

# Variety and agronomic performance of faba beans in medium and high rainfall zones in SA

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## Key findings

- Seasonal conditions had an overriding influence on crop performance and bean yields in 2015.
- Early sowing benefited yields in less favourable low/medium rainfall environments where biomass production was lower.
- Sowing densities above the recommended rates of 24 plants/m<sup>2</sup> led to high increases in biomass production at flowering time however, had no effect on final grain yield.
- Seed size was small in 2015, adjust seeding rates accordingly to maintain optimum plant populations for 2016.

## Why do the trial?

The faba bean time of sowing trials form part of the five year project; 'DAV000113, Expanding the use of pulses in the southern region, 2010 -2015', a Southern Pulse Agronomy Project funded by GRDC and being implemented by SARDI in conjunction with DEDJTR Victoria and DPI NSW.

Early sowing of faba beans is a widely adopted strategy to establish crops early if rains are timely, potentially increasing yields. A frequent run of dry springs has also necessitated growers to adapt early sowing as a way of managing heat and moisture stress. Previous research by SARDI has however shown that early sowing is beneficial in the less favourable low/medium rainfall areas. In high rainfall areas the benefits from early sowing have been less definitive as early sown crops often result in high levels of vegetative growth, resulting in poor light penetration, flower retention and pod set along with increased disease pressure which may have adverse effect on yields.

The release of new faba bean varieties such as PBA Samira and PBA Zahra which have improved agronomic and disease traits offer opportunities for growers to have high and profitable yields in the high yielding environments. Our aim was to improve our understanding of faba bean varietal response to early time of sowing in both low/medium and high biomass production environments.

## How was it done?

<b>Plot size</b>	1.75 m x 10.0 m	<b>Fertiliser</b>	MAP (10:22) + ZN 2% @ 100 kg/ha
<b>Seeding date</b>	<i>Hart</i> 14 <sup>th</sup> April, 7 <sup>th</sup> May, 27 <sup>th</sup> May <i>Tarlee</i> 17 <sup>th</sup> April, 7 <sup>th</sup> May, 25 <sup>th</sup> May		

Sowing date by variety trials were conducted at two sites: Hart and Tarlee, representing medium and high rainfall areas respectively. The trial was designed as a split plot randomised complete block design with sowing date as the main plot and faba bean varieties as the sub-plots replicated thrice. Six faba bean varieties, Farah, AF09167 (new early flowering line under evaluation), PBA Zahra (AF05095-1), PBA Rana, Nura, and PBA Samira were sown at the above three sowing dates at both sites.



A sowing density by timing trial using faba bean variety PBA Samira, was also conducted at Tarlee. The trial was similarly designed as a split plot, randomised complete block design with sowing date as the main plot and sowing densities as the sub-plots replicated thrice. PBA Samira was sown under six densities of 12, 16, 20, 24, 28 and 32 plants/m<sup>2</sup> at the three sowing timings above.

The faba beans were direct drilled with narrow points using a plot cone seeder on 22.5 cm (9 inches) row spacing at a depth of 5 cm. Early control to prevent disease establishment was maintained by applying, 145 ml/ha Tebuconazole + 2.3 L/ha Chlorothalonil during the vegetative stage, 2 L/ha Chlorothalonil + 500 ml/ha Carbendazim at pre flowering/canopy closure and further foliar fungicides were applied as required in line with district practice. A number of plant and seed measurements were undertaken at different stages including at; a) pre flowering- plant establishment, NDVI, b) flowering – day to first flower, plant height, biomass cuts, c) maturity & harvest – plant height, yield and d) post-harvest – seed weight (g/100 seed).

## Results and discussion

### Review of seasonal conditions, 2015

The growing seasonal rainfall (GSR) (April-October) of 228 mm at Hart and 329 mm at Tarlee was below the long term average GSR of 313 and 398 mm for the two respective sites. Above average winter rainfall in the early growing months favoured high crop establishment and vigour and presented conditions for crops to develop high biomass canopies during the latter part of winter. Little disease pressure occurred in the trials due to regular applications of foliar fungicides.

