

Stress Stages in Oat Australia

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PREMIUM
FOOD AND WINE FROM OUR
CLEAN
ENVIRONMENT

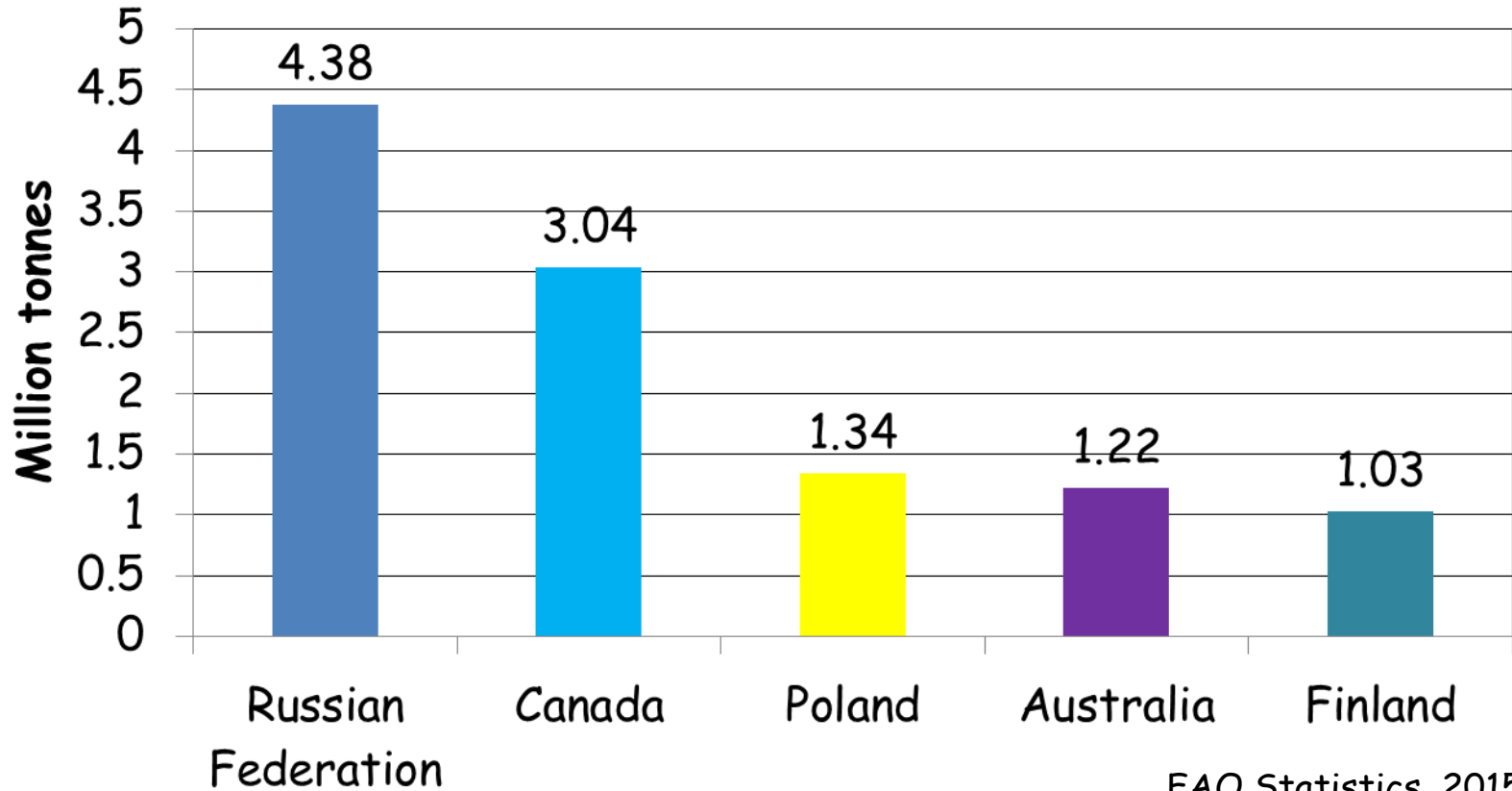




Australian Oat Production

- 1.5 million t. – grain
- 850,000 t – export hay
- Demand increasing 10 to 15% per annum
- Growers receiving competitive prices for grain and hay

