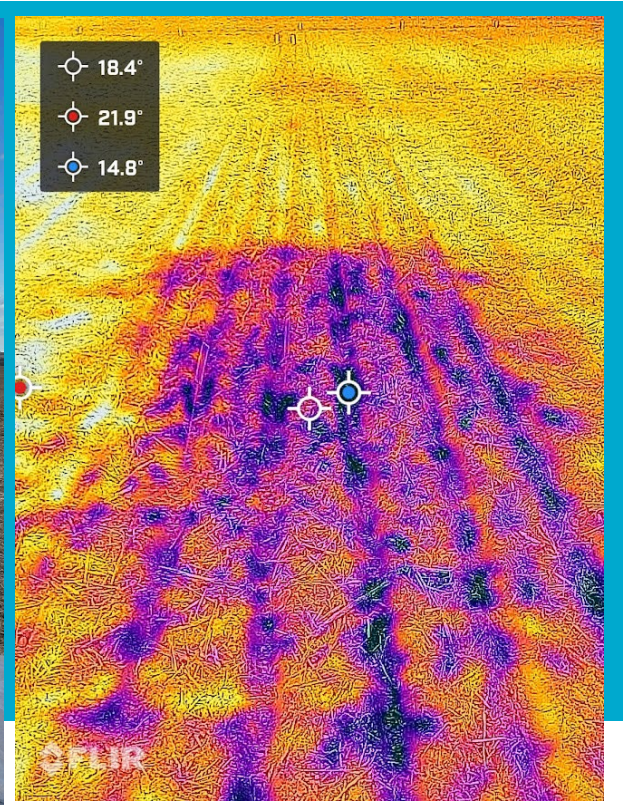



Dissecting water and temperature conditions influencing canola establishment in the seed bed

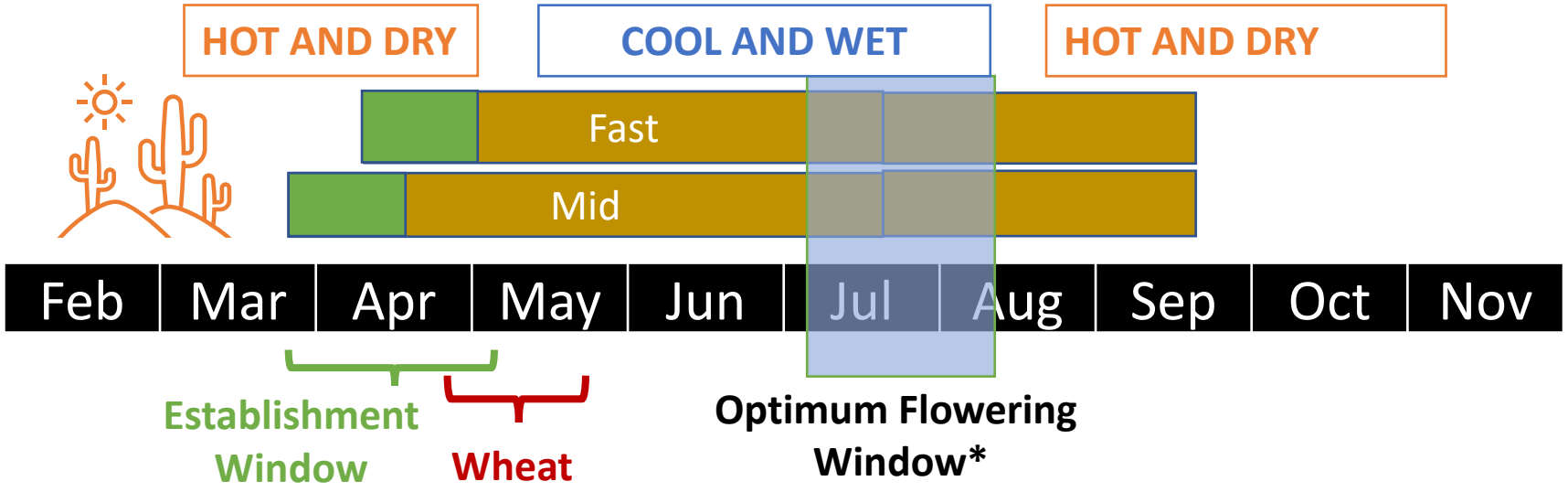
Kenton Porker, Andrew Fletcher, Andrew Ware, Therese McBeath, John Kirkegaard

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

CSIRO

Successful crop establishment synchronises crop management and development with environment

Karoonda*/ Wynarka



The problem: Canola seed is difficult to establish on time due to marginal and volatile seed bed conditions (1-3cm deep)

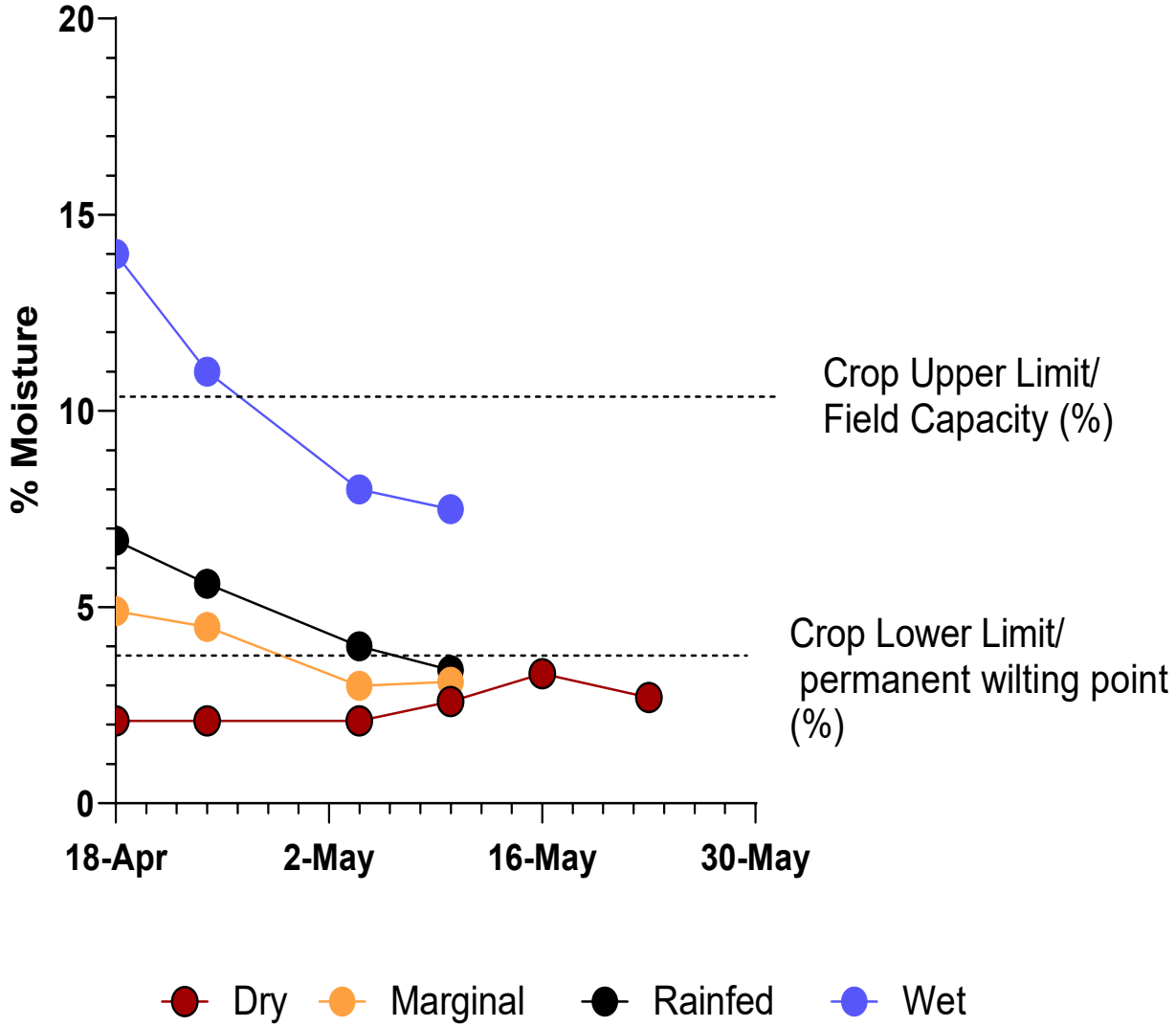
*Lilley et al 2019

Germination → emergence → **establishment**

What's too hot and too dry? Do they interact? What can we do about it?