At both sites, varieties sown in mid-April flowered (day to first flower) during the middle of winter, while those sown during early-May and late-May flowered during late winter and early spring (Table 1). The time of flowering varied between varieties and across sowing dates however these differences remained consistent across the two sites. Farah and AFO9167 were the earliest flowering varieties at each time of sowing, and flowered at similar dates (within 4 days of each other) and generally around 10 days in front of all other varieties. PBA Rana and Nura flowered at similar times and were often similar to PBA Samira. PBA Zahra flowered between PBA Rana/Nura and PBA Samira.

Crops received low spring rainfall and severe 'heat shock' in early October where maximum temperatures were in excess of 35°C for several days, leading to a quick 'hay off' of the high biomass that had been set earlier in the season. The combination of high temperatures and low stored soil moisture during the critical reproductive period (late flowering and pod filling) had a huge impact on bean yields across many districts in SA.

*Table 1. 50% flowering dates recorded for six faba bean varieties sown at three different dates at Hart and Tarlee, 2015.*

Variety	Time of sowing- Hart 2015			Time of sowing - Tarlee 2015		
	14-Apr	6-May	27-May	15-Apr	7-May	25-May
<b>Farah</b>	3-Jul	4-Aug	25-Aug	9-Jul	10-Aug	28-Aug
<b>AFO9167</b>	7-Jul	2-Aug	28-Aug	9-Jul	10-Aug	28-Aug
<b>PBA Zahra</b>	14-Jul	12-Aug	5-Sep	20-Jul	18-Aug	4-Sep
<b>PBA Rana</b>	16-Jul	14-Aug	4-Sep	23-Jul	20-Aug	4-Sep
<b>Nura</b>	16-Jul	14-Aug	4-Sep	23-Jul	20-Aug	4-Sep
<b>PBA Samira</b>	20-Jul	14-Aug	5-Sep	23-Jul	20-Aug	8-Sep

## Biomass production

Biomass production measured as dry matter weight (t/ha) was assessed early in the season at the day of first flower for each variety across sowing dates. The Tarlee trial produced the highest amounts of biomass ranging between 2.1 and 2.5 t/ha. There were only small differences in the amount of biomass produced at flowering across all varieties and sowing dates (Figure 1). The season at Tarlee presented better conditions enabling higher biomass levels compared to those at Hart. At Hart, early sown beans produced higher amounts of biomass compared to the two late sowings which produced similar amounts of biomass to each other.

Varieties differed in the amount of biomass production at the flowering stage but this depended on the site. PBA Zahra and PBA Samira produced similar or higher amounts of biomass compared to other varieties at Tarlee. The two early flowering varieties, Farah and AF09167 had low biomass levels at this site. At Hart however, AF09167, was associated with the highest biomass levels compared to all varieties which performed similarly (Figure 2).

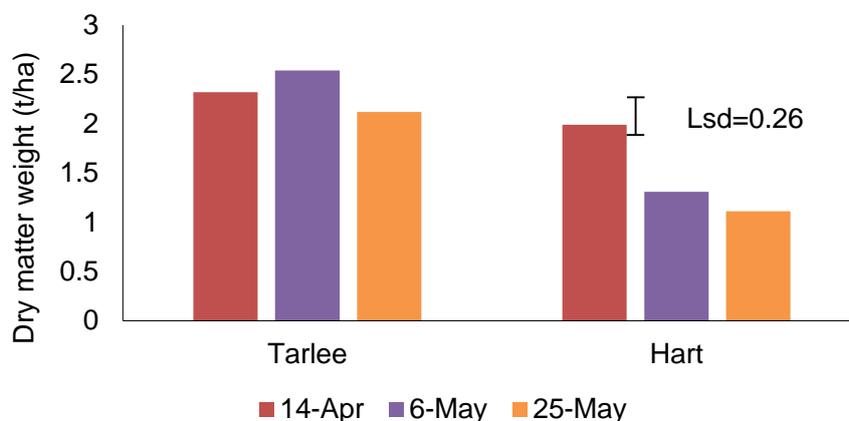


Figure 1. Dry matter production (t/ha) at commencement of flowering averaged across six faba bean varieties sown at three different sowing dates at Tarlee and Hart, 2015.

