Lentil herbicide management in southern low rainfall environments

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RESEARCH

Location:
Minnipa Agricultural Centre, paddock N9
Rainfall
Av. Annual: 325 mm
Av. GSR: 241 mm
2018 Total: 269 mm
2018 GSR: 208 mm
Paddock History
2018: Field pea
2017: Oat
2016: Barley
Soil Type
Loam
Soil Test
pH at 10 to 30 cm: 7.9
Plot Size
1.75 m x 10 m x 3 reps
Trial Design
Experimental: Randomised complete block
Yield Limiting Factors
Moisture stress

Key messages

- **Interactions between herbicide and application rate did not have differing responses for grain yield, biomass yield, or gross margin at Minnipa, 2018.**
- **Combined herbicide and application timing treatments did show differences in grain yield, biomass yield and gross margin.**
- **Metribuzin and Diuron treatments indicated increased safety levels (58-466% higher biomass and 6-161% higher grain yield) and lower economic risk compared to Terbuthylazine treatments.**
- **For herbicide applications incorporated by sowing, Metribuzin was of lower economic risk (45% higher gross margin) than Diuron.**

Why do the trial?

Break crops continue to occupy a small percentage of arable land across the southern low rainfall zone, despite extensive research demonstrating their role and value in farming systems. This is generally thought to be due to a perception that break crops have an increased risk and production cost, compared to cereals. There is also a lack of confidence about correct break crop management required to reduce production risk and minimise inputs in a low rainfall system. There is little information in this area, as break crop development has largely occurred in medium and high rainfall zones, and often these strategies are inappropriate for low rainfall environments. The aim of this work is to identify low-risk break crop management strategies for the low rainfall zone.

Herbicide damage in lentil commonly occurs in low rainfall environments. This trial aims to identify crop safety levels and economic risk of pre- and post-emergent herbicide use on lentil across different soil types and environments in the southern low rainfall zone. This project builds on previous GRDC-funded projects, including DAV00113 (southern region pulse agronomy).

How was it done?

To address the knowledge gap, a lentil herbicide management trial was established at Minnipa Agricultural Centre in 2018. The trial was arranged in a randomised complete block design with one lentil variety, PBA Hurricane XT. There were 24 treatments in the trial, with each treatment replicated three times. Treatments included a combination of six herbicides (Group B and C), each applied at two timings and a high and low rate for each timing (Table 1). An untreated control was not included in the trial, as Metribuzin applied at a low rate incorporated by sowing (IBS) is considered to be a control or standard treatment for the purpose of this experiment.

Measurements taken include grain yield, biomass yield, gross margin, normalised difference vegetation index (NDVI), and site soil characteristics. The Rural Solutions 'Farm Gross Margin and Enterprise Planning Guide' was used to calculate gross margin, using actual inputs in the trial and values provided in the gross margin guide. Crop safety level is determined by crop response to herbicide application.

In addition to herbicide treatments, Sprayseed was applied to the trial site prior to sowing. Sowing was conducted on 22 June 2018 using an experimental plot seeder with 27 cm row spacings. Incorporated by sowing (IBS) and post-sowing pre-emergent (PSPE) herbicide treatments were applied on 22 June 2018. Post-emergent herbicide treatments were applied on 1 August 2018. Biomass cuts were taken on 21 September 2018 at early flowering. Harvest was conducted on 16 November 2018. Data was analysed using Genstat 19th Edition.

Table 1 Lentil herbicide treatments compared in the trial. IBS = incorporated by sowing, PSPE = post-sowing pre-emergent.

Chemical	Application Timing	Application Rate	
		Low	High
Metribuzin 750 g/kg	IBS	150 g	280 g
Metribuzin 750 g/kg	PSPE	150 g	180 g
Diuron 900 g/kg	IBS	500 g	1000 g
Diuron 900 g/kg	PSPE	550 g	800 g
Terbuthylazine 750 g/kg	IBS	500 g	1000 g
Terbuthylazine 750 g/kg	PSPE	500 g	860 g
Chemical A*	IBS	1.0x	1.5x
Chemical A*	PSPE	0.7x	1.0x
Chemical B*	PSPE	1.0x	1.6x
Chemical B*	Post-emergent	1.0x	1.6x
Chemical C*	PSPE	1.0x	1.5x
Chemical C*	Post-emergent	1.0x	1.5x

** Note that some herbicides are currently unregistered for use in lentil and these treatments were included for experimental purposes only. The results within this document do not constitute a recommendation by the author or author's organisation for that particular use.*
A reminder that any off-label herbicide use can result in crop damage, and product label rates, permits, plant-back periods and directions for use must be adhered to.

