

B4 Sowing Date, MRZ Mid North (Hart), South Australia

B5 Sowing Date, HRZ South East (Bool Lagoon), South Australia

B6 Sowing Date x Plant Density, MRZ Lower Eyre Peninsula (Yeelanna), South Australia

B7 Sowing Date x Plant Density, HRZ Mid North (Tarlee), South Australia

SARDI collaborators – Andrew Ware, Port Lincoln and Amanda Pearce, Naracoorte

Aim

To gain an understanding of the effect of varying sowing time on yield of faba bean varieties sown in contrasting environments of high (favourable) and low to medium rainfall (less favourable) faba bean growing areas.

Background

Choosing the optimum sowing time is key to managing and reducing risk to abiotic stress and increasing yields of pulses. Pulses are particularly sensitive to abiotic stresses associated with cold/frosts and heat during the reproductive stages of podding and grain filling. Due to an expansion of faba bean production outside of traditional areas and the development of new varieties with improved agronomic traits, an understanding of optimum sowing time by variety will help to maximize yields in these different environments. Early sowing of faba beans, particularly in favourable environments and seasons, results in large bulky canopies potentially leading to issues with light and pollinator penetration, flower retention, pod-setting and disease management. Faba bean sowing date by variety were sown across contrasting environments in SA to improve our understanding of production in the traditional and more favourable growing areas represented by sites at Tarlee (Mid-North, SA) and Bool Lagoon (South East, SA) and in the non-traditional areas, marginally suited areas represented by Yeelanna (Eyre Peninsula, SA) and Hart (Mid-North, SA). Agronomic evaluation of the optimum sowing rate for the faba bean varieties was also conducted at Tarlee (HRZ) and Yeelanna (MRZ). Following the heavy rains in 2016, the trial at Tarlee became severely waterlogged and with the heavier soils that characterize the site, crops took longer to recover which had a significant effect on plant growth. Due to the variability in growth, the results from this site have not been included in the report. Further, the report presents a summary of individual sites together with respective measurements, a more detailed cross-site/year's analysis is underway to improve on our understanding on the main drivers of yield in faba beans.

B4 Sowing Date, MRZ Mid North (Hart), South Australia

Treatments

Varieties: Five commercial varieties; Farah, PBA Zahra, PBA Rana, Nura and PBA Samira
Three advanced breeding lines; AF09167, AF09169 and AF1212

Plant density: 24 plants/m²

Sowing dates: Early sowing (14 April), Mid sowing (7 May), Late sowing (26 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

Irrigation immediately post early sowing (Tarlee and Hart), 20mm

The advanced breeding lines were chosen to evaluate their adaptation in high biomass producing environments and to explore their potential in low rainfall faba bean growing areas. The determinate line has a growth type similar to lupins with characteristics of a terminal inflorescence that develops after the plants have developed flowers at about 4 or 5 nodes at which growth in plant height is restricted. This experimental line was included in our trials to help understand the potential of this trait in managing canopy growth where conventional plant types may produce too much vegetative growth at the expense of grain yield. Sowing occurred in relatively dry seed bed conditions, necessitating a manual irrigation event of 20 mm of water immediately post sowing (early sowing only) to enhance seed germination. Agronomic measurements and observations were taken including phenology, dry matter weight and grain yield.

Seasonal snapshot

- The Hart field site received a growing season rainfall of 356 mm in 2016, which was above the long term average of 305 mm. The last month of autumn recorded a total of 36 mm marking the break to the season, which was followed by wet conditions in winter and heavy rains in early to mid-spring.
- Wet conditions favoured early crop vigour and provided ideal conditions for beans to develop large canopies.
- Wet conditions also favoured development of disease and small outbreaks of ascochyta blight (AB) were observed in varieties such as Farah, PBA Rana and PBA Zahra. Strategic sprays during vegetative growth, at canopy closure and during podding were applied to control AB. Symptoms of faba bean rust disease were found in the determinate line during the reproductive stages of flowering and podding.
- Cool, wet conditions during spring favoured pod filling and prolonged maturation of crops. As a result, significantly high yields above long term averages were recorded.