A sowing density by seeding time trial was also conducted at Tarlee with PBA Samira. In this trial seeding density had a significant effect on biomass production which increased as sowing density increased outside the currently recommended rate of 24 plants/m<sup>2</sup>. An increase in sowing density from 24 to 32 plants/m<sup>2</sup> produced an extra 1 t/ha (Figure 2).

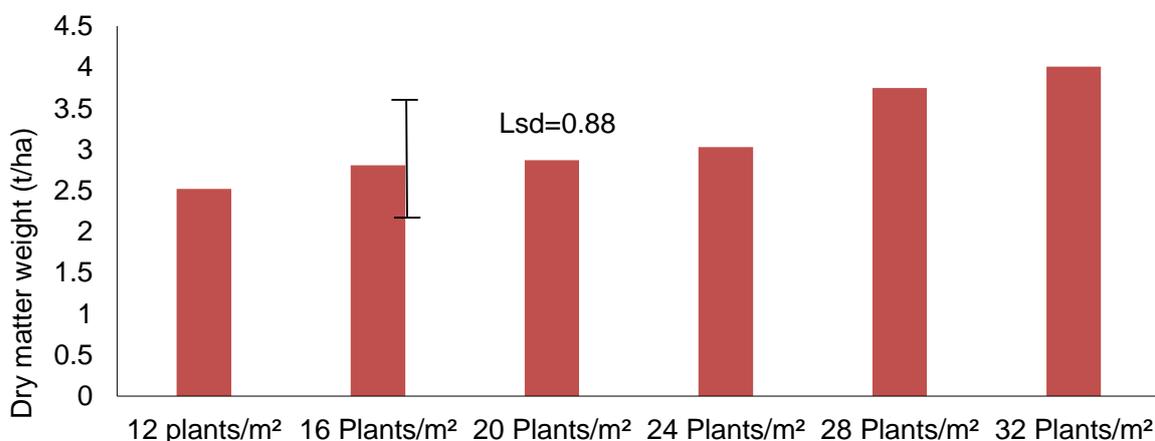


Figure 2. Dry matter production (t/ha) of PBA Samira at commencement of flowering under six different sowing densities (12-32 plants/m<sup>2</sup>) averaged across three sowing timings at Tarlee, 2015.

## Grain yield

Faba bean yields in many areas of SA in 2015 were lower than normal, despite the large biomass that had been set through the season. Sowing early in mid-April was beneficial at Hart compared to sowing in early-May with a further drop in yield in the latest sowing (Figure 3). However, at Tarlee the least benefit was achieved from sowing early compared to the two later sowings, which performed similarly to each other. It is worth noting that variable levels of pod loss occurred particularly at the early time of sowing at Tarlee due to strong wind events in late November which reduced grain yields to some extent.

Averaged across sites and sowing timings, the variety that was most responsive to early sowing in 2015 was the early flowering and maturing breeding line AF09167 (Table 2). This was followed by PBA Rana which also responded to early sowing. PBA Samira and PBA Zahra yielded similarly over the three sowing times and generally the same as Nura and Farah.

