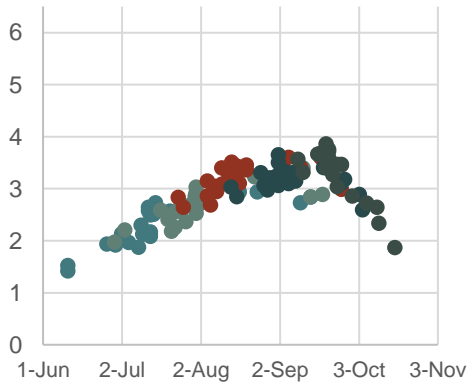
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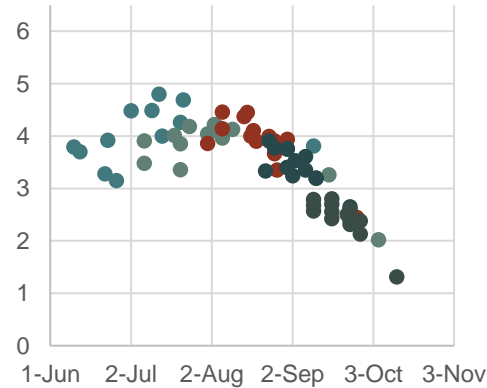
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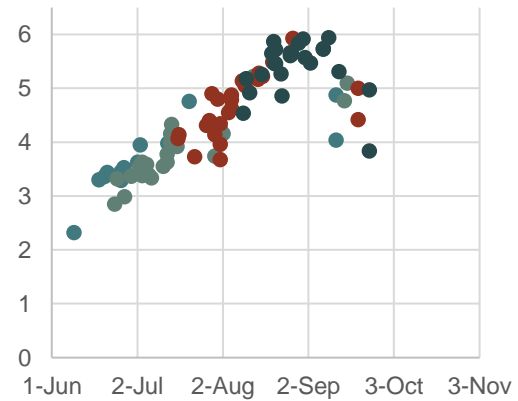
Mullewa 2017



