Canopy Cover is an Alternative to Biomass Sampling in Juncea Canola Breeding

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Introduction

- Canola crops commonly face terminal drought in Australia
- There are limited alternative crops for low rainfall environments in Australia
- Juncea canola has some advantages over canola as an oilseed break-crop option for low rainfall areas (250-350mm) –

e.g. Growers previously achieving <1.5T/HA canola.

- offers pod shatter resistance / direct-heading
  (option reducing on windrowing costs / increased grower flexibility)

- offers crop sequencing benefits →15-20% increase in wheat yield (Kirkegaard)
  (yield increases post-canola cf. wheat on wheat)

- offers a disease break for cereal diseases like Crown Rot, CCN &Take-All + reduces Rhizoctonia levels
- Drought and heat tolerance

Canola (AgOutback) 0 t/ha

Juncea canola (0.4 t/ha)

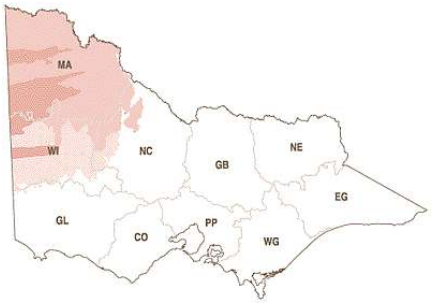
Photos by
Dr Rob Norton

Introduction

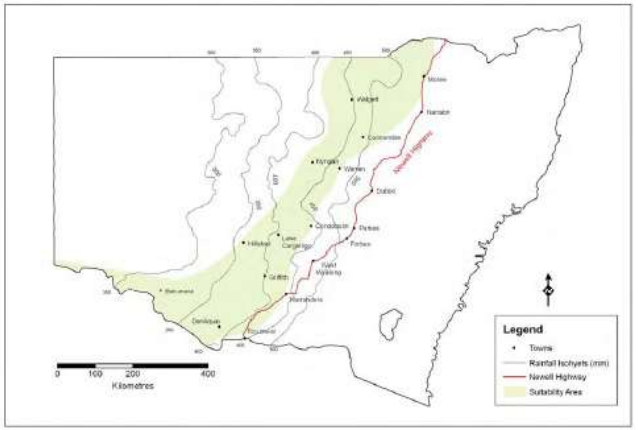
- Hybrid cultivars: been routinely grown in *napus* canola
- Several studies: Exploitable heterosis in *B. juncea.*
- Hybrid juncea canola research initiated by Viterra (now Seednet)
- Lack of knowledge: traits help maintain heterosis under low rainfall environments.

Potential of Juncea Canola

With better varieties, if juncea canola takes 10% of the cereal area in low rainfall areas, production area for juncea would be over 600,000 ha in eastern Australia (Norton et al 2005).



Victoria



NSW

Introduction

- Pre-anthesis growth in canola is important for enhanced seed yield (Thurling and Das, 1979, Faraji, 2010, Habekotte, 1993) in Mediterranean environment.

Crop vigour measurement

Biomass sampling: direct, most common and accurate, time and resource demanding

Optical methods like light interception, digital photos are indirect methods but easy and quick to use and have enough accuracy for LAI for several crops

