



Optimising
Irrigated Grains

Optimising Irrigated Grains (FAR1906-003RTX) A Grains Research & Development Corporation (GRDC) investment

PROVISIONAL HARVEST RESULTS:

Irrigated Faba Bean Trials



Released: 24 February 2021

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:



Irrigation Research &
Extension Committee



tia
TASMANIAN
INSTITUTE OF
AGRICULTURE



SFS
Southern Farming Systems

Finley Irrigated Research Centre NSW

Irrigated trials conducted at the Finley irrigated research centre 2020 were managed by FAR Australia, hosted by Southern Growers.

Trial 1 Optimum Plant Population Under Overhead Irrigation

Location: Finley IRC

FAR Code: FAR F20-01-1

Sown: 28 April 2020

Cultivar: PBA Amberley and Fiesta VF

Harvested: 30th November 2020

Rotation position: Wheat (2019), Faba beans (2018), Fallow after Rice (2017)

Soil type & Management: Red clay, Cultivation with speed disc to incorporate stubble in Autumn

Irrigation: Overhead lateral irrigation 6 x 25mm in spring. Total applied 150mm (1.5 ML/ha)

GSR: April-October 244mm. Total water available (GSR + Irr) 394mm

Key Messages:

- *There was no significant difference in grain yield between Fiesta VF and PBA Amberley under overhead irrigation*
- *Seed rate had a significant impact on grain yield with yield maximised at plant populations of 16 plants/m² and above*
- *There was no significant difference in pod number between the plant populations although there was a trend suggesting lower pod numbers at populations of 10 plants/m².*
- *Plant population had a significant impact on crop height with a shorter crop at 10 plants/m².*
- *There was an interaction between cultivar and plant population on early dry matter production (8 node) where PBA Amberley maximised early dry matter production at 23 plants/m² and Fiesta VF maximised early dry matter production at 45 plants/m²*
- *Plant population had an impact on dry matter production at early flowering with plant populations of 16/m² and above producing significantly more dry matter than 10-11 plants/m².*
- *Water use efficiency (WUE) for PBA Amberley based on 4.38t/ha was 15.4kg/mm.*

Table 1. Grain yield (t/ha) of four seed rates with two different cultivars grown under overhead irrigation.

Plants/m ² (actual)		Yield t/ha		
Amberley	Fiesta	PBA Amberley Yield t/ha	Fiesta VF Yield t/ha	Mean Yield t/ha
10	11	3.00 -	3.31 -	3.15 b
16	16	4.50 -	4.93 -	4.72 a
23	31	4.83 -	4.84 -	4.84 a
32	45	5.17 -	5.15 -	5.16 a
Mean		4.38 -	4.56 -	
LSD Seed Rate p = 0.05		0.49	P val	<0.001
LSD Cultivar p=0.05		ns	P val	0.343
LSD Seed Rate x Cultivar.		ns	P val	0.719

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Table 2. Influence of plant population and cultivar on canopy composition, plants/m² (GS13) and crop height (harvest) – assessed GS13 (2 June), harvest (25 Nov).

Seed Rate (seeds/m ²)	Plants population			Crop Height		
	PBA Amberley	Fiesta VF	Mean	PBA Amberley	Fiesta VF	Mean
	Plants/m ²	Plants/m ²	Plants/m ²	cm	cm	cm
12 seeds/m ²	9.8 -	10.5 -	10.1 c	78 -	77 -	77 b
24 seeds/m ²	15.5 -	16.0 -	15.8 c	88 -	97 -	92 a
36 seeds/m ²	22.8 -	31.0 -	26.9 b	85 -	92 -	89 a
48 seeds/m ²	31.8 -	45.0 -	38.4 a	86 -	93 -	90 a
Mean	19.9 -	25.6 -		84 -	90 -	
Cultivar LSD		7.7			6.4	
P val		0.099			0.069	
Seed Rate LSD		9.2			5.4	
P val		<0.001			<0.001	
Cultivar x Seed Rate LSD		ns			ns	
P val		0.415			0.300	

Table 3. Influence of plant population and cultivar on canopy composition, pods/m² (harvest) and height to first pod (harvest) – assessed harvest (25 Nov).

Treatment	Canopy composition	
	Pods/m ²	1st Pod Height (cm)
PBA Amberley		
10 plants/m ²	261 -	20.5 -
16 plants/m ²	315 -	21.4 -
23 plants/m ²	359 -	26.4 -
32 plants/m ²	351 -	23.2 -
Fiesta VF		
31 seeds/m ²	353 -	26.7 -
Mean	328	23.6
Cultivar x Seed Rate LSD	79	ns
P val	0.087	0.154

Table 4. Influence of plant population and cultivar on dry matter production (t/ha) at 8 node – assessed 7 July.

Dry Matter Production at 8 node				
Plants/m ²		PBA Amberley	Fiesta VF	Mean
Amberley	Fiesta	t/ha	t/ha	t/ha
10	11	0.19 d	0.17 d	0.18 c
16	16	0.25 cd	0.35 bc	0.30 b
23	31	0.31 bc	0.41 b	0.36 b
32	45	0.36 b	0.57 a	0.46 a
Mean		0.28 -	0.38 -	
LSD Seed Rate p =		0.08	P val	<0.001
LSD Cultivar		0.12	P val	0.077
LSD Seed Rate x		0.11	P val	0.040

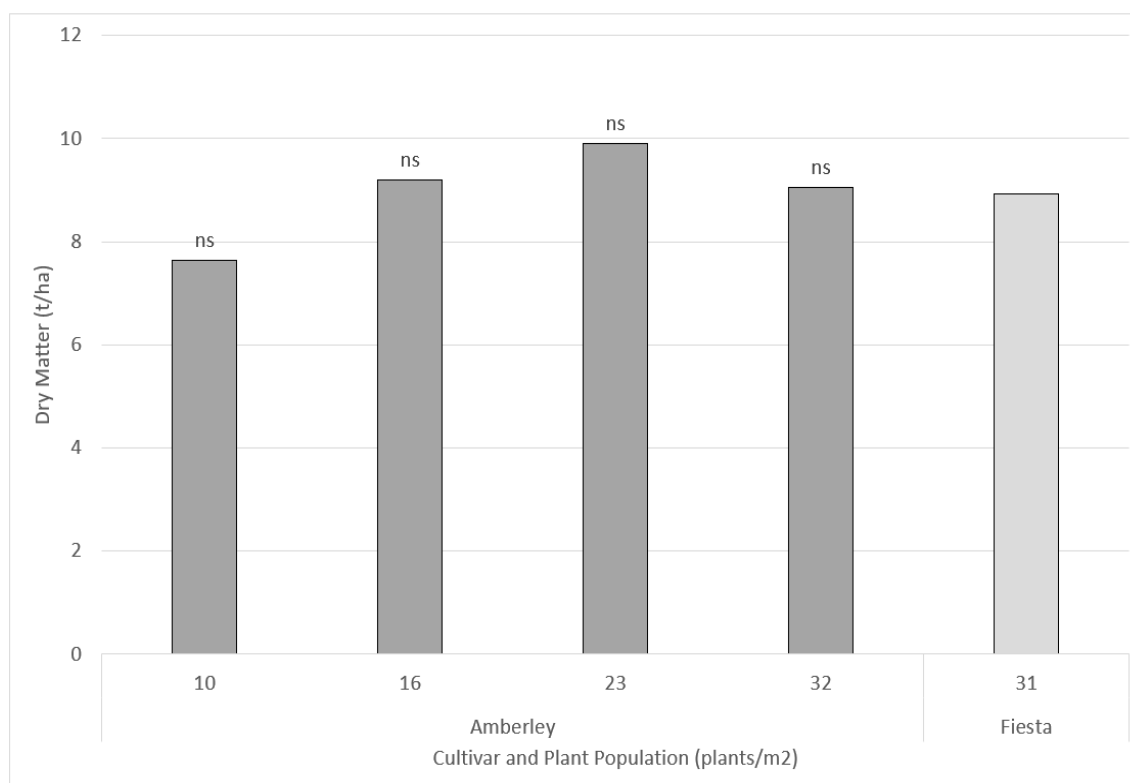
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Table 5. Influence of plant population and cultivar on dry matter production (t/ha) at GS63 – assessed 31 August.

