GROWING PULSES IN THE RIVERINE PLAINS REGION

KEY MESSAGES

- Due to lower-than-average rainfall during September, 2023 was generally a low disease pressure year for faba beans in the Riverine Plains
- Low levels of Cercospora leaf spot and chocolate spot were detected at both the Daysdale and Bundalong trial sites, with, the chocolate spot susceptible variety PBA Bendoc showing a significant yield improvement of up to 1.1t/ha due to fungicide application
- Six pulse species were assessed for adaptation at the Daysdale site, with lupins averaging 2.15t/ha, field peas 2.44t/ha, faba beans 2.00t/ha, lentils 1.21t/ha, vetch 1.16t/ha, and chickpeas averaging 2.22t/ha
- Faba bean yield was lower than expected at the Daysdale site due to the dry finish
- Estimated residual nitrogen legacy from the different pulse species ranged from 97kg N/ha to 146kg N/ha; the rule of thumb for net biological nitrogen contribution from pulse species is 19 kg N/t of dry matter
- Maintaining seeding rate at 25 plants/m^2 or above was essential to optimising grain yield
- Ultimately, the dry September period experienced in 2023 reduced the yield potential of pulse crops across the region, as it coincided with flowering and pod-setting in most pulse species.

AIM

To develop management approaches that increase the adoption and productivity of grain legumes, in particular faba beans, in areas dominated by canola – wheat rotations, leading to more resilient farming systems.

BACKGROUND

Replicated field trials were established during 2023 at Daysdale and Bundalong to evaluate the response of different legume species and cultivars to disease control, nutrient and canopy management.

DAYSDALE (NSW)

METHOD

Sowing date: 4 May

Starter fertiliser: 80kg MAP/ha

Row spacing: 22.5cm

Stubble: Wheat stubble, kelly chained pre-sowing

The Daysdale site consisted of six legume species variety screening trials on a red loam soil, as well as a faba bean disease management trial (Tables 1 and 2).

Table 1 Pulse species, seeding rates and varieties sown in the 2023 Daysdale trials. Bolded varieties were also tested under high nitrogen status (100 kg N/ha applied as urea).

SPECIES	SEEDING RATE (SEEDS/M^2)	VARIETIES			
Faba Beans	25	**PBA Samira**	PBA Amberley	PBA Nasma	PBA Ayla
Lupins	60	**PBA Bateman**	Murringo	Lawler	Luxor
Field Peas	60	**PBA Butler**	PBA Taylor	PBA Pearl	APB Bondi
Vetch	80	**Timok**	Benetas	RM4	Morava
Chickpeas	50	**CBA Captain**	Genesis 090	PBA HatTrick	PBA Seamer
Lentils	120	**PBA Hallmark**	PBA Kelpie XT	GIA Leader	ALB Terrier

Table 2 Faba bean varieties and fungicide strategies used in the Daysdale faba bean disease management trial, 2023.

Cultivars
PBA Amberley (MR-MS)
PBA Bendoc (S)
PBA Samira (MS)

	Fungicide applied	**Date (Growth stage)**
Nil	Nil	---
Old Chemistry	2.3L/ha Chlorothalonil 720 + 0.5L/ha Carbendazim 500 2.3L/ha Chlorothalonil 720 + 0.5L/ha Carbendazim 500	29 Aug (Mid flower) 2 Oct (Podding)
New Chemistry	0.75L/ha Miravis Star 0.75L/ha Veritas	29 Aug (Mid flower) 2 Oct (Podding)
Complete	0.145L/ha Tebuconazole 430 2.3L/ha Chlorothalonil 720 + 0.5L/ha Carbendazim 500 0.75L/ha Miravis Star 0.75L/ha Veritas	24 Jul (8 node) 3 Aug (Start flowering) 29 Aug (Mid flower) 2 Oct (Podding)

The old chemistry treatment includes older, multi-site chemistry with purely protective activity, while the new chemistry treatment utilises new modes of action with longer lasting protection and some curative activity. The complete control treatment is aimed at keeping the canopy completely free of disease.

RESULTS

DISEASE MANAGEMENT

There was low disease pressure during the 2023 growing season and the moderately resistant to chocolate spot variety PBA Amberley showed no significant yield response to fungicide strategy, while the moderately susceptible and susceptible varieties PBA Samira and PBA Bendoc showed significant responses to fungicide application (Table 3).