Flowering and biomass production

- The advanced breeding line AF09169, flowered 25 days earlier than Farah, AF09167, AF11212 and AF13250 which all flowered at similar dates when sown at the mid-April timing (Table 1).
- Commercial varieties Nura, PBA Rana and PBA Samira flowered less than 10 days from each other but one month after the advanced breeding line, AF09169 when sown at the mid-April timing.
- Differences in the time taken for varieties to flower decreased considerably when sown in early and late May compared with the mid-April sowing date. The early flowering varieties flowered between 10 and 17 days earlier than the later maturing varieties (Nura, PBA Rana and PBA Samira) at the May 7 sowing and the difference was even less at the last sowing date (27 May).
- Varieties differed in the amounts of biomass produced at commencement of flowering however this was dependent on sowing date (Table 2). Most varieties recorded higher amounts of biomass from the earliest sowing date while the two later sowings recorded lower and more variable biomass between varieties.
- Early flowering varieties Farah, AF09167, AF11212 and AF13250 recorded lower amounts of biomass at the mid and later sowing dates compared to the early sowing date. Similarly later flowering varieties PBA Zahra and PBA Rana, had reduced dry matter weight with delayed sowing. In contrast, the biomass of Nura and PBA Samira was unaffected by sowing date.
- It is worth noting that averaged across varieties, higher amounts of biomass were produced at the site in 2016 in the order of 4.37 (TOS 1) > 3.45 (TOS 2) > 2.94 (TOS 3) t/ha at flowering in 2016 compared with the previous year at 1.99 (TOS 1) > 1.31(TOS 2) = 1.11(TOS 3).

Table 1: Calendar date and number of days from sowing to commencement of flowering of nine faba bean varieties sown at three different dates at Hart field site, 2016.

Variety	Date of commencement of flowering			No. of days to commencement of flowering from sowing date		
	Time of sowing			Time of sowing		
	14-Apr	7-May	26-May	14-Apr	7-May	26-May
AF09167	26-Jul	5-Aug	22-Aug	103	90	88
AF09169	1-Jul	5-Aug	23-Aug	78	90	89
AF11212	26-Jul	8-Aug	22-Aug	103	93	88
AF13250	29-Jul	11-Aug	24-Aug	106	96	90
Farah	26-Jul	5-Aug	22-Aug	103	90	88
Nura	6-Aug	22-Aug	25-Aug	114	107	91
PBA Rana	5-Aug	15-Aug	25-Aug	113	100	91
PBA Samira	8-Aug	22-Aug	26-Aug	116	107	92
PBA Zahra	29-Jul	15-Aug	25-Aug	106	100	91

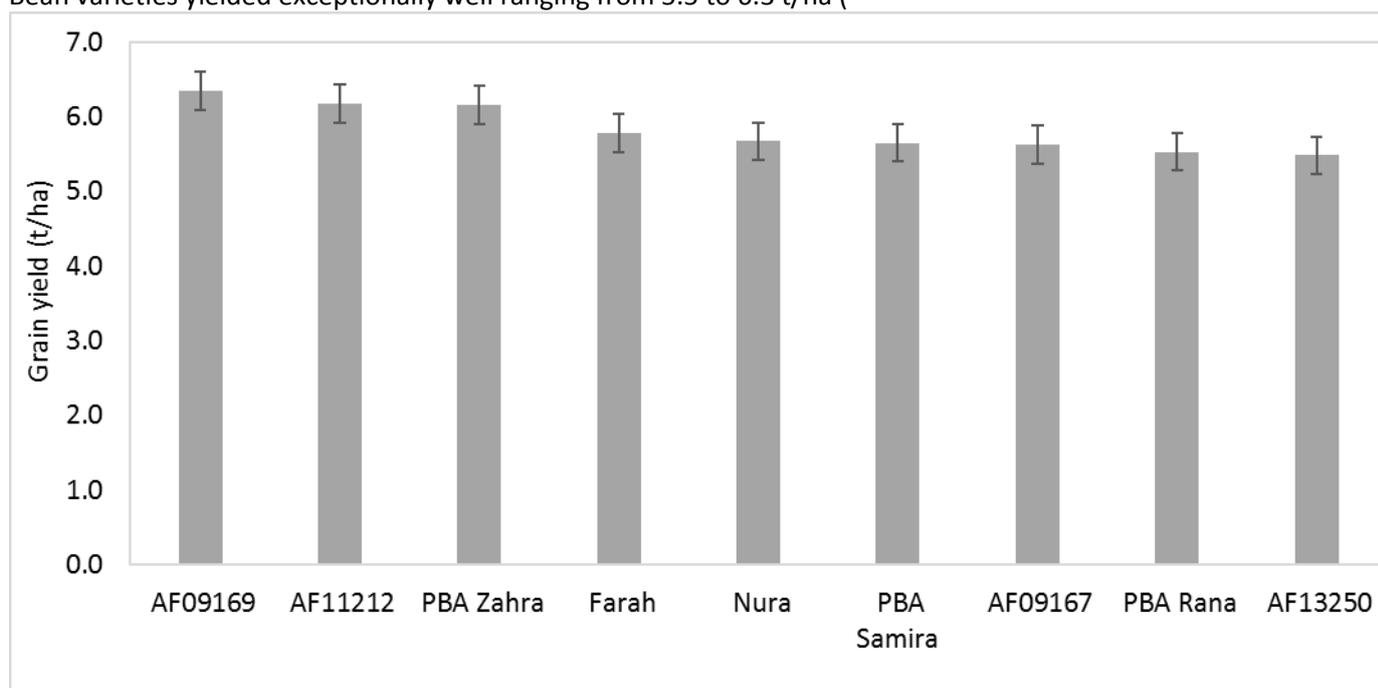
*Commencement of flowering was taken as 50 % flowering and determined by 50 % of plants within plot having one opened flower

