Safe recropping after Lontrel in winter crop systems in southern Australia

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Summary Lontrel* Herbicide (300 g a.e. L^{-1} clopyralid) has been widely used in southern Australia for control of weeds of the Asteraceae and Fabaceae families, in winter crops such as cereals and canola. It is commonly used at 75–150 mL ha^{-1} as a tankmix partner with other broadleaf herbicides in winter cereals, or at up to 300 mL ha^{-1} in canola. It has moderate persistence in the soil and is broken down by microbial activity. Breakdown is fastest under warm, moist soil conditions.

Concerns had been expressed about the potential of Lontrel to carryover to subsequent susceptible crops and cause injury. Dow AgroSciences conducted six trials to determine whether label recommendations for safe plantback periods for sensitive crops were valid.

Results showed that currently labelled plantback periods were safe for susceptible crops. Nine months was required for safe planting of sensitive crops after 300 mL ha^{-1} Lontrel was applied.

This paper summarises those trials and shows new recommendations for the registered product label.

Keywords Lontrel, plantback, winter crops, southern Australia.

INTRODUCTION

Since the introduction of Lontrel to the winter crop market in Australia, it has gained wide acceptance as a cost-effective, selective herbicide for control of certain annual broadleaf weeds in winter cereals and canola. Lontrel has excellent activity on Asteraceae and Fabaceae weeds, families that include some key weeds such as capeweed (*Arctotheca calendula* (L.) Levyns) and volunteer legumes.

In cereals it is commonly used as a tankmix partner at rates of 75–150 mL ha^{-1}, whilst in canola it is used at rates up to 300 mL ha^{-1}.

Use of these rates in either cereals or canola the season before planting susceptible legume crops has resulted in isolated cases of concern. In situations where very dry conditions occurred between application and the winter break the following year, Lontrel symptoms have sometimes been observed in germinating crops. Lontrel symptoms have been more obvious where straw was concentrated in 'header tracks' at harvest time and/or where stubble was left standing after the cereal was harvested.

This series of trials was completed to determine whether the current label statements for safe plantback periods were valid.

MATERIALS AND METHODS

Dow AgroSciences conducted six replicated