The improved disease resistance of PBA Amberley over PBA Bendoc was highlighted by a lack of disease present, less than two percent of leaf area, in the untreated control plots (Figure 1). This indicates its reduced need for fungicide treatments, at least under low disease pressure situations. When growing PBA Amberley, growers should be aware of its long growing season and requirement for early sowing.

When disease was controlled in the complete control treatment, there was no yield difference between the three varieties tested, with yield ranging from 2.04t/ha to 2.20t/ha. This treatment included four fungicide applications from late July to early October and the dry conditions experienced during late winter and early spring were a likely contributing factor to this result.

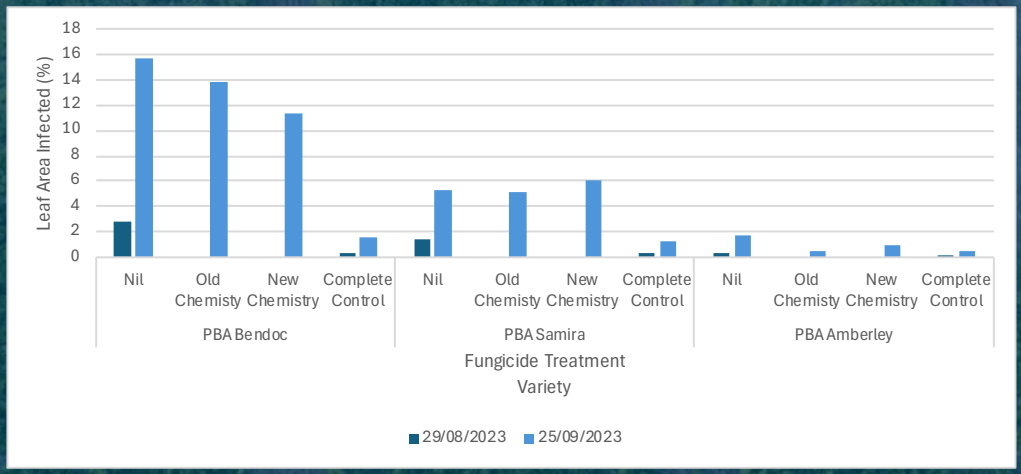


Figure 1 Chocolate spot infection of faba bean plots at Daysdale, NSW, 2023.

Table 3 Effect of fungicide management and faba bean variety on grain yield (t/ha) at Daysdale, NSW.

	PBA BENDOC	PBA SAMIRA	PBA AMBERLEY	MEAN
Nil	1.90 c	1.88 c	2.10 ab	1.96 c
Old chemistry	2.15 ab	1.88 c	1.99 bc	2.01 bc
New chemistry	2.15 ab	2.15 ab	2.09 ab	2.13 a
Complete control	2.20 a	2.04 abc	2.04 abc	2.09 ab
Mean	2.10 -	1.99 -	2.05 -	
Cultivar	P Value	0.170	LSD	ns
Fungicide	P Value	0.013	LSD	0.11
Cultivar x Fungicide	P Value	0.049	LSD	0.19

For the varieties that responded to fungicide, there was no benefit to early fungicide applications before early-mid-flowering. This has been a consistent result across other sites included in this project work, even under high disease-pressure situations, such as during 2021 – 2022. By delaying the first fungicide application until early-mid flowering, legume growers have a much better idea of the seasonal outlook and the yield potential of the crop. This enables more informed tactical decisions to be made around fungicide use, i.e. if a dry spring is forecast, applications can be reduced, conversely if a wet spring and high yield potential is forecast, the use of high rates of fungicide using good chemistry is recommended.

VARIETY COMPARISON TRIALS

While the trial design does not allow statistical comparisons between species, we can see that most species performed reasonably well given the dry start to early spring, with no crop failures occurring.