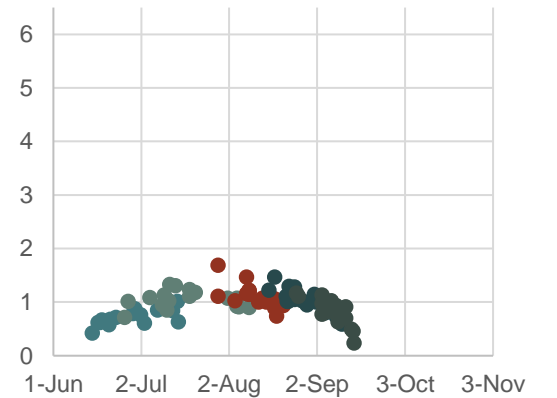
Mullewa 2021



Mullewa 2022

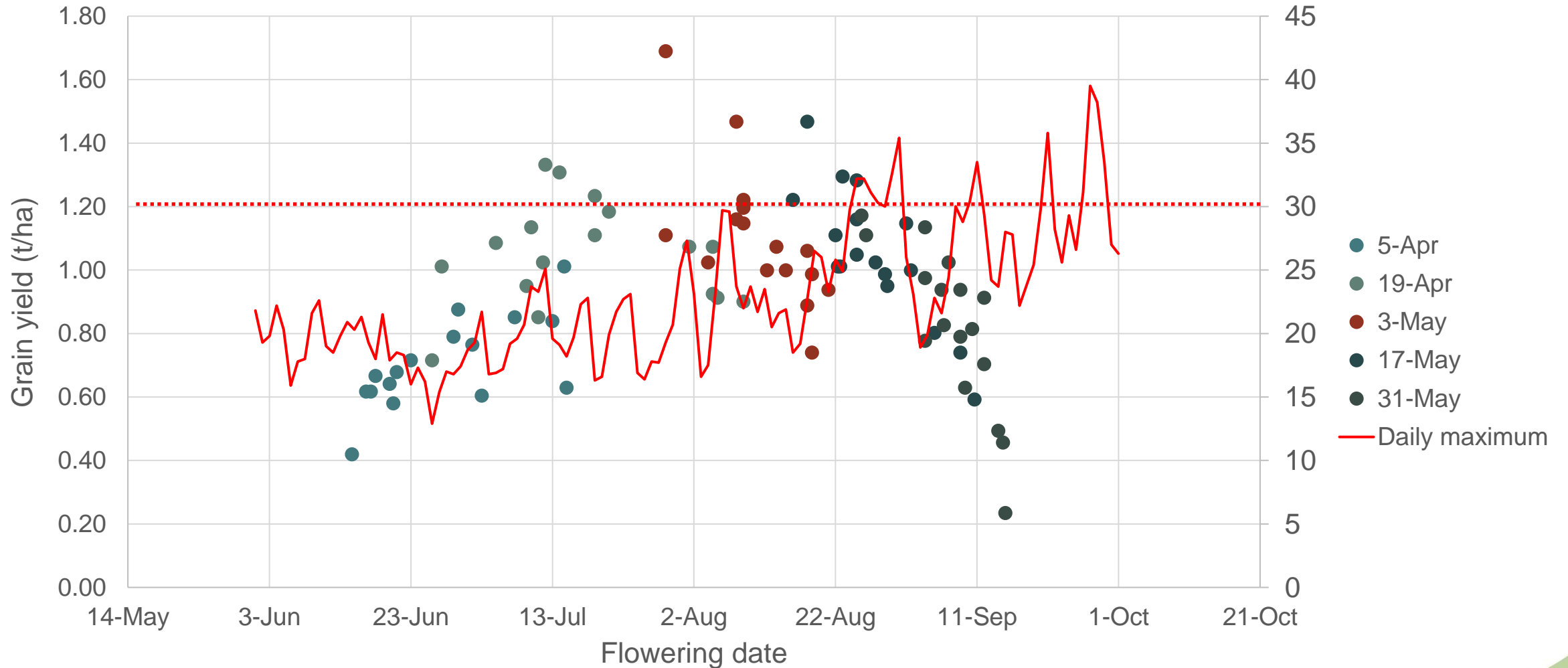


