

24. Managing bean crop canopies to optimize yield potential

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KEY MESSAGES

- Trial work funded by GRDC via the Southern Pulse Agronomy Program.
- Early sowing of beans in 2016 at Bool Lagoon did not increase grain yields.
- Agronomic treatments applied at Conmurra in 2016 did not alter plant canopy size or plant architecture.
- Trial planning for 2017 is underway.

Trial Background

Advanced modern farming systems incorporating minimal tillage, stubble retention, improved soil moisture storage and varieties with improved agronomic traits offer opportunities for early sowing and increasing yield potential. Canopy management strategies for controlling high biomass production often associated with early sowing in favorable environments may be critical in improving the reliability and performance of this increasing popular agronomic practice in faba beans.

Southern Pulse Agronomy (SPA), a bi-state research program (SARDI and Agriculture Victoria) funded by GRDC, has ongoing targeted agronomic research aimed at delivering best management strategies, all of which have influence on canopy development of pulse crops.

Results from two trials being conducted in the South East are discussed below.

Bool Lagoon Time of Sowing Trial

Improved soil moisture storage from reduced soil disturbance as a result of minimal or no-tillage has allowed growers to sow crops earlier. The frequent occurrence of variable rain accompanied by high temperatures during the critical crop growth stages of flowering and pod filling has also exacerbated the need to bring forward the sowing date to reduce the adverse effects of drought and heat during these stages.

Three TOS's were evaluated at Bool Lagoon with 5 faba bean varieties, 1 broad bean variety and 4 experimental faba beans. The sowing dates were TOS 1 27 April (irrigation used for establishment), TOS 2 19 May and TOS 7 June.

Long term analysis (2006-2015) of faba bean sowing date trials in high rainfall environments has generally found a flat or nil grain yield response to sowing date. However, within each individual year grain yields can show a positive, negative or no response to sowing timings and this has been a result of variety responsive due to varying seasonal conditions and yield limiting factors such as disease or lodging. In 2016 significant differences were observed between varieties and TOS dates (Figure 1), with faba beans overall having a negative response to sowing early.

Grain yields on average at TOS 2 (4.3 t/ha) and TOS 3 (4.5 t/ha) were significantly higher than TOS 1 (3.9 t/ha) (in contrast to the dry season of 2015, where TOS 1 had the highest yields). Across the trial PBA Samira had the highest yield at TOS 2, 5.7 t/ha. When averaged across the three TOS's Nura had the highest yield (5.1 t/ha) which was significantly the same as PBA Samira, PBA Kareema and PBA Zahra. The three highest yielding faba bean varieties had higher yields at TOS 2 compared to the other TOS's. PBA Kareema had greater yields at TOS 1, decreasing with TOS. In contrast Farah and PBA Rana had their highest yields at TOS 3. The results show that the new varieties PBA Samira and PBA Zarah outclass the varieties they have been released to replace, Farah and PBA Rana respectively.

In the high rainfall conditions of 2016, when biomass production was high, harvest index (i.e. grain yield to biomass ratio) was significantly reduced with earlier sowings (Figure 2).

Grain quality was significantly different between varieties and TOS (Table 1). PBA Kareema, the only broad bean evaluated, on average had the greatest 100 seed weight, 121.9 gm. The two larger bean varieties PBA Rana and PBA Zarah, had average weights of 85.1 gm and 81.0 gm respectively. Nura had the lowest grain weight, and PBA Samira was larger than Farah. Grain weights decreased with later TOS.