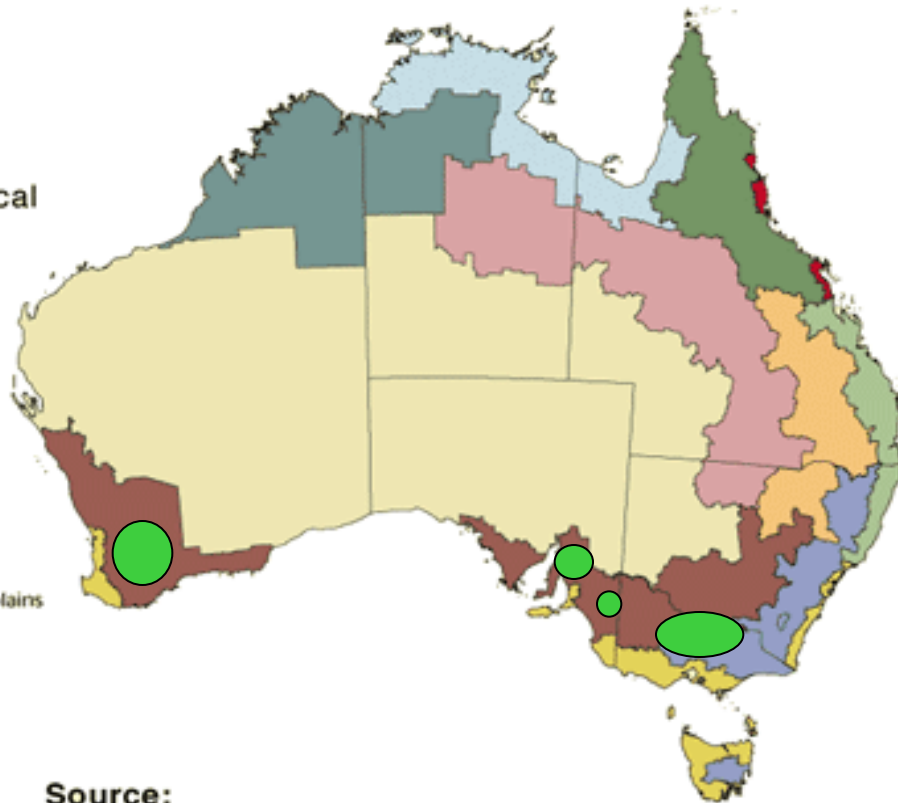
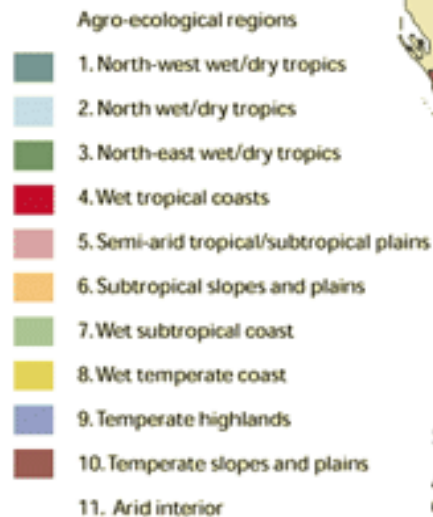
Top Five Oat Producing Countries 2010-1013



FAO Statistics, 2015

Australian Agricultural Zones

Figure 1.1 Agro-ecological regions of Australia



Source:

Agriculture Fisheries Forestry-Australia 1996.
©Commonwealth of Australia 2001

- Non-traditional oat growing regions
- Inconsistent rain events yearly
- Factors highlight importance of understanding stress stages in oat

Literature - Critical Periods



- Established for many crops-
maize, sunflowers, soybean,
chickpea . . .
- Wheat and barley differ in
critical period
- Important to establish for oat



Creating Controlled Stress



- Shade plants for a period of time through all developmental stages
- Shade reduces photosynthesis — similar to effects of water or nutrient stress