Mullewa 2023

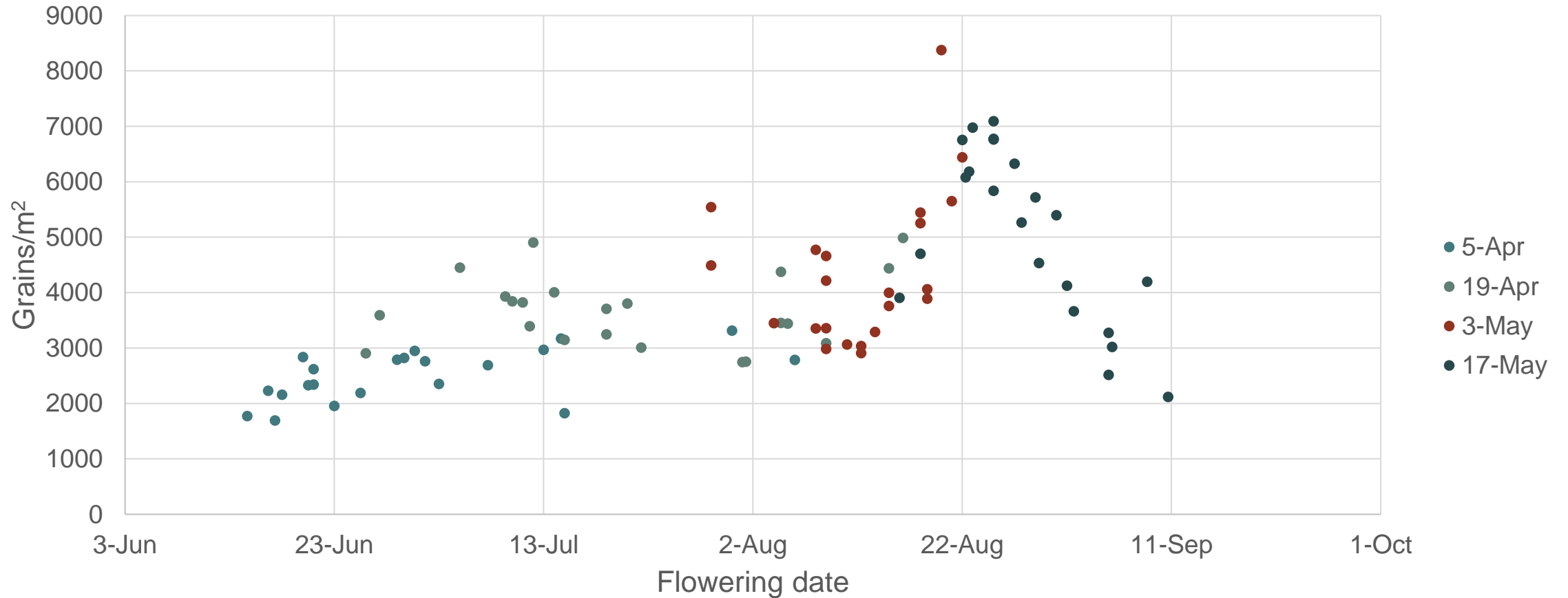


Flowering date

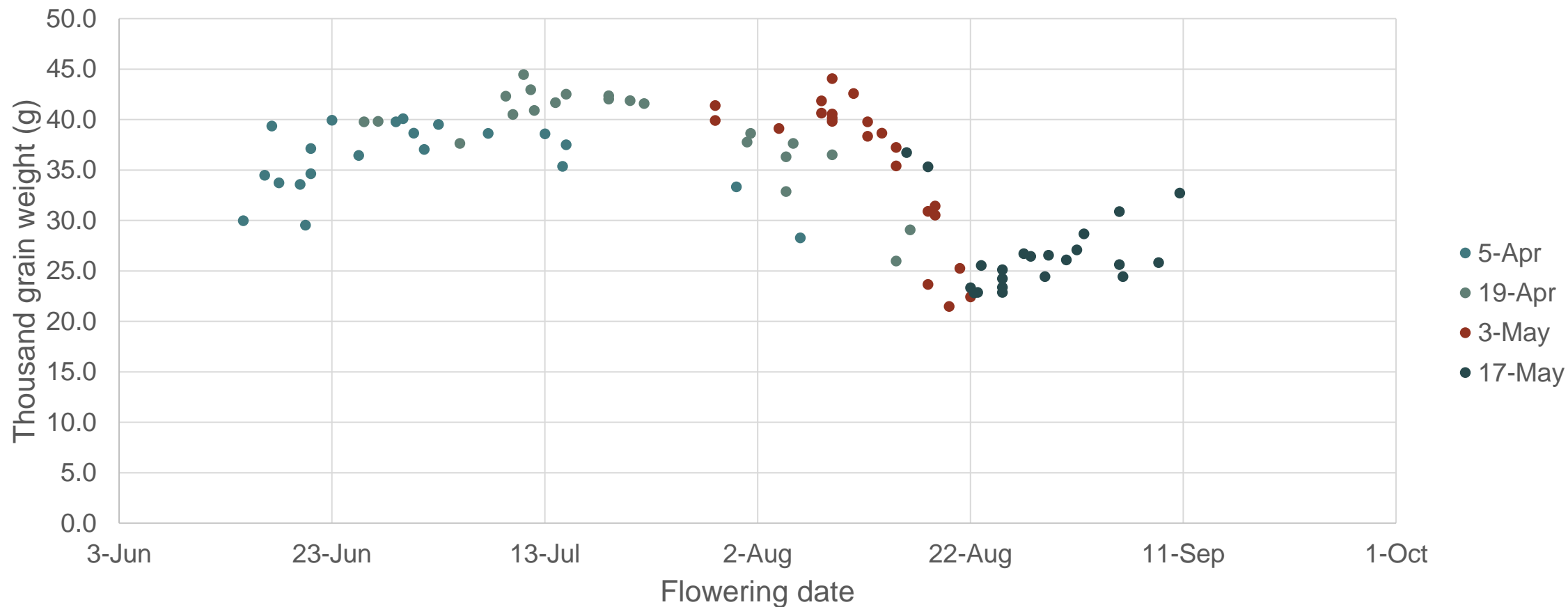