Dry Matter Production at Early Flowering (GS63)				
Plants/m ² (actual)		PBA Amberley	Fiesta VF	Mean
Amberley	Fiesta	t/ha	t/ha	t/ha
10	11	1.02 -	1.31 -	1.16 b
16	16	1.73 -	2.33 -	2.03 a
23	31	1.88 -	2.76 -	2.32 a
32	45	2.23 -	2.94 -	2.59 a
Mean		1.72 b	2.33 a	
LSD Seed Rate p = 0.05		0.67	P val	0.001
LSD Cultivar p=0.05		0.41	P val	0.018
LSD Seed Rate x Cultivar.		ns	P val	0.822

**Figure 1.** Influence of plant population on dry matter at harvest – assessed 25 November.

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The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Trial 2 Optimum Plant Population Under Flood Irrigation

Location: Finley IRC

FAR Code: FAR F20-01-2

Sown: 28 April 2020

Cultivar: PBA Amberley and Fiesta VF

Harvested: 30th November 2020

Rotation position: Wheat (2019), Faba beans (2018), Wheat (2017)

Soil Management: Cultivation with speed disc to incorporate stubble in Autumn

Irrigation: Flood irrigation 3 x 80mm in spring. Total applied 240mm (2.4 ML/ha)

GSR: April-October 244mm. Total water available (GSR + Irr) 484mm

Key Messages:

- Productivity exceeded 7t/ha with faba beans grown under flood irrigation and though not statistically comparable were 2t/ha higher yielding than the identical trial set up under overhead irrigation.
- Based on 90mm more water applied the faba beans grown on flood had higher pod numbers and greater harvest dry matter than their overhead irrigation equivalents.
- There was no significant difference ($p=0.08$) in grain yield between Fiesta VF and PBA Amberley under flood irrigation with an average yield of 6.71t/ha and 7.05t/ha respectively.
- Seed rate and resultant plant population had a significant impact on grain yield with yield maximised at populations of 23 plants/m² and above.
- There was no significant difference in pod number between the plant populations, indicating higher pod numbers per plant at the lowest populations.
- Plant population had an impact on early dry matter production (8 node) with plant populations of 20/m² and above producing significantly more dry matter than 11 – 13 plants/m².
- There was an interaction between cultivar, plant population and dry matter production at early flowering (GS 63) where PBA Amberley maximised dry matter production at lower populations (20 plants/m²) than Fiesta VF which maximised dry matter production at 27 plants/m².
- Averaging grain yield and dry matter at harvest PBA Amberley had a harvest index of 45.4% (data not shown).
- The WUE for the higher yielding variety PBA Amberley (7.05t/ha) was 18.9kg/mm.

Table 1. Grain yield (t/ha) of four seed rates with two different cultivars grown with flood irrigation.

Plants/m ² (actual)		Cultivar		Mean
Amberley	Fiesta	PBA Amberley Yield t/ha	Fiesta VF Yield t/ha	Yield t/ha
11	13	6.28 -	6.12 -	6.20 b
20	25	7.45 -	6.75 -	7.10 a
31	27	7.33 -	7.06 -	7.19 a
26	31	7.15 -	6.92 -	7.04 a
Mean		7.05 -	6.71 -	
LSD Seed Rate p = 0.05		0.35	P val	<0.001
LSD Cultivar p=0.05		0.42	P val	0.083
LSD Seed Rate x Cultivar.		ns	P val	0.381

Table 2. Influence of seed rate and cultivar on plant population – assessed GS13 (5 June).

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	Cultivar		Mean
	PBA Amberley	Fiesta VF	
Seed Rate	Plants/m²	Plants/m²	Plants/m²
12 seeds/m ²	11.1 -	12.8 -	11.9 c
24 seeds/m ²	20.0 -	25.0 -	22.5 b
36seeds/m ²	30.6 -	26.7 -	28.6 a
48 seeds/m ²	26.1 -	31.1 -	28.6 a
Mean	21.9 -	23.9 -	
Cultivar LSD	ns	P val	0.446
Seed Rate LSD	5.8	P val	<0.001
Cultivar x Seed Rate LSD	ns	P val	0.354

Table 3. Influence of plant population and cultivar on canopy composition, pods/m² and height to first pod – assessed at harvest (26 Nov).

Treatment	Canopy composition	
	Pods/m ²	1st Pod Height (cm)
PBA Amberley		
12 seeds/m ²	451 -	23.8 -
24 seeds/m ²	453 -	28.9 -
36seeds/m ²	472 -	27.9 -
48 seeds/m ²	436 -	32.6 -
Fiesta VF		
36seeds/m ²	557 -	31.3 -
Mean	474	28.9
Cultivar x Seed Rate LSD	ns	ns
P val	0.409	0.193

Table 4. Influence of plant population and cultivar on dry matter production (t/ha) at 8 node – assessed 7 July.

Dry Matter Production at 8 node				
Plants/m ² (actual)		PBA Amberley	Fiesta VF	Mean
Amberley	Fiesta	t/ha	t/ha	t/ha
11	13	0.18 -	0.25 -	0.22 b
20	25	0.50 -	0.45 -	0.47 a
31	27	0.43 -	0.56 -	0.49 a
26	31	0.55 -	0.55 -	0.55 a
Mean		0.41 -	0.45 -	
LSD Seed Rate p = 0.05		0.14	P val	<0.001
LSD Cultivar p=0.05		ns	P val	0.266
LSD Seed Rate x Cultivar.		ns	P val	0.581