Table 2: Dry matter production (t/ha) at commencement of flowering of nine faba bean varieties sown at three different dates at Hart field site, 2016.

Variety	Dry biomass weight (t/ha)		
	Time of sowing		
	14-Apr	7-May	26-May
AF09167	4.28	3.29	2.51
AF09169	3.58	3.11	3.07
AF11212	3.38	2.38	2.53
AF13250	4.72	2.89	3.19
Farah	5.31	2.48	2.75
Nura	3.91	3.69	3.04
PBA Rana	4.97	3.64	2.65
PBA Samira	4.03	4.93	3.69
PBA Zahra	5.14	4.63	3.05
LSD (P =0.05)		1.09	

Grain yield

- There was no sowing date by variety interaction for grain yields at Hart.
- Sowing date was significant for grain yield despite the very high yields achieved at all sowing dates. The mid-April sowing date had the highest grain yield and the Mid-May the lowest across all varieties (Fig 1).
- Bean varieties yielded exceptionally well ranging from 5.5 to 6.3 t/ha (



- **Figure 2),** which was well above long term averages for this site. Two early flowering varieties, AF09169 and AF11212 had the highest yields, equal to the commercial variety PBA Zahra. All other varieties had lower yields with little to no differences between them.

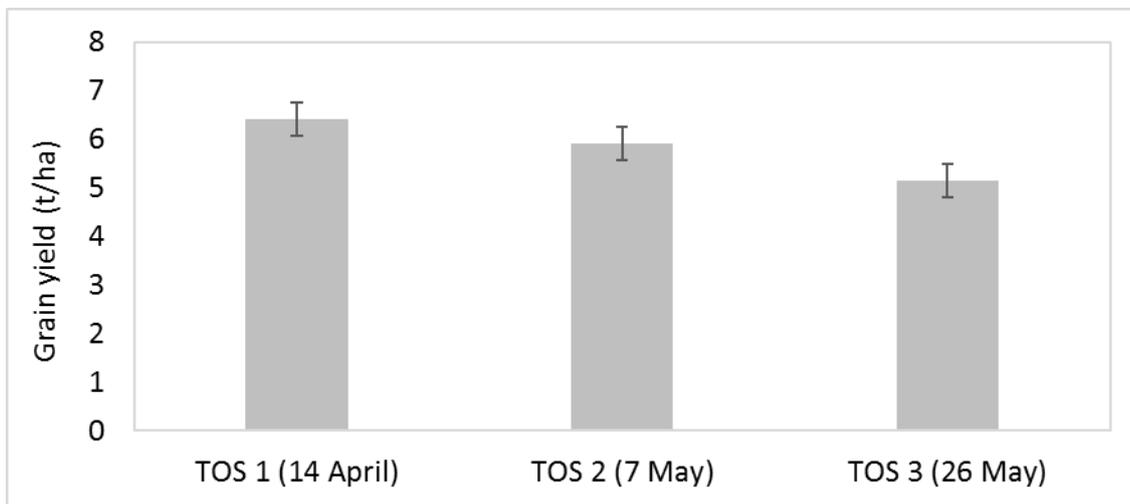


Figure 1: Grain yield (t/ha) across three sowing dates averaged across nine faba bean varieties at Hart field site, Mid-North SA, 2016.