Mullewa 2023



Grains/m² increase in late August



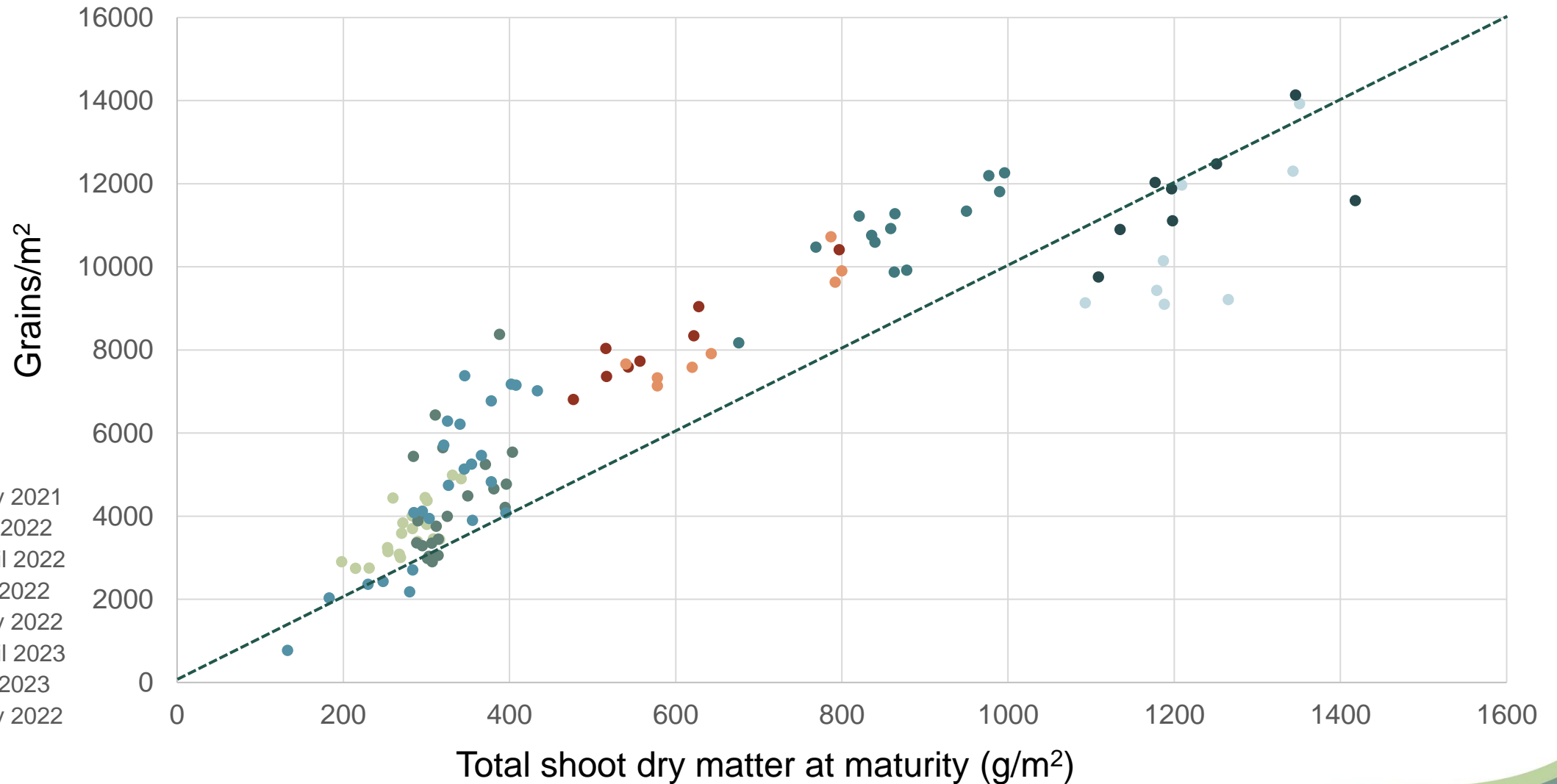
