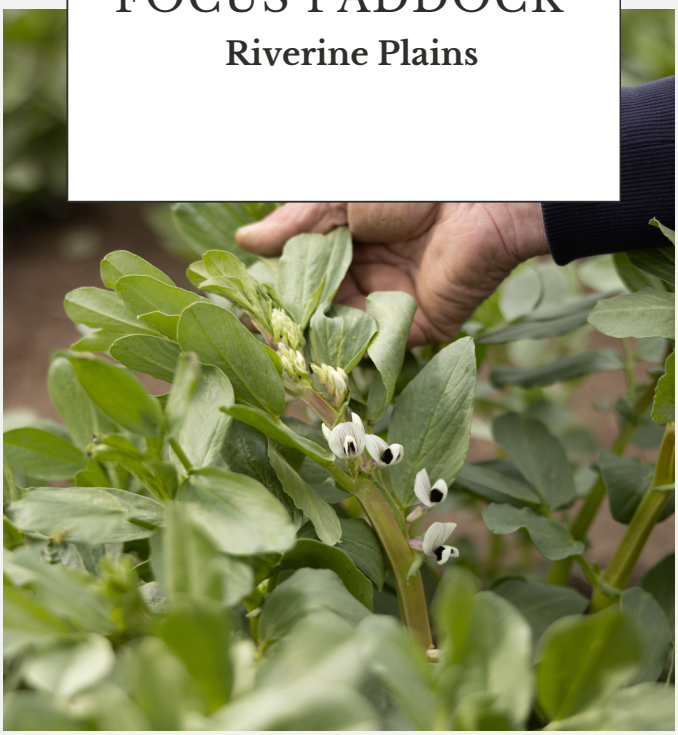
Does seeding rates in irrigated beans provide higher yields?

FOCUS PADDOCK
Riverine Plains



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Key Learnings

High rainfall (decile 10) significantly impacted on yield and disease of faba beans.

Due to the season, faba beans were largely unprofitable, even though there is evidence in dry years they can be profitable.

Dry matter measurements indicate that the nitrogen fixed could save up to $413/ha the following year in nitrogen costs (based on January 2023 pricing).

Aim

To demonstrate that higher seeding rates in irrigated beans provides higher yields and to compare the economics of irrigated beans to irrigated canola and wheat.

Background

A local Grains Research and Development Corporation (GRDC) and Field Applied Research (FAR) Australiaresearch trial has shown that higher planting densities in irrigated faba beans are correlated to higher yields.

Faba beans are not regularly grown in local irrigation systems, so in 2022, a demonstration was sown to test and discuss the results with the Riverine Plains Irrigation Discussion Group.

Method

The site was soil tested on the 17 May 2022 to provide background information for the site (Table 1). Treatments were decided in consultation with FAR Australia and the host farmer, to test two varieties and a range of plant populations (Table 2). Treatments were two seeder widths wide (24m) and 1000m long. Yields were measured by the host farmer's yield monitor.

A gross margin analysis was completed at the end of the seasonto compare the profitability of irrigated winter crops in the region. The analysis used actual grain prices, irrigated yields, irrigation water (Table 3) and the following input prices: MAP $1,300/t, Urea $1,500/t.

Table 1. Site description

Irrigation type	Centre pivot
Rainfall (mm): Jan – March Rainfall (mm): April – October	258 498
Sowing date	22 April 2022
Row Spacing	165mm
Soil type	Clay loam
pH CaCl2 (0-10cm)	5.9
Soil Mineral N kgN/ha (0-30cm) Soil Mineral N kgN/ha (30-60cm) Total Mineral N kgN/ha (0-60cm)	101.6 22.1 123.7
Phosphorus (Colwell)	39
Potassium (Colwell)	240
Sulfphur (KCl40)	10

Results

Dry matter samples were taken from three treatments at mid-pod fill on the 17 October 2022. At this stage, the plants were badly lodged, and chocolate spot disease was causing loss of green leaf. Visual inspection indicated that the conditions had greatly reduced the number of pods on the faba beans.