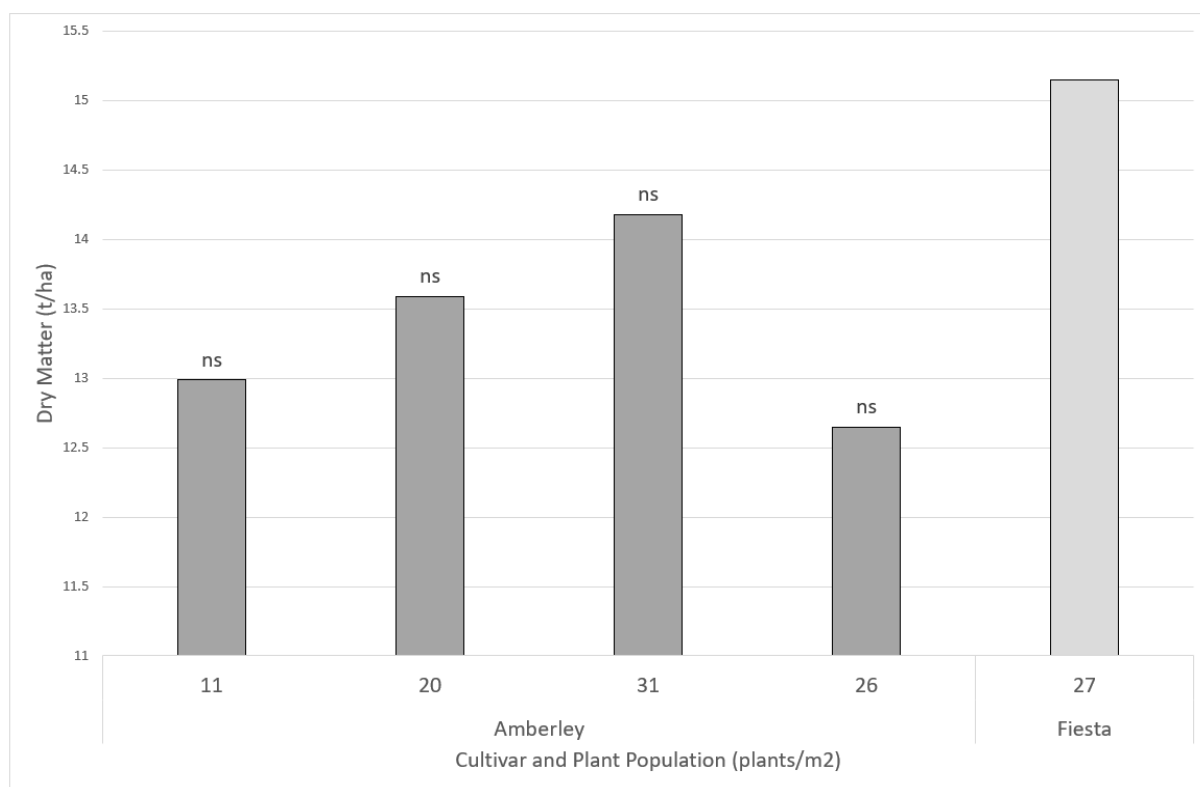
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Table 5. Influence of plant population and cultivar on dry matter production (t/ha) at GS63 – assessed 31 August.

Dry Matter Production at early flowering (GS63)						
Plants/m ² (actual)		PBA Amberley		Fiesta VF		Mean
Amberley	Fiesta	t/ha		t/ha		t/ha
11	13	0.88	f	0.99	ef	0.93 c
20	25	1.83	bc	1.36	de	1.59 b
31	27	1.58	cd	2.32	a	1.95 a
26	31	1.65	bcd	2.01	ab	1.83 ab
Mean		1.48	-	1.67	-	
LSD Seed Rate p = 0.05		0.30		P val		<0.001
LSD Cultivar p=0.05		ns		P val		0.403
LSD Seed Rate x Cultivar.		0.41		P val		0.003

**Figure 1.** Influence of plant population on dry matter production (t/ha) at harvest – assessed 26 November.

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Trial 3 Influence of Rhizobium Inoculation on the Break Crop Effect of Faba Bean Yield and Profitability

Location: Finley IRC

FAR Code: FAR F20-02-1

Sown: 28 April 2020

Cultivar: PBA Bendoc

Harvested: 30th November 2020

Rotation position: Wheat (2019), Faba beans (2018), Fallow after Rice (2017)

Soil Management: Cultivation with speed disc to incorporate stubble in Autumn

Irrigation: Overhead lateral irrigation 6 x 25mm in spring. Total applied 150mm (1.5 ML/ha)

GSR: April-October 244mm. Total water available (GSR + Irr) 394mm

Key Messages:

- There were no yield benefits of rhizobium inoculation or N input in irrigated faba beans on this research site.
- No benefit was observed in either dry matter, N uptake or root nodule score.
- The WUE based on a trial mean of 6.38t/ha was 22.5kg/mm.

Table 1. Influence of rhizobium inoculation on faba bean grain yield (t/ha) and protein (%).

Treatment Rate & Timing		Grain yield and quality	
		Yield t/ha	Protein %
1.	Untreated	6.35 -	13.6 -
2.	Alosca 10kg/ha	6.31 -	13.4 -
3.	Alosca 20kg/ha	6.38 -	13.8 -
4.	Alosca 30kg/ha	6.07 -	13.3 -
5.	40 kg N/ha pod set	6.79 -	14.1 -
6.	40 kg N/ha IBS	6.35 -	13.6 -
Mean		6.38	13.6
LSD		ns	ns
P val		0.412	0.336

Table 2. Influence of rhizobium inoculation on faba bean dry matter production and nitrogen uptake at mid flowering and harvest – assessed GS64 (11 Sep) and harvest (25 Nov).

Treatment Rate & Timing		Mid flowering (GS64)		Harvest
		Dry matter t/ha	Nitrogen (N) Kg/ha	Dry matter Kg/ha
1.	Untreated	5.31 -	202 a	12.93 -
2.	Alosca 10kg/ha	5.46 -	153 bc	10.57 -
3.	Alosca 20kg/ha	4.40 -	152 bc	11.62 -
4.	Alosca 30kg/ha	5.13 -	183 ab	12.74 -
5.	40 kg N/ha pod set	4.15 -	139 c	9.99 -
6.	40 kg N/ha IBS	5.33 -	201 a	14.17 -
Mean		4.96	172	12.00
LSD		ns	38	3.10
P val		0.198	0.011	0.093

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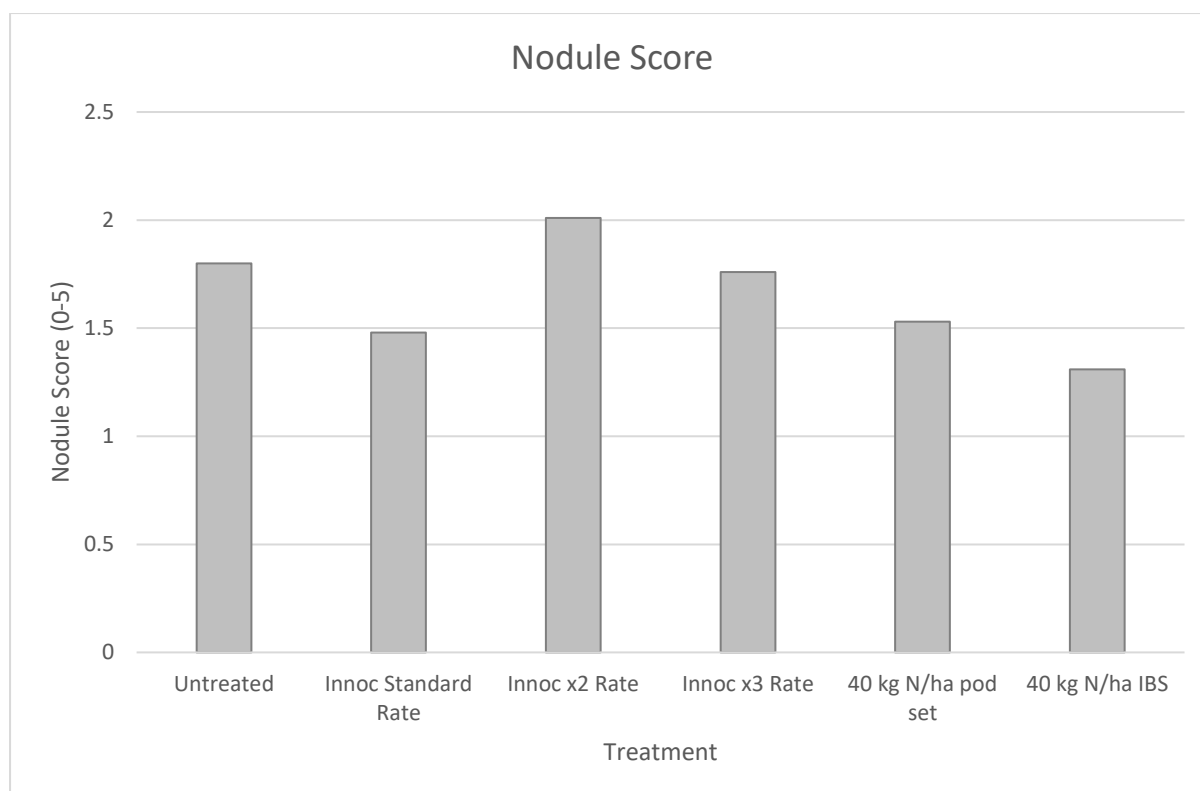