What happened?

Dry seasonal conditions, combined with low levels of stored soil moisture (2-12%), were experienced across many cropping regions of South Australia in 2018. Minnipa experienced below average rainfall from February to July. For this reason, sowing was delayed until late June following 28 mm of rainfall in the two weeks prior. Minimal rainfall (0.04 mm) was recorded following sowing and the first two herbicide application timings. Lentil emergence occurred on 9 July 2018. In the week following post-emergent herbicide treatments (August 1-7), 43 mm of rainfall was recorded.

Application rate, regardless of herbicide used, affected biomass yield response of PBA Hurricane XT at Minnipa in 2018. Higher herbicide rates resulted in lower biomass yield (0.62 t/ha) compared to low herbicide rates (0.82 t/ha), as could be expected. However, interactions between application rate and herbicide had similar biomass yield responses (P=0.705). Combinations of herbicide and application timing did affect biomass yield at Minnipa, 2018 (Figure 1). Terbuthylazine applied post-sowing pre-emergent (PSPE) had the lowest biomass yield compared to all other herbicide treatments, including Terbuthylazine incorporated by sowing (IBS). This result supports the recommended IBS use of Terbuthylazine reported on the label. Metribuzin and Diuron, applied both PSPE and IBS, had 37-82% higher biomass yield than Terbuthylazine. This indicates that Metribuzin and Diuron have increased safety levels for use in lentil (58-466% higher biomass yield), compared to Terbuthylazine.

The mean site grain yield for PBA Hurricane XT was 0.71 t/ha. The interactions between herbicide and application rate did not have observable differences for grain yield at Minnipa, 2018 (P=0.94). However, combinations of herbicide and application timing did affect grain yield response (Figure 2), as previously observed for biomass yield. Terbuthylazine applied PSPE had lower grain yield than all other herbicide treatments, including Terbuthylazine IBS. Terbuthylazine IBS had similar grain yield response to Diuron IBS, but 13-18% lower than Diuron applied PSPE and both Metribuzin application timings. Comparable grain yield responses were observed for Metribuzin applied PSPE and IBS, and Diuron applied PSPE. Diuron IBS had similar grain yield to Metribuzin IBS and Diuron applied PSPE, but 14% lower than Metribuzin applied PSPE.