Water potential and temperature interactions in seedbed furrow (1-3cm)

(South Australia, Wynarka sandy soil)
Median long-term April rainfall = 19.3mm
30% chance of receiving rainfall >10mm over 2 days



Dry

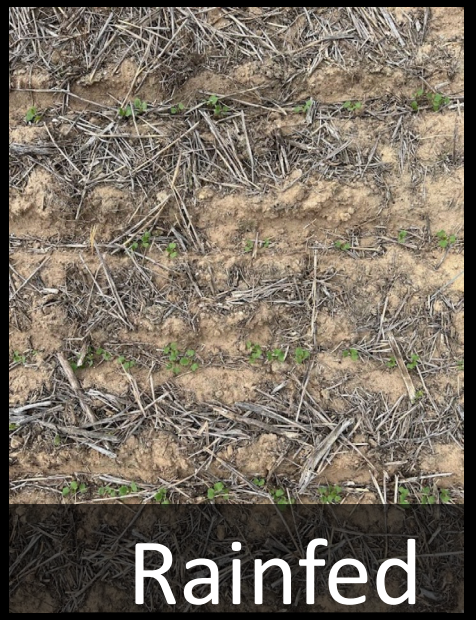
1 plants/m²

1.6%

Marginal

34 plants/m²

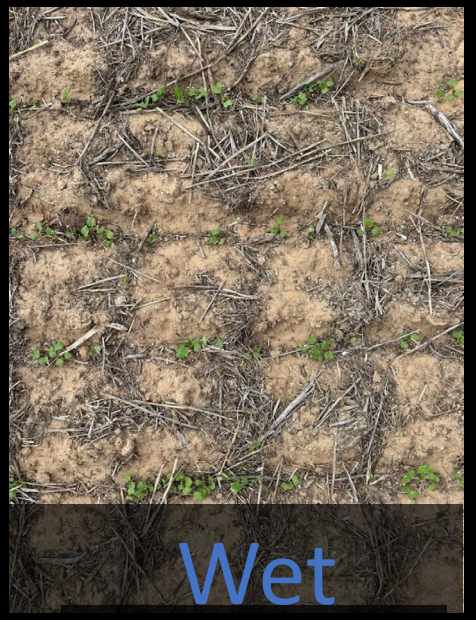
56%



Rainfed

41 plants/m²

68%



Wet

42 plants/m²

71%

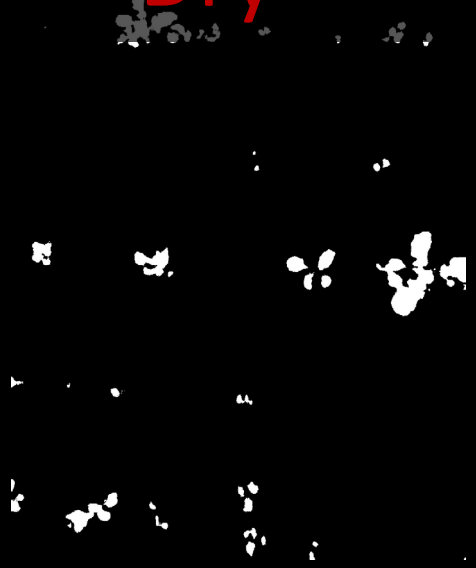
2 May (14 days after sowing)

Dry

Marginal

Rainfed

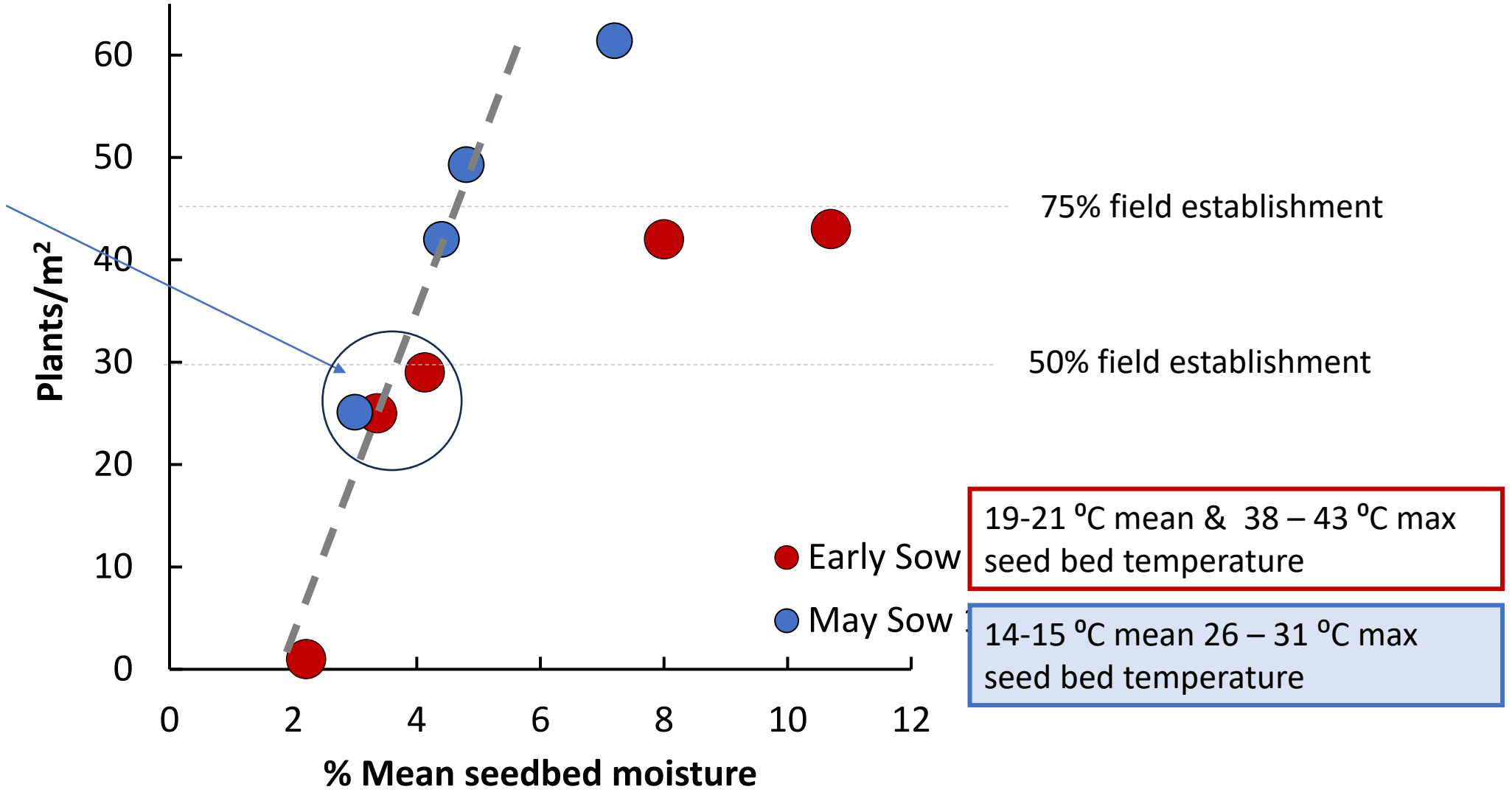
Wet



20 Jun (62 days after sowing)

Seedbed moisture conditions and establishment in the 200°Cd period from sowing at 2.5 cm sowing depth

6.2 – 6.8 mm water supply (as irrigation or rainfall) Maintained 5mm water balance >2 days



19-21 °C mean & 38 – 43 °C max seed bed temperature

14-15 °C mean 26 – 31 °C max seed bed temperature

The top 3 cm dries quickly - Inform simple crop establishment rules;

“drying conditions are more sensitive to solar radiation, wind speed, and humidity than temperature” = Evaporation ETo FAO56 (Penman-Monteith 1948)

Water Balance Method =
WB of preceding day + Rainfall – Eto

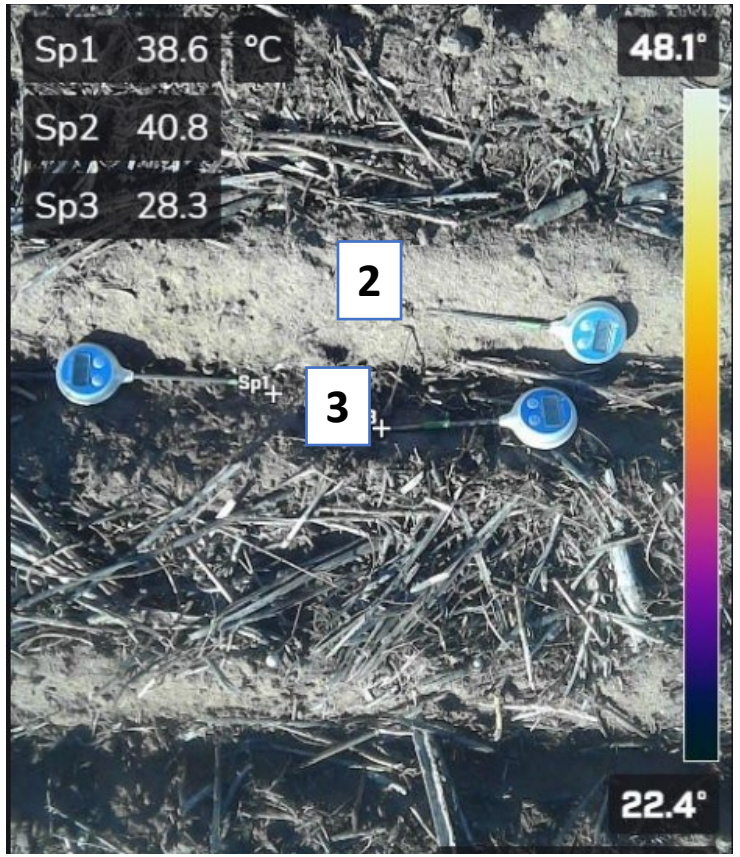
(Wynarka, South Australian low rainfall example 1 April – 10 May)