Figure 1. Influence of treatments tested on root nodule scores (0-5 scale) Assessed at 9 node 17-Jul – cv PBA Bendoc.

6 plants were randomly dug out from each plot, roots were gently washed to remove soil. The nodules were counted as effective (pink outside and healthy pink inside) and non-effective (black, white and green). A score based on the number and distribution of effective nodules was calculated from the table below.

Table 3. Nodule scoring system.

Nodule Score	Distribution and Number of Effective Nodules	
	Crown (Top 5cm)	Elsewhere
0	0	0
0.5	0	1 to 4
1.0	0	5 to 9
1.5	0	>10
2.0	<10	0
2.5	<10	<10
2.75	<10	>10
3.0	>10	0
4.0	>10	<10
5.0	>10	>10

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The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Trial 4 Disease Management Strategies for Faba Beans Grown Under Irrigation

Location: Finley IRC

FAR Code: FAR F20-07-1

Sown: 28 April 2020

Cultivar: PBA Amberley and Fiesta VF

Harvested: 30th November 2020

Rotation position: Wheat (2019), Faba beans (2018), Fallow after Rice (2017)

Soil Management: Cultivation with speed disc to incorporate stubble in Autumn

Irrigation: Overhead lateral irrigation 6 x 25mm in spring. Total applied 150mm (1.5 ML/ha)

GSR: April-October 244mm. Total water available (GSR + Irr) 394mm

Key Messages:

- Neither PBA Amberley or Fiesta VF gave a significant yield response to either three spray foliar fungicide programme.
- PBA Amberley had lower disease incidence than Fiesta VF but levels of disease were very low.
- Both fungicide strategies had good control of low disease levels compared to the untreated plots.
- An accidental overspray by a farm contractor applied tebuconazole 145ml/ha for cercospora at the vegetative stage to the whole trial on 1st August. This may have reduced the response to fungicide over the untreated.
- Based on a trial mean of 6.4t/ha the WUE was 22.5kg/mm.

Table 1. Fungicide strategies applied to the trial.

Strategy	Treatment mL/ha		
	6 Node (7 July)	Early-Flower (4 Sep)	Mid-Flower (2 Oct)
1. Untreated	-	-	-
2. Expensive	Veritas @ 1 L/ha	Aviator Xpro @ 600mL/ha	Veritas @ 1 L/ha
3. Cheap	Tebuconazole 430 @ 145 mL/ha	Chlorothalonil 720 @ 1.4 L/ha	Chlorothalonil 720 @ 1.4 L/ha

Please note a contractor overspray of fungicide (tebuconazole 145ml/ha) was made on 1st August for cercospora which may have reduced disease in all treatments

Table 2. Influence of fungicide strategy on grain yield under different fungicide strategies.

Treatment	Grain Yield		
	PBA Amberley Yield t/ha	Fiesta VF Yield t/ha	Mean Yield t/ha
1. Untreated	6.15 -	6.31 -	6.23 -
2. Expensive	6.36 -	6.66 -	6.51 -
3. Cheap	6.53 -	6.40 -	6.46 -
Mean	6.34 -	6.46 -	
LSD Fungicide p = 0.05	ns	P val	0.104
LSD Cultivar p=0.05	ns	P val	0.733
LSD Fungicide x Cultivar P=0.05	ns	P val	0.286

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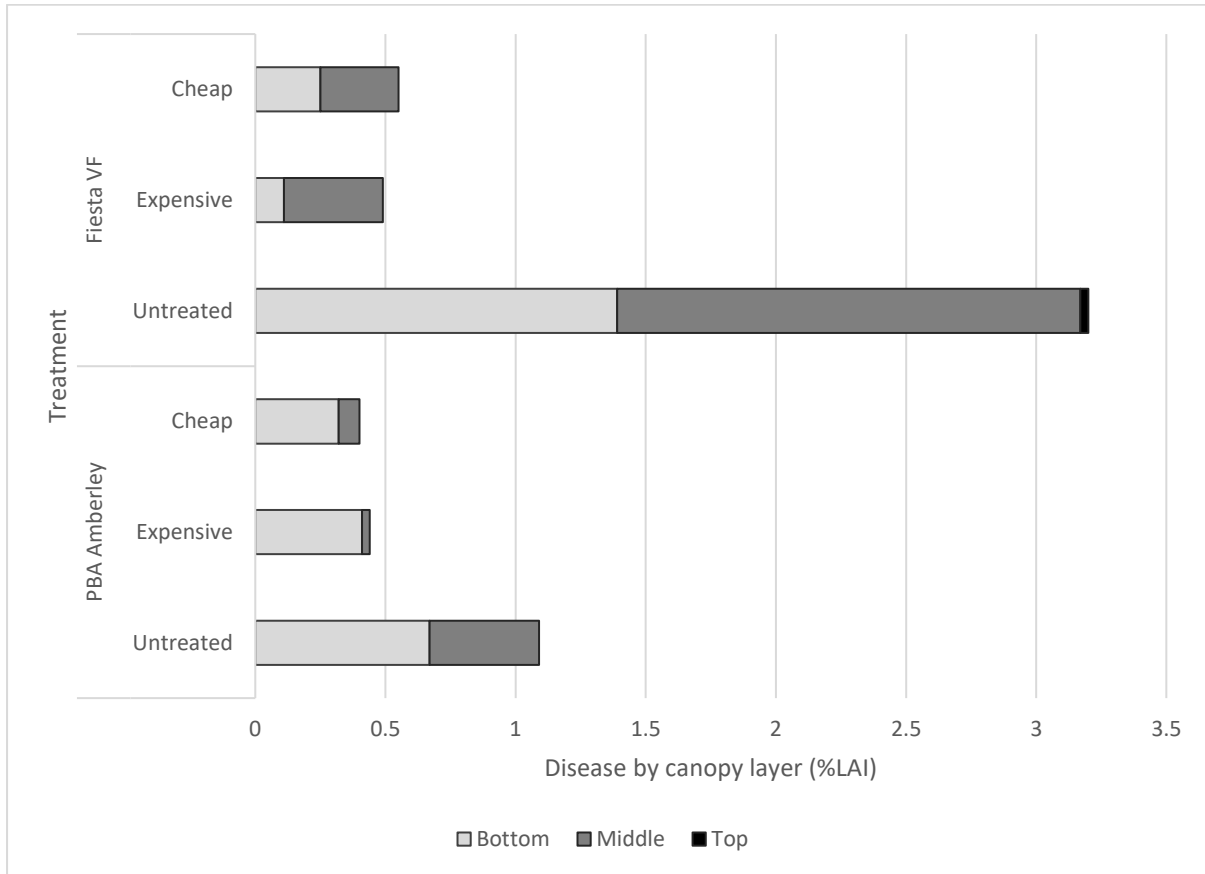


Figure 1. Cercospora leaf spot infection 28 days after fungicide application at mid-flower – Assessed 28-Oct at GS83.