Materials and Methods



Trial design—3 rep
split plot, variety
main plot, shade
subplot
Shade treatment
11 2-week periods
consecutively
through crop cycle

Materials and Methods



- Shade treatment imposed by PVC frames 1 x 1.3 m
- Frame covered with black nylon net
- Shade cloth intercepted 90% solar radiation

Weekly Phenology



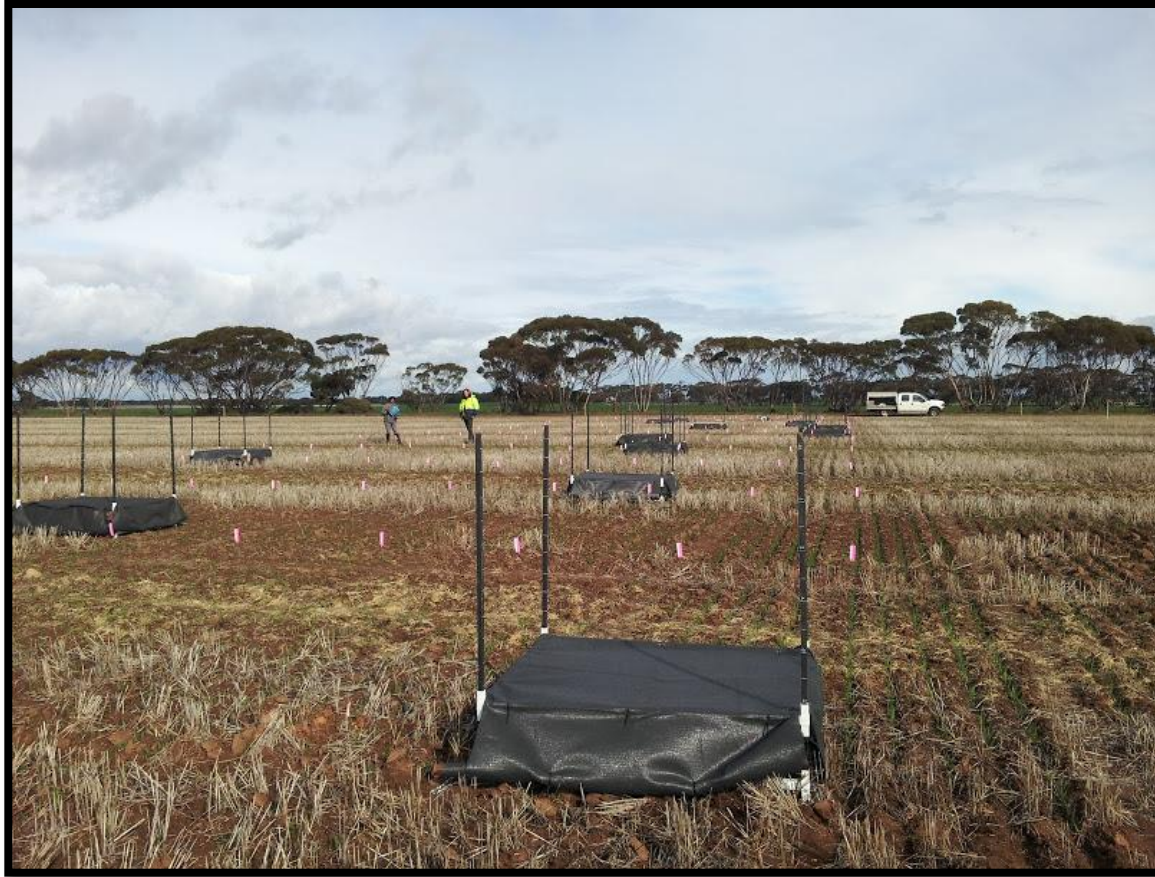
- Notes were taken weekly for plant phenology—
seedling
emergence to
senescence
- Plant growth stage related to yield reduction due to shaded treatment

