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Pre-emergent herbicide management for pulse crops in Southern NSW

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Key Messages

- A series of trials were established near Buronga in south west NSW in 2017 to investigate safety margins of registered pre-emergent herbicides and the effectiveness of agronomic strategies to minimise the risk of damage to chickpea, lentil and field pea crops.
- The application of metribuzin at high rates resulted in yield losses across all pulse crops and reduced profitability.
- The application of diuron, terbuthylazine and simazine were not found to cause significant damage or yield loss, however very dry weather in winter did not provide favorable conditions for herbicide damage and therefore trials such as this need to be repeated over several seasons to reach a conclusion on herbicide safety.
- There was a benefit to sowing at 6 cm rather than 3 cm giving an average 25% increase in grain yield across the three pulse crops.
- Applying herbicide IBS (incorporated by sowing) with a no-till system rather than applying PSPE (post sow pre-emergent) also improved crop safety.

Background

Pulse crops such as chickpea, lentil and field pea have become an important component of crop sequences in the Mallee dryland cropping region of south western NSW. While they have become an established part of the rotation, refining crop agronomy for local conditions remains a challenge. One priority for Mallee pulse crop farmers is to gain a better understanding of the implications of applying pre-emergent herbicide.

Aim

The cropping region in south western NSW is a dry environment (<350 mm annual rainfall) characterized by sandy loam soil types and a coarse textured surface layer. Dry sandy soils are a known risk factor for crop damage caused by pre-emergent herbicides, especially soluble group C herbicides that can wash into the seed furrow with rainfall soon after sowing. Therefore, the aim of these trials was to improve farmer understanding of:

- Safe rates of application for commonly used pre-emergent herbicides registered for use in each specific pulse crop
- Management strategies that can be employed by farmers to increase the safety of pre-emergent herbicide use in pulse crops: sowing depth and timing of herbicide application (pre or post sowing)

About the trial

Six separate trials were developed to investigate the impact of herbicide rate or agronomic management strategies on productivity of chickpea (Table 1 and 4), lentil (Table 2 and 5) and field pea (Table 3 and 6).

All six trials were sown between the 3rd and 4th of June 2017 at a site located approximately 20 km east of Buronga on a red sandy loam soil type that is typical of the south western NSW cropping region. A knockdown herbicide was applied to the site prior to sowing. The trials were sown using a no-till plot seeder with 6 rows at 28 cm row spacing. Single super was applied at a rate of 100 kg/ha to all treatments. Chickpea (var. Genisis 090), Lentil (var. PBA Jumbo2) and Field Pea (PBA Wharton) were sown at 90 kg/ha, 50 kg/ha and 100 kg/ha respectively.

Throughout the season the site was managed to keep it free of grass weeds, insects and disease. The site was baited for mice both post sowing and throughout the season.

In each trial, sprinkler irrigation was used to simulate rainfall following herbicide application. This irrigation simulated an intense 17 mm rainfall event and was applied in the few days following sowing, prior to the emergence of the pulse crops.

All treatments were measured throughout the season using both quantitative and qualitative assessments.

The key measurements undertaken on each trial were plant establishment, Normalised Differential Vegetation Index (NDVI): measured using a GreenSeeker®, herbicide damage and grain yield.

Table 1. *Treatments for the chickpea pre-emergent herbicide safety trial. All herbicides were incorporated by sowing (IBS). Post sowing rainfall was simulated using a traveling irrigator to apply approximately 17 mm of water.*

Trial	Crop	Herbicide	Rates	Irrigation
1	**Chickpea**	Nil	Nil	+/-
		Simazine (900 g/kg)	Low Label – 800 g/ha High Label – 1100 g/ha 2x Label – 2200 g/ha	+/-
		Diuron (900 g/kg)	Low Label – 830g/ha High Label – 1100 g/ha 2x Label – 2200 g/ha	+/-
		Metribuzin (750 g/kg)	Low Label – 180g/ha High Label – 280 g/ha 2x Label – 560 g/ha	+/-
		Terbuthylazine (850 g/kg)	Low Label – 860g/ha High Label – 1200 g/ha 2x Label – 2400 g/ha	+/-
		Isoxaflutole (750 g/kg)	Label – 100 g/ha 2x Label – 2400 g/ha	+/-
		Simazine (900 g/kg) + Isoxaflutole (750 g/kg)	Label – 800 g/ha + 100 g/ha	+/-