Please note a contractor overspray of fungicide (tebuconazole 145ml/ha) was made on 1st August for cercospora which may have reduced disease in all treatments.

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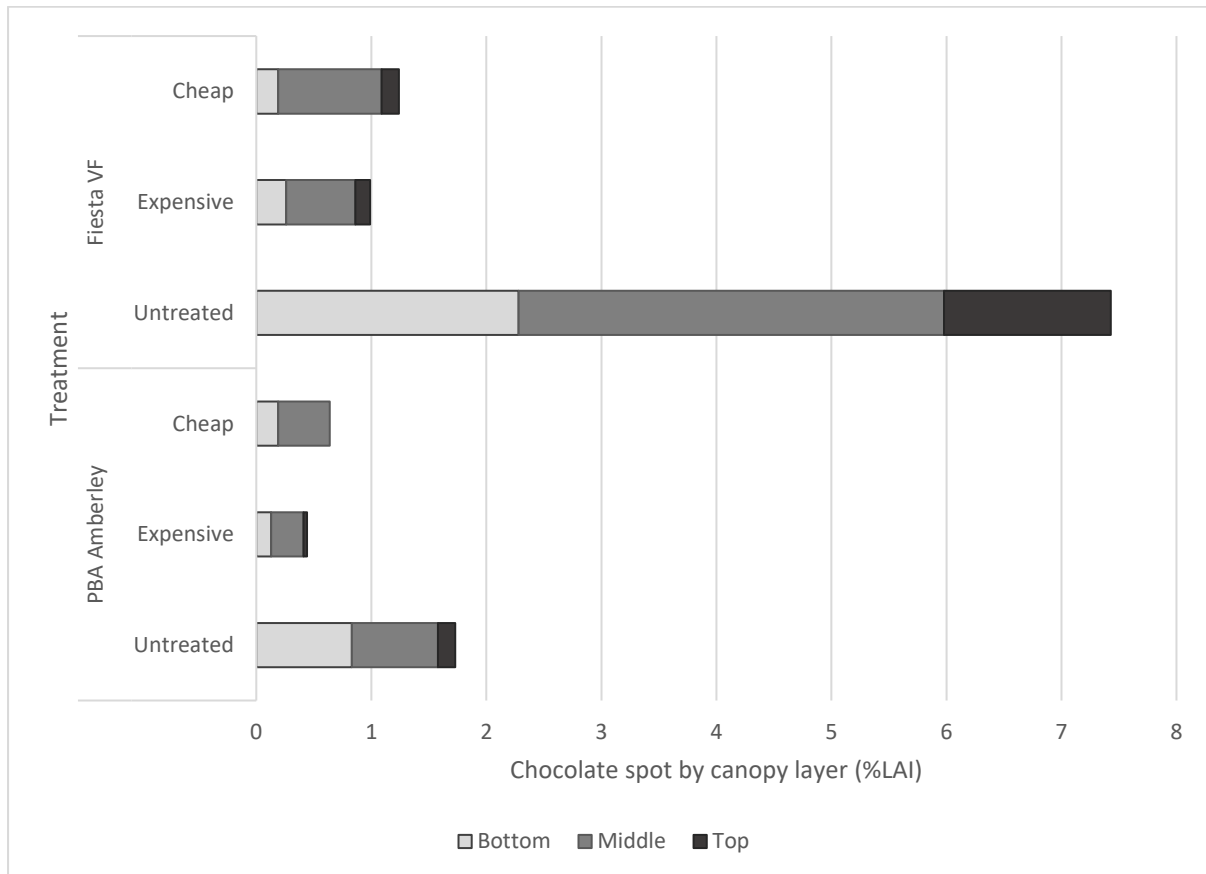


Figure 2. Influence of fungicide strategy on Chocolate spot infection 28 days after fungicide application at mid-flower – Assessed 28-Oct at GS83.

Please note a contractor overspray of fungicide (tebuconazole 145ml/ha) was made on 1st August for cercospora which may have reduced disease in all treatments.

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Trial 5 Influence of Plant Growth Regulation on Faba Bean Yield and Profitability Under Irrigation

Location: Finley IRC

FAR Code: FAR F20-09-1

Sown: 28 April 2020

Cultivar: PBA Bendoc

Harvested: 30th November 2020

Rotation position: Wheat (2019), Faba beans (2018), Fallow after Rice (2017)

Soil Management: Cultivation with speed disc to incorporate stubble in Autumn

Irrigation: Overhead lateral irrigation 6 x 25mm in spring. Total applied 150mm (1.5 ML/ha)

GSR: April-October 244mm. Total water available (GSR + Irr) 394mm

Key Messages:

- *Experimental PGR application in irrigated faba beans gave no significant yield effects although application influenced crop height at early pod set and harvest in this irrigated trial.*
- *Applying a single experimental PGR (FAR PGR 1) applications at the start of flowering had a significant effect on plant height at pod set and harvest*
- *Sequencing this earlier treatment with FAR PGR 2 at the end of flowering had no further effect on crop height.*
- *Reducing plant population to 12 plants/m² reduced yield significantly compared to 19 and 29 plants/m², with 29 plants/m² associated with the highest yields in the trial.*
- *Reducing plant population reduced crop height at pod set (a reduction in height of 6cm for every 7-10 plants/m² reduction in plant population), but had no significant effect on final crop height at harvest*
- *There was no lodging recorded in this trial*
- *Based on 5.03 t/ha the Water Use Efficiency was 17.7 kg/mm (total water available – 110mm soil evaporation).*

Table 1. Influence of seed rate (plant population) and PGR application on grain yield (t/ha).