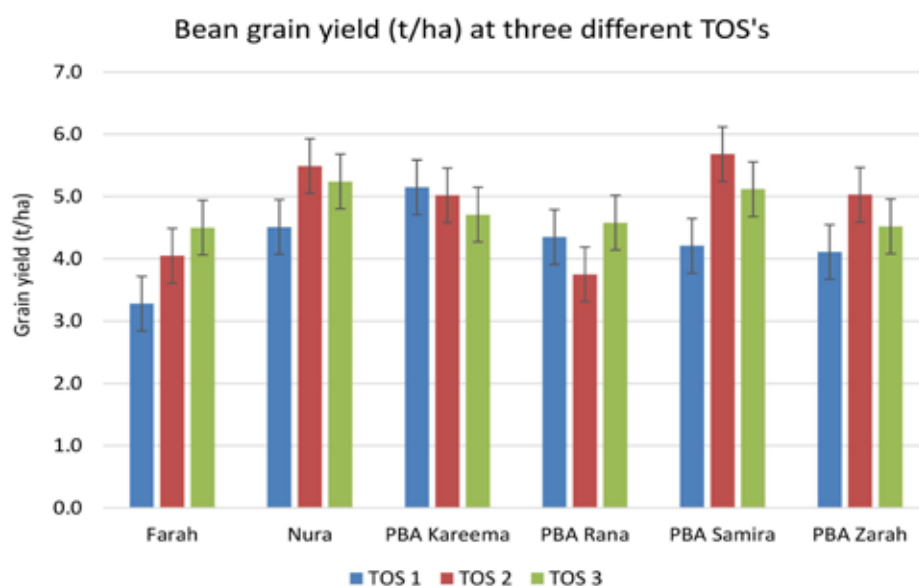


Figure 1: Variety grain yield (t/ha) at three different TOS's at Bool Lagoon in 2016.

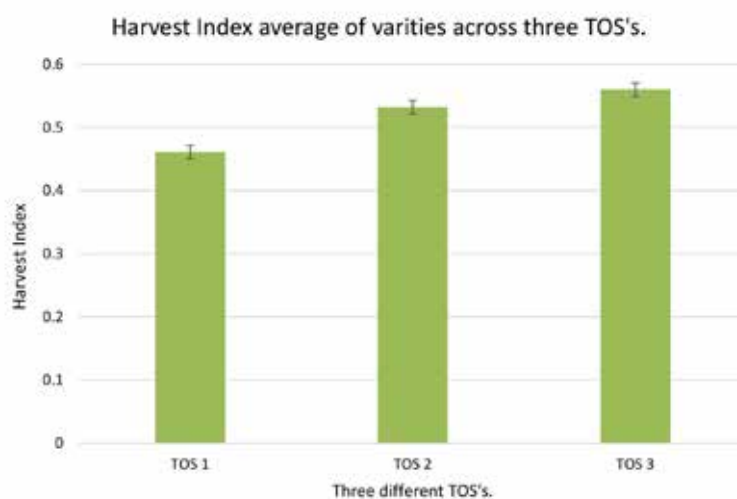


Figure 2: Harvest Index average for all varieties at three different TOS's at Bool Lagoon in 2016.

Table 1: 100 seed weight (grams) of each variety at three TOS's.

	100 Seed Weight (gm)			
	TOS 1	TOS 2	TOS 3	Variety Average
Farah	71.9	70.5	71.2	71.2
Nura	71.5	67.9	66.6	68.7
PBA Kareema	122.8	127.1	115.8	121.9
PBA Rana	88.5	85.8	81.1	85.1
PBA Samira	80.4	77.0	72.0	76.5
PBA Zarah	84.6	82.0	76.4	81.0
TOS average	86.6	85.0	80.5	
	P Value	I.s.d		
Variety	<.001	2.8		
TOS	<.001	1.5		
Variety X TOS	0.011	4.8		

Conmurra plant growth regulants (PGRs) in canopy management trial

Plant growth regulants (PGRs) modify plant physiological processes and may have an important role in manipulating canopy growth to suit early sowing and maximise potential yields under different environments. Over the last three years, a range of experimental PGRs, chemicals and agronomic treatments have been evaluated on faba bean and broad bean in Southern Pulse Agronomy trials in South Australia and Victoria, with results showing some treatments reduced plant height without altering grain yield. Results also suggest that application timing of treatments is important.

Building on 2014 and 2015 trial results from Bool Lagoon, a broad bean trial was sown at Conmurra on 17 May 2016 to continue evaluation into the use of chemicals and agronomic management techniques to manipulate broad bean plant architecture without decreasing yields. The trial was relocated to Conmurra to maximize the full potential of the broad bean (PBA Kareema) and also to value add to the MFMG field days.

Chemical treatments were used to either stimulate lateral branching, reduce growth or reduce vegetative biomass (Figure 3 illustrates application timings). In 2016 mechanical pinching was evaluated as an agronomic technique. The early application was undertaken with the aim to stimulate lateral branching and the late application to trigger pod set (Figure 4).

The 2016 trial resulted in no significant differences between the NIL treatment and the experimental treatments (Table 2). Compared to the NIL treatment there were no significant decreases in plant height with the application of the treatments. The NIL was 135 cm in height at maturity and the shortest treatment was the early mechanical pinching at 87 cm. Harvest index was similar between all treatments and the NIL (no significant differences). Grain yield averaged 4.3 t/ha and 100 seed weight 123 grams, with no significant differences observed.



Figure 3: Broad bean growth at early application, 20 July 2016 (A), and late application, 2 September 2016 (B).

