Department of Primary Industries and Regional Development
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GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

Broadleaf herbicide options in faba beans

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Key messages

- Pre-emergent herbicides were equally as effective at controlling broadleaf weeds as post-emergent herbicides in this faba bean trial,
- Reflex® is a new pre-emergent herbicide option for control of broadleaf weeds with good residual activity and is effective at reducing weed density and biomass
- If a post-emergent herbicide is required Ecopar® is best for broadleaf weed control in non-imi-tolerant varieties and Intercept® is good for imi-tolerant varieties

Aims

To better understand the efficacy and crop safety of broadleaf herbicide options for faba bean crops grown on sandy soils in Western Australia, focusing on new varieties; PBA Amberley and PBA Bendoc.

Background

Currently there are limited broadleaf herbicide options registered for use in faba bean crops under the Australian Pesticide and Veterinary Medicines Authority (APVMA). Options are limited to pre-emergent herbicides, only two post-emergent herbicides (Ecopar® and Raptor®) registered for all faba bean varieties and imidazolinone (imi) herbicide Intercept® registered under an APVMA permit for PBA Bendoc only (an imi-tolerant variety). These post-emergent herbicides have some crop safety issues that have not thoroughly been investigated on Western Australian sandy soils.

New pre-emergent product, Reflex® (novel active ingredient formesafen) is being registered for pulse crops in March 2021 and has promise to be effective in our WA farming systems with good control of wild radish and longer residual (up to 12 weeks). This could be widely beneficial to WA growers with sustained control on later emerging weeds when dry sowing with late season breaks.

Other break crop options such as canola have been grown rather than faba beans due to better herbicide options for weed control, easy marketability and more consistent economic returns. However in recent years there have been increased hectares planted to faba beans in the Esperance port zone (EPZ) as market prices have been high and soil amelioration has meant soils are more suitable for growing. With increased sowings there comes more of a need to investigate agronomic practices for faba beans, particularly weed control.

Method

In 2020 a replicated small plot trial was set up at the Esperance Downs Research Station (EDRS). The trial included two varieties of faba beans; PBA Bendoc and PBA Amberley, with seven different herbicide treatments applied to each of the varieties, a total of 14 treatments (Table 1). Three herbicide treatments were applied pre-emergent, incorporated by sowing (IBS), three applied post emergent on 5 June, four weeks after

sowing (WAS) when faba beans were at the three- to five-leaf stage and one treatment was left with no herbicide application, Nil (Table 1). Post-emergent treatment plots all had a pre-emergent IBS herbicide application of Terbyne Xtreme® 875 and Terrain® 500 WG at a rate of 0.86kg/ha and 0.18kg/ha, respectively.

Seed was inoculated with TagTeam® before seeding and 100kg/ha of superphosphate fertiliser was spread over the trial at seeding.

Table 1. Treatment list with application timing herbicide applied and rate applied

Treatment	Application timing	Herbicide treatment	Rate
1	n/a	Nil	n/a
2	Pre-emergent 1 May	Terbyne Xtreme® 875	0.86 kg/ha
3		Terbyne Xtreme® 875 + Terrain® 500 WG	0.18 kg/ha
4		Terbyne Xtreme® 875 + Reflex®	1.5 L/ha
5	Post-emergent 5 June	Raptor®	45 g/ha
6		Intercept®	0.75 L/ha
7		Ecopar®	0.8 L/ha

In-season data collection

Establishment counts were taken four WAS by counting plants along two rows either side of a 1m ruler at two locations per plot.

Herbicide damage scoring was done on each plot using the European Weed Research Council (EWRC) scoring system (Table 2) two weeks, four weeks and six weeks after post-mergent herbicide.