Data Collection and Analysis



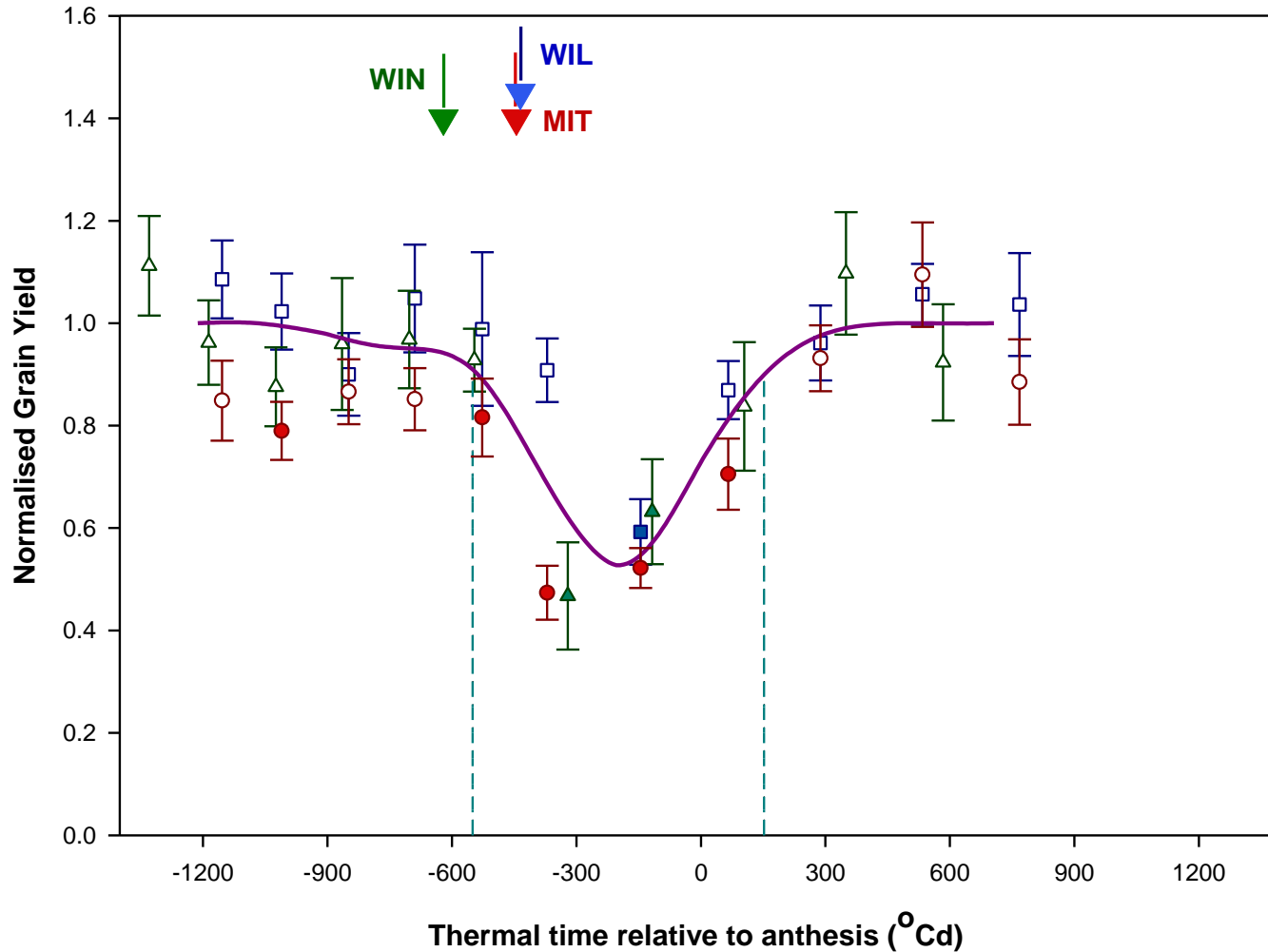
- Grain yield, yield components—grain number, grain weight, number of tillers m^{-2}
- Data analysed ANOVA
- Significance of unshaded control compared to shaded treatment—Fisher's partial least square differences