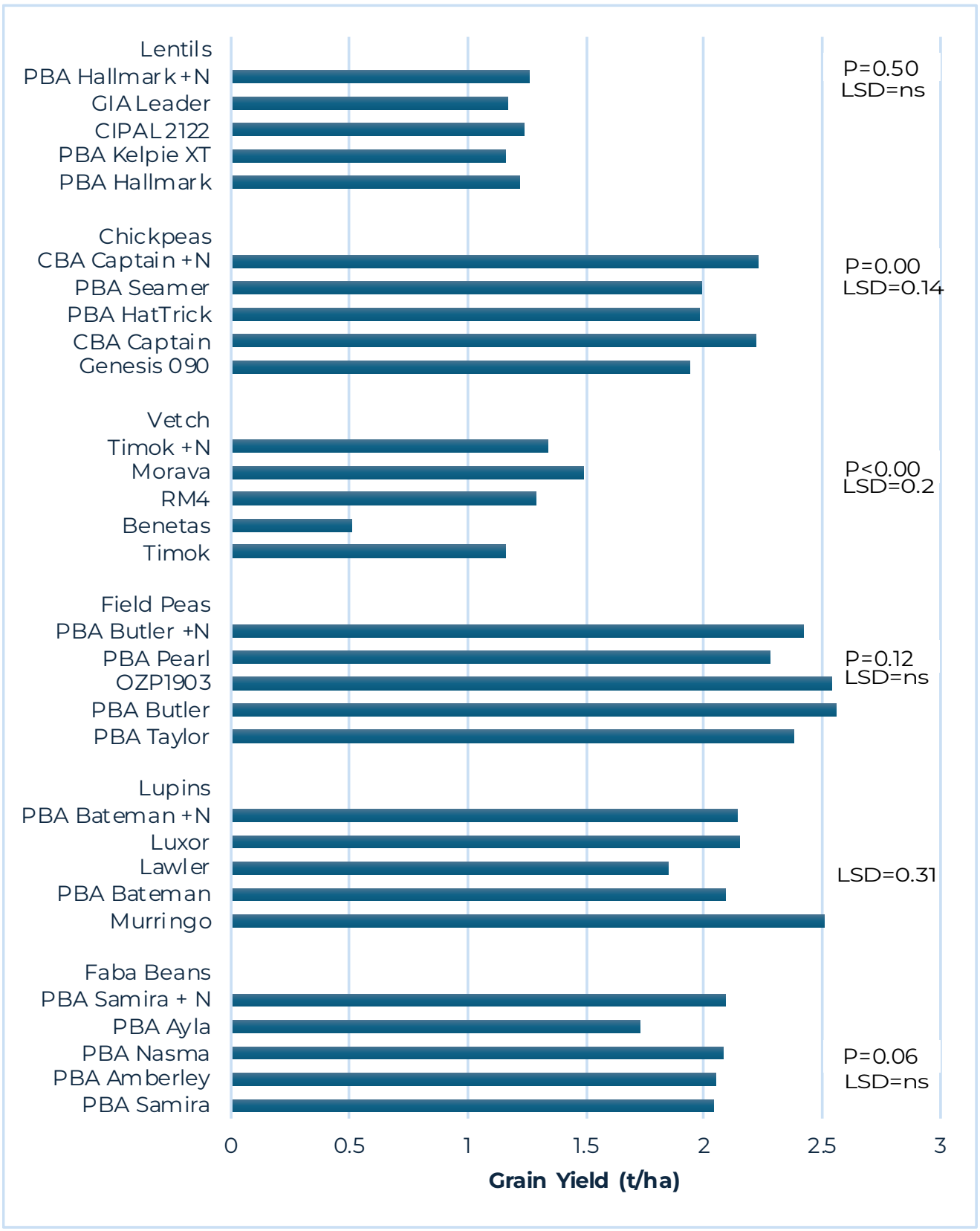
For faba beans, field peas, and lentils there was no statistical difference between the varieties tested. Species with significant varietal differences included chickpeas, vetch and lupins, with CBA Captain chickpea outyielding all other chickpea varieties. The vetch variety Benetas was significantly lower yielding than other varieties, likely because it has a longer phenology compared to other varieties and suffered from the dry spring. The albus lupin variety Murringo outyielded the other lupin varieties. Across all varieties, there was no yield increase seen when in-crop nitrogen was applied.

A big part of the NSW Pulse project is getting a better understanding of the nitrogen fixing abilities of the different pulse species, to get a better idea of the legacy effects of the pulse crop. This involves collecting peak biomass samples and analysing them to determine the amount of nitrogen in the crop that is derived from the atmosphere (fixed nitrogen). The results from 2023 trials are not yet available, but estimates are provided in Table 4, based on previous years' results.