Table 2. European Weed Research Council (EWRC) rating scale used to score the level of crop tolerance following herbicide application

EWRC score	Crop tolerance	Efficacy (weed kill)	Weed control (%)
1	No effect	Complete kill	100
2	Very slight effects; some stunting and yellowing just visible	Excellent	99.9–98
3	Substantial chlorosis and or stunting; most effects probably reversible	Very good	97.9–95
4	Strong chlorosis/stunting; thinning of stand	Good–acceptable	94.9–90
5	Increasing severity of damage	Moderate but not generally acceptable	89.9–82
6	Increasing severity of damage	Fair	81.9–70
7	Increasing severity of damage	Poor	69.9–55
8	Increasing severity of damage	Very poor	54.9–30
9	Total loss of plants and yield	None	29.9–0

Weed counts were done by counting weeds along two rows either side of a 1m ruler at two locations four WAS on 27 May, and again two weeks on 19 June and six weeks after post-emergent spray on 20 July. The final weed count was done by dividing the weeds into species and sizes.

Nodulation was assessed by pulling up 10 plants per plot. Roots were carefully washed and were assessed using the nodule scoring rating in Table 3.

No biomass cuts were taken at the trial due to flooding of the trial. Yield results are confounded due to the uneven flooding of the trial and have not been analysed.

An accidental application of Raptor® was applied across the entire trial on 24 June.

Table 3. Nodulation rating system for pulses.

Nodulation score	Description
0	No nodules
1	<5 nodules or 1 large nodule
2	<10 nodules or 2 large nodules
3	<15 nodules or 3 large nodules
4	<20 nodules or 4 large nodules
5	<25 nodules or 5 large nodules
6	<10 nodules or 6 large nodules
7	Crown nodulation incomplete or >30 nodules
8	Crown nodulation <1cm^3
9	Crown nodulation >1cm^3
10	>2 crown nodules >1cm^3

Nodulation assessements are usually done at 7–8 weeks after sowing, and sometimes again at 13–15 weeks for grain legume species.

Results and discussion

There was no difference in plant establishment between herbicide treatments, however on average there were higher plant numbers in the plots sown to PBA Amberley, with an average of 33 plants/m^2, compared to PBA Bendoc, with an average of 32 plants/m^2. These plant numbers hit target sowing rates of 30 plants/m^2. There was good nodulation across the whole site with a score of 7. There was no difference in nodulation between varieties or treatments.

Number and size distribution of weeds

The main weeds at the site were medic and capeweed. Weed counts after the pre-emergent spray (before any post-emergent spray) show that there was no difference in the amount of weeds left behind between the pre-emergent treatments. All pre-emergent herbicide applications significantly reduced the amounts of weeds with an average of 13 weeds/m^2, compared to the nil with over double the amount of weeds at 32 weeds/m^2 (Figure 1). There were no differences in weed numbers between the two faba bean varieties.

The second weed count showed a sustained suppression of weeds from the applied pre-emergent herbicides, however there was still no significant difference between their efficacies (Figure 1). Ecopar® had the best weed suppression of the post-emergent herbicides with an average of 19 weeds/m^2 compared to an average of 39 weeds/ m^2 in plots sprayed with Raptor®. There was little difference in the number of weeds between plots with only pre-emergent treatments and plots with both a pre-emergent and post-emergent herbicide application. This indicates there could be similar control of weeds with only a pre-emergent herbicide spray to when a post-emergent herbicide is used.