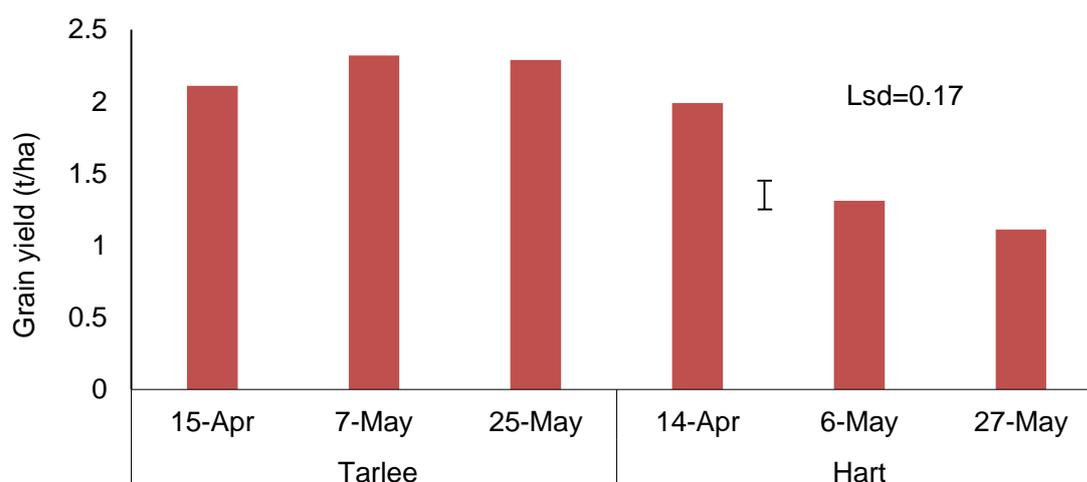


Figure 3. Grain yield (t/ha) averaged across six faba bean varieties sown at three different sowing dates at Tarlee and Hart, 2015.

Table 2. Grain yield (t/ha) of six faba bean varieties sown at three different timings at Hart and Tarlee in 2015.

Variety	Time of sowing (ToS)		
	ToS 1*	ToS 2*	ToS 3*
PBA Zahra	1.81	1.85	1.87
AF09167	2.74	1.95	1.62
Farah	2.05	1.86	1.75
Nura	1.84	1.90	1.70
PBA Rana	1.96	1.42	1.39
PBA Samira	1.92	1.90	1.89
LSD= 0.258			
* Hart TOS 1 = 14 April; TOS 2 = 06 May; TOS 3 = 27 May			
* Tarlee TOS 1 = 15 April; TOS 2 = 17 May; TOS 3 = 25 May			

Results from the sowing density by timing trial in PBA Samira at Tarlee found there was no grain yield response to any plant density treatment (12 – 32 plants per sq. m) across all three timings. This was despite the large differences in biomass production that had been found at flowering between the recommended 24 and 32 plants/m<sup>2</sup>. Faba bean seed size achieved under the dry spring conditions of 2015 was considerably smaller (approximately 10%) when compared to the five year average in SA. Therefore, to achieve the recommended plant populations in 2016, seeding rates will need to be adjusted accordingly.

## Summary / implications

Long term analysis (2006-2015) of faba bean sowing date trials has generally found a flat or no grain yield response to sowing date in higher rainfall areas such as Tarlee. However, within individual year's grain yield has shown positive, negative or no response to sowing timings and this has been variety responsive due to varying seasonal conditions and yield limiting factors. This pattern was reflected this season where early sown faba beans did not result in a yield increase over later sowing dates nor lead to a decrease in yields at Tarlee regardless of variety or plant density. The lack of response however, seems to be a more common occurrence in higher rainfall areas where biomass production is high and harvest index (grain yield to biomass ratio) is often significantly reduced when sown early.

There is a positive relationship between early sowing and yield in less favourable or moisture limited environments such as Hart and therefore this practice should be maintained to optimise yields. Long term faba bean yields (2008 – 2015) from National Variety Trial and Pulse Breeding Australia trial programs have shown that the two new varieties, PBA Zahra and PBA Samira have consistently produced higher yields compared to other varieties across SA. PBA Zahra, had a yield advantage of more than 5% over older varieties such as Fiesta VF, Farah, Nura and Fiord. PBA Samira was the second highest yielding variety yielding more than 5% over Nura. Although the yield potential of both varieties is more optimised in high yielding environments, their performance was comparable to other varieties under severe heat and moisture stress conditions experienced in 2015. The new line which is currently under evaluation, AF09167, was highly responsive to the early sowing across the two sites and could also offer opportunities for high yields under such tough finishing conditions.

Agronomic management such as varying sowing density did not have any effect on bean yield this season. In high rainfall environments, an increase in sowing density outside of the recommended 24 plants/m<sup>2</sup> led to an increase in biomass production at flowering and despite no effect on grain yield. This increase may be detrimental in years with more favourable finishes.

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