Table 4 Estimated nitrogen fixing ability of different pulse species during 2023

SPECIES	VARIETY	YIELD (T/HA)	BIOMASS (T/HA)	ESTIMATED N FIXED* (KG N/HA)	N BALANCE # (KG N/HA)
Faba Bean	PBA Samira	2.04	5.52	182	103
Lupin	PBA Bateman	2.09	7.08	234	138
Field Pea	PBA Butler	2.56	5.75	190	97
Vetch	Timok	1.16	5.81	192	136
Chickpea	CBA Captain	2.22	6.20	205	143
Lentil	PBA Hallmark	1.22	5.56	183	138
* Nitrogen fixed estimate based on 33kg N fixed per tonne of above ground biomass from 2021 results.					
# Nitrogen balance calculated by N fix estimate minus N removed by grain.					

Figure 2 Grain yield of each variety of the six pulse species tested at Daysdale, NSW in 2023.



BUNDALONG

METHOD

Sowing date: 24 April
Starter fertiliser: 80kg MAP/ha
Row spacing: 22.5 cm
Stubble: Standing wheat stubble

The Bundalong site hosted three faba bean trials investigating disease management (Table 5), crop nutrition (trial data not presented as no treatment effects were seen), and canopy management (Table 6).

Table 5 Fungicide strategies applied to both PBA Bendoc and PBA Amberley at Bundalong during 2023

	APPLICATION DATE AND GROWTH STAGE				
TREATMENT	**12-JUL 8 NODE**	**1-AUG 12 NODE/ EARLY FLOWER**	**16-AUG GS60-61**	**6-SEP GS65**	**2-OCT MID-PODDING**
Untreated Control	-	-	-	-	-
1 Unit	-	-	-	-	Chlorothalonil 2.3L/ha + Carbendazim 500mL/ha
2 Units	-	-	-	Chlorothalonil 2.3L/ha + Carbendazim 500mL/ha	Chlorothalonil 2.3L/ha + Carbendazim 500mL/ha
3 Units	-	-	Mancozeb 2kg/ha + Nosclex 300g/ ha	Chlorothalonil 2.3L/ha + Carbendazim 500mL/ha	Chlorothalonil 2.3L/ha + Carbendazim 500mL/ha
4 Units	Tebuconazole 145mL/ha	-	Mancozeb 2kg/ha + Nosclex 300g/ ha	Chlorothalonil 2.3L/ha + Carbendazim 500mL/ha	Chlorothalonil 2.3L/ha + Carbendazim 500mL/ha
2 Units Expensive	-	-	-	Miravis Star 750mL/ha	Veritas 750mL/ha
1 Unit Reactive	-	-	-	Miravis Star 750mL/ha	-
Complete Control	Tebuconazole 145mL/ha	Mancozeb 2kg/ha + Procymidone 240g/ha	Mancozeb 2kg/ha + Nosclex 300g/ ha	Miravis Star 750mL/ha	Veritas 750mL/ha
Experimental	Tebuconazole 145mL/ha	-	Mancozeb 2kg/ha + Nosclex 300g/ ha	Experimental fung FAR23-01	Veritas 750mL/ha

The reactive treatment is designed to be 'reactive' to disease infection, so applications were delayed until disease had developed in the canopy, while the complete control treatment is designed to go above and beyond what is commercially reasonable to completely remove the influence of disease. The experimental treatment replicates the four-unit treatment but involves new and experimental (not commercial in 2023) products.

Table 6 Canopy management strategies applied to both PBA Samira and PBA Amberley at Bundalong during 2023.

TREATMENT	AIM OF TREATMENT
Standard plant density (target 25 plants/m²)	Control
Low plant density (target 12 plants/m²)	
High plant density (target 50 plants/m²)	

RESULTS

DISEASE MANAGEMENT

Similarly to Daysdale, overall disease infection was low at the Bundalong site due to a lack of conducive conditions, with chocolate spot again being the main disease infecting faba bean canopies. The low disease pressure allowed more flexibility in the timing of fungicide applications, as well as the products being used.