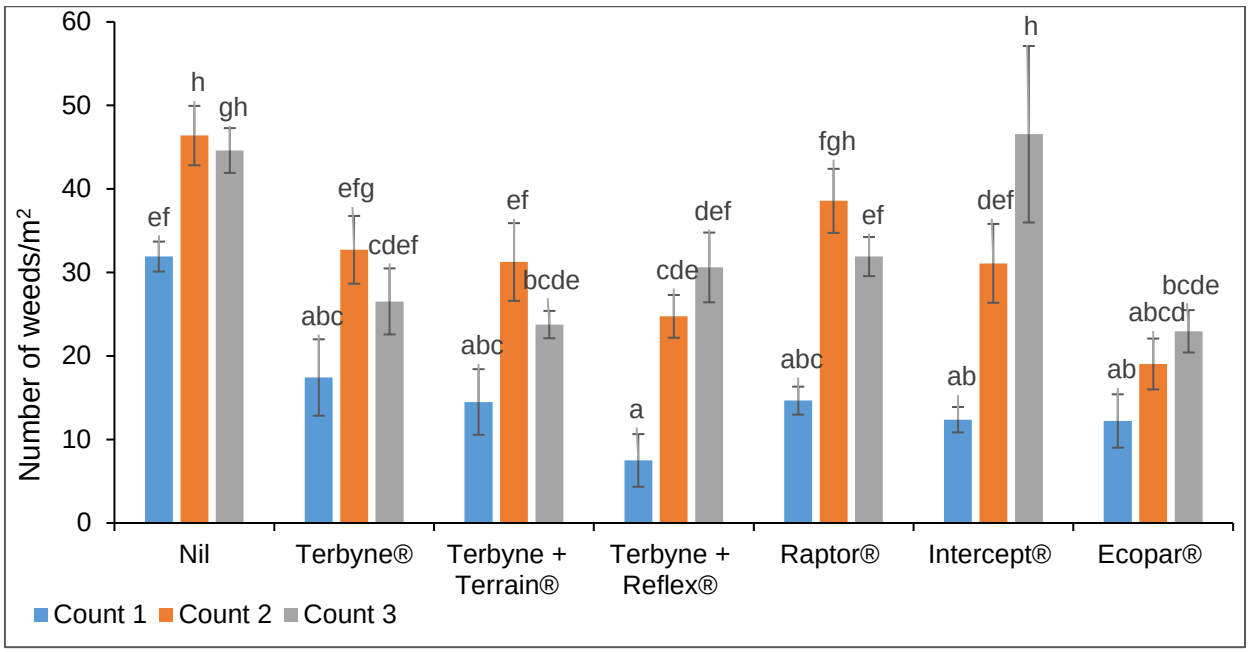

Figure 1. Weed density/m^2: Count one 27 May (four WAS), count 2 19 June (two weeks after post-emergent application) and count 3 20 July (six weeks after post-emergent application). Error bars show standard error and letters show significance between treatments at P≤0.05.

