Optimised Canola Profitability (CSP00187)

Summary 1 March 2017

SUSTAINABLE AGRICULTURE FLAGSHIP
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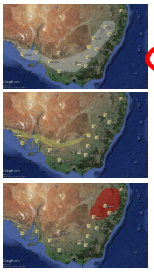
GRDC | NSW Department of Primary Industries | SARDI | Mallee Sustainable Farming | Victoria | BCG | Charles Sturt University | CSIRO

The challenge.....

To deliver 3:1 return on investment by 2020



Specific strategies

- Early sowing systems (low/medium rainfall)
- Risk management – low input (low rainfall)
- Harvest management (Module 3 - north)
- Up to date agronomic advice throughout

3:1 return on investment?

- Total GRDC spend on the project is $6 M (1.2 M pa)
- Around 1 M ha of the 3 M ha sown are potentially suitable for earlier sowing
- Assuming $40/ha average increase in GM for 1 week earlier sowing

  Only need 150,000 ha (15%) to be sown 1 week earlier to generate $6 M pa.
- Easily achieve 3:1 ROI during the project, while benefits will be ongoing

Early Sowing

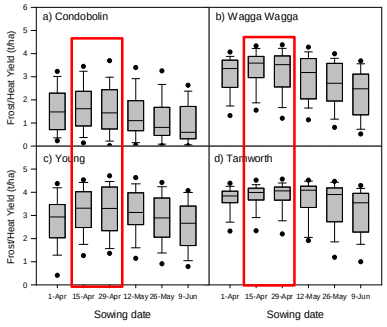
Our strategy

- Identify optimum flowering period (OFP) for the sites
  frost, heat, water stress, radiation,
- Target sowing date x variety to hit the OFP
  understand phenology adaptations
- Manage for adequate biomass at flowering for yield target
  nitrogen, seeding rate, growth type (which is most cost-effective?)
- Identify ways to allocate more of the biomass to grain
  Interesting varietal traits?
  e.g. 44Y89 and Diamond has higher HI, also quicker pod maturity

2016 in review

- Wet, little stress, high yields (Decile 7-10)
  - Less advantage in early sowing generally
  - Higher yield with later sowing at some sites
  - "Flexible" varieties identified (eg Archer)
  - Varieties NOT to sow early identified
  - Oil increased with late sowing
- Disease risk high
  - Severe if flowering too early
- High N requirement
  - Responsive to high levels (300 kg/ha)

Earlier sowing – 2016 in context.....

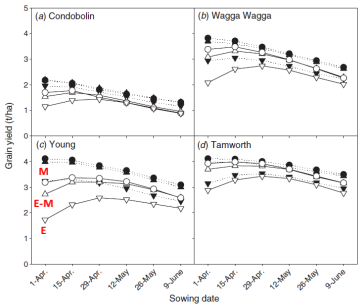


Simulated and published data from 2002-2012
early-mid variety

- Move to mid-April
- Little benefit to early April
- But as good as early May
- Tamworth late April

Kirkegaard et al (2016) Crop and Pasture Science

Earlier sowing – 2016 in context…..



Simulated and published data from 2002-2012 for early-mid variety

Mid-maturity have flat response through April

Mid and Early-Mid similar

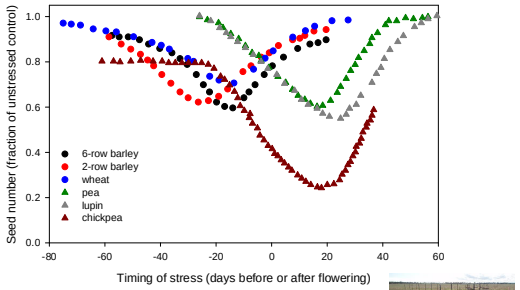
Early have largest penalty for early sowing

Early have lower overall yield potential?