Table 2. *Treatments for the lentil pre-emergent herbicide safety trial. All herbicides were incorporated by sowing (IBS). Post sowing rainfall was simulated using a traveling irrigator to apply approximately 17 mm of water.*

Trial	Crop	Herbicide	Rates	Irrigation
2	**Lentil**	Nil	Nil	+/-
		Diuron (900 g/kg)	Low Label – 830g/ha High Label – 1100 g/ha 2x Label – 2200 g/ha	+/-
		Metribuzin (750 g/kg)	Low Label – 180g/ha High Label – 280 g/ha 2x Label – 560 g/ha	+/-
		Terbuthylazine (850 g/kg)	Low Label – 860g/ha High Label – 1200 g/ha 2x Label – 2400 g/ha	+/-

Table 3. *Treatments for the field pea pre-emergent herbicide safety trial. All herbicides were incorporated by sowing (IBS). Post sowing rainfall was simulated using a traveling irrigator to apply approximately 17 mm of water.*

Trial	Crop	Herbicide	Rates	Irrigation
3	**Field Pea**	Nil	Nil	+/-
		Diuron (900 g/kg)	Low Label – 830g/ha High Label – 1100 g/ha 2x Label – 2200 g/ha	+/-
		Metribuzin (750 g/kg)	Low Label – 180g/ha High Label – 280 g/ha 2x Label – 560 g/ha	+/-
		Terbuthylazine (850 g/kg)	Low Label – 860g/ha High Label – 1200 g/ha 2x Label – 2400 g/ha	+/-

Table 4. *Treatments for the chickpea agronomic strategies trial. Pre-emergent herbicides were either incorporated by sowing (IBS) or applied post sowing pre-emergent (PSPE). Seed was sown at a depth of 3 or 6 cm. Post sowing rainfall was simulated using a traveling irrigator to apply approximately 17 mm of water.*

Trial	Crop	Herbicide	Rates	Application	Seeding Depth	Irrigation
4	**Chickpea**	Nil	Nil	Nil	3 or 6 cm	+/-
		Simazine (900 g/kg)	800 g/ha	IBS or PSPE	3 or 6 cm	+/-
		Diuron (900 g/kg)	830g/ha	IBS or PSPE	3 or 6 cm	+/-
		Metribuzin (750 g/kg)	180g/ha	IBS or PSPE	3 or 6 cm	+/-
		Terbuthylazine (850 g/kg)	860g/ha	IBS or PSPE	3 or 6 cm	+/-
		Isoxaflutole (750 g/kg)	100 g/ha	IBS or PSPE	3 or 6 cm	+/-
		Simazine (900 g/kg) + Isoxaflutole (750 g/kg)	800 g/ha + 100 g/ha	IBS or PSPE	3 or 6 cm	+/-

Table 5. *Treatments for the lentil agronomic strategies trial. Pre-emergent herbicides were either incorporated by sowing (IBS) or applied post sowing pre-emergent (PSPE). Seed was sown at a depth of 3 or 6 cm. Post sowing rainfall was simulated using a traveling irrigator to apply approximately 17 mm of water.*

Trial	Crop	Herbicide	Rates	Application	Seeding Depth	Irrigation
5	**Lentil**	Nil	Nil	Nil	3 or 6 cm	+/-
		Diuron (900 g/kg)	830g/ha	IBS or PSPE	3 or 6 cm	+/-
		Metribuzin (750 g/kg)	180g/ha	IBS or PSPE	3 or 6 cm	+/-
		Terbuthylazine (850 g/kg)	860g/ha	IBS or PSPE	3 or 6 cm	+/-

Table 6. *Treatments for the field pea agronomic strategies trial. Pre-emergent herbicides were either incorporated by sowing (IBS) or applied post sowing pre-emergent (PSPE). Seed was sown at a depth of 3 or 6 cm. Post sowing rainfall was simulated using a traveling irrigator to apply approximately 17 mm of water.*

Trial	Crop	Herbicide	Rates	Application	Seeding Depth	Irrigation
6	**Field Pea**	Nil	Nil	Nil	3 or 6 cm	+/-
		Diuron (900 g/kg)	830g/ha	IBS or PSPE	3 or 6 cm	+/-
		Metribuzin (750 g/kg)	180g/ha	IBS or PSPE	3 or 6 cm	+/-
		Terbuthylazine (850 g/kg)	860g/ha	IBS or PSPE	3 or 6 cm	+/-

Results & Discussion

Metribuzin was identified herbicide most likely to cause damage to all three pulse crops tested (lentil, chickpea and field pea). However significant damage only occurred at higher rates and not the lower label rates that are most commonly used on the sandy soils of the south western NSW Mallee region. Isoxaflutole also showed the potential to damage chickpea.

