

The effect of sowing date and irrigation management on faba bean – Leeton 2021

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Key findings

- Sowing faba bean on 29 April (sowing date one – SD1) achieved a higher grain yield compared with sowing on 21 May (SD2).
- Irrigating faba bean with 2 spring irrigations on a border check layout increased grain yield when compared with rainfed.
- PBA Nasma[®] was the highest yielding variety achieving 9.36 t/ha when averaged across both sowing dates and irrigation treatments.

Keywords

faba bean, 2021, Leeton, sowing date, irrigation

Introduction

To maximise faba bean productivity and yield, it is important to optimise sowing time and the amount of applied irrigation water. Faba bean is affected by a range of abiotic stresses such as moisture stress and extreme temperatures (both low and high). An irrigated faba bean experiment was established at Leeton Field Station (LFS) in 2021 to determine the effect of sowing time and irrigation on 4 varieties of faba bean in southern NSW. This paper reports the findings from the 2021 experiment.

Site details

Location	Leeton Field Station
Soil type	Grey vertosol
Previous crop	Barley
Rainfall	137 mm (1.4 ML)
Starter fertiliser	120 kg/ha Utiliser pulse mix (nitrogen [N]:7.48, phosphorus [P]:17.64, potassium [K]:6.24, calcium [Ca]:6.4, zinc [Zn]:0.32).
Herbicides	<ul style="list-style-type: none">• 1.7 L/ha Trilogy[®] (480 g/L trifluralin) (SD1 on 1 June and SD2 on 11 June).• 1.2 kg/ha Terbyne[®] Xtreme[®] (875 g/L terbuthylazine) (SD1 on 1 June and SD2 on 11 June).• 0.1 L/ha Verdict[®] (520 g/L haloxyfop) (SD1 only on 28 July).• 0.19 mL/ha Leopard[®] (200 g/L quizalofop-p-ethyl) (SD2 only on 13 August).
Fungicide	<ul style="list-style-type: none">• 600 mL/ha Aviator[®] Xpro[®] (150 g/L prothioconazole and 75 g/L bixafen) (22 June).• 2.2 kg/ha Dithane[®] (750 g/kg mancozeb) (13 July).• 1.0 L/ha Veritas[®] (200 g/L tebuconazole and 120 g/L azoxystrobin) (29 July).• 500 mL/ha Howzat[®] (500 g/L carbendazim) (7 applications from 22 August to 20 October).

Harvest dates

- Hand harvested cuts were conducted from 3 November to 23 November.
- All plots were machine harvested on 14 December.

Treatments

The experiment included 4 varieties, 2 sowing dates and 2 irrigation treatments (Table 1) replicated 4 times. The experiment was a split-split plot design with irrigation treatment as main plots, sowing date as subplots and varieties randomised within the subplots.

Table 1 Varieties, sowing dates and irrigation treatments evaluated in the LFS faba bean experiment, 2021.

Treatment		Comment
Variety	PBA Amberley [Ⓛ]	Mid season variety released in 2020 and recommended for high rainfall areas of southern NSW
	PBA Marne [Ⓛ]	Shorter season variety released in 2018 and recommended for lower rainfall areas
	PBA Nasma [Ⓛ]	Large seed variety released in 2015 and recommended for northern NSW
	PBA Samira [Ⓛ]	Mid season variety released in 2014 and recommended for southern NSW
Sowing date (SD)	SD1: 29 April 2021	Very early in the recommended sowing window (irrigated)
	SD2: 21 May 2021	Late in recommended sowing window (irrigated)
Irrigation	Irrigated	Two spring irrigations: 16 September and 21 October
	Non-irrigated	No spring irrigations applied

Trial establishment

The whole paddock was pre-irrigated 5 days before SD1 to provide a full moisture profile across the experiment location. It was estimated that the irrigated treatments received a total of 447 mm, which included rainfall, pre-irrigation and spring irrigation, while the non-irrigated treatments received an estimated 289 mm, including rainfall and pre-irrigation only (Table 2).

Table 2 Rainfall and estimated irrigation quantity for the LFS faba bean experiment, 2021.

Irrigation and rainfall	Irrigated treatments	Non-irrigated treatments
Pre-irrigation	150 mm (1.5 ML)	150 mm (1.5 ML)
In season rainfall	137 mm (1.4 ML)	137 mm (1.4 ML)
Irrigation: 16 September	80 mm (0.80 ML)	0 mm
Irrigation: 21 October	80 mm (0.80 ML)	0 mm
Total	447 mm (4.5 ML)	289 mm (2.9 ML)

Rainfall data was sourced from an in-crop weather station located at LFS and supplied by Cropsol.

Irrigation quantities were estimated from experience conducting previous experiments where quantities were measured.

Assessments

At physiological maturity a 2 m² biomass cut was collected to determine total above ground biomass. Maximum grain yield, harvest index and hundred seed weight were calculated from the plant cut taken at maturity.

Results

Grain yield

PBA Nasma[Ⓛ] was the highest yielding variety with 9.36 t/ha when averaged over sowing date and irrigation treatments, significantly more than the other 3 varieties (Table 3). PBA Marne[Ⓛ] was the second highest yielding variety with 8.62 t/ha. PBA Amberley[Ⓛ] and PBA Samira[Ⓛ] had similar yields with 8.01 t/ha and 8.26 t/ha, respectively (Table 3). The late April sowing (SD1) achieved a maximum grain yield of 9.31 t/ha. This reduced by 16%, to 7.83 t/ha when sowing was delayed until late May (SD2) (Table 4). Applying 2 spring irrigations increased the maximum grain yield from 7.63 t/ha for non-

irrigated treatments to 9.51 t/ha for irrigated treatments, when averaged over variety and sowing date (Table 5).

