

B15 Canopy Management, MRZ Mid North (Hart), South Australia

B16 Canopy Management, HRZ South East (Conmurra), South Australia

B17 Canopy Management, MRZ Eyre Peninsula (Cockaleechee), South Australia

B18 Canopy Management, HRZ Mid North (Tarlee), South Australia

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Aim

To test further the PGR treatments that had the greatest effect on agronomic traits, to better understand the best application timings in order to improve performance and maximize yield potential of faba beans/broad bean .

Background

Research conducted by SARDI over the last four years has shown that application of PGRs did not benefit grain yield but rather some PGRs improved agronomic traits such as plant height, necking and lodging. Further, effective responses in agronomic traits were obtained when PGRs were applied at the early vegetative growth stage compared with later applications at early bud development or pre-flowering.

Treatments

Varieties:	PBA Samira (Hart and Yeelanna), PBA Kareema (Conmurra)
Plant density:	24 plants/m ²
Sowing dates:	Hart (Mid-North) -14 April, Tarlee (Mid North)- 7 May, Conmurra (South East)-17 May, Cockaleechee (Eyre Peninsula) – 6 May
Fungicides	145 ml/ha Tebuconazole + 2.3 L/ha Chlorothalonil during the vegetative growth 2 L/ha Chlorothalonil + 500 ml/ha Carbendazim at pre flowering/canopy closure
Seed dressing	Nil
Row spacing	22.5 cm
Plot size	10 m x 1.75 m
Fertilizer	MAP + Zn (2%) @ 100 kg/ha at sowing

Trial details

The treatments were applied as foliar applications. Table 1, Table 2 and Table 3 presents treatment combinations applied at Hart (Mid-North), Conmurra (South East) and Cockaleechee (Eyre Peninsula) SA, sites respectively. Faba bean variety PBA Samira, was used in the trial at Hart and Cockaleechee (Eyre Peninsula, SA) due to its suitability in medium and high rainfall faba bean districts. Broad bean, PBA Kareema was used at the Conmurra (South East, SA) site.

Agronomic measurements included plant height (cm), lodging at maturity (1-9 scale where 1 = lodged) and grain yield. Plant height measurements were only taken at the commencement of flowering as plants were lodged heavily at the time of harvest.

****Note. 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***

a) Canopy management MRZ Mid North (Hart), South Australia

Results

- A treatment response was found for plant height at flowering and lodging at maturity indicating that these parameters varied significantly among treatments.
- Two treatments; Ethephon & Trinexapac-Ethyl and Paraquat & Diquat significantly reduced plant height more than physical terminal bud removal and the nil treatment. Lodging was reduced only by the application of Ethephon & Trinexapac Ethyl treatment (Table 1).
- There was no significant treatment response for grain yield and the average grain yield across treatments was 5.6 t/ha.

Table 1: Plant height (cm) and lodging (1-9 scale) in faba bean variety, PBA Samira as affected by application of four canopy management treatments, Hart (Mid-North) SA, 2016.

Treatment	Plant height (cm) at flowering	Lodging (1-9 scale)*
Nil	53	2
Physical terminal bud removal	48	2
Ethephon & Trinexapac-Ethyl	36	5
Paraquat & Diquat	34	3
LSD (P = 0.05)	11.60	1.13

*Lodging scores 1-9 scale where 1 = flat and 9 = erect; numbers represent angle from ground as follows: 0-10° = 1, 11-20° = 2, 21-30° = 3, 31-40° = 4, 41-50° = 5, 51-60° = 6, 61-70° = 7, 71-80° = 8, 81-90° = 9

b) Canopy management HRZ South East (Conmurra), South Australia

Results

- There were no significant differences between the Nil treatment and the experimental treatments for plant height at maturity, grain yield and seed quality (Table 2).
- Grain yield averaged 4.3 t/ha and 100 seed weight 123 g, with no significant differences observed across the treatments.

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 (South East), SA 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
l.s.d		29.93	0.71	8.44
cv%		2.0	6.5	1.7

c) Canopy management MRZ Cockaleechee, (Eyre Peninsula), SA

Results

- A significant treatment response was found for plant biomass (harvested at maturity) and grain yield (Table 3).
- Application of some treatments led to a reduction in the amount of plant biomass, this however had a corresponding negative effect on grain yields when compared to the Nil treatment (Table 3). Hence although these treatments had a positive effect in modifying plant architecture, the 2016 season favoured long cool finishing grain filling conditions with significantly higher grain yields being obtained in the Nil treatment.

- Application of two PGRs Chlormequat and Trinexapac Ethyl did not affect the amount of plant biomass produced. However their effect on grain yield was mixed with reductions at some application timings but not at others (Table 3). This result was interesting considering that Chlormequat Chloride is considered as a 'growth retardant' and it may be that these two PGRs were not quite as effective as Ethephon under the high growth conditions of 2016.

Table 3: Effect of applied treatments on plant biomass production at maturity (t/ha) and grain yield (t/ha) of PBA Samira at Cockaleeche (Eyre Peninsula), SA in 2016. Shading represents treatments with significant response in biomass and grain yield (t/ha) as a result of treatment application.

Treatment	Application Time	Biomass (t/ha) at maturity	Grain yield (t/ha)
Nil		10.6	6.7
Ethephon	Early vegetative	8.47	4.77
Ethephon	Late vegetative	11.25	3.12
Ethephon	Early and Late	6.97	2.8
Ethephon and Chlormequat Chloride	Ethephon (early); Chlormequat(late)	7.27	5.1
Ethephon and Trinexapac-Ethyl	Ethephon (early); Trinexapac-Ethyl (late)	7.6	5.13
Paraquat and Diquat	Early vegetative	7.14	5.16
Chlormequat Chloride	Early vegetative	10.65	5.92
Chlormequat Chloride	Late vegetative	10.82	5.95
Chlormequat Chloride	Early and Late	9.08	3.75
Trinexapac-Ethyl	Early vegetative	9.95	6.15
Trinexapac-Ethyl	Late vegetative	9.97	4.57
Mechanical pinching	Early vegetative	7.67	4.93
Mechanical pinching	Late vegetative	8.02	4.12
Metosulam & Diflufenican	Early	5.23	2.77
Clopyralid	Early	9.47	2.5
LSD (P<0.05)		1.6	1.53

#shading represents significant differences

Conclusion

- Contrasting results were obtained from the application of PGRs at the three different sites indicating environmental conditions may be an important factor for effective PGR response. In high rainfall environments such as at Conmurra in South East, there was no response to PGR application while variable responses for plant architecture (plant height and biomass) and grain yield were obtained in the medium rainfall environments such as Hart (Mid-North) and Cockaleeche (Eyre Peninsula) depending on PGR and treatment. The above average rainfall may have favoured high biomass production in high rainfall environments therefore overriding any effects from application of PGRs as was observed at Conmurra, South East, SA.
- In medium rainfall environments such as Hart (Mid-North) and Cockaleeche (Eyre Peninsula) in SA, plant growth responses (plant height and biomass production) to PGR application were observed in some treatments. However where plant growth was reduced, a corresponding reduction in grain yield was also observed in comparison to the Nil treatment indicating that, in favourable seasons, a reduction in yield potential (biomass) may in-turn result in yields not being optimised.
- A reduction in grain yield was observed at Yeelanna in 2016, following application of Ethephon at early vegetative growth stage. This result has not been previously observed in our trials and the cause for such a reduction is still unclear.
- Further field evaluation across multiple application timings will occur to better understand the application timings that have the greatest effect on plant growth without a negative grain yield response.