Figure 3 demonstrates that crop damage from metribuzin applied at the 2x rate resulted in a large economic loss for each pulse. Relative to the low rate treatment, applying the double rate to lentils and field pea's reduced gross margins by $70-$80/ha, while the 2x treatment applied to chickpea resulted in a loss of $264/ha. Therefore farmers should try to minimize the risk of damage from these herbicides where high rates could be applied, such as double overlap and headlands. It is recommended that technology such as high accuracy auto steers and automatic section control systems be used.

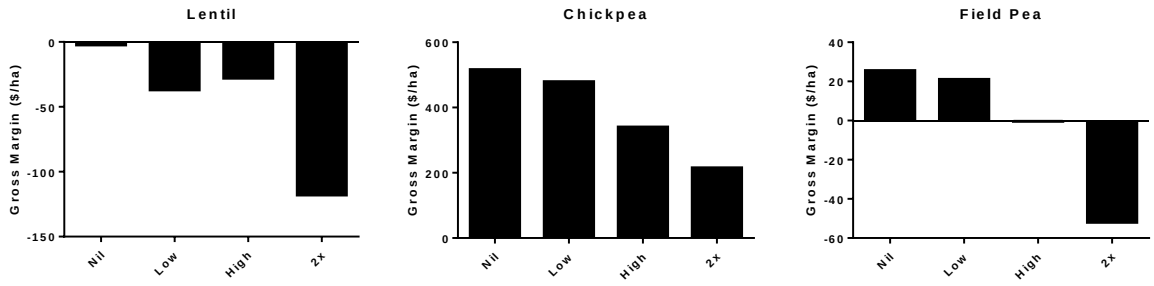

***Figure 3**. Gross margin analysis of the impact of increasing rate of metribuzin (nil, low (180 g/ha), high (280 g/ha), 2x (560 g/ha)) on lentil, chickpea and field pea.*

Gross margins based on January 2018 grain prices of $420/t for Lentil $900/t for Kabuli chickpea and $285/t for field pea. Prices and costs sourced from the 2018 Farm Gross Margin and Enterprise Planning Guide 2018 (https://grdc.com.au/resources-and-publications/all-publications/publications/2018/farm-gross-margin-and-enterprise-planning-guide-2018)

The application of diuron, terbuthylazine and simazine did not affect the crop when applied at any rate in these trials. This was somewhat unexpected as the terbuthylazine in particular warns against the use of higher rates in Mallee soils. However, seasonal conditions following sowing were not conducive to herbicide damage with dry weather persisting for more than two months following sowing and therefore lack of rain to move the chemical into the root zone. We applied a spray irrigation to try and simulate a heavy rainfall event following sowing, however this did not have a significant interaction with any of the herbicide treatments in any of the trials. It appears that the sprinkler irrigation was not as effective as anticipated at replicating an intense rainfall event.

One of the consistent findings was the benefit of sowing each of the pulse crops at 6 cm rather than 3 cm. Sowing deep resulted in improved vegetative growth, less herbicide damaged and greater grain yield for each pulse crop. On average this led to a 25% increase in grain yield across the three pulse crops. Therefore, based on these trials and past research, farmers should sow this pulse crops deep (>5cm) in all circumstances. Applying herbicide IBS with a no-till system rather than applying PSPE also improved safety.

Implications for commercial practice

Farmers in south western NSW should take steps to minimize the risk of crop damage when using pre-emergent herbicides in pulse crops grown on sandy loam soils, especially. Improved safety can be achieved from sowing pulse crops deep, using IBS in a no-till seeding system, and selecting low label rates. Furthermore, care should be taken to minimise the instances where high rates could be applied, such as areas of overlap or on headlands. Adoption of technology such as high accuracy autosteer and spray control systems can help to minimise these areas.

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