

Effect of combinations of sowing time, seed rate and herbicides on ryegrass management in faba beans (Washpool, SA)

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Key findings

- Propyzamide provided stable and effective ryegrass control at both sowing times. In contrast, simazine + trifluralin standalone or followed by clethodim, was more effective in time of sowing (TOS) 2 than in TOS 1.
- Increased crop ground cover from higher faba bean seed rates reduced ryegrass growth and head density. An increase in faba bean seed rate from 20 to 40 seeds/m² reduced ryegrass head density from 35 to 21 heads/m² (41%).
- The combination of propyzamide followed by Factor + clethodim was able to almost eliminate ryegrass head production (0.1 heads/m²).
- Faba beans sown on May 26 produced significantly greater grain yield than the crop sown on 22 June. This is consistent with general grower experience of superior performance of faba beans when sown early.
- As ryegrass density at the trial site was low (< 35 plants/m²), grain yield of faba beans in herbicide treatments ranged from 2.48 to 2.65 t/ha and was unaffected by herbicide treatments (P=0.309). These results suggest faba beans can tolerate low ryegrass densities without suffering any loss in grain yield.

Why do the trial?

Delayed sowing can provide opportunities to exhaust the seedbank of weeds before seeding the crop, but late sown crops can be less competitive with weeds and allow them to set a large amount of weed seeds. Faba beans are generally considered highly responsive to earlier sowing when soils are warmer and crop growth rates tend to be high. Early sown faba bean crops have been shown to out yield crops sown later in the season. Some growers start seeding their faba bean crops before ANZAC day every year to take advantage of good growing conditions. Therefore, it is important to investigate sowing time in combination with other practices across different rainfall zones. The review of Widderick *et al.* (2015) also recommended research on sowing time in many crops.

Crop seed rate is an easy tactic for the growers to adopt, provided they are convinced of its benefits to weed management and profitability. Faba beans are a very large seeded crop, which means increasing plant density can have serious effects on seed costs as well as logistics during seeding. Growers are also reluctant to increase faba bean seed rates due to concerns about the negative impact of high seed rate on foliar fungal disease pressure.

This field trial was undertaken at Washpool in the Mid North, which is in the medium rainfall zone of South Australia. The aim of the trial was to investigate factorial combinations of sowing time, seed rate and herbicides on the management of annual ryegrass in faba beans.

How was it done?

This field trial was established in a split-split plot design and investigated combinations of the faba bean sowing time, seed rate and herbicides for annual ryegrass control.

Location	Washpool, South Australia
Seedbank soil cores	21 April, 2021
Plot size	1.37 m x 10 m
Seeding date	TOS 1: May 26, 2021; TOS 2: June 22, 2021
Seeding rate	20, 30 and 40 seeds/m ²
Herbicide treatments	1) Simazine 1.1 kg + Trifluralin 800 mL/ha IBS 2) Simazine 1.1 kg + Trifluralin 800 mL/ha IBS Fb Clethodim 500 mL/ha GS13 ARG 3) Propyzamide 2 L/ha IBS 4) Propyzamide 2 L/ha IBS Fb Factor 150 g + Clethodim 500 mL/ha GS13 ARG
Replicates	Three
Variety	Bendoc
Seeder	Knife points, press wheels, 22.8 cm (9") row spacing

Measurements collected include; pre-sowing weed seedbank, crop establishment (plants/m²), weed density (plants/m²), ryegrass head density (heads/m²), ryegrass seed production and faba bean grain yield (t/ha).

At Washpool in 2021, It was an extremely dry start to seeding, with only 5.4 mm rainfall received in April (Table 1). Summer months were also extremely dry with well below average rainfall, meaning very little soil moisture was available at the site. Sowing was delayed until May 26 (TOS 1) to allow good soil moisture conditions for pre-emergent herbicide activity. Once winter started, rainfall received at the site was well above the long-term average. Spring rainfall was below average but the month of November was extremely wet (128.2 mm). However, the crop had already reached maturity at this stage and did not benefit from late rain.