Kirkegaard et al (2016) Crop and Pasture Science

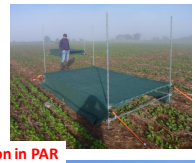
The "critical period" (shading) experiments

- Use shade to create discrete periods of "stress"
- Investigate "critical yield formation period" – understand drivers

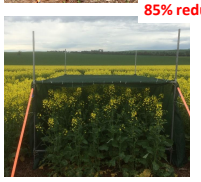


Wheat: Fischer 1985
Barley: Arisnabarreta & Miralles 2008
Pea, Lupin: Sandaña & Calderini 2012
Chickpea: Lake & Sadras 2014

Shade covers

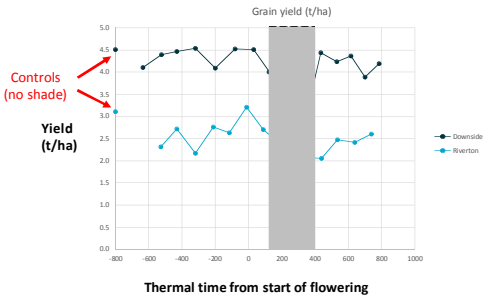


85% reduction in PAR



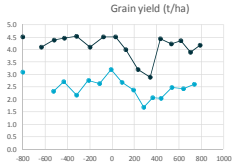
Results

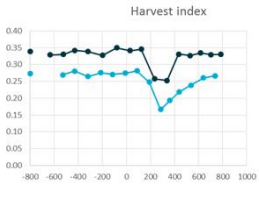
Same critical period (100-400 °Cdays post-flowering)

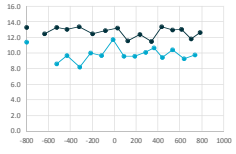


Components

Yield ≠ Biomass

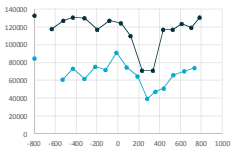


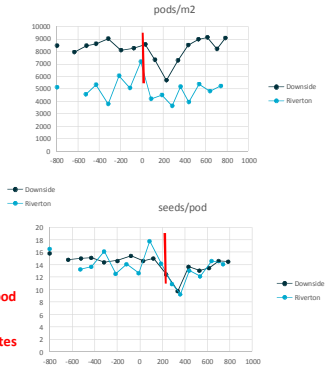




Components

Driven by grain number (pods/m2 and seed/pod)

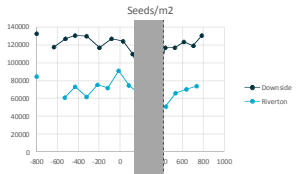




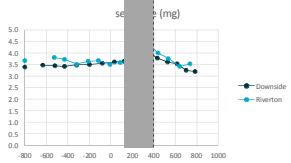
Pods/m2 affected earlier than seeds/pod
Similar reductions ~35%
Seeds/pod remarkably stable across sites

Components

Grain number Decreased 48%



Seed size couldn't fully compensate



Grain weight Increased 29%

Phenology studies – Canberra, Gatton

- 25 cultivars; 3-4 sowing dates; 3 day lengths

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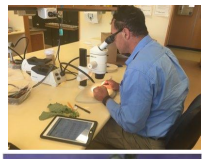
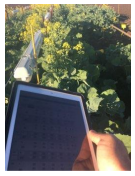
Regular measurement





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Conclusions – Gatton, Canberra

- Vernal time influences flowering in many varieties.
- Only a few of varieties tested responded to photoperiod.
  Vernal time to initiation, then photoperiod green bud to flowering
- Next steps for new knowledge
  Build parameters to describe cultivar phenology in APSIM model
  Link to genetic studies to develop predictive capacity for other varieties.

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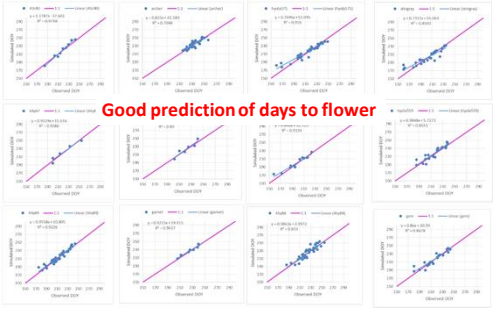
Validation of phenology parameters



Good prediction of days to flower

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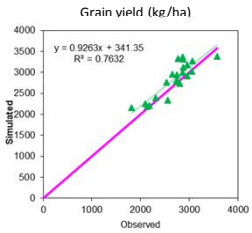
Yield simulations and scenarios with APSIM

Yeelanna 2016

(2 TOS x 3 N timing x 4 variety)



What ifs....

