<u>Faba Bean, Disease Management x Plant Density, HRZ North East (Dookie), Victoria</u> <u>Faba Bean, Disease Management, HRZ North East (Dookie), Victoria</u>

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Aim

To investigate the adaptability of a range of faba bean varieties and breeding lines to different plant densities and fungicide programs.

Treatments

Varieties:	See tables 1 and 2
Plant Densities:	See tables 1 and 2
Fungicide strategies:	See tables 3 and 4

Table 1. Seed Weight and estimated Sowing Rate (kg/ha) to achieve targeted plant densities of each of the varieties sown in fungicide strategy x plant density trial at Dookie Victoria in 2019.

Variety	Seed Weight		Plant Density (kg/ha)		
variety	(g/1000 seed)	15 (plants/m ²)	25 (plants/m ²)	35 (plants/m ²)	
PBA Samira	769	138	223	315	
PBA Zahra	724	109	181	253	
Farah	547	82	137	191	
PBA Amberley (AF11023)	597	107	173	245	

Table 2. Seed Weight and estimated Sowing Rate (kg/ha) to achieve the target plant population sown in fungicide strategy trial at Dookie Victoria in 2019.

Variety	Seed Weight (g/1000 seed)	Plant Density (kg/ha) 20 (plants/m²)
PBA Samira	769	177
PBA Bendoc	585	135
PBA Zahra	724	145
Farah	547	109
Fiesta VF	642	128
PBA Amberley (AF11023)	597	137

Table 3. Fungicide strategies in plant density trial

	Early (6/8 node)	Early flowering	Mid-late flowering	Post flower
Nil fungicide	Nil	Nil	Nil	Nil
	Tebuconazole	Carbendazim	Carbendazim	Carbendazim
Best practice	150 ml	500ml	500ml	500ml
	Veritas	Aviator	Carbendazim	
Complete control	1L	600ml	500ml	

Table 4. Fungicides in fungicide strategy trial

	Early (6/8 node)	Early flowering	Mid-late flowering	Post flower
Nil fungicide	Nil	Nil	Nil	Nil
	Tebuconazole	Carbendazim	Carbendazim	Carbendazim
Best practice	150 ml	500ml	500ml	500ml
	Veritas	Aviator	Carbendazim	
Complete control	1L	600ml	500ml	
	Mancozeb	Mancozeb	Mancozeb	Mancozeb
Old chemistry	1.5kg	1.5kg	1.5kg	1.5kg
	Veritas	Aviator	Aviator	
New chemistry	1L	600ml	600ml	

Table 5. Other Site Details

	Dookie	
Sowing Date	29 April	
Stubble height (cm)	30	
Row Spacing (cm)	22.5	
Fertiliser (kg/ha) ¹	50	
1 MAP (9 2 20 2 0 2 7)		

¹ MAP (9.2, 20.2, 0, 2.7)

Disease Management x Plant Density

Results and Interpretation

 Key Messages: In a season with very little disease pressure, small varietal differences in chocolate spot did occur throughout the season, but these differences did not manifest into yield differences. Seed rate was critical to maximise yield in 2020, where lower seeds rates produced significantly lower yields when compared to higher seed rates.

Seed rates also had a major effect on crop architecture, with lower seed rate treatments podding over a longer portion of the stem and having a higher pod number but lower overall dry matter harvest than that of higher seed rates.

Disease: interactions between disease and variety or fungicide programs were insignificant. Best practice offered best disease protection in a low disease-pressure season, with only 2.0 – 2.9% of the leaf area being infected with chocolate spot on the top part of the canopy on the 25th of September (Table 7).

PBA Amberley, Farah and PBA Zahra had significantly less leaf area infected (0.2-0.5%) with chocolate spot in the top part of the canopy at both the 10th and 25th of September. (Table 8) Green leaf retention (GLR) on 25th September was at least 9.6% higher in Amberley (61.7%) than any other variety.