Table 1. Rainfall received at Gulnare near Washpool in 2021 and the long-term average for the site.

Month	Rainfall (mm)	
	2021	Long-term average
Jan	13.2	21.1
Feb	8.6	21.5
Mar	14.1	18.2
Apr	5.4	32.0
May	26.2	48.6
Jun	85.6	57.4
Jul	102.0	57.8
Aug	43.6	57.2
Sep	16.8	52.1
Oct	37.8	42.7
Nov	128.2	32.6
Dec	1.4	25.6
Annual total	482.9	466.8
GSR total	317.4	347.8

Results and Discussion

Faba bean plant density

Crop density was significantly influenced by the time of sowing ($P=0.027$), crop seed rate ($P=0.001$) and the interaction between sowing time and seed rate ($P=0.024$). It is important to note that established plant density was very close to the target plant density. The interaction between the sowing time and crop seed rate appears to be associated with much higher crop density at the highest seed rate in TOS 2 (35.9 compared to 45.2 plants/m²).

It is quite likely that dry soil conditions at sowing in TOS 1 may have reduced faba bean establishment. Faba beans are a very large seeded legume crop and the germination and establishment can be reduced by dry soil conditions, particularly at high seed rates.

Table 2. Effect of the interaction between crop sowing time and seed rate on the establishment of faba beans.

Crop seed rate (seeds/m ²)	Faba bean density (plants/m ²)	
	TOS 1	TOS 2
20	20.9	22.6
30	31.6	33.7
40	35.9	45.2
LSD ($P\leq 0.05$)	3.52	

Ryegrass plant density and head density

The soil seedbank for ryegrass at the site was low (102 ± 48 ryegrass seeds/m²). Ryegrass plant density in this trial was significantly influenced by interaction between crop sowing time and the herbicide treatments ($P=0.002$). Propyzamide treatments provided stable ryegrass control in both sowing times (Table 3). In contrast, simazine + trifluralin by itself or followed by (Fb) clethodim provided greater weed control in TOS 2 than in TOS 1. It is possible that increased soil moisture conditions at sowing in TOS 2 may have been conducive to improved weed control from this treatment.

Ryegrass head density (m²) was significantly affected by crop seed rate ($P=0.038$), herbicide treatment ($P=0.001$) and the interaction between time of sowing and herbicides ($P=0.03$). An increase in crop ground cover through higher seed rates was able to reduce ryegrass growth and head density. Increasing faba bean seed rate from 20 to 40 seeds/m² reduced ryegrass head density from 35 to 21 heads/m² (41%). Consistent with the trends observed for ARG plant density, simazine + trifluralin treatments had about half the ARG head density in TOS 2 than in TOS 1.

As stated earlier, better soil moisture in TOS 2 is likely to have improved efficacy of simazine + trifluralin than in TOS 1 (Table 4). The combination of propyzamide fb Factor + clethodim was able to almost eliminate ARG head production (0.1 heads/m²). These results indicate the likely presence of clethodim resistance in the ryegrass population present at this site. Previous studies have shown improvement in ryegrass control when Factor (butoxydim) is added to clethodim when treating clethodim resistant populations.

Table 3. Interaction between crop sowing time (TOS) and herbicides on annual ryegrass (ARG) plant density (ARG plant/m²).

Herbicide treatment	ARG plants/m ²	
	TOS 1	TOS 2
Propyzamide 2 L/ha IBS	5.4	5.0
Propyzamide 2 L/ha IBS Fb Factor 150 g + Clethodim 500 mL/ha GS13 ARG	1.0	0.8
Simazine 1.1 kg + Trifluralin 800 mL/ha IBS	34.4	14.1
Simazine 1.1 kg + Trifluralin 800 mL/ha IBS Fb Clethodim 500 mL/ha GS13 ARG	14.7	5.2
LSD (P≤0.05)	9.04	

Table 4. Interaction between crop sowing time (TOS) and herbicides on annual ryegrass (ARG) head density (ARG heads/m²).