Grain weight decrease in late August



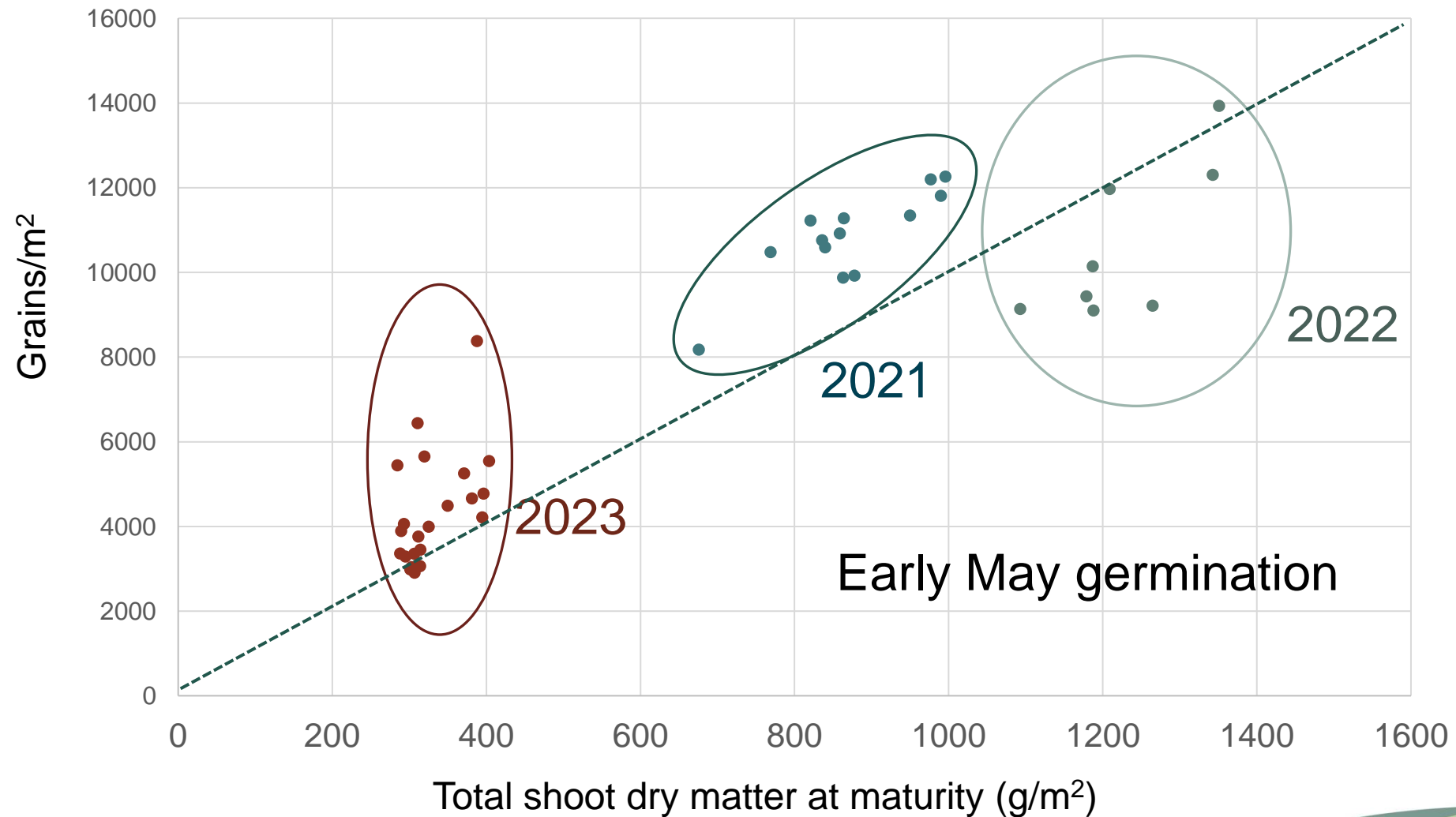
Grain size x stress complications