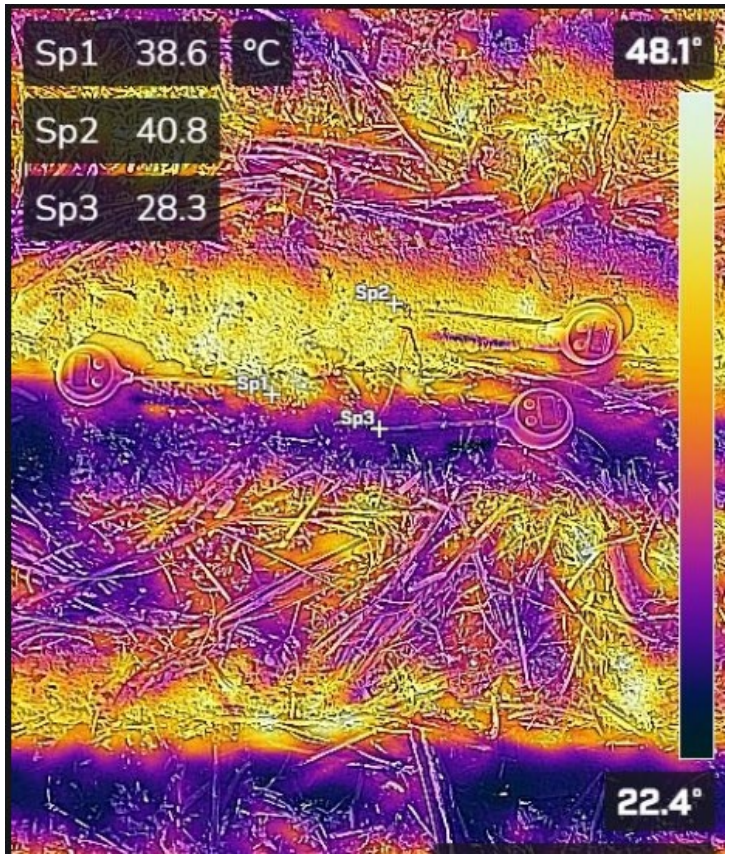
- 5mm WB = 61% of seasons (Sandy soils)
- 15mm WB = 28% of seasons (water repellent soils?, sodic clay?)

The effect of supra optimal (>38^{o}C) surface and seed bed temperatures on establishment is a work in progress

Radiation intensity influences surface temp (time of day, residues etc)

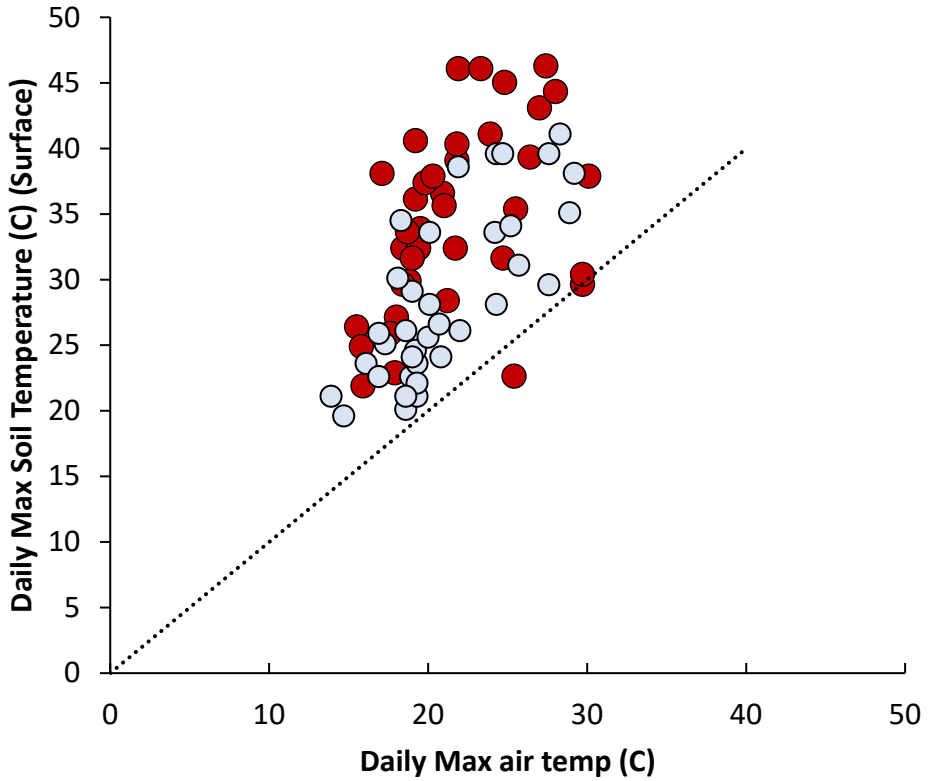
N



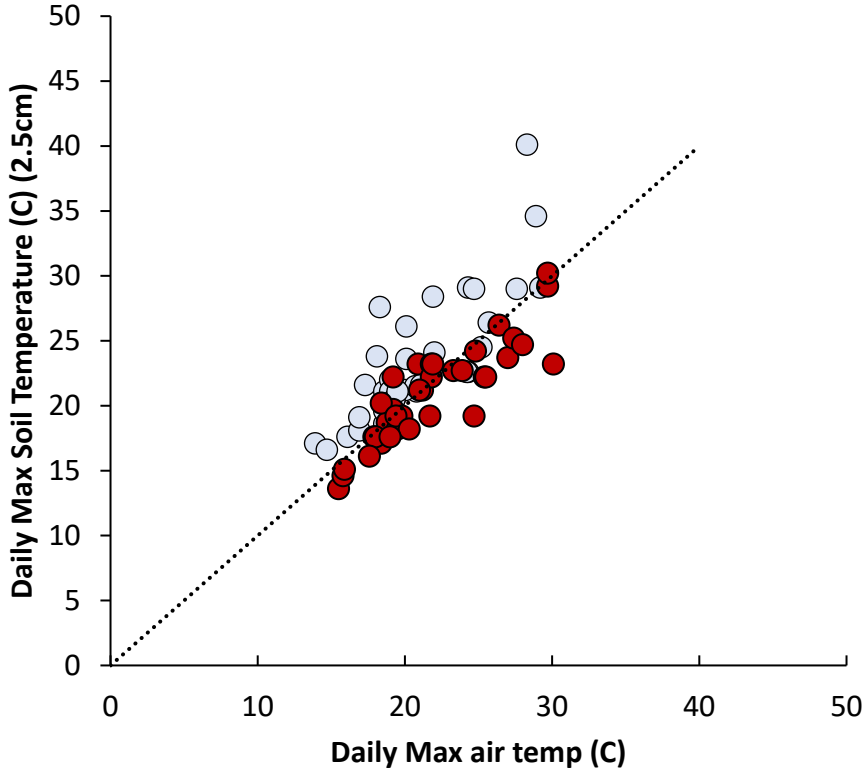


Ambient air temp = 24.8^{o}C

Soil texture has different thermal properties Ungarra Clay vs Wynarka Sand



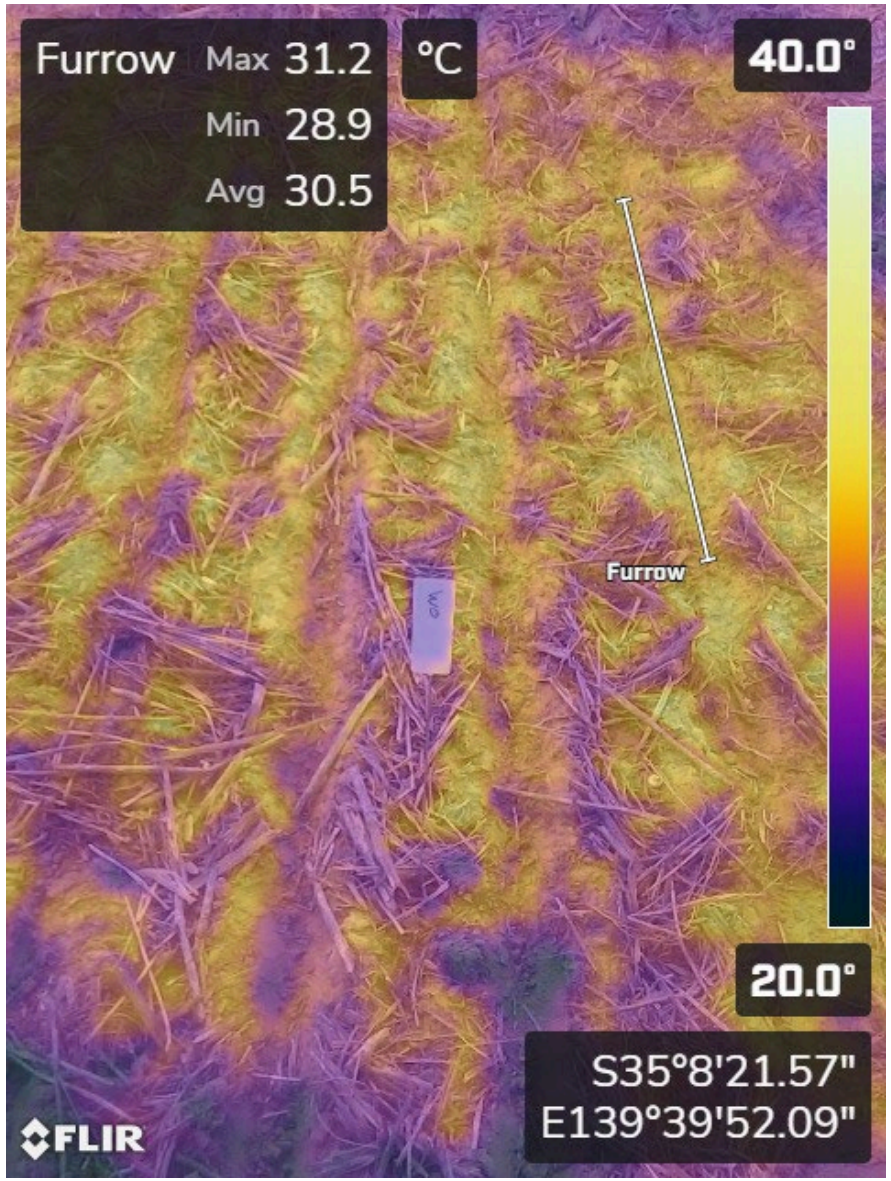
Surface Soil MaxT up to 20C hotter than AirT in a clay and sandy soil