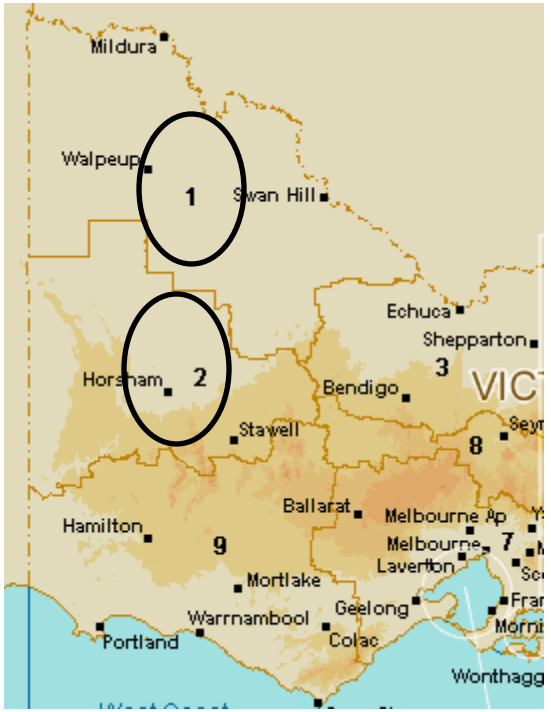
Objectives

- to compare the direct and indirect methods of vigour assessment at anthesis, and

- to determine the usefulness of crop vigour at anthesis in prediction of seed yield of juncea canola hybrids in low rainfall environments.

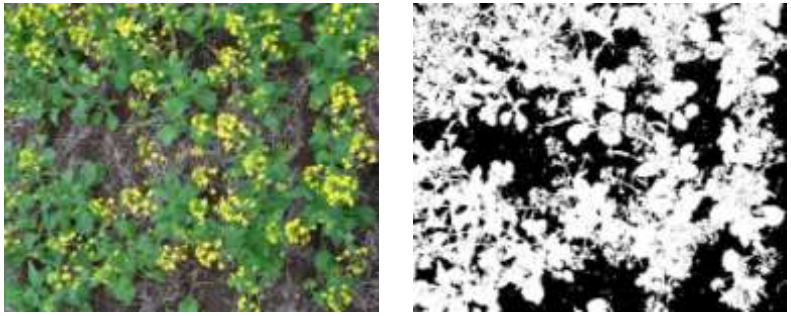
Materials and Methods

Region	Locations	Genotypes
2012		
Wimmera (Med rainfall)	Horsham	19 *B. juncea* hybrids
Mallee (low rainfall)	Beulah, Piangil	19 *B. juncea* hybrids
2013		
Wimmera (Med rainfall)	Horsham	4 hybrids + 6 parental lines
Mallee (low rainfall)	Beulah	4 hybrids + 6 parental lines



Observations

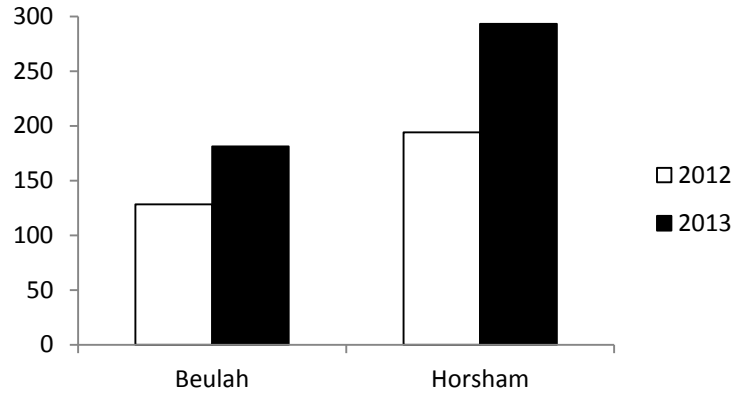
Days to flowering, biomass at anthesis, canopy cover by ceptometer in 2012 and digital photos in 2013, seed yield