Herbicide treatment	ARG heads/m ²	
	TOS 1	TOS 2
Propyzamide 2 L/ha IBS	19.6	16.0
Propyzamide 2 L/ha IBS Fb Factor 150 g + Clethodim 500 mL/ha GS13 ARG	1.2	0.1
Simazine 1.1 kg + Trifluralin 800 mL/ha IBS	80.7	40.8
Simazine 1.1 kg + Trifluralin 800 mL/ha IBS Fb Clethodim 500 mL/ha GS13 ARG	26.8	13.4
LSD (P≤0.05)	23.01	

Faba bean grain yield

Grain yield of faba beans in this trial was significantly influenced by the time of sowing (P=0.029) and crop seed rate (P=0.001). Faba beans sown on May 26 produced significantly greater grain yield than the crop sown on June 22 (Figure 1). This is consistent with general grower experience of superior performance of faba beans when sown early. If rainfall conditions in April had been more favourable, it would have been possible to sow even earlier to achieve higher yields.

Growers are often reluctant to sow faba beans at seed rates greater than 30 seeds/m². This is largely due to high seed costs as well as logistical issues of sowing a large seeded crop at high seed rates. However, the results of this trial showed yield benefits of higher seed rate up to 40 seeds/m² (Figure 2). Therefore, it's important for local growers to carefully consider gross margins of higher seed rates in their situation.

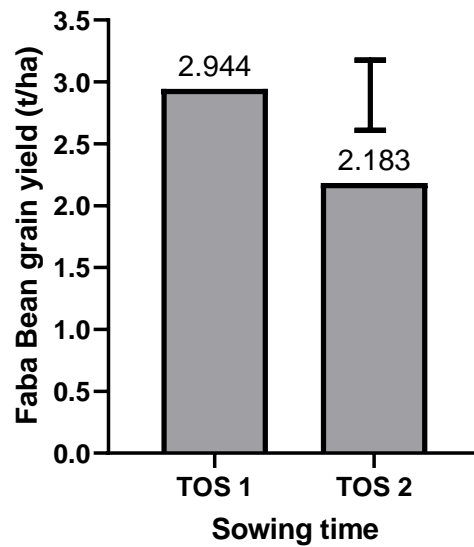


Figure 1. Effect of faba bean sowing time on its grain yield ($P=0.029$).

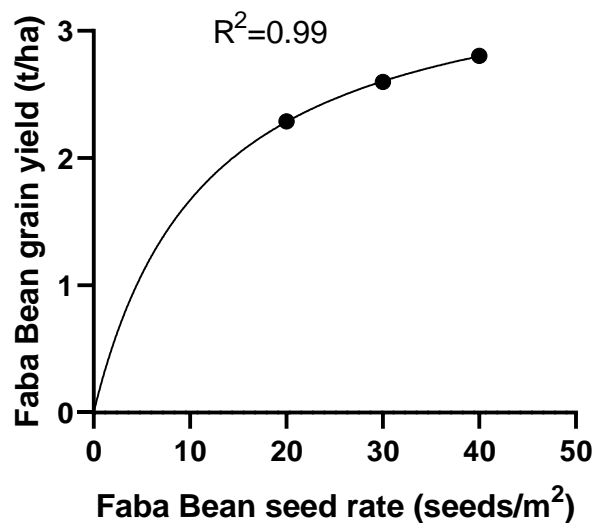


Figure 2. Effect of faba bean seed rate on its grain yield. The hyperbolic relationship accounted for 99% of variability in the trend.

As ryegrass density at the trial site was low (< 35 plants/m²), grain yield of faba beans in herbicide treatments ranged from 2.48 to 2.65 t/ha and was unaffected by herbicide treatments ($P=0.342$). These results suggest faba beans can tolerate low ryegrass densities without any loss in grain yield. However, failure to effectively control low ryegrass densities can lead to large build-up in ryegrass seedbank for subsequent crops.

Acknowledgements

The research undertaken in this project (GRDC project 9175134) was made possible by the significant contributions of growers through both trial cooperation and the support of the GRDC, the authors would like to thank them for their continued support.

Collaboration with the Hart Field-Site Group is also gratefully acknowledged.