Despite the low disease pressure, statistically significant yield gains were achieved using several of the fungicide strategies described in Table 5. Despite differences in disease resistance ratings, both varieties responded the same way to the fungicide strategies applied (no statistical interaction). When variety yield was averaged and compared across treatments (Table 7), all fungicide strategies gave a significant yield increase above the untreated control. The 'experimental strategy' achieved the highest yield (6.20t/ha) with an increase of 0.94 t/ha above the untreated control. Across all fungicide treatments, PBA Amberley was significantly higher yielding than PBA Bendoc.

Table 7 Effect of fungicide management and faba bean variety on grain yield (t/ha) at Bundalong, Vic.

	Yield (t/ha)			
TREATMENT	**PBA AMBERLEY**		**PBA BENDOC**	**MEAN**
Untreated Control	5.54 -		4.98 -	**5.26 c**
1 Unit	6.07 -		5.47 -	**5.77 b**
2 Units	6.33 -		5.71 -	**6.02 ab**
3 Units	6.16 -		6.12 -	**6.14 a**
4 Units	5.89 -		5.73 -	**5.81 b**
2 Units Expensive	5.96 -		5.63 -	**5.80 b**
1 Unit Reactive	6.03 -		5.94 -	**5.98 ab**
Complete Control	6.08 -		5.75 -	**5.92 ab**
Experimental	6.36 -		6.04 -	**6.20 a**
Mean	**6.05 a**		**5.71 b**	
Variety	**LSD**	0.23	**P val**	0.018
Fungicide Strategy	**LSD**	0.28	**P val**	<0.001
Variety x Fungicide Strategy	**LSD**	ns	**P val**	0.302

CANOPY MANAGEMENT

The canopy management trial allowed us to test methods which have the potential to influence canopy structure or improve crop standability, with the aim of increasing crop yields. This focussed on using high and low plant densities with two faba bean varieties as described in Table 5. The results showed that none of the treatments improved grain yield (Table 8), despite their effect on lodging (Figure 3). There was a significant yield reduction when plant populations were reduced from 25 plants/m^2 to 13 plants/m^2.

Table 8 Effect of canopy management and faba bean variety on grain yield (t/ha) at Bundalong, Vic

	Yield (t/ha)			
TREATMENT	**PBA AMBERLEY**		**PBA SAMIRA**	**MEAN**
Low plant density (target 12 plants/m^2)	5.46 -		5.87 -	**5.66 b**
Standard plant density (target 25 plants/m^2)	5.95 -		6.00 -	**5.97 a**
High plant density (target 50 plants/m^2)	5.99 -		6.09 -	**6.04 a**
Mean	5.82 -		5.97 -	
Variety	LSD	ns	P val	0.107
Canopy Management	LSD	0.19	P val	0.010
Variety x Canopy Management	LSD	ns	P val	0.102

Crop lodging was significantly affected by plant density (Figure 3), with the low plant density resulting in less lodging, but also reduced yield. Increasing the seeding rate did not result in more lodging or yield compared to the standard density. The biggest factor influencing crop lodging was variety choice, with PBA Amberley having significantly lower lodging scores than PBA Samira. Yield data from two years of trials hasn't been able to demonstrate an improvement grain yield with canopy management strategies. While they may help with the harvestability of the crop due to the prevention of grain yield losses, the nature of harvesting trials (low and slow to collect all grain) means this is not evident in the results.