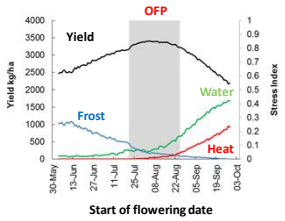
- Sowing time x variety optimisation
- Hybrids vs TT
- Seasonal risks (including disease)
- N application strategies
- Biomass relationships
- Stress timing effects
- Value of a "flexible" variety

Economics and risk (prices, costs)

Optimal flowering periods (start of flowering)

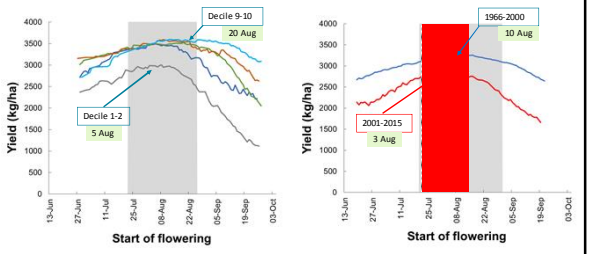
Wagga Wagga

- Critical for WUE and yield
- Determined by;
  - Seasonal water availability
  - Temperature
  - Radiation
  - Frost and heat
- A compromise of all factors



Lilley et al., unpublished

OFP varies with season and climate (Wagga Wagga)



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Optimal flowering periods – disease?

- Critical for WUE and yield
- Determined by;
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  - Radiation
  - Frost and heat
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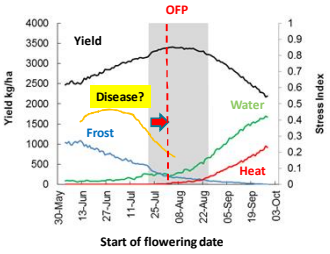
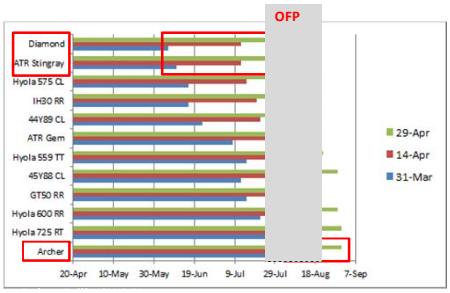
- A compromise of all factors



Lilley and Sprague, unpublished

Stable flowering time – flexible sowing



2014 - 2016 Outcomes (so far)

Early Sowing (in a nutshell)

- Support to safely move sowing windows back into mid-April
- Exception was nth NSW, and possibly Yeelanna (warmer environments) – development too quick (low biomass, frost risk, less acclimation)
- **Varieties identified for sowing early April – late April = flexible (Archer)**
- Varieties identified NOT to sow early (Hyola575, Diamond)
- Varieties identified suitable for late sowing (e.g. Diamond)
- Simulation with improved parameters for 2014-2016 data should confirm
- OFPs developed from abiotic stresses need adjusted for biotic constraints

This work is a component of the Optimised Canola Profitability Project (CSP00187), a collaboration between CSIRO, NSWDPI and GRDC in partnership with SARDI, CSU, MSF, BCG.

John Kirkegaard, Jeremy Whish, Julianne Lilley, Susie Sprague, Chris Helliwell, Heping Zhang, Jens Berger, Andrew Ware, Rohan Brill, Don MacCaffrey, Felicity Harris, Blake Gontar, Sergio Moroni, Ian Menz, Rick Graham, Ian Ludwig, Mark Seymour, Penny Riffkin, Brendan Christy, Christine Walela

Thank you

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The challenge.....

To deliver 3:1 return on investment by 2020

Specific strategies

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- Risk management – low input (low rainfall)
- Harvest management (Module 3 - north)
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Optimised Canola Profitability

2014 - 2016

Risk management in (former) low rainfall zone

- OP-TT vs Hybrid? **OP-TT**
- Sow on date (dry) vs wait for break? **Wait to ensure success, or to pull out**
- N management – can we delay? **Best to have N upfront to cover Decile 5?**

  Maybe better to grow after legume (2017 trial Mildura)?
  Maybe chance to zone manage N on variable soil (Karoonda)?
  All this is very modelable

- Context of whole-farm system may override individual paddock/year profit?
- Grain legumes graze, grain, hay very competitive

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Optimised Canola Profitability

2014 – 2016 Harvest

Harvest losses?

- Delaying harvest significantly reduces yield, and pod guard can reduce losses
- Don't windrow < 60% colour change, use desiccants anytime after 20%
- Later harvesting/windrowing increases yield and oil up to 95% colour change
- Only 25-30% of yield is on main stem – "old rules" don't apply