	Seed Rate (Plants/m ²)			Mean
	12 seeds/m ² (12 plants/m ²)	24 seeds/m ² (19 plants/m ²)	36 seeds/m ² (29 plants/m ²)	
	Yield t/ha	Yield t/ha	Yield t/ha	Yield t/ha
Untreated	3.94 -	4.91 -	5.18 -	4.68 -
FAR PGR 1 GS61	3.91 -	4.79 -	5.09 -	4.60 -
FAR PGR 1 GS61, PGR 2 GS 69	3.90 -	4.65 -	4.82 -	4.45 -
Mean	3.92 b	4.78 a	5.03 a	
LSD Seed Rate p = 0.05		0.38	P val	<0.001
LSD PGR Strategy p=0.05		ns	P val	0.404
LSD Seed Rate x PGR P=0.05		ns	P val	0.942

Yield figures followed by different letters are considered to be statistically different (p=0.05)

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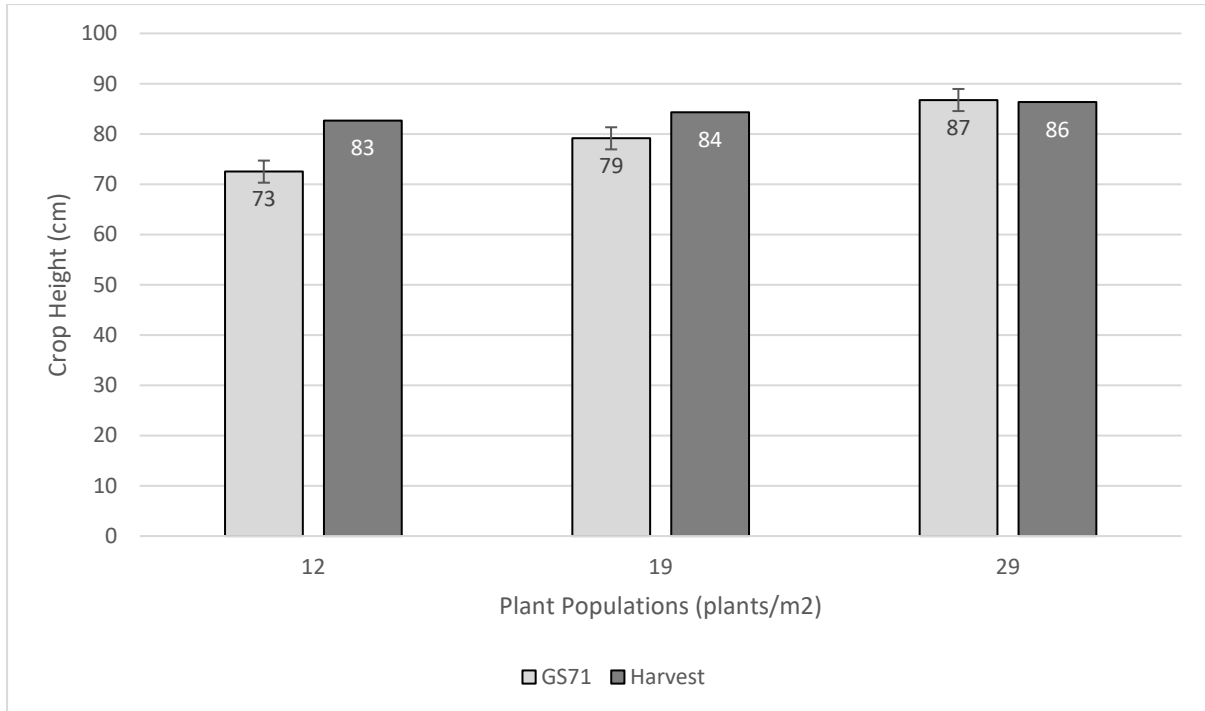


Figure 1. Plant population effect on crop height at GS71 (24-Sep) and pre-harvest (26-Nov). GS71 – P value 0.002, LSD 4.4cm. Harvest - P value 0.495, LSD ns.

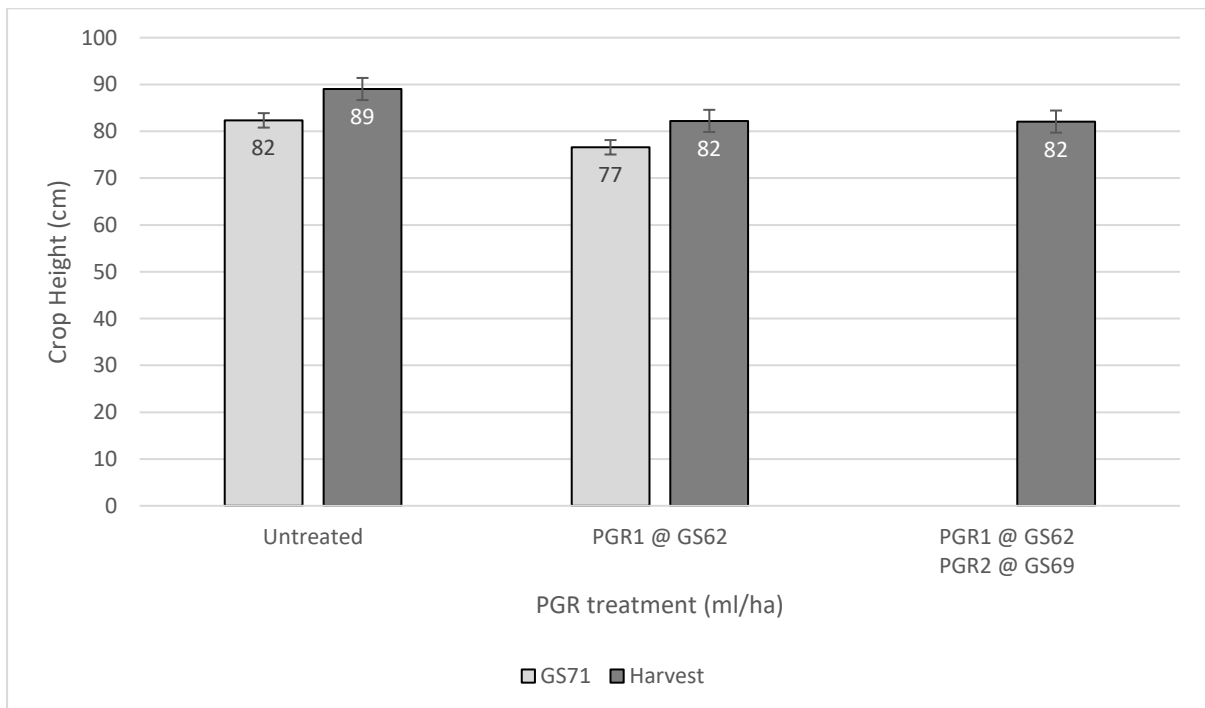


Figure 2. PGR effect on crop height at GS71 (24-Sep) and pre harvest (26-Nov). GS71 – P value=0.002, LSD 3.1. Harvest – P value=0.009, LSD 4.7cm.

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Kerang VIC

Irrigated trials conducted at the Kerang irrigated research centre 2020 were managed by the Irrigated Cropping Council.

Trial 1 Optimum Plant Population Under Sprinkler Irrigation

Location: Kerang, Victoria

FAR Code: ICC F20-01-3

Sown: 8 May 2020

Cultivar: PBA Amberley and Farah

Harvested: 16 December 2020

Rotation position: Dryland vetch/brown manure 2019

Soil Type: Neutral medium grey clay

Irrigation: Overhead sprinkler irrigation 5 timings, totalling 129mm (1.29 ML/ha)

GSR: April-October 250mm. Total water available 379mm

Key Messages:

- *Establishment rate for the trial averaged 90%.*
- *There were small differences in early canopy development in early August that became significant at the beginning of flowering. Farah tended to have similar biomass to PBA Amberley.*
- *At harvest, only PBA Amberley was assessed for biomass, and there was no significant difference between the sowing rates.*
- *At harvest, PBA Amberley and Farah had similar yields with the 18, 24 and 36 seeds/m² seeding rate.*
- *An 18 seeds/m² equated to 16 plants /m² plant establishment.*
- *Harvest Index ranged from 0.43 to 0.72 but was influenced by the variable biomass data.*
- *Water use efficiency was 10.8 kg/mm*

Table 1. Establishment - Plant population (plants/m²) established from four seed rates with two different cultivars grown under sprinkler irrigation.