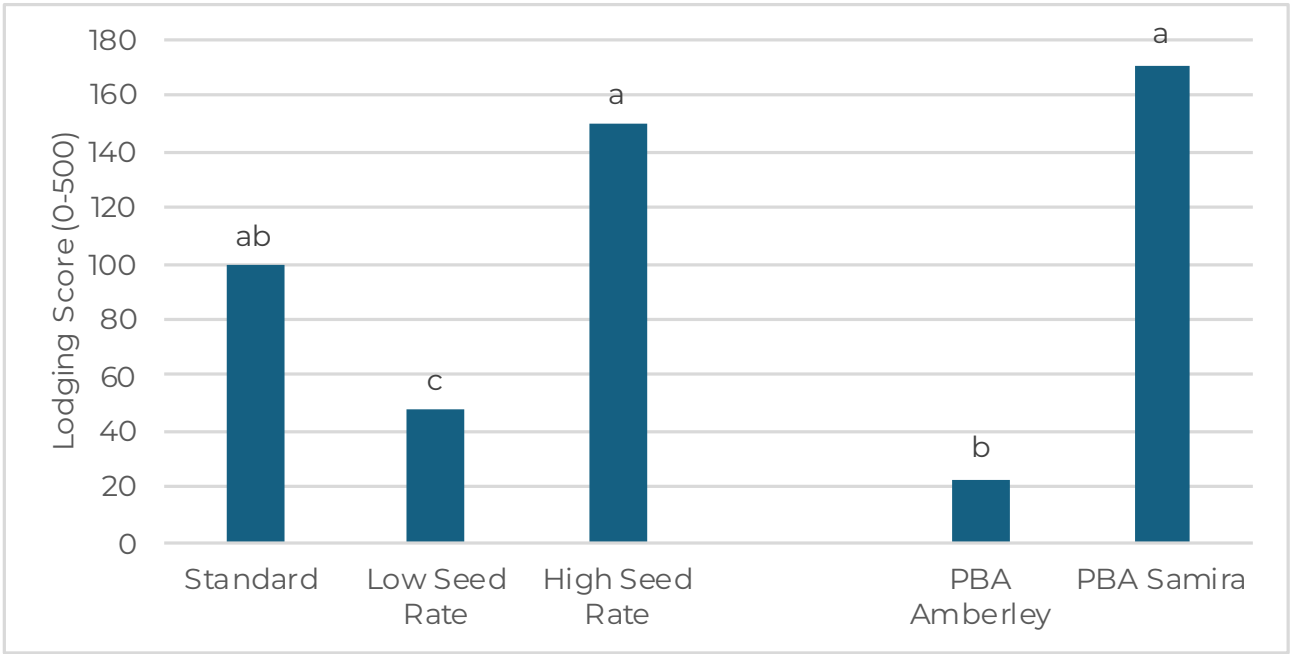


Figure 3 Influence of canopy management strategies and faba bean variety (analysed separately) on crop lodging, lodging score calculated by severity (0-5) x percentage of plot affected (0-100).

Detailed assessments of canopy structure were undertaken within the different seeding rate (low, standard and high) treatments in PBA Amberley (Table 9).

Table 9 Canopy structure of PBA Amberley at varying seed rates.

TREATMENT	PLANTS/M²	STEMS/ PLANT	STEMS/M²	PODS/STEM	PODS/M²	SEEDS/POD
Low Seed Rate	12 d	4.8 a	51 b	7 a	385 -	2.4 -
Standard Control	25 c	2.9 b	70 a	6 bc	397 -	2.4 -
High Seed Rate	46 a	1.8 c	84 a	5 c	355 -	2.3 -
Mean	28	3.1	70	6	381	2.4
LSD	7	0.7	17	1	ns	ns
P val	<0.001	<0.001	0.023	0.018	0.561	0.639

Results showed that plant density had a significant effect in PBA Amberley on the number of stems produced per plant and the number of pods produced per stem, with plants grown under low plant densities producing a greater number of stems and pods when compared to plants grown under standard and high plant densities.

The greater stem/plant and pod/stem numbers produced by PBA Amberley when grown under low plant densities failed to compensate for the lower plant numbers, with the yield achieved under this treatment 0.49t/ha lower than the standard seeding rate and 0.53t/ha lower than the highest seeding rate.

SUMMARY

2023 was another successful year for growing pulses in the Riverine Plains region with faba bean yields exceeding 6t/ha. Disease pressure was low, which provided growers with more flexibility in their fungicide program and timing and product choice were less significant compared to previous high-pressure years. Yield penalties were still observed where no fungicide was used.

Management options that were trialed to reduce lodging in faba beans were unsuccessful at increasing yields. Reducing plant numbers to reduce lodging came at a yield penalty, showing the importance of maintaining plant populations at or above 25 plants/m². If lodging is present in the crop, care can be taken at harvest to prevent losses.

At Daysdale grain legume yields ranged from 0.51t/ha (Benetas vetch) to 2.56t/ha (PBA Butler field peas). Lentils, field peas and faba beans showed no differences between varieties, but variety choice in vetch, lupins and chickpeas did cause significant yield differences.

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CONTACT

Authors: Tom Price, Ben Morris, Rebecca Murray

Organisation: Field Applied Research (FAR) Australia

Email: tom.price@faraustralia.com.au