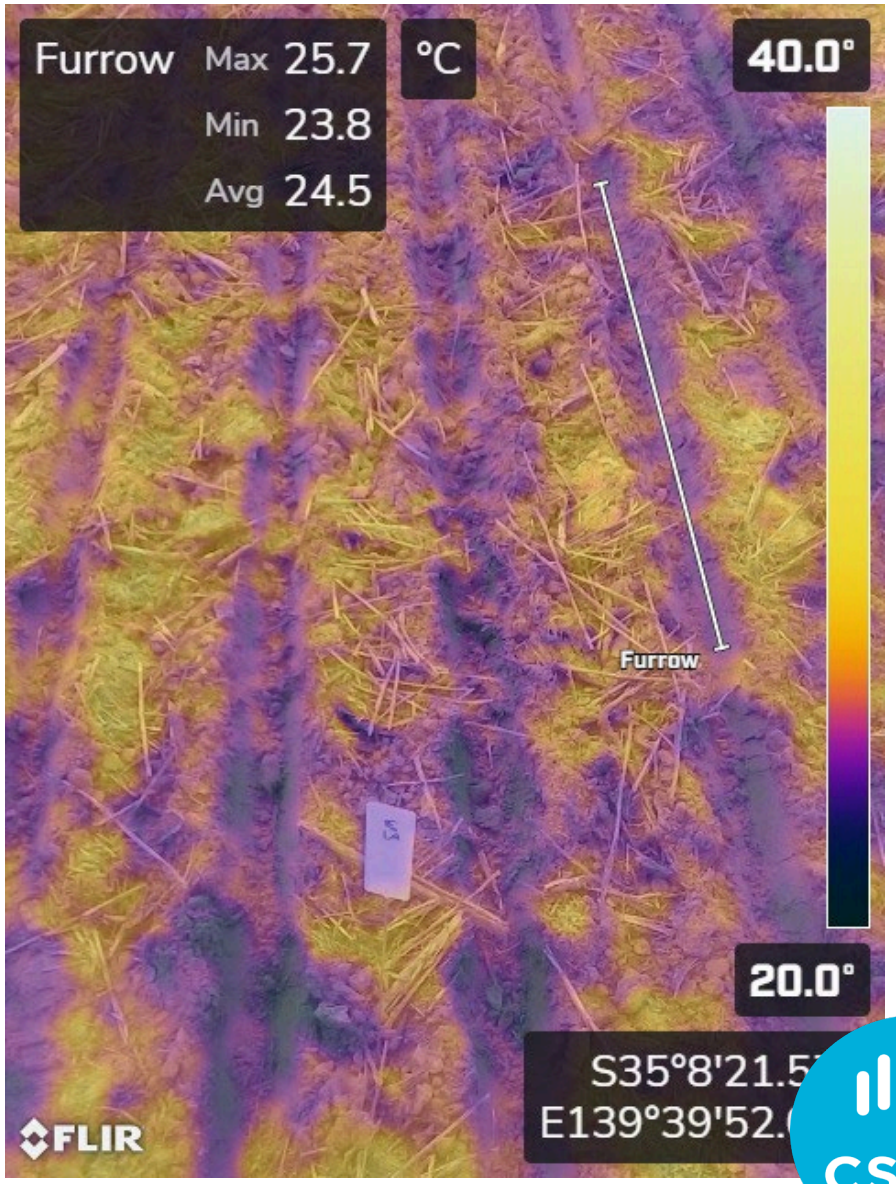
clay soil had greater buffering than the sandy soil when placed at **2.5cm deep (seed bed)**