- Crop architecture: Plant height increased with seeding rate. PBA Samira planted at 35 plants/m² was
 the tallest crop reaching a 94.5 cm (Table 9). In both PBA Samira and PBA Amberley, the height at
 which the bottom most pod formed was closest to the ground at 15 plants/m². Although pod number
 and 1000 seed weight were highest in 15 plants/m² in both PBA Amberley and PBA Samira, harvested
 dry mater was lowest in these treatments. This suggests harvest index in the lower plant populations of
 each variety was significantly higher (HI of around 55%) than the higher seed rates (HI of around 40%).
- Grain Yield: Grain yields were very good averaging a 2.79 t/ha across the trial despite a very dry spring. Farah had the lowest seed weight (65 g per 1000 seeds) but produced the highest yield of 3t/ha. This suggests that Farah produced smaller grains than the other varieties (Figures 1 and 3) There were significant differences in yield (2.58 and 2.85 t/ha) between plant densities (15 and 25 plants/m²). Plant densities less than 25 plants/m² resulted in a yield penalty (Figure 2) Green Leaf Retention (GLR) was closely linked with plant population. However, yield reflected the opposite of the expected outcome. Lower plant populations had higher GLR due to lower plant biomass and delayed water use (Figure 1)

There were significant differences in disease levels/GLR between varieties, however these did not translate to yield differences. Amberley had the highest GLR but due to the very dry spring could not convert the late green leaf and low disease pressure into grain yield.

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Plant density (plants/m ²)	PBA Samira	PBA Zahra	Farah	PBA Amberley	Average
15	13	14	15	14	14
25	18	21	23	20	21
35	26	27	28	29	28
Average	19	21	22	21	

Table 6. Establishment (plants/m²) of faba bean varieties sown at different rates 22 May 2019.

LSD (P<0.05) sowing rate x variety = ns; sowing rate = 2; variety = 2.

Table 7. Chocolate spot disease score (0 – no disease; 100 – dead) and Green leaf retention (%) of various fungicide programs in 2019.

Fungicide Program)	GLR (%)	
	Sep - 10		Sep - 25	Sep - 25
	Тор	Bottom	Тор	Bottom
Untreated	0.4	1.1	2.5	60
Best Practice	0.1	0.9	2.1	48
Complete Control	0.5	0.9	2.4	50
LSD (P<0.05)	ns	ns	ns	ns

Table 8. Chocolate spot disease score (0 – no disease; 100 – dead) and Green leaf retention (%) of different varieties in 2019.

Variety		GLR (%)		
	Sep - 10		Sep - 25	Sep - 25
	Тор	Bottom	Тор	Bottom
PBA Samira	0.5	1.2	2.9	50
PBA Zahra	0.3	1.0	2.1	52
Farah	0.3	1.1	2.4	47
PBA Amberley (AF11023)	0.2	0.6	2.0	62
LSD (P<0.05)	0.2	0.25	0.48	6.73

Table 9. Faba bean phenology of new and existing faba bean varieties, and plant population in 2019.

Variety	Plant density (plants/ m ²)	Plant Height (cm)	Bottom pod Height (cm)	Stem length between bottom and top pod (cm)	Pod Number	Branches per plant	Dry matter harvest (t/ha)	1000 Seed weight (g)
	15	92.4	36.3	25.8	6.8	3.8	4.26	619
PBA Samira	25	90.2	48.2	16.9	3.9	3.0	6.73	616
	35	94.5	51.5	17.8	4.7	3.3	6.88	610
	15	83.8	37.3	21.5	6.3	4.3	4.53	604
(AF11023)	25	91.8	45.6	17.8	4.5	3.8	5.19	622
	35	94.3	53.7	13.7	3.9	3.1	6.03	613
LSD (P<0	.05)	6.1	8.2	7.2	1.8	0.6	1.74	ns



Figure 1. Effects of varieties and plant populations on green leaf retention% (assessed 25 September) and grain yield (t/ha) at Dookie 2019. Error bars are a measure of LSD. LSD GLR = 11.65



Figure 2. Grain Yield (t/ha) of faba bean plant populations at Dookie 2019. Error bars are a measure of LSD. LSD = 0.13.



Figure 3. Grain Yield (t/ha) and thousand seed weights (TSW) of faba bean varieties at Dookie 2019. Error bars are a measure of LSD. LSD Yield= 0.08: LSD TSW = 8.7.