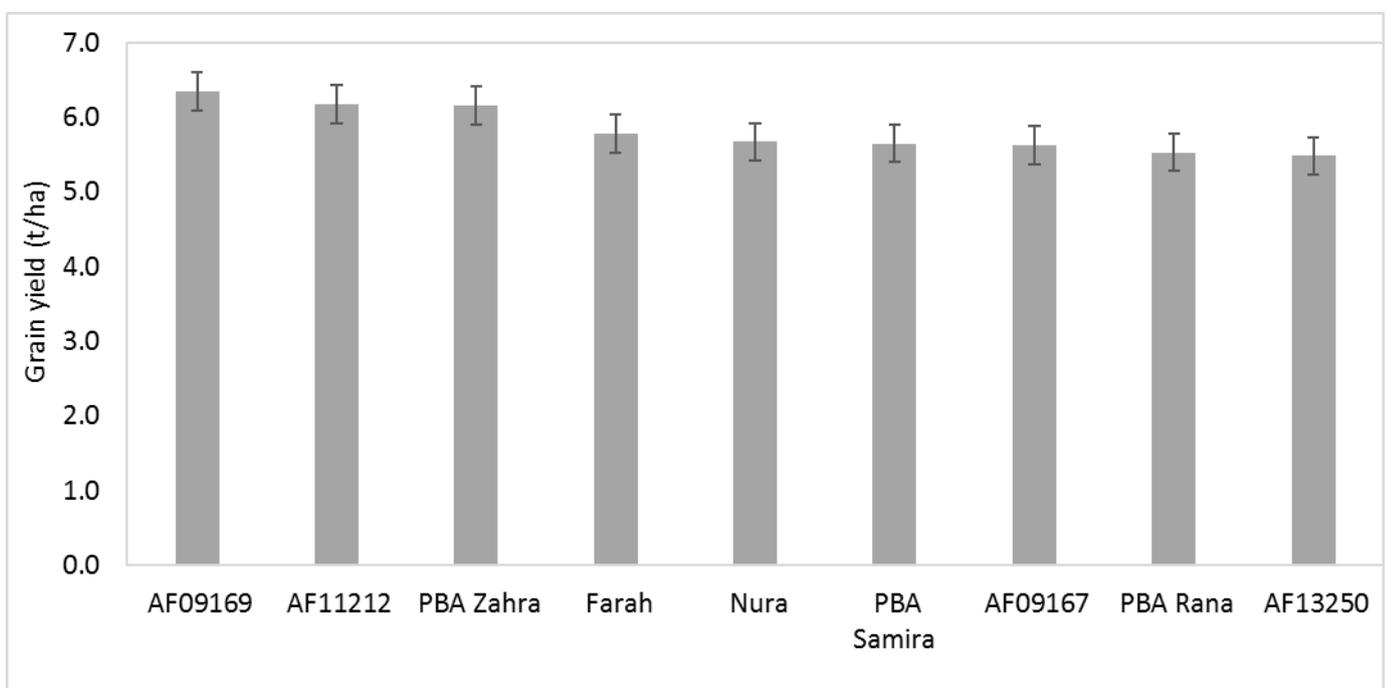


Figure 2: Grain yield (t/ha) of nine faba bean varieties averaged across three sowing dates at Hart field site, Mid-North SA, 2016.

Conclusion

- In the less favourable faba bean growing areas such as Hart, sowing early under favourable conditions increased the yield potential (biomass production) of most varieties therefore benefiting grain yields.
- Grain yields were increased by sowing early (mid-April to early-May) over later sowing (end of May) and varieties with agronomic characteristics of early flowering and high biomass production optimised yields even under the very favourable conditions.
- These results support previous findings in this region that early sowing regardless of seasonal conditions is beneficial for faba bean production if disease is managed. This is unlike in more favourable environments of the Mid North where early sowing often results in no yield improvement or a yield reduction.