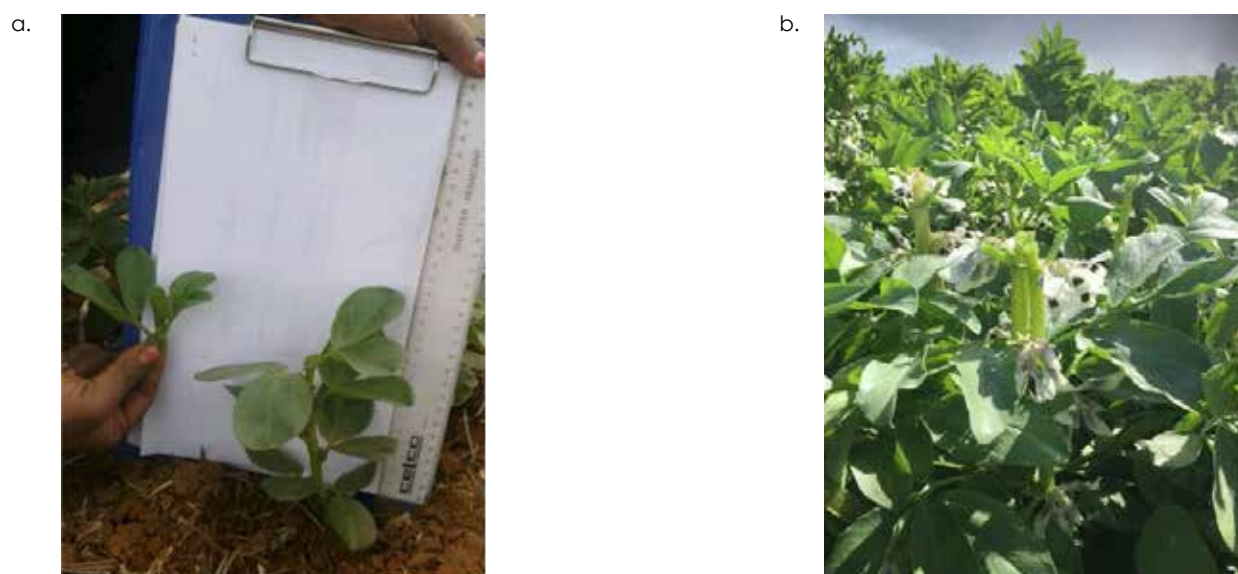


Figure 4: Example of mechanical pinching early (A) (20 July 2016), and late (B) (11 October 2016).

Table 2: Effect of applied treatments on plant height at maturity as % NIL, grain yield (t/ha) and 100 seed weight (gm) of broad bean (PBA Kareema) at Conmurra in 2016.

Treatment*	Application Time	Plant height at maturity % NIL (135 cm)	Grain yield (t/ha)	100 seed weight (gm)
NIL	-	100	4.3	128
Ethephon	Early vegetative	101	4.1	128
Ethephon	Late vegetative	94	4.5	125
Ethephon	Early and Late vegetative	107	4.3	132
Paraquat and Diquat	Early vegetative 250 ml	98	4.3	124
Paraquat and Diquat	Early vegetative 500 ml	99	4.1	120
Trinexapac-Ethyl	Early vegetative	106	4.4	123
Trinexapac-Ethyl	Late vegetative	96	3.8	122
Chlormequat	Early vegetative	89	4.1	117
Chlormequat	Late vegetative	101	4.8	120
Chlormequat	Early and Late vegetative	101	4.6	125
Mechanical Pinching	Early vegetative	65	3.7	118
Mechanical Pinching	Late vegetative	94	4.0	120
Ethephon, Trinexapac-Ethyl	Ethephon (early veg), Trinexapac-Ethyl (late veg)	105	4.3	123
Ethephon, Chlormequat	Ethephon (early veg), Chlormequat (late veg)	100	4.9	122
Mean		131	4.3	123
P value (0.05)		0.25	0.24	0.44
I.s.d		29.93	0.71	8.44
cv%		2.0	6.5	1.7

***The treatments in this research contain unregistered plant growth regulators and herbicides, and application rates and timings, and were undertaken for experimental purposes only. The results within this document do not constitute a recommendation for that particular use by the author or author's organisation**

Conclusion

In 2016 early sowing of beans at Bool Lagoon did not increase grain yields. In 2016 at Conmurra no differences were observed between the NIL and treatments applied, suggesting there was no modification to plant physiological processes or manipulation of canopy growth or plant architecture. The SPA program are meeting in March 2017 to determine trial work for the upcoming season.

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