Disease Management Strategies

Results and Interpretation

- Key Messages: In 2020 grin yields were high (3.36 and 2.96 t/ha) considering the dry finish to the season. As with the sowing rate trial, varieties that were slower to mature and held a green canopy for longer and could not convert the green leaf area into yield due to the very dry spring conditions Variety selection is the key to minimise diseases. However, in low disease pressure situations, less disease doesn't mean higher yields.
- Establishment: Faba beans performed very well if they were established well in the medium rainfall zone around Dookie. Establishment was reasonably even and reached the target plant densities. For instance, PBA Samira, which had the lowest establishment was only 2 plants/m² lower than the target and Fiesta was 2 plants/m² denser than the target rate of 20 plants/m² (Table 10). Although differences were small, Fiesta (21.7 plants/m²) had significantly higher establishment than AF11023 (18.3 plants/m²) and PBA Samira (17.9 plants/m²)

Disease: Disease management program had no effect.
 Very low levels (below 2.5% LAI) of chocolate spot were evident throughout the trial when assessed on both the 10th and 25th of September. There were slight but significant differences in LAI with PBA Amberly consistently having less chocolate spot on upper or lower canopy at both times of assessment compared to the other varieties (Table 11)
 Cercospora was also assessed at the same time and again very low levels of disease were observed.
 Fiesta VF showed significantly more Cercospora in the bottom part of the canopy than PBA Amberley,

PBA Bendoc and PBA Zahra at both times (Table 12)

• Yield: Fiesta VF had the most cumulative % of disease LAI but produced higher grain yield than PBA Samira, PB Zahra and Amberley. For instance, Fiesta VF yielded 400 kg/ha more than PBA Amberley but had around 2 times the disease than PBA Amberley. This is because disease levels were very low (Figure 4) and no differences occurred between management programs.

TSW was highest in varieties where yield was lowest. Meaning in varieties like PBA Samira, PBA Zahra and Amberly we had significantly less grain produced but these grains were significantly heavier by up to 100 g per 1000 seeds.

Target Plant Population	Establishment (plants/m ²) ¹
PBA Samira	17.9
PBA Bendoc	19.7
PBA Zahra	20.4
Farah	19.7
Fiesta VF	21.7
PBA Amberley	18.3
LSD (P<0.05)	2.1

Table 10. Establishment (plants/m²) of faba bean varieties 22 May 2019.

¹Target plant population is 20 plants/m²

Table 11. Chocolate spot disease scores (0 – no disease; 100 – dead) for different varieties in 2019.

		Chocolate	Spot (% LAI)	
Variety	Sept 10		Se	pt 25
	Тор	Bottom	Тор	Bottom
PBA Samira	0.5	1.2	0.8	2.1
PBA Bendoc	0.4	1.4	0.7	1.9
PBA Zahra	0.4	1.3	0.3	2
Farah	0.3	1.7	0.4	1.8
Fiesta VF	0.6	1.8	0.6	2.4
PBA Amberley	0.1	0.9	0.3	1.3
LSD (P<0.05)	0.3	0.4	0.4	0.4

Table 12. Cercospora disease scores (0 – no disease; 100 – dead) for different varieties in 2019.

	Cercospora (% LAI)		
Variety	Sept 10	Sept 25	
	Bottom	Тор	Bottom
PBA Samira	1.4	0.2	1.8
PBA Bendoc	1.3	0.1	1.2
PBA Zahra	1.1	0	0.9
Farah	1.6	0.2	1.6
Fiesta VF	2	0.2	1.9
PBA Amberley	0.4	0.1	1
LSD (P<0.05)	0.5	0.25	0.68



Figure 4. Disease (% LAI) and Grain Yield (t/ha) of faba bean plant populations at Dookie 25 September 2019. Error bars are a measure of LSD. LSD Yield = 0.115).



Figure 5. Grain Yield (t/ha) and thousand seed weights (TSW) of faba bean varieties at Dookie 2019. Error bars are a measure of LSD. LSD Yield = 0.115: LSD TSW = 11.77).

Conclusions: Grain yield in faba beans at Dookie were very good averaging around 3 t/ha given that
the season had a reasonable start but a very harsh dry finish. The seasonal conditions meant that
specific disease management packages had no bearing on final yields. Varietal features influenced
grain yield significantly. This could be due to disease resistance or later maturity. In both trials the
yields were lower in varieties that were greener for longer. These varieties could not convert GLR to
yield in the harsh dry spring.

The best management practice for 2020 would be to sow Fiesta VF faba beans at 20 plants/m² and not spray fungicides. In the long term this will likely not be the best management package for the Dookie region. In 2021 these trials are to be repeated to see if the seasonal effects of 2020 can be negated and disease management practices can be observed in a more "normal" growing season.