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

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Key messages

- Propyzamide provided stable and effective ryegrass control at both sowing times. In contrast, simazine + Trifluralin by itself or followed by clethodim was more effective in TOS 2 than in TOS 1. It is possible superior soil moisture conditions at sowing in TOS 2 may have improved weed control in these treatments.
- Increased crop ground cover from higher faba bean seed rates reduced ryegrass growth and spike density. An increase in faba bean seed rate from 20 to 40 seeds/m^2 reduced ryegrass spike density from 35 to 21 spikes/m^2 (41%).
- The combination of propyzamide followed by Factor + Clethodim was able to almost eliminate ryegrass spike production (0.1 spikes/m^2). Previous studies have also shown improvement in ryegrass control when Factor (butroxydim) is added to clethodim when treating clethodim resistant populations.
- Faba beans sown on 26 May 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/m^2), 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. However, failure to effectively control low ryegrass densities can lead to large build-up in ryegrass seedbank for subsequent crops.

Background

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.

Methods

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.

Table 1. Management details.

Operation	Details
Location	Washpool, South Australia
Seedbank soil cores	21 April, 2021
Plot size	1.37 m x 10 m
Seeding date	TOS 1: 26 May, 2021; TOS 2: 22 June, 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	3
Variety	Bendoc
Seeder	Knife points, press wheels, 22.8 cm (9”) row spacing

All data collected during the growing season was analysed using the Analysis of Variance function in GenStat version 19.0.

Measurements: pre-sowing weed seedbank, crop density, weed density, ryegrass spike density, ryegrass seed production, faba bean grain yield.

It was an extremely dry start to the season in 2021, with only 5.4 mm rainfall in April (Table 2). Summer months were also extremely dry with well below average rainfall. Therefore, there was very little soil moisture available at the site to seed the crop in April. Crop sowing was delayed until 26 May (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), but the crop had already reached maturity and did not benefit from late rains.

Table 2. Rainfall received at Gulnare near Washpool in 2021 and the long-term average for the site.

	Rainfall (mm)	
Month	**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 x crop seed rate appears to be mainly associated with much higher crop density at the highest seed rate in TOS 2 (35.9 Vs 45.2 plants/m^2). It is quite likely dry soil conditions at sowing in TOS 1 may have reduced faba bean establishment. Faba beans are a very large seeded legume crop and its germination and establishment can be reduced by dry soil conditions especially at high seed rates.

Table 3. Effect of the interaction between crop sowing time and seed rate on the establishment of faba beans.

	Faba bean density (plants/m^2))	
Crop seed rate (seeds/m^2)	**TOS 1**	**TOS 2**
20	20.9	22.6
30	31.6	33.7
40	35.9	45.2
P	0.024	
LSD (P=0.05)	3.52	

Ryegrass plant density and spike density

The ryegrass soil seedbank at the site was quite low (102 ± 48 ryegrass seeds/m^2). 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 4). 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 superior soil moisture conditions at sowing in TOS 2 may have been conducive to improved weed control from this treatment.

Ryegrass spike or head density 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 spike density. Increased faba bean seed rate from 20 to 40 seeds/m^2 reduced ryegrass spike density from 35 to 21 spikes/m^2 (41%). Consistent with the trends observed for ARG plant density, simazine + Trifluralin treatments had about half the ARG spike density in TOS 2 than in TOS 1. As mentioned earlier, better soil moisture in TOS 2 is likely to have improved efficacy of simazine + Trifluralin than in TOS 1 (Table 5). The combination of propyzamide fb Factor + Clethodim was able to almost eliminate ARG spike production (0.1 spikes/m^2). 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 (butroxydim) is added to clethodim when treating clethodim resistant populations.

Table 4. Effect of the interaction between crop sowing time (TOS) and herbicides on annual ryegrass (ARG) plant density (ARG plant/m^2).

	ARG plants/m^2	
Herbicide treatment	**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
P	0.002	
LSD (P=0.05)	9.04	

Table 5. Effect of the interaction between crop sowing time (TOS) and herbicides on annual ryegrass (ARG) spike density (ARG spikes/m^2).

	ARG spikes/m^2	
Herbicide treatment	**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
P	0.03	
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 26 May produced significantly greater grain yield than the crop sown on 22 June (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/m^2. 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/m^2 (Figure 2). Therefore, it's important for local growers to carefully consider gross margins of higher seed rates in their situation.

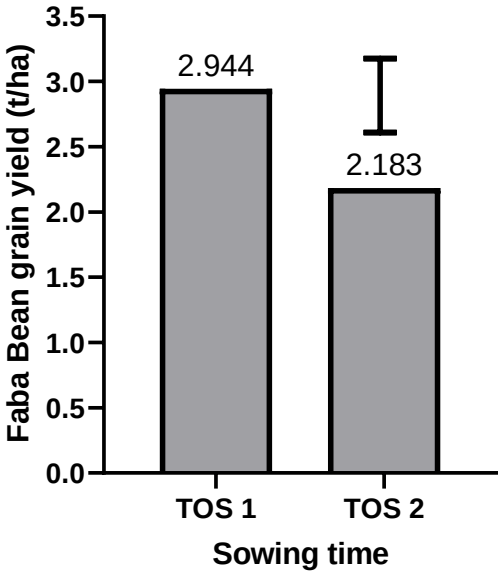

Figure 1. Effect of faba bean sowing time on its grain yield (P=0.029).

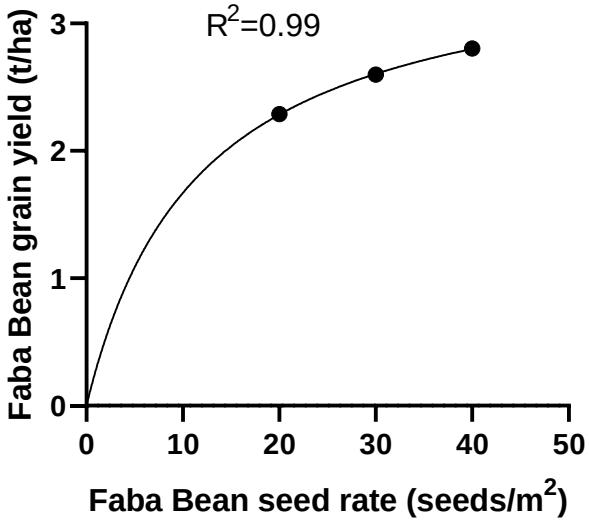

Figure 2. Effect of faba bean seed rate on its grain yield. The hyperbolic relationship accounted for 99% of variability in the trend.

As ryegrass density at the trial site was low (<35 plants/m^2), 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.