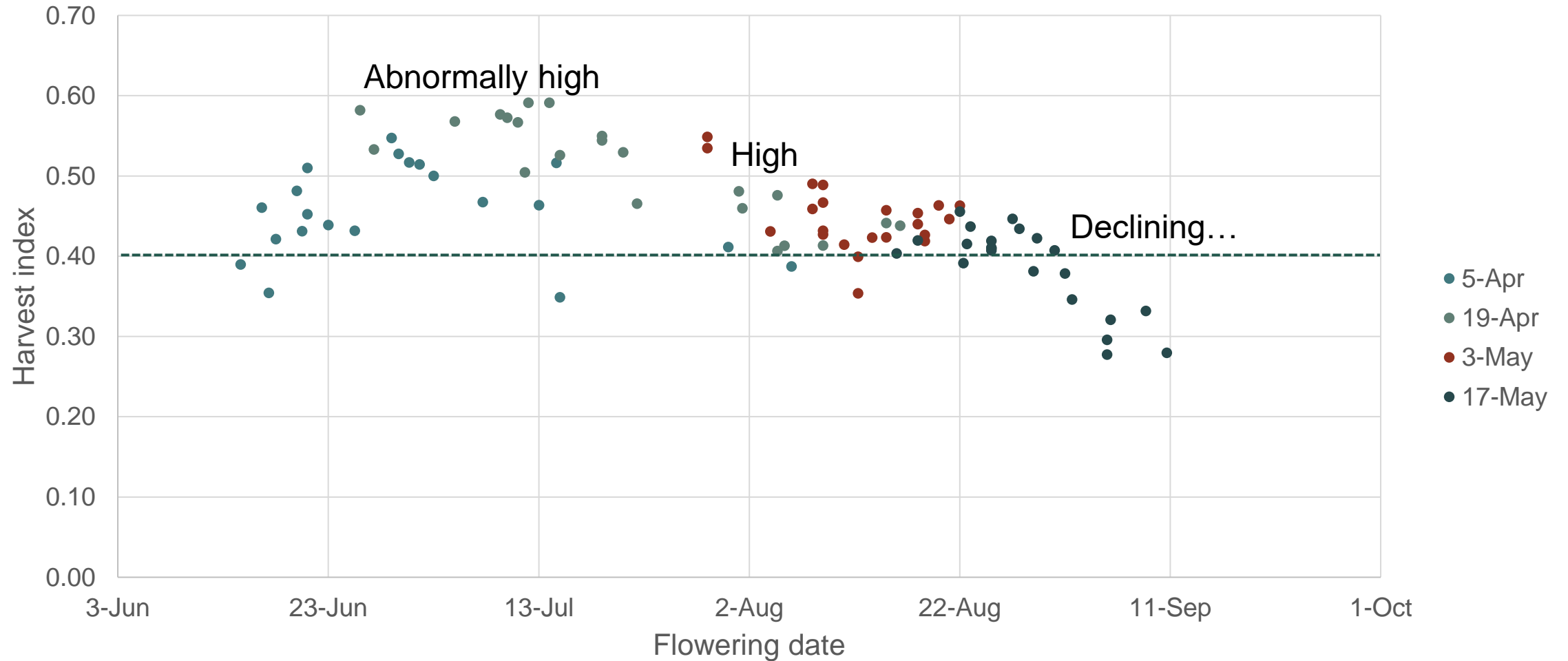
Grains/m² x Dry matter



Are grain numbers lacking?