The highest yielding treatment was four, the Paddock Amberley site (26 plants/m2), which yielded 0.98t/ha. The second highest yielding treatment was one, Bendoc (25 plants/m2) and the lowest yielding treatment was two, Bendoc (29 plants/m2). Refer to Table 2.

Due to the waterlogging and diseased conditions, the case study paddock of faba beans yielded approximately 1t/ha, dramatically reducing the gross margin to a loss of $349/ha. As these results were not representative of all faba bean crops in the region, farmers were interested in the economics of faba beans in a situation where they were less waterlogged. As such, in consultation with farmers, the economic analysis was based on actual prices, yields achieved in the region on irrigated paddocks (no irrigation water was applied in 2022) refer Table 3.

The yields achieved were about 25% below the target set at the beginning of the year, due to the waterlogged conditions. The analysis showed that faba beans were significantly less profitable in 2022 compared to canola, due to lower yields and poorer prices (Table 3).

Table 2. Treatments

Treatment	Seeding rate kg/ha*	Actual plant population plants/m2	Dry Matter at mid-pod fill tonnes/ha	Grain yield tonnes/ha	Estimated nitrogen fixation kg N/ha **
Control: Bendoc 22 plants/m2	150	21	11.9	0.68	190.4
1: Bendoc 25 plants/m2	170	25	#	0.71	#
2: Bendoc 29 plants/m2	200	29	8.4	0.26	134.4
3: Amberley 25 plants/m2	235	40	10.8	0.64	172.8
4: Paddock Amberley	170	26	#	0.98	#

*Seeding rates were calculated based on Bendoc 300 grain weight 148g, Amberley 300 grain weight215g.
#These plots were not measured.
**Based on 16kgN/t of above ground DM (Glover et al, 2013).

Table 3. Economic parameters

Crop type	Actual price $/t	Actual yield (in the region) t/ha	Irrigation water applied mm/ha	Gross margin $/ha
Wheat	$350	5.2	0	$800
Canola	$700	2.8	0	$976
Faba beans	$300	3.0	0	$458

Observations and comments

The purpose of the demonstration was to show that higher planting densities for irrigated faba beans produce higher yields. However, the demonstration was affected by excessive rainfall, water logging and disease, which meant that the crop could not reach its potential.

In the 2022 scenario of high disease pressure, the highest seeding rates had the most disease pressure, and were lower yielding. The narrow row spacing of the paddock also provided conditions that favoured the spread of disease, as the large crop and narrow row spacing did not allow much airflow through the canopy. The Amberley variety did appear to perform better than Bendoc, which may be due to its higher disease resistance. However, Amberley is a long season variety compared to Bendoc and not really suited to the Riverine Plains region, particularly when the region experiences a hot, dry spring.

If yields of 5.5t/ha plus can be achieved in irrigated faba beans, the returns are similar to irrigated wheat, however lower than canola. Historically, high gross margins of irrigated faba beans have been demonstrated over several years in the irrigated cropping trials at Kerang (Pers. comm D Jones, 2022) however there is very low adoption by growers. The results of this demonstration have shown that disease can be devastating in faba beans for both yield and gross margin, which explains the reluctance of growers to adopt them in irrigated cropping systems. If the faba beans can fix 190kgN/ha, this is equivalent to 413kg urea per hectare.

Based on urea prices as of January 2023 of $1,000/t this represents a financial benefit in the following years of $413/ha. If this benefit can be realised, by the following crops, it may provide farmers with more incentive to grow beans.

A lower risk option of incorporating a nitrogen fixing legume is to sow a high-density legume pasture option. This option has more flexibility as it can be made into hay or grazed by livestock. The ability to terminate the pasture early, by making hay or brown manuring, also makes it an effective option to then double crop with maize in an irrigated cropping system.

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