Seed Rate	Established Population		
	PBA Amberley Plants/m ²	Farah Plants/m ²	Mean Plants/m ²
10 seeds/m ²	8.5 e	8.8 e	8.6 c
18 seeds/m ²	13.8 de	19.7 cd	16.7 b
24 seeds/m ²	21.8 bcd	22.9 bc	22.4 b
36 seeds/m ²	29.2 ab	34.5 a	31.9 a
Mean	18.3	21.5	
LSD Seed Rate p = 0.05	5.98	P val	<0.001
LSD Cultivar p=0.05	NS	P val	0.134
LSD Seed Rate x Cultivar.	8.46	P val	0.689

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Table 2. Canopy measurements – dry matter (DM t/ha).

Dry matter (t/ha)				
Sowing Rate (seeds/m ²)	10	18	24	36
Plant Pop				
PBA Amberley	9	14	22	29
Farah	9	20	23	35
Vegetative 6 August				
PBA Amberley	0.58 b	0.50 b	0.79 b	0.72 b
Farah	0.80 b	0.76 b	1.25 a	1.31 a
p _{var} = <0.001, p _{rate} = 0.012, p _{v_{xr}} = 0.514, lsd _{v_{xr}} = 0.405, cv% = 32.9				
Early Flowering				
PBA Amberley	1.55 b	2.06 b	2.84 ab	2.79 ab
Farah	1.73 b	2.53 ab	3.75 a	3.37 a
p _{var} = 0.119, p _{rate} = 0.010, p _{v_{xr}} = 0.902, lsd _{v_{xr}} = 1.421, cv% = 37.4				
Harvest				
PBA Amberley	7.32	6.57	6.42	5.31
Farah			8.36	
p = 0.321, lsd = NS, cv% = 18.6				

All biomass analysis should be treated with caution due to the high cv%.

Farah demonstrated higher biomass when compared to PBA Amberley at the higher seeding rates at early August. By early flowering, there was no difference between the varieties at the higher rates, but looking at Amberley alone, sowing rate made no difference to biomass.

At harvest this trend continued with all sowing rates in Amberley having similar biomass. Maximum biomass achieved at harvest by PBA Amberley was 7.32t DM/ha at the lowest seeding rate.

Table 3. Yield (t/ha), grain quality (g/100seeds/m²) and harvest index.

Grain Yield (t/ha)				
Sowing Rate (seeds/m ²)	10	18	24	36
PBA Amberley	3.29 c	4.31 a	4.59 a	4.38 a
Farah	3.59 bc	3.96 ab	4.35 a	4.37 a
p _{var} = 0.754, p _{pop} = 0.001, p _{v_{xp}} = 0.445, lsd _{v_{xp}} = .660, cv% = 9.2				
Seed Size (g/100 seeds)				
PBA Amberley	82.1 a	81.3 ab	80.6 ab	81.8 a
Farah	78.7 ab	76.1 bc	71.2 c	73.2 c
p _{var} = <0.001, p _{rate} = 0.176, p _{v_{xr}} = 0.396, lsd _{v_{xr}} = 5.41, cv% = 4.0				
Harvest Index				
PBA Amberley	0.43	0.59	0.62	0.72
Farah			0.44	
p = 0.136, lsd = NS, cv% = 22.1				

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Highest yield grain was from the 24 seeds/m² rate in Amberley, but not significantly different to the 18 and 36 seeds/m² in both varieties. 18 seeds/m² equates to a plant population of approximately 16 plants/m².

Seed size in Amberley was not affected by sowing rate, although seeding rate did influence seed size in Farah.

Harvest Index was not influenced by seeding rate, however the data should be viewed with caution due to the high variability of the data.

The average yield for the trial was 4.1 t/ha. This represents a WUE of 15.2 kg/mm.

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Trial 2 Optimum Plant Population Under Flood Irrigation

Location: Kerang, Victoria

FAR Code: ICC F20-01-4

Sown: 8 May 2020

Cultivar: PBA Amberley and Farah

Harvested: 15 December 2020

Rotation position: Dryland vetch/brown manure 2019

Soil Type: Neutral medium grey clay

Irrigation: Flood irrigation 3 applications totalling 330mm (3.3 ML/ha)

GSR: April-October 250mm. Total water available 580mm

Key Messages:

- Establishment rate for the trial averaged 99%.
- There were small differences in early canopy development in early August that became significant at the beginning of flowering. Farah tended to have greater biomass than PBA Amberley.
- At harvest, only PBA Amberley was assessed for biomass, and there was no significant difference between the sowing rates.
- At harvest, PBA Amberley had similar yields with the 18, 24 and 36 seeds/m² sowing rate.
- Farah had similar yields across all sowing rates.
- An 18 seeds/m² equated to 18 plants /m² establishment.
- Harvest Index ranged from 0.37 to 0.73 but was influenced by the variable biomass data.
- Water use efficiency was 15.4 kg/mm

Table 1. Establishment - Plant population (plants/m²) established from four seed rates with two different cultivars grown under flood irrigation.

Seed Rate	Established Population		
	PBA Amberley Plants/m ²	Farah Plants/m ²	Mean Plants/m ²
10 seeds/m ²	13.4 d	14.1 d	13.7 d
18 seeds/m ²	16.2 cd	20.1 bc	18.1 c
24 seeds/m ²	23.9 b	24.7 b	24.3 b
36 seeds/m ²	32.0 a	35.6 a	33.8 a
Mean	21.4	23.6	
LSD Seed Rate p = 0.05	2.85	P val	<0.001
LSD Cultivar p=0.05	NS	P val	0.287
LSD Seed Rate x Cultivar.	4.03	P val	0.905

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Table 2. Canopy measurements – dry matter (DM t/ha).

Dry matter (t/ha)								
Sowing Rate (seeds/m ²)	10		18		24		36	
Vegetative 6 August								
PBA Amberley	1.00	b	1.55	ab	1.42	ab	1.53	ab
Farah	1.07	b	1.28	b	1.58	ab	1.92	a
p _{var} = 0.553, p _{rate} = 0.023, p _{v_{vr}} = 0.473, lsd _{v_{vr}} = 0.608, cv% = 29.1								
Early Flowering								
PBA Amberley	3.53	cd	4.79	bcd	4.29	cd	5.04	bcd
Farah	3.38	d	5.17	bc	6.10	ab	6.90	a
p _{var} = 0.026, p _{rate} = 0.002, p _{v_{vr}} = 0.229, lsd _{v_{vr}} = 1.696, cv% = 23.5								
Harvest								
PBA Amberley	11.12		9.69		11.06		11.40	
Farah	16.7							
p = 0.770, lsd = NS, cv% = 22.9								

All biomass analysis should be treated with caution due to the high cv%.

Farah demonstrated higher biomass when compared to PBA Amberley at the higher seeding rates at early flowering. This trend continued at harvest (24 seeds/m² rate only) but was not statistically different due to the large variation in the data.