Wet soil is cooler

Tarp Line

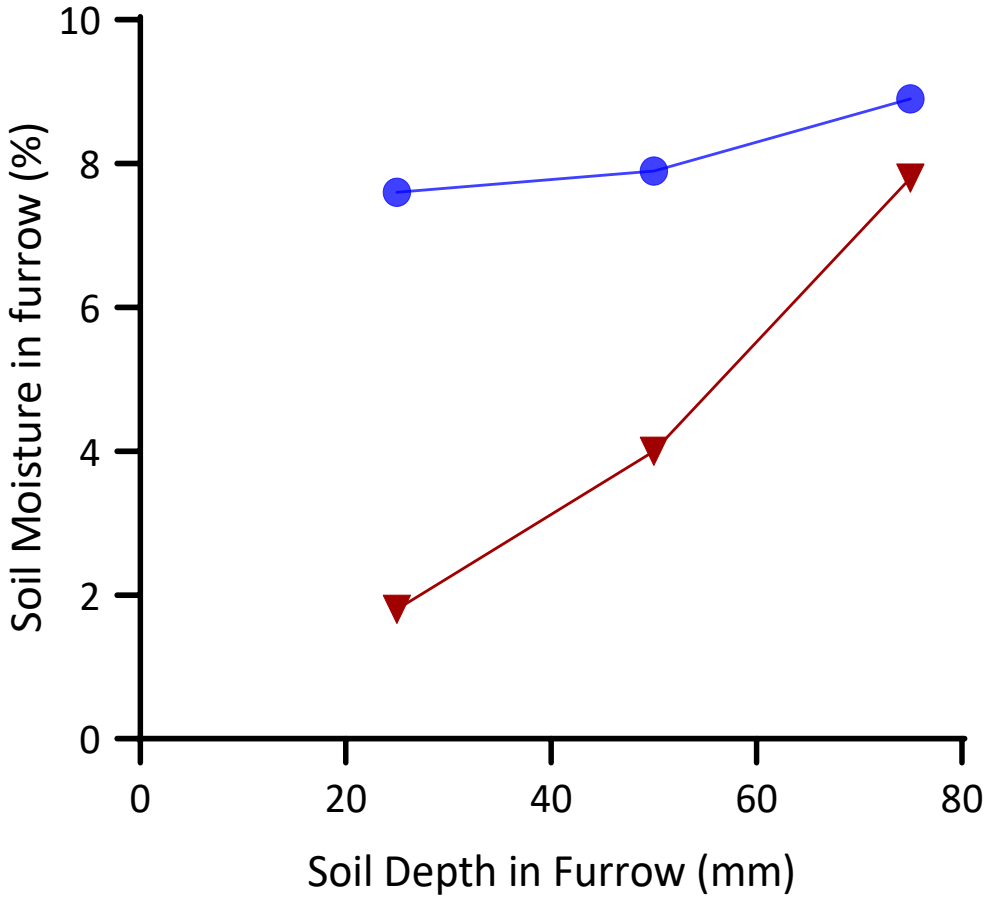


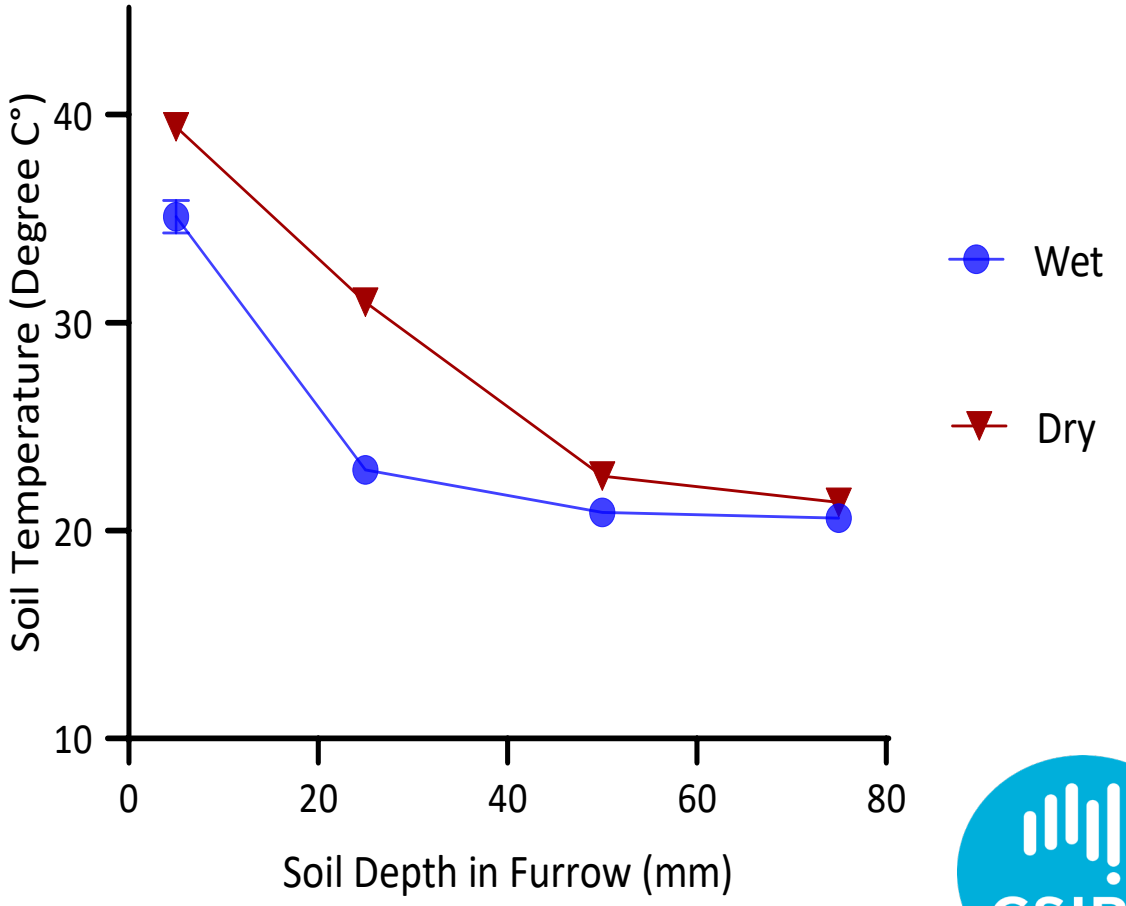
Dry



Wet

Reliable solutions (genetics and engineering) to establish canola from greater depth may be one way to increase success of germination, and emergence?





Developing solutions to improve crop establishment will de-risk and expand the cropping area of canola

Thank you

@kentonp_ag

Fundamental principles that influence crop establishment all interact - develop solutions to improve crop establishment

- Seedbed moisture
  - wetters, stubble cover
- Temperature
  - stored moisture, sow date, depth, texture
- Depth x soil strength
  - Hypocotyl length, soil type, engineering (press wheel pressure),

CSIRO

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

EPAG RESEARCH

NSW GOVERNMENT Department of Primary Industries

BCG

goa GRAIN ORANA ALLIANCE

AgGrow AGRONOMY + RESEARCH

GOVERNMENT OF WESTERN AUSTRALIA Department of Primary Industries and Regional Development

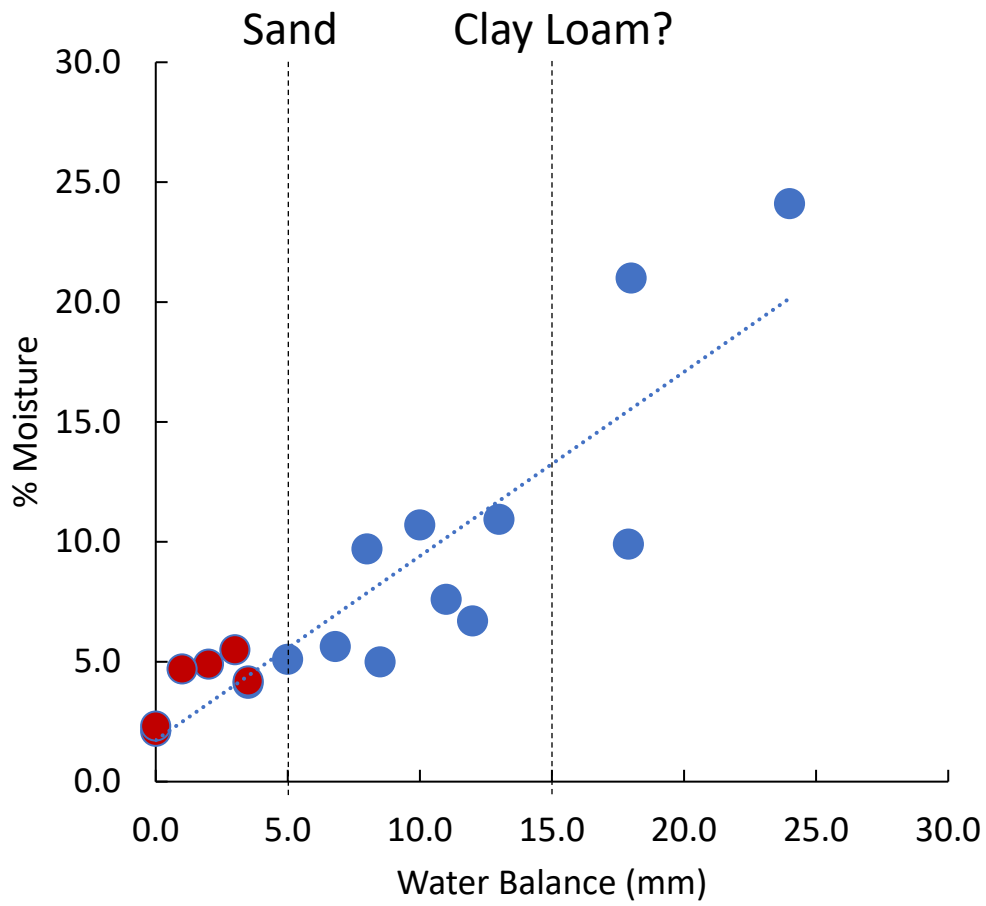
living farm

BRILLAG AGRONOMY & RESEARCH

Inform simple sowing rules and ‘complex’ models that determine establishment opportunity for canola in a warm drying soil

“drying conditions are more sensitive to solar radiation, wind speed, & humidity than ambient temperature”

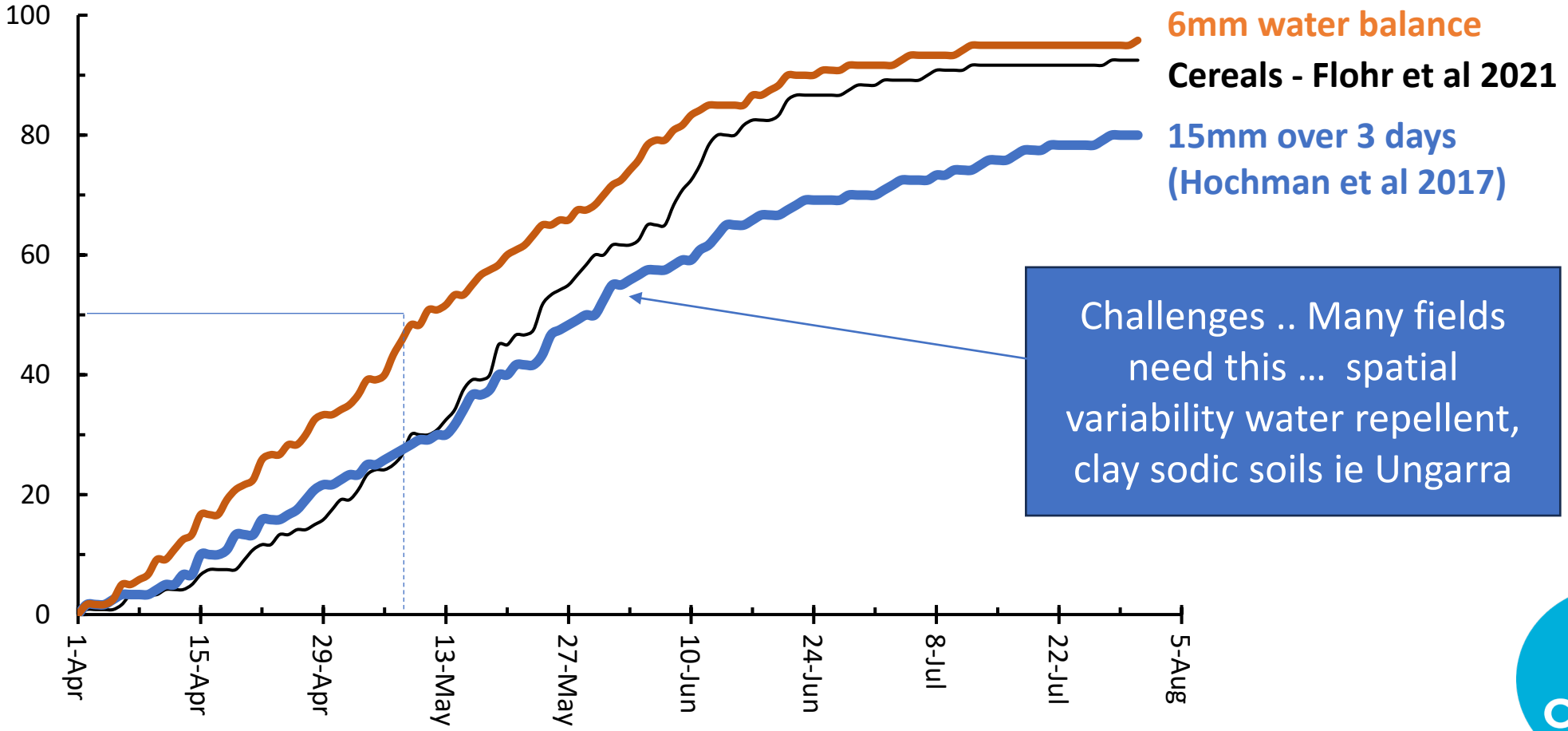
Water Balance Method = WB of preceding day + Rainfall – ETo (FAO56 Penman-Monteith 1948)