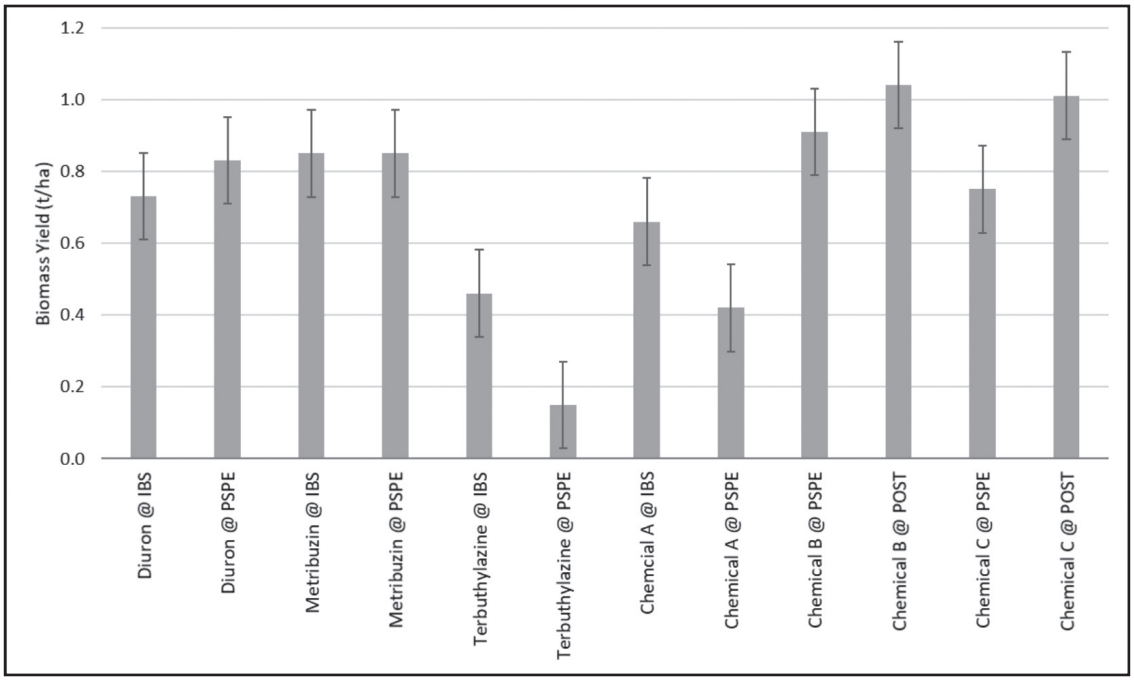

Figure 1 Biomass yield response of PBA Hurricane XT lentil to combined herbicide and application timing at Minnipa, 2018. Error bars represent least significant difference (0.24 t/ha).

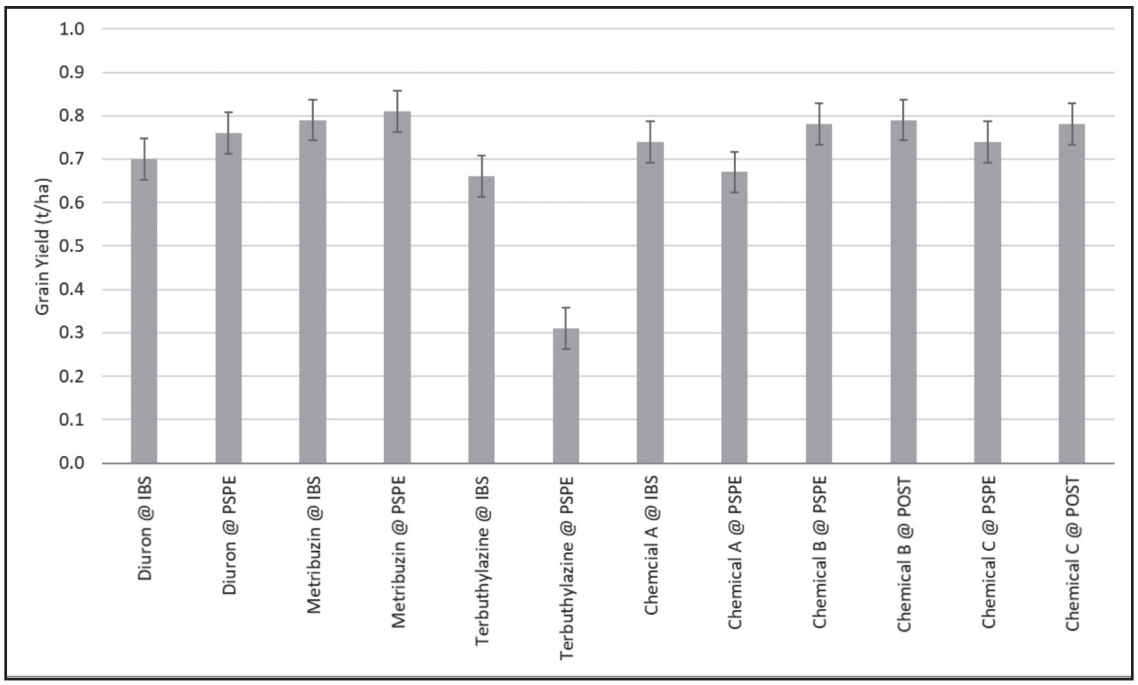

Figure 2 Grain yield response of PBA Hurricane XT lentil to combined herbicide and application timing at Minnipa, 2018. Error bars represent least significant difference (0.095 t/ha).

Interactions between herbicide and application rate had similar gross margin responses at Minnipa in 2018 (P=0.892). However, the combination of herbicide and application timing did influence gross margin response (Figure 3). Metribuzin applied PSPE ($138/ha) and IBS ($132/ha) resulted in equal highest gross margins. However, there was no reduction in profit from applying Chemical B, Chemical C or Diuron applied PSPE at Minnipa in 2018. There was also no difference in gross margin response between Diuron applied PSPE and IBS. However, the application of Diuron IBS ($91/ha) resulted in a lower gross margin than Metribuzin IBS ($132/ha). In summary, although application of Diuron IBS had similar grain yield and biomass yield responses compared to Metribuzin IBS, it was less profitable. Therefore, if IBS timing is preferred over PSPE, the use of Diuron is of higher economic risk than Metribuzin. Terbuthylazine applied to lentil was the least profitable herbicide, particularly when applied PSPE (-$78.10/ha). Terbuthylazine IBS had a similar gross margin to Diuron IBS and therefore has higher economic risk than the use of Metribuzin.