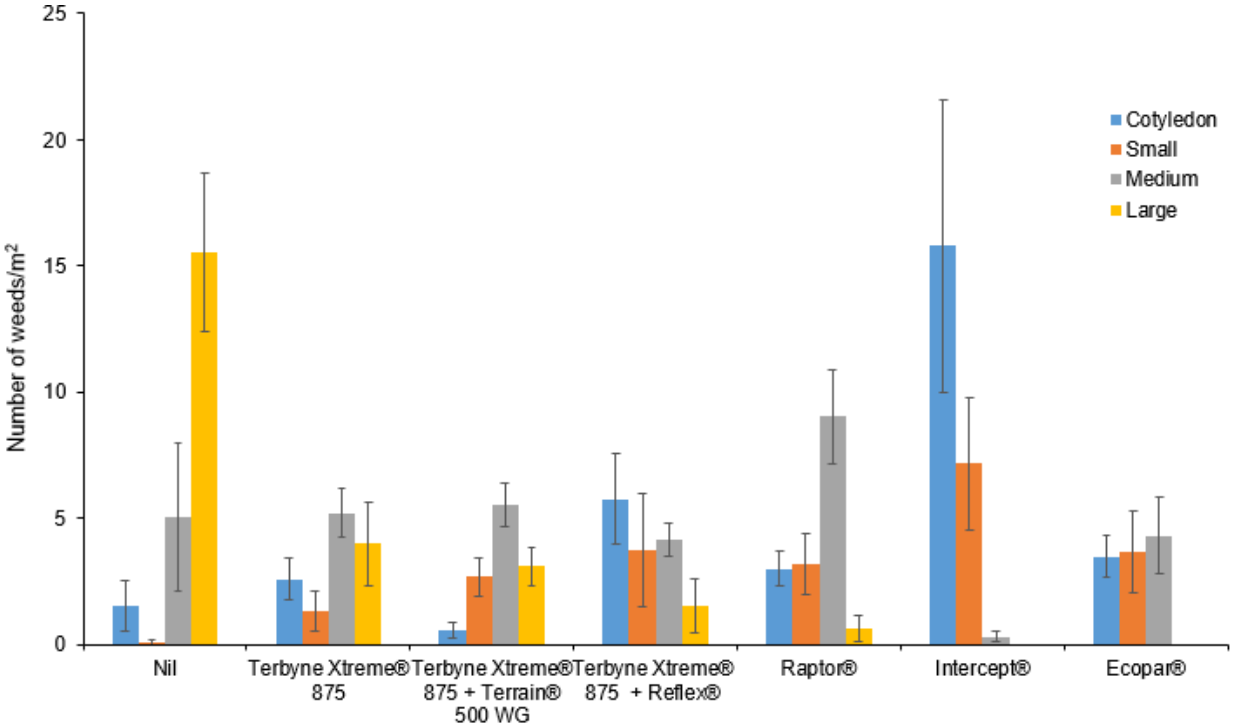

Figure 2. Weed counts taken six weeks after post-emergent herbicide was applied, per weed size. (Error bars show standard error).

By the third weed count data shows that all the pre-emergent herbicides had sustained suppression of weeds compared to the nil where the nil had an average of 45 weeds/m^2 and pre-emergent treatments plots had an average of 27 weeds/m^2 (Figure 1). There was still no significant difference in weed numbers between the three pre-emergent treatments. Ecopar® remained the most effective post-emergent herbicide at supressing weed numbers. Intercept® had the highest number of weeds, higher than

pre-emergent treatment plots. These counts were done after an extra, accidental Raptor®. spray, therefore weed numbers, particularly those from pre-emergent treatments, may be skewed.

In this final weed count, weed size was also measured. Results show that untreated control plots had mostly large weeds present (Figure 2). All other plots had low numbers of large weeds. Weeds present in pre-emergent treatments varied in size where Terbyne® and Terbyne®+Terrain® treatments both had a majority of medium sized weeds with some small and large weeds, while Terbyne®+Reflex® treatment had mostly weeds at the cotyledon growth stage and very few large weeds. These results indicate that Reflex® has good efficacy early in the season, controlling earliest germinating weeds and has good residual of up to 12 WAS.

All post-emergent herbicides did not have many large weeds. Intercept® had many weeds (an average of 15 weeds/m^2) at the cotyledon stage. The Raptor® treatment had most weeds at the medium size and Ecopar® had an even spread between cotyledon, small and large (Figure 2). It is important to note that post-emergent treatments had no to very few large weeds present compared to the pre-emergent treatments. Well-established faba bean crops should have a better capacity to outcompete weeds for water and nutrients when weeds are at cotyledon, small and even medium growth stage. Intercept® had the highest number of weeds present, most at the cotyledon stage, likely due to crop damage in PBA Amberley, inhibiting the faba bean crop to have capacity to outcompete with these weeds.

Herbicide damage

Herbicide damage ratings done six weeks after the post-emergent herbicide sprays and four weeks after the accidental Raptor® spray across the trial show there was little to no damage caused in pre-emergent treatment plots (Figure 3). The greatest herbicide damage score resulted from Intercept® on PBA Amberley with a damage score of 85%, likely to cause significant yield loss (Figure 3). This is expected as PBA Amberley is not an imi-tolerant variety. Intercept® applied to PBA Bendoc left little damage with score of 30%, with plants showing slight discolouration but unlikely to cause yield loss. All other post-emergent treatments had the same crop damage rating, 33–45%. Although Ecopar® showed signs of yield impacting damage earlier after application, this data indicates that the crop has ability to grow out of this damage with limited potential yield loss.