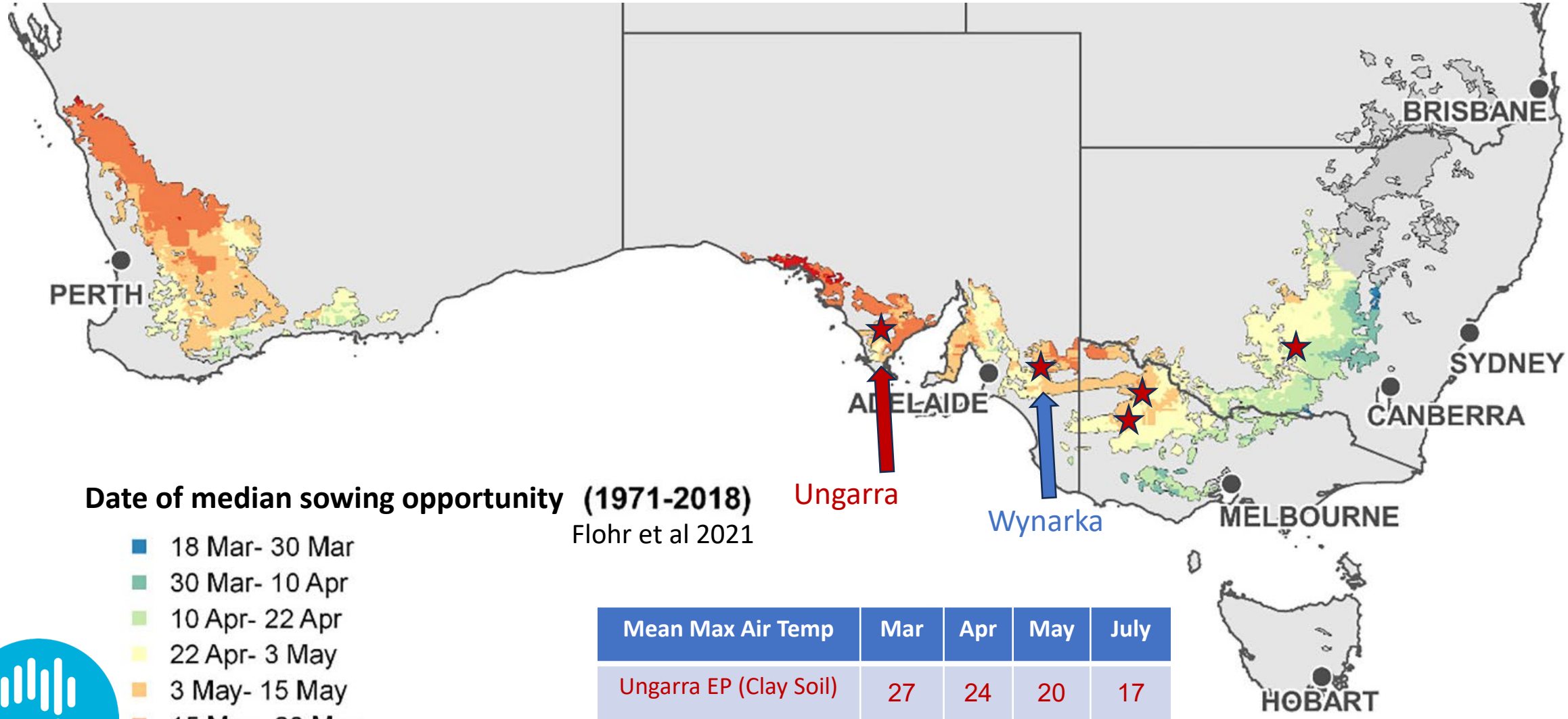
Balance of 0mm was reset on the 1st March

Thanks

If canola crops could reliably be established on a water balance of 5mm it increases the sowing opportunity <10 May from 28% to 50% of seasons in the Mallee



Air (and soil) temperatures are warm and soil moisture is marginal in the required sowing window-



Mean Max Air Temp	Mar	Apr	May	July
Ungarra EP (Clay Soil)	27	24	20	17
Wynarka (Sand)	28	24	19	16

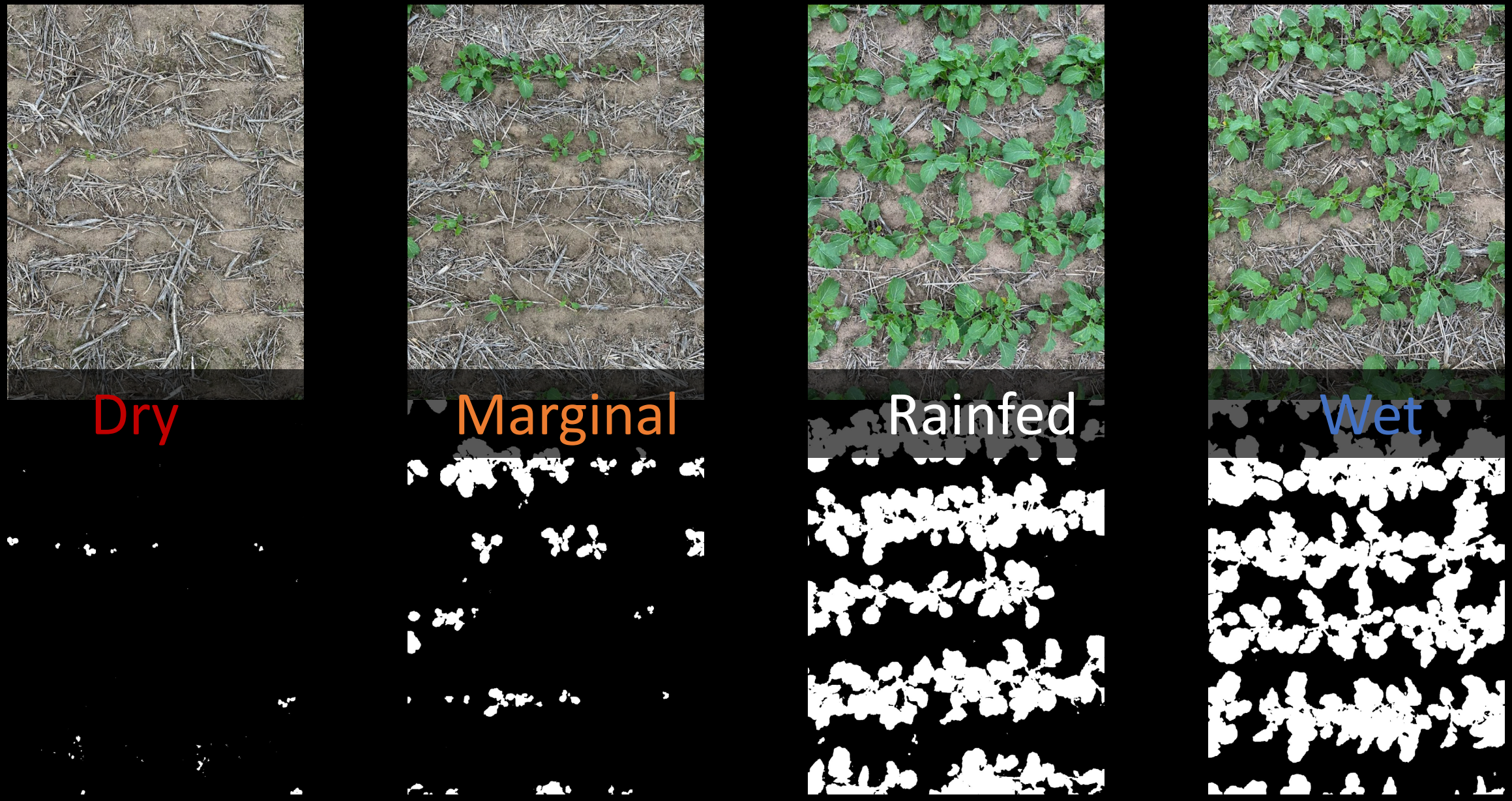
Dry

Marginal

Rainfed

Wet

19 May (31 days after sowing)



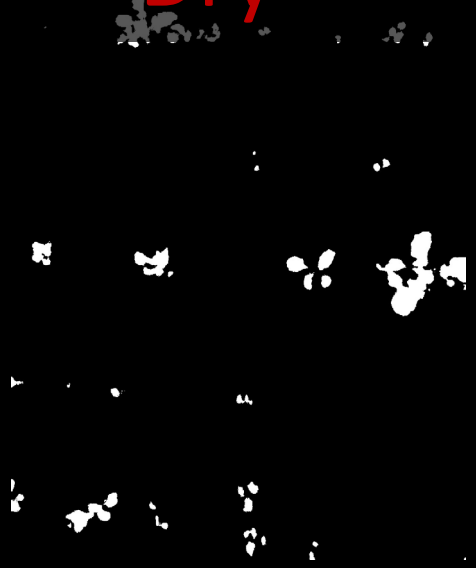
30 May (42 days after sowing)

Dry

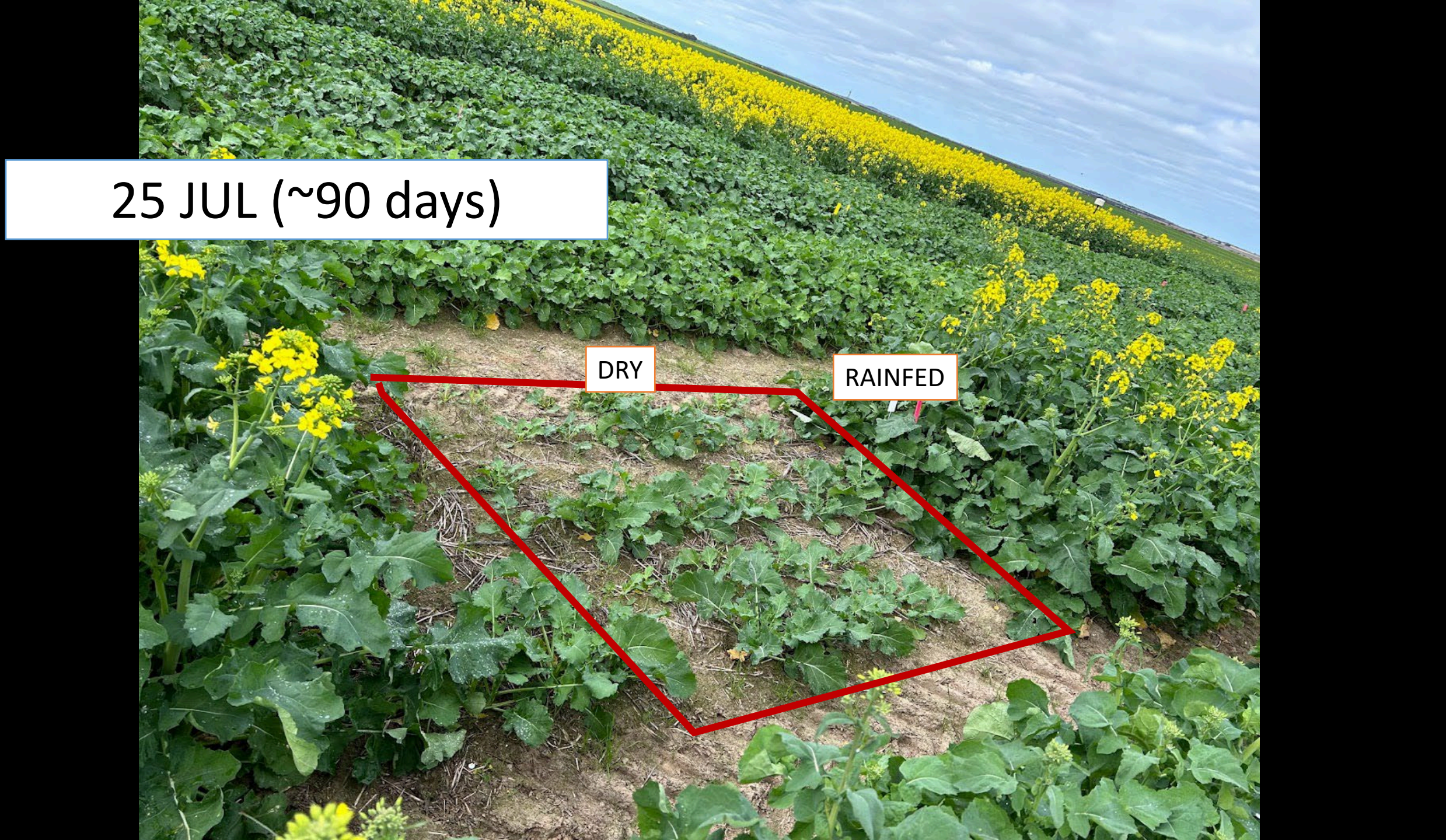
Marginal

Rainfed

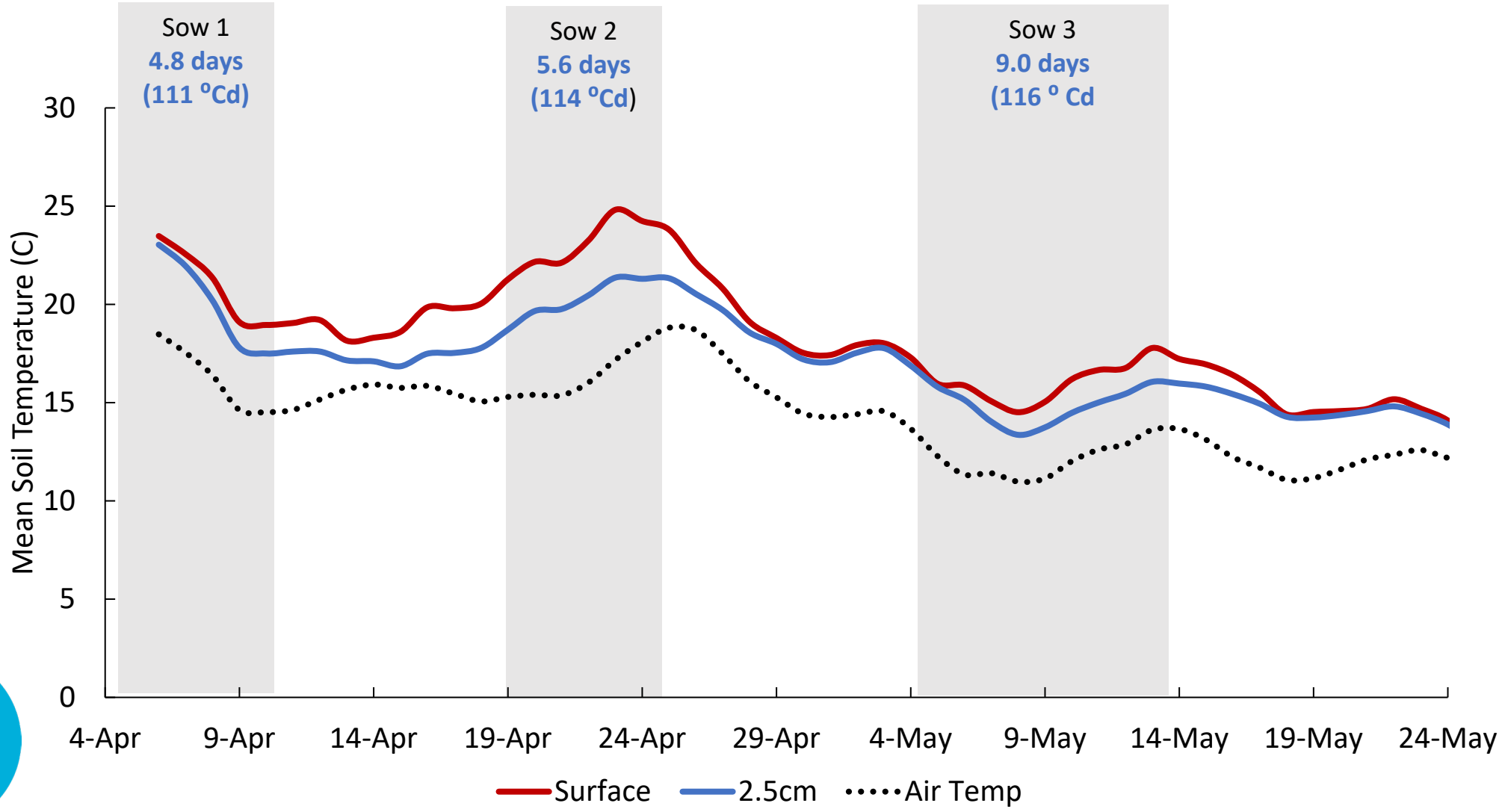
Wet



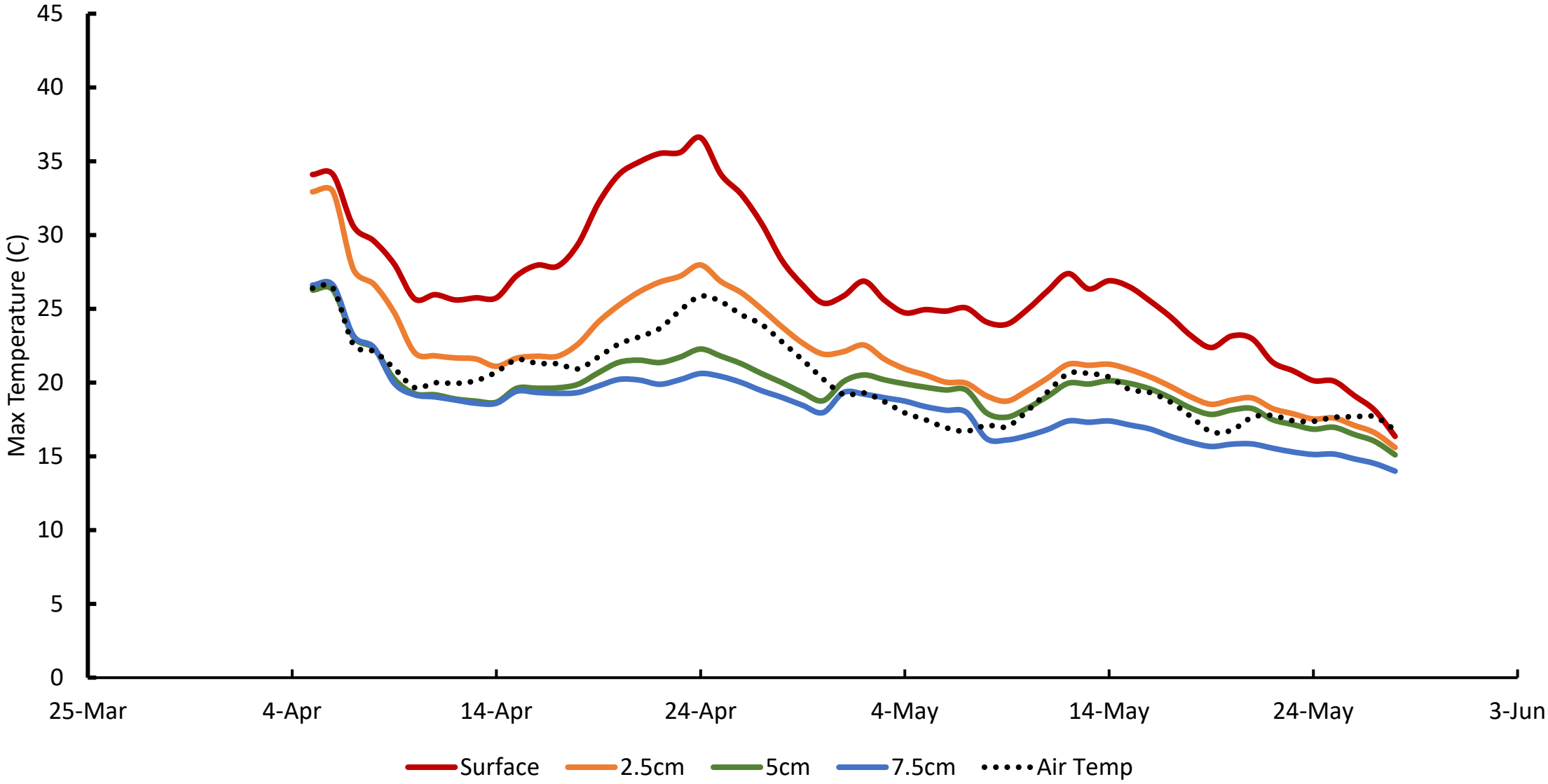
20 Jun (62 days after sowing)

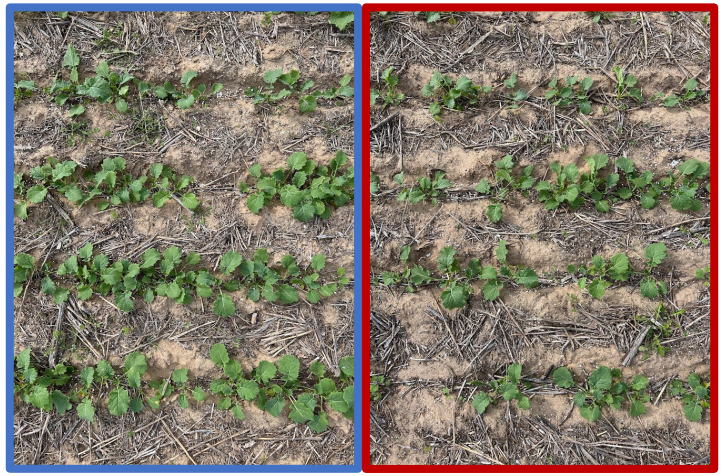

25 JUL (~90 days)
DRY
RAINFED

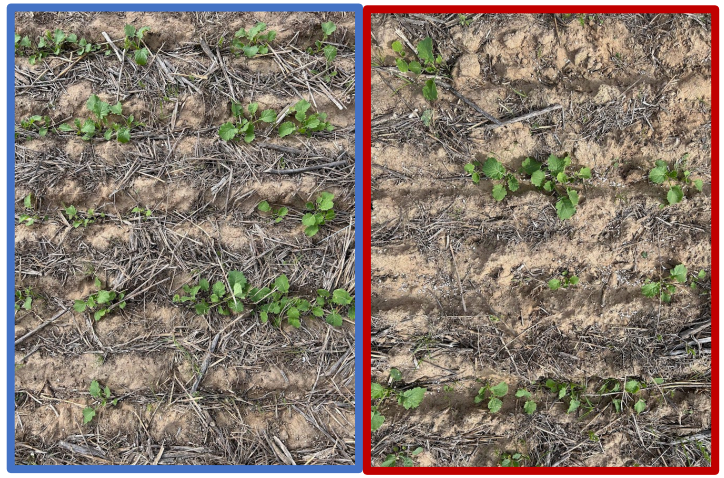
Mean Soil temperature and time to 50% emergence (30 plants/m^2) from 2.5cm sowing depth under optimal moisture



Max Soil temperature (rainfed)

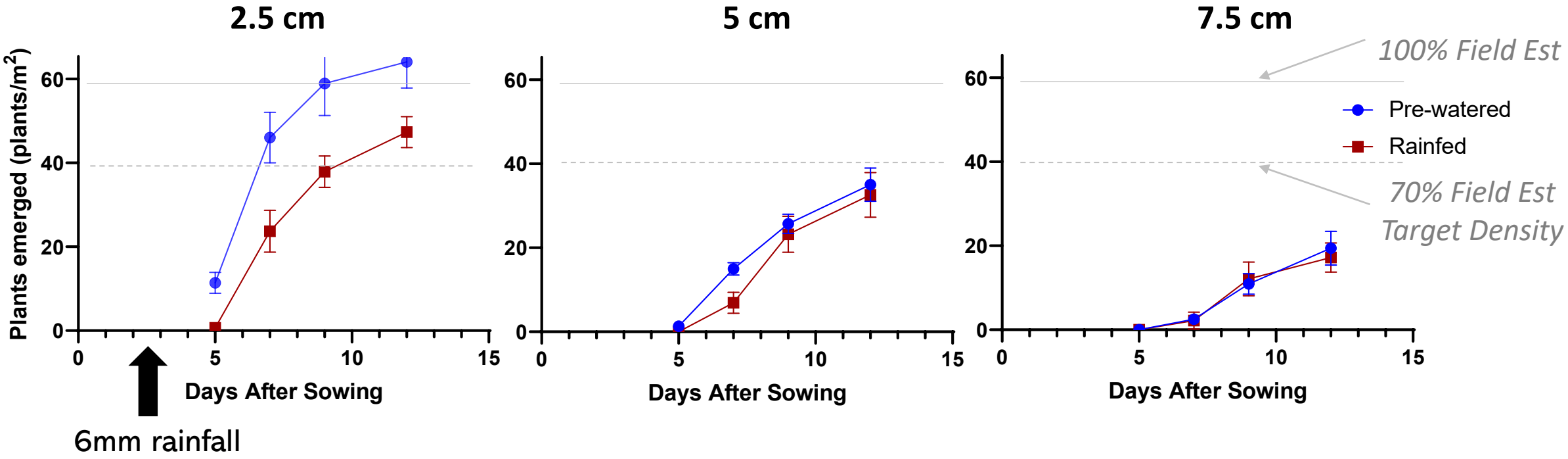






Warm and drying top 1 -3cm
More sensitive to water and temp?

More sensitive to soil strength above seed and hypocotyl length?
Water and temperature differences more stable



x




Updated May 30 4 sowing depths, 2.5, 5, 7, and 10 cm. Canopies closing in now…but notice the capeweed escapes are only where there were open spaces!

Sowing deeper into moisture is <u>not yet</u> the solution to avoid a drying seed bed… establishment reduced by 10% for every 1cm deeper seed placement below 5cm at optimal moisture