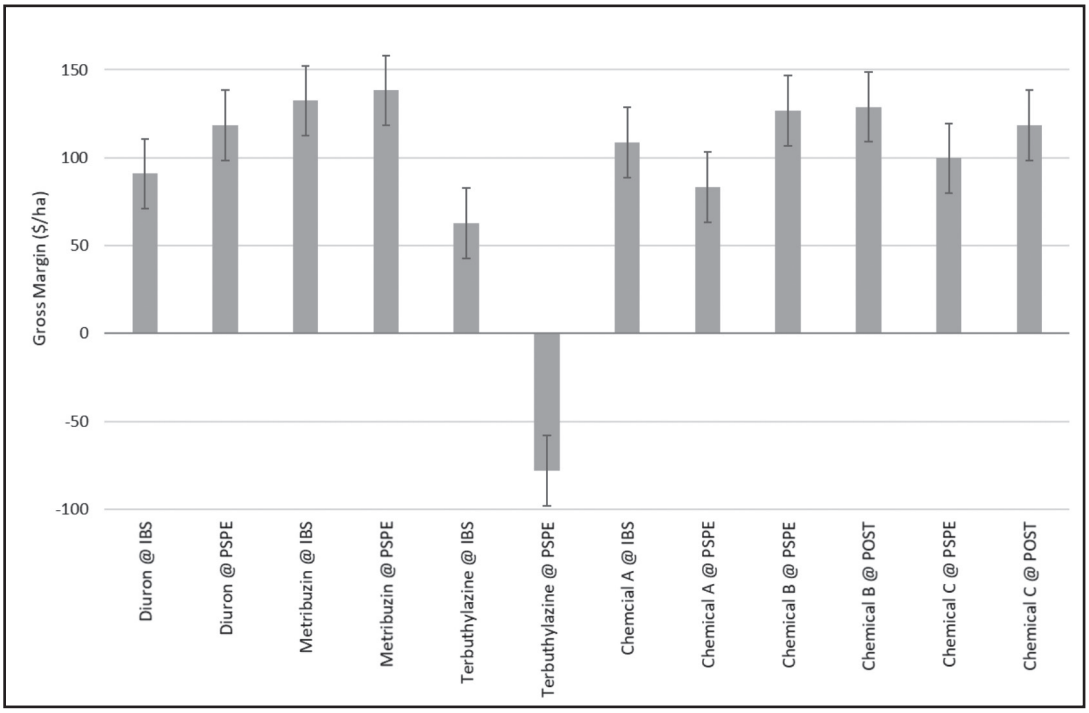

Figure 3 Gross margin response of PBA Hurricane XT lentil to combined herbicide and application timing at Minnipa, 2018. Error bars represent least significant difference ($39.81/ha).
Note: Gross margins represent average case scenarios and should be used as a guide only.

What does this mean?

Herbicide choice and application timing is important to reduce risk associated with lentil production in low rainfall environments, particularly as lentil is sensitive to herbicide use in dry conditions. Terbuthylazine expressed a lower safety level and higher economic risk than Diuron and Metribuzin in lentil at Minnipa in 2018, with lentil generally more sensitive to Terbuthylazine than other pulse crops. The use of Diuron or Metribuzin was lower risk in this environment, with biomass yield 58-466% and grain yield 6-161% higher than Terbuthylazine treatments. If IBS application is preferable to PSPE application, Metribuzin was a lower risk option than Diuron in this environment. However, if applying herbicide PSPE, economic and production risk was similar for Diuron and Metribuzin and either option would be suitable. The experimental herbicides used in this trial show potential safe use in lentil and a lower risk than use of Terbuthylazine. If registration occurs for the use of these experimental herbicides in lentil, they have potential for safe control of weeds when applied in-crop to herbicide-tolerant (XT) lentil varieties.

This report only contains results from one season at Minnipa, and any conclusions drawn do not apply to other low rainfall environments and seasons at this stage. For this reason, replicated trials were established at multiple locations across the southern low rainfall zone in 2018 and will be continued in 2019. Collated data obtained from multiple low rainfall environments will validate this research.

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