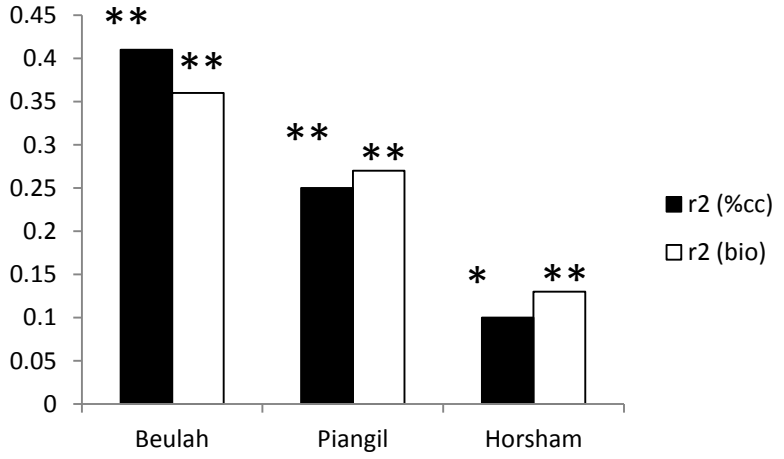
59% canopy cover

Results

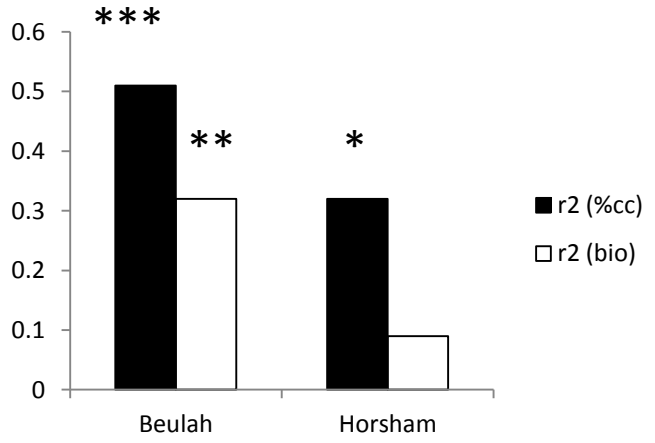
Crop season rainfall, mm



Coefficient of determination (r^2) of SY against canopy cover and biomass



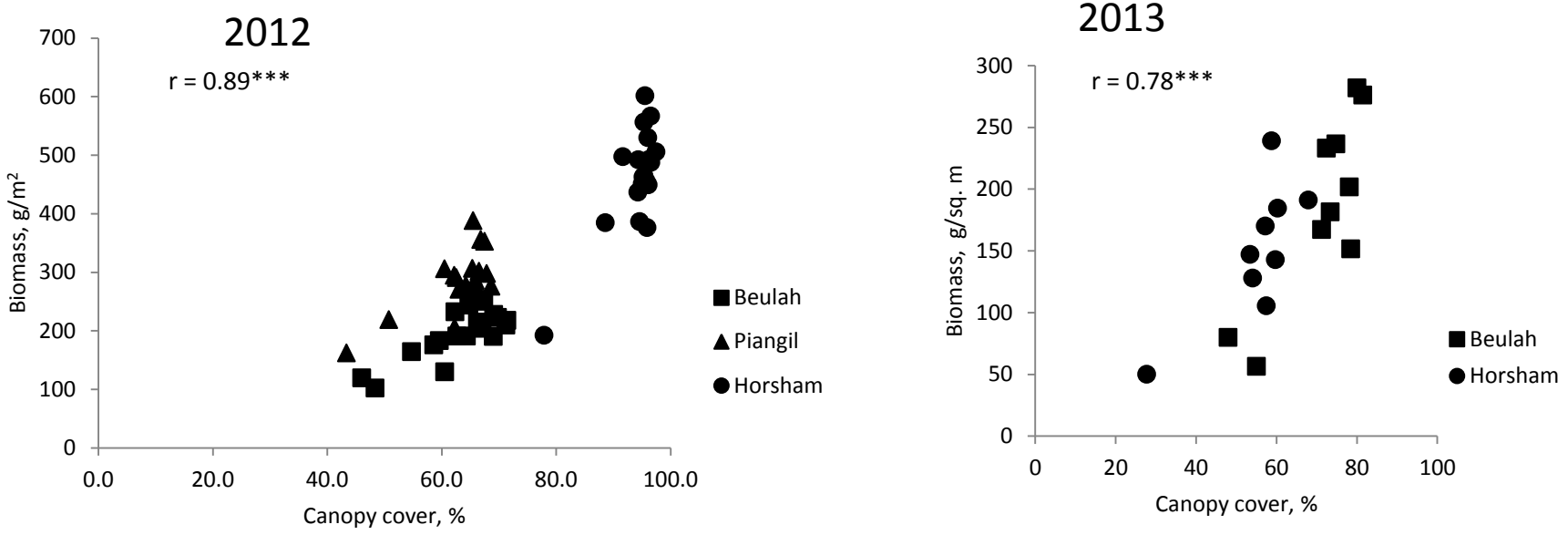
2012



2013

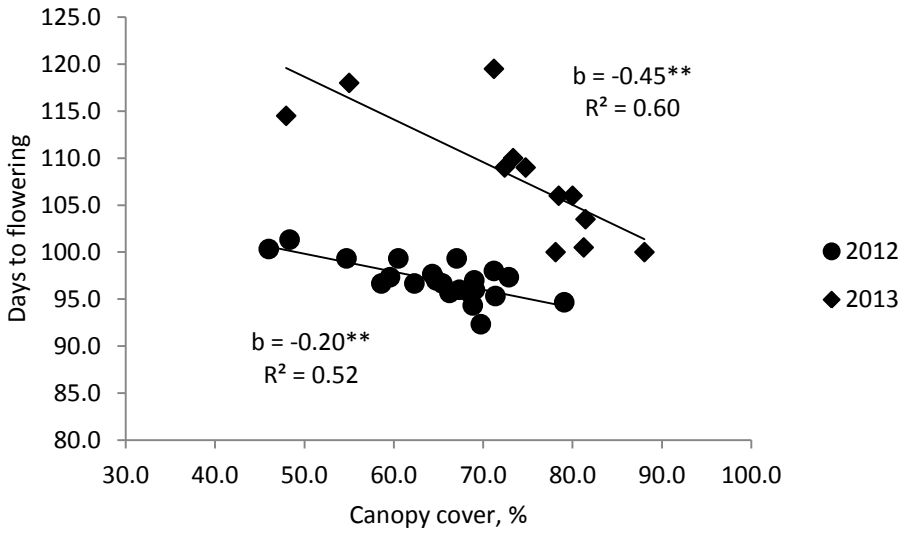
*, **, *** indicate level of significance of slope at 0.05, 0.01 and 0.001 alpha level, respectively

Relationship between Biomass and Canopy cover



Relationship between Canopy cover and days to flowering

Beulah



Discussion and Conclusions

- Crop vigour at anthesis was more important for seed yield under drought conditions than favourable conditions.
- Crop vigour at anthesis could be measured with optical methods as canopy cover
- Canopy cover was a better predictor of seed yield than biomass under low rainfall environments.
- Better adapted (earlier flowering) genotypes had better canopy cover.
- Both **early vigour** and **early flowering** are important in Mediterranean environments.
- Canopy cover a useful breeding tool for breeding drought tolerance.

Discussion and Conclusions

- Early vigour/vigour at anthesis not popular as a selection criterion as it is hard to measure.

- Handy techniques such as the ceptometer and photography are now available to measure vigour.

- These methods are effective in selection of drought tolerant lines for low rainfall environments.

Acknowledgements

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- Seednet Staff: Steve Barnes and David Hoffmann

		Canopy cover (%)		Biomass (g/m^2)	
Location	Year	b (±s.e.)	r^2	b (±s.e.)	r^2
Beulah	2012	13.3**±2.2	0.41	2.2**±0.4	0.36
Piangil	2012	21.5**±6.9	0.25	3.2**±0.7	0.27
Horsham	2012	15.0*±5.9	0.10	0.75**±0.2	0.13
Beulah	2013	12.1***±2.7	0.51	1.5**±0.5	0.32
Horsham	2013	7.2*±2.6	0.32	0.7±0.6	0.09