Harvest index



Crown rot – Merredin 2023



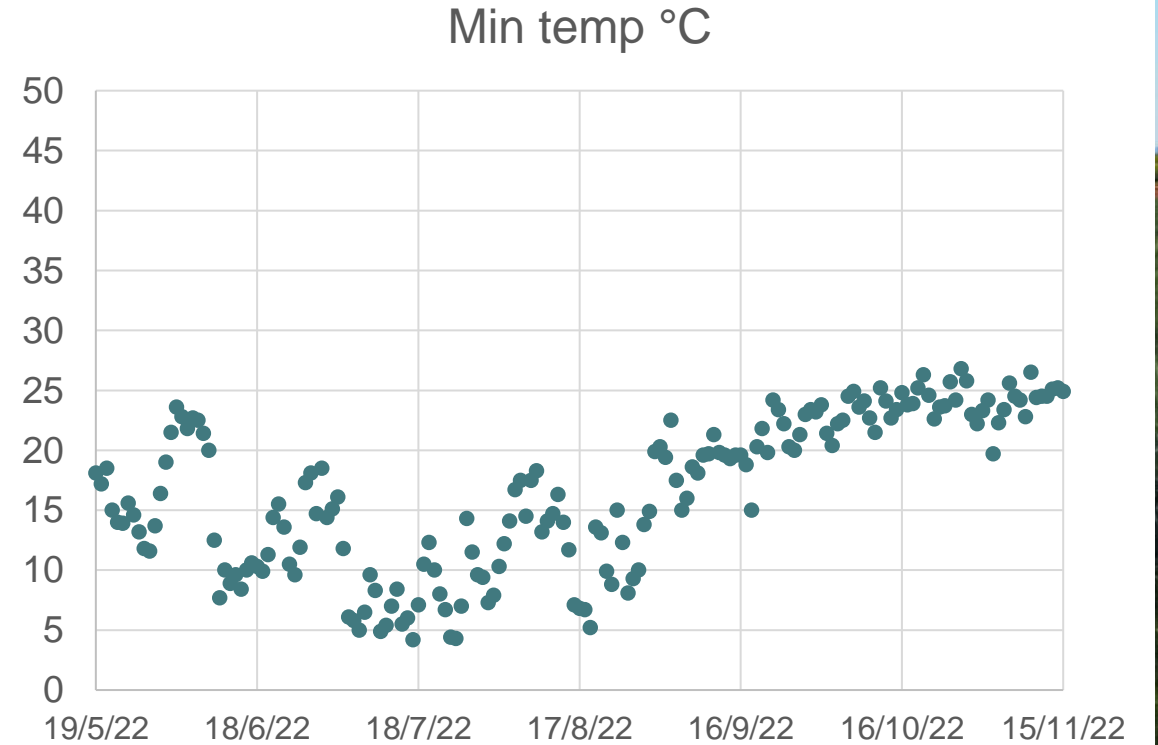
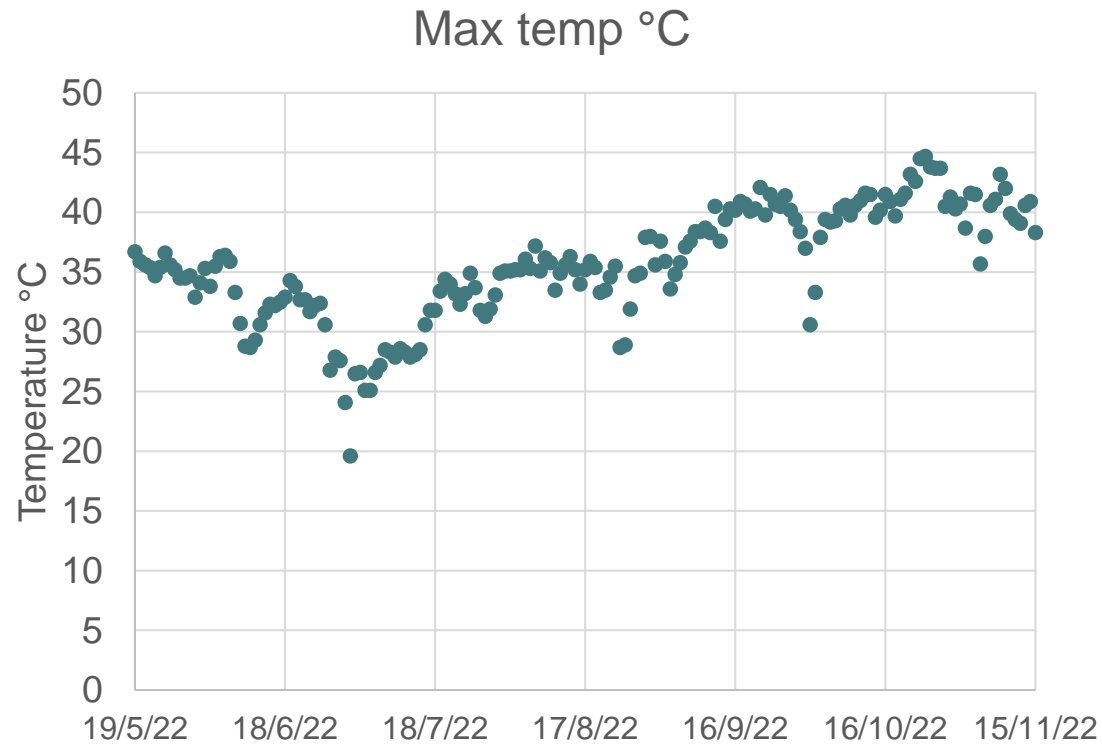
Can hotter environments tell us more?



Kununurra – heat tolerance nursery



Kununurra – heat tolerance nursery



**Wheat can still yield in hot environments
if water and N available**



Key messages

- There are no intrinsic yield loss by temperature functions across current wheat data
- Heat events are much less pronounced than frost and likely amplify drought conditions
- Terminal drought (or even intermittent drought) remain consistent in driving yield patterns in low rainfall wheat data
- Factors such as crown rot are likely to exacerbate losses from heat

Tips for hot, drier conditions

- Plant available water is king!
 - Avoid later flowering times on shallow, drought prone soils
- Choose varieties with proven performance in good and bad seasons
 - High yielding across stressed and favourable conditions
 - Varieties relative screenings performance holds up
 - Avoid varieties highly susceptible to crown rot
- Avoiding heat and terminal drought too much can lose yield potential
 - TOS x maturity

Thank you

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