Table 3 Variety results averaged across all sowing dates and irrigation treatments in the LFS faba bean experiment, 2021.

Treatments	Maximum grain yield (t/ha)	Total biomass (t/ha)	Harvest index (%)	Hundred seed weight (g)	Protein (%)
PBA Nasma [Ⓛ]	9.36	17.88	52.7	77.33	11.55
PBA Marne [Ⓛ]	8.62	16.76	51.3	68.99	12.42
PBA Amberley [Ⓛ]	8.01	16.21	49.6	65.44	12.04
PBA Samira [Ⓛ]	8.26	16.21	51.0	70.58	12.29
I.s.d. ($P < 0.05$)	0.44	0.58	1.2	1.76	0.39

I.s.d. = least significant difference.

Total biomass

PBA Nasma[Ⓛ] achieved the highest average total biomass at 17.88 t/ha when averaged over the 2 sowing dates and 2 irrigation treatments (Table 3). PBA Amberley[Ⓛ] and PBA Samira[Ⓛ] recorded the lowest accumulated biomass at 16.21 t/ha each, which was similar to the 16.76 t/ha of biomass accumulated by PBA Marne[Ⓛ] (Table 3).

When sown on 29 April (SD1), at the beginning of the optimal sowing window, the average accumulated biomass was 18.59 t/ha (Table 4). When sowing was delayed until 21 May (SD2), the total accumulated biomass was 14.94 t/ha, a reduction of 19.5% compared with SD1 (Table 4). The irrigated treatment produced significantly more total biomass (18.28 t/ha) than the non-irrigated treatment (15.25 t/ha), an increase of 19.8% when averaged across all varieties and sowing dates (Table 5).

Table 4 Sowing date results averaged across all variety and irrigation treatments in the LFS faba bean experiment, 2021.

Treatments	Maximum grain yield (t/ha)	Total biomass (t/ha)	Harvest index (%)	Hundred seed weight (g)	Protein (%)
SD1: 29 April	9.31	18.59	49.9	73.66	12.1
SD2: 21 May	7.83	14.94	52.4	67.51	12.0
I.s.d. ($P < 0.05$)	0.56	0.74	1.3	1.31	n.s.

I.s.d. = least significant difference.

Harvest index

Harvest index is the proportion of the total biomass that is converted into grain yield. Harvest index for the 4 varieties ranged from 49.6% to 52.7% (Table 3). PBA Nasma[Ⓛ] converted the highest percentage of total biomass to grain yield with 52.7% (Table 3), which was significantly higher than all other varieties, whilst PBA Amberley[Ⓛ] at 49.6% had the lowest of all the varieties (Table 3).

Sowing date significantly affected the harvest index of the crops. When varieties were sown on 29 April (SD1), the harvest index was 49.9%, significantly lower than 52.4% for the later sowing in May (SD2) (Table 4). The higher conversion of biomass to grain yield when sown later contrasted the lower accumulated biomass. The higher harvest index at the later sowing (SD2) did not fully compensate for the lower accumulated biomass. Spring irrigation increased the conversion of total biomass into grain yield with 52.1% and 50.1% for irrigated and non-irrigated treatments, respectively (Table 5).

Table 5 Irrigation treatment results averaged across all variety and sowing date treatments in the LFS faba bean experiment, 2021.

Treatments	Maximum grain yield (t/ha)	Total biomass (t/ha)	Harvest index (%)	Hundred seed weight (g)	Protein (%)
Irrigated	9.51	18.28	52.1	71.97	12.23
Non-irrigated	7.63	15.25	50.1	69.20	11.92
I.s.d. (P<0.05)	0.58	0.77	n.s.	1.37	n.s.

I.s.d. = least significant difference.

Hundred seed weight

PBA Nasma[®] had the highest hundred seed weight at 77.33 g and was significantly heavier than all other varieties. In contrast, PBA Amberley[®] recorded the lowest hundred seed weight at 65.4 g (Table 3).

Sowing date had a significant effect on the hundred seed weight. Crops sown on 29 April (SD1) had a hundred seed weight of 73.66 g with an 11.2% reduction in seed size to 67.51 g when sown on 21 May (SD2) (Table 4).

Applying a spring irrigation treatment significantly increased hundred seed weight from 69.2 g to 71.97 g over the non-irrigated treatment when averaged across all varieties (Table 5).

Summary

PBA Nasma[®] was the best performing variety, achieving the highest grain yield when averaged across sowing dates and irrigation treatments. PBA Nasma[®] also had the largest seed with a hundred seed weight of 77.3 g, highest total biomass (17.88 t/ha) and largest harvest index (52.7%) when compared with the other 3 varieties.

Sowing date had a significant effect on grain yield, reducing by 1.48 t/ha, when sowing was delayed from 29 April to 21 May 2021. Both the 2020 and 2021 irrigated faba bean experiments demonstrated significant yield increases with a late April sowing time when compared with a mid May sowing time. Sowing in late April also had an increasing effect on biomass by 19% and hundred seed weight by 8%, in contrast harvest index reduced by 4%.

Applying 2 spring irrigations increased yield by over 24% to 9.51 t/ha, through increased biomass by 19.8%, harvest index by 2% and hundred seed weight by 4% when compared with the non-irrigated treatments.

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