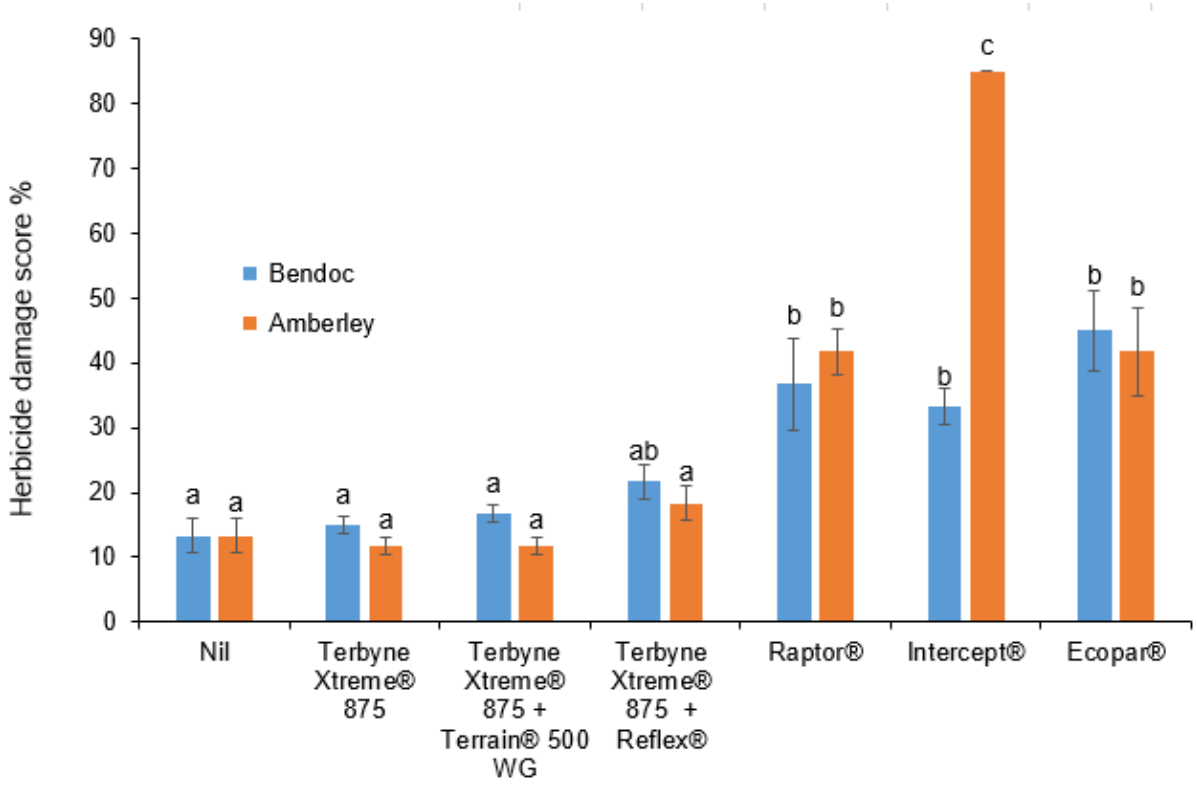

Figure 3. Herbicide damage scores (%) taken six weeks after post-emergent herbicide was applied. (Error bars show standard error and different letters show significant differences between treatments when P≤0.05).

Conclusion

Data from this trial indicates that applying only a pre-emergent herbicide applied to faba beans can be just as effective in controlling weeds as applying a post-emergent herbicide. Reflex® looks promising for use in faba bean crops as, although a number of weeds between the pre-emergent treatments did not change, there were mostly only small and cotyledon sized weeds, likely to be outcompeted, in Reflex® plots. If a post-emergent herbicide is needed Ecopar® had the best weed control but some early crop damage. The crop grew out of this damage, however it is unknown if this caused any yield loss. Intercept® is a good option for controlling weeds if growing PBA Bendoc. Do not use this chemistry when growing PBA Amberley.

Acknowledgments

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