Maximum biomass achieved at harvest by PBA Amberley was 11.4 t DM/ha at the highest seeding rate, but was not statistically different to all other seeding rates.

Table 3. Yield and grain quality.

Grain Yield (t/ha)								
Sowing Rate (seeds/m ²)	10		18		24		36	
PBA Amberley	6.78	c	7.65	ab	7.88	a	7.83	a
Farah	6.62	c	6.77	c	7.03	bc	6.97	c
p _{var} = <0.001, p _{pop} = 0.009, p _{v_{vp}} = 0.302, lsd _{v_{vp}} = 0.642, cv% = 6.1								
Seed Size (g/100 seeds)								
PBA Amberley	73.8		72.8		75.3		74.0	
Farah	72.0		73.2		73.5		73.8	
p _{var} = 0.162, p _{rate} = 0.248, p _{v_{vr}} = 0.487, lsd _{v_{vr}} = NS, cv% = 2.4								
Harvest Index								
PBA Amberley	0.55		0.73		0.65		0.61	
Farah	0.37							
p = 0.329, lsd = NS, cv% = 21.3								

Highest yield grain was from the highest rate (36 seeds/m²) of PBA Amberley. However the yields of the 18, 24 and 36 seeds/m² was statistically similar.

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All seeding rates of Farah had similar yields.

PBA Amberley was the higher yielding variety.

Seed size was not influenced by variety or seeding rate.

Harvest Index was highly variable, due to the variation in the biomass data obtained via quadrat cuts and should be viewed with caution.

The average yield for the trial was 7.2 t/ha. This represents a WUE of 15.0 kg/mm.

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Trial 3 Disease Management Strategies for Faba Beans Grown Under Irrigation

Location: Kerang, Victoria

FAR Plot: ICC F20-07-2

Sown: 18 May 2020

Cultivar: PBA Samira and Farah

Harvested: 16 December 2020

Rotation position: Dryland vetch/brown manure 2019

Soil Type: Neutral medium grey clay

Irrigation: Flood irrigation 3 applications totalling 320mm (3.2 ML/ha)

GSR: April-October 250mm. Total water available 570mm

Key Messages:

- Disease pressure was low for the season and very little disease was observed in the trial.
- Analysis of the yield data indicates that the 'expensive' fungicide strategy did improve grain yield.

Table 1. Fungicide strategies tested.

Strategy	Crop Growth Stage		
	Vegetative	Early Flowering	Early Podding
Untreated (control)	No Fungicide	No Fungicide	No Fungicide
'Cheap'	145 ml/ha tebuconazole	1.0 l/ha chlorothalonil	1.0 l/ha chlorothalonil
'Expensive'	1.0 l/ha Veritas	0.6 l/ha Aviator	1.0 l/ha Veritas

Table 2a. Fungicide strategy and yield (t/ha).

Strategy	Yield (t/ha)
Untreated (Control)	6.58 b
'Cheap'	6.48 b
'Expensive'	6.99 a
P val	0.006
LSD	0.298
cv%	4.2

Table 2b. 2 Way ANOVA: Yield (t/ha).

Strategy	Farah	PBA Samira
Untreated (Control)	6.32 ab	6.84 c
'Cheap'	6.22 a	6.74 c
'Expensive'	6.69 bc	7.29 d

$p_{var} = <0.001$, $p_{fun} = 0.006$, $p_{vxf} = 0.952$, $lsd_{vxf} = 0.42$, $cv\% = 4.2$

Analysis of the yield data indicated that there was no interaction between variety and fungicide strategy ($p = 0.952$).

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PBA Samira was a higher yielding cultivar than Farah (6.96 t/ha vs 6.41 t/ha, $p = <0.001$, lsd = 0.243) and the 'expensive' strategy was higher yielding than the 'cheap' and untreated strategies.

Disease assessments through the later part of the season only found low levels of disease in the lower canopy. Foliar lesions were identified as cercospera, and mainly on the leaves that were beginning to senesce deep in the canopy.

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Trial 4 Influence of Plant Growth Regulation on Faba Bean Yield and Profitability Under Irrigation

Location: Kerang, Victoria

FAR Code: ICC F20-09-2

Sown: 18 May 2020

Cultivar: PBA Bendoc

Harvested: 16 December 2020

Rotation position: Dryland vetch/brown manure 2019

Soil Type: Neutral medium grey clay

Irrigation: Flood irrigation 3 applications totalling 320mm (3.2 ML/ha)

GSR: April-October 250mm. Total water available 570mm

Key Messages:

- Yield was reduced by the late application of 'PGR2', which could be partially explained by the smaller bean size of the plots treated with 'PGR2'
- Some height reduction was measured by the 1 application of 'PGR1' at early flowering. A further application of 'PGR2' at late flowering did not affect final plant height.
- Lodging was influenced more by population than PGR application, with the low population of 12 seeds/m² having the least lodging and yielding similar to the higher population treatments.

Table 1. Faba Bean treatments to reduce lodging and brackling.

Treatments	Vegetative
Population	12, 24 and 36 seeds/m ²
Single PGR	'PGR1' at early flowering
Dual PGR	'PGR1' at early flowering + 'PGR2' at end of flowering

Table 2. Establishment - Plant population (plants/m²) established from three seed rates grown under flood irrigation.

Seed Rate	PBA Bendoc Plants/m ²
12 seeds/m ²	13.4 c
24 seeds/m ²	23.7 b
36 seeds/m ²	32.8 a
Mean	23.9
P Seed Rate p = 0.05	<0.001
LSD Seed Rate p=0.05	3.20
cv%	16.5

Analysis of the yield, seed size, plant height or lodging score at harvest data indicated that there was no interaction between population and PGR strategy for any of these parameters measured.

As presented in Table 3a, population had no effect on yield, seed size or plant height. It did, however influence lodging score. The result should be viewed with caution due to the large variability in the data.

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Table 3b illustrates the effect of the PGR applications. Yield was reduced with the use of 'PGR2' in the dual PGR treatment, as was seed size. Seed size was 93.5% of the untreated control, which is close to the reduced yield of 92.2%.

Lodging score for the single PGR was lower than that of the control and the dual application, but as there was considerable variability in the data, this result should be viewed with caution.

Table 3a. Effect of population on yield, bean size, plant height and lodging score.

Strategy	Yield (t/ha)	Seed Size (g/100s)	Plant Height (cm)	Lodging Score
12 seeds/m ²	7.42	67.3	101.2	1.6 a
24 seeds/m ²	7.40	67.9	107.1	3.3 b
36 seeds/m ²	6.74	67.8	102.5	3.4 b
p	0.631	0.688	0.126	<0.001
lsd	NS	NS	NS	0.866
cv%	6.3	2.9	6.8	30.6

Table 3b. Effect of PGR on yield, bean size, plant height and lodging score.

Strategy	Yield (t/ha)	Seed Size (g/100s)	Plant Height (cm)	Lodging Score
Untreated (control)	7.31 a	69.4 a	109.6 a	3.0 a
Single PGR	7.30 a	68.7 a	100.4 b	4.0 b
Dual PGR	6.74 b	64.9 b	100.8 b	3.1 a
p	0.006	<0.001	0.006	0.046
lsd	0.3798	1.665	5.96	0.866
cv%	6.3	2.9	6.8	30.6

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