Results-Pinery 2013



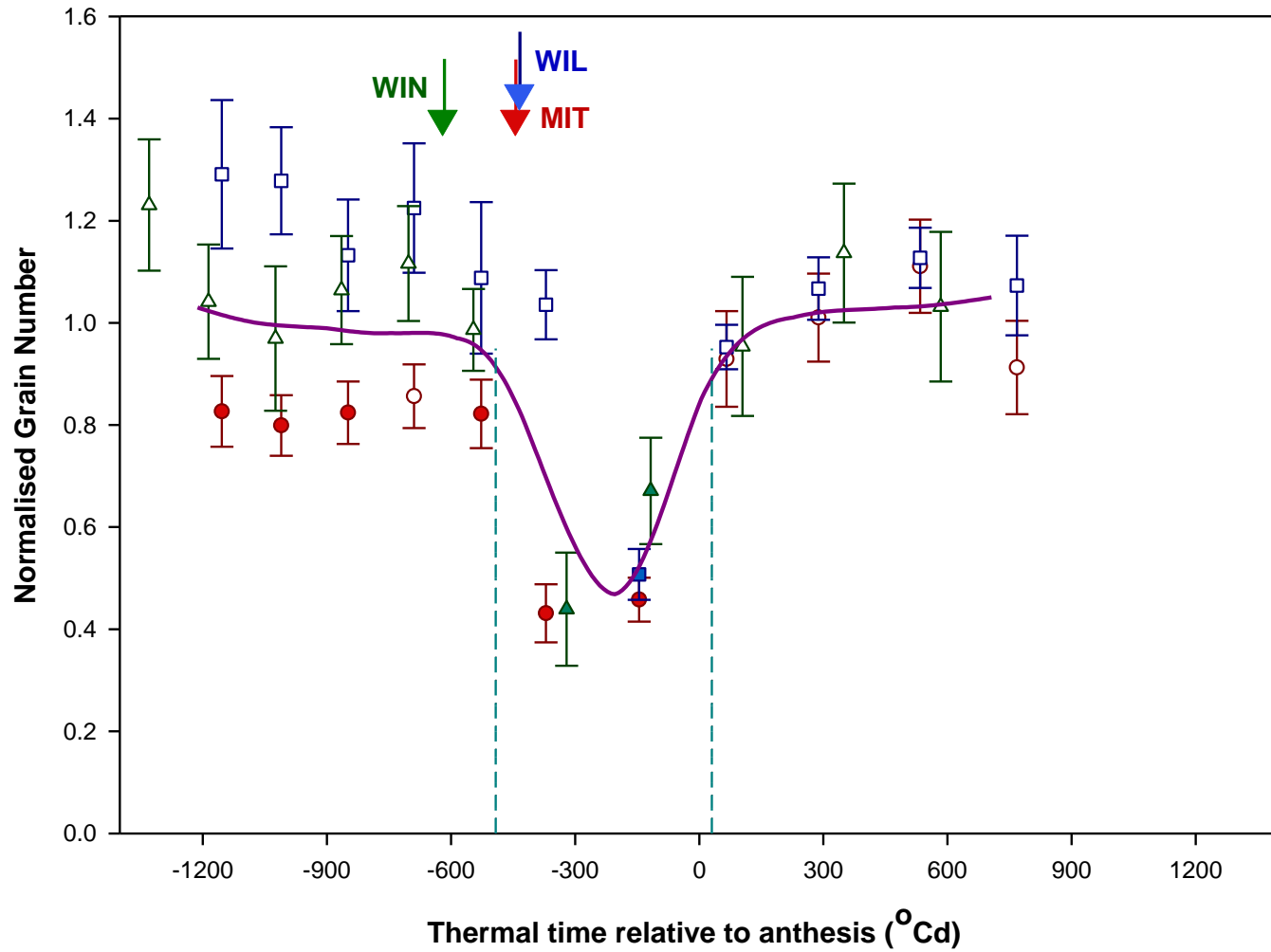
- Annual rainfall 406 mm
- Growing season rainfall, April to November 353 mm
- Higher than average rain, May to August
- Only 15 mm in October (38% lower than long term)
- 5.4 mm in Novembers compared to average 28.1 mm

Pinery, South Australia



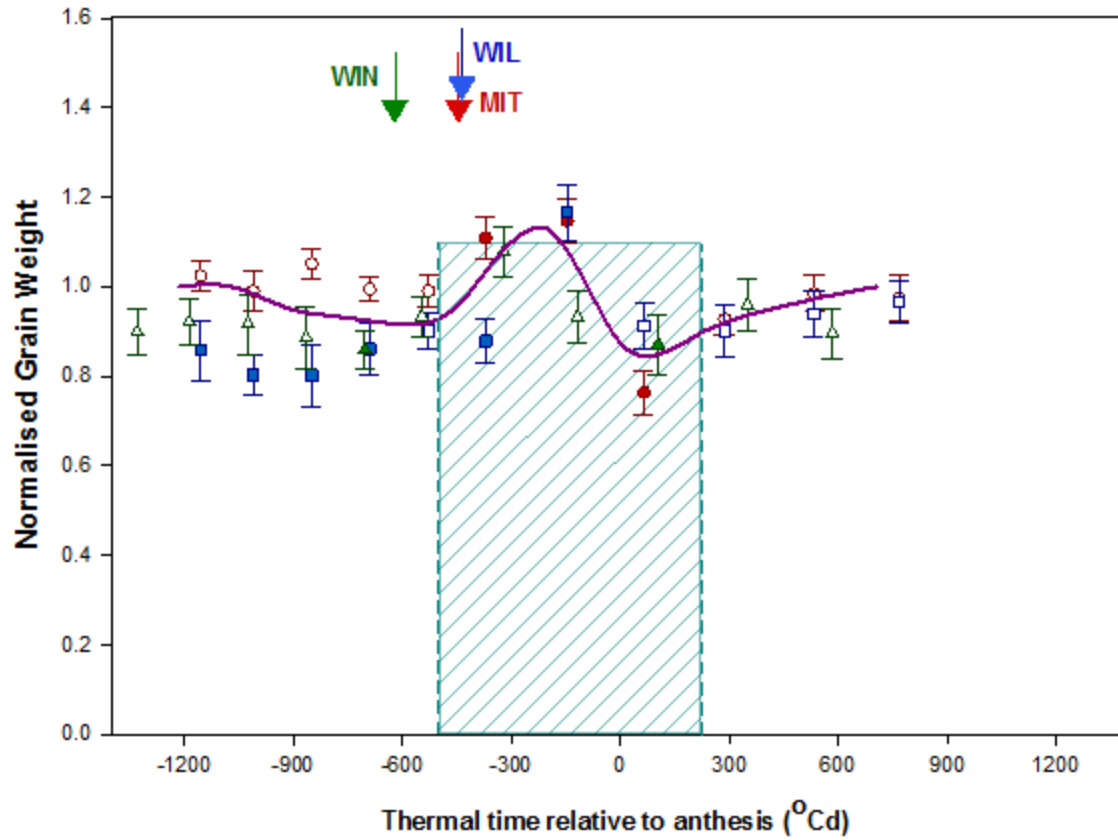
- Average grain yield 3.25 t/ha (1.0 on y axis)
- Anthesis is 0 on the x axis
- Thermal time scale = daily mean temperature
- Closed symbols are significantly different to the control

Pinery, South Australia



- 1.0 = 10,000 grains m⁻²

Pinery, South Australia



- 1 = 33mg

Conclusions



- Critical period for stress was between 84 to 125 days after sowing
- Greatest effect near Z40 to Z60, booting to panicle emergence
- Grain yield reduction significant for three varieties during window
- Grain number m^{-2} accounted for yield response
- Grain weight largely unresponsive to stress except in Williams
- Number of heads m^{-2} not significant

Critical Period of Stress in the Breeding Program

- Successful crop management –avoids critical periods of stresses such as drought and frost
- Improve management options to increase grain yield
- Develop more effective evaluation procedures for stress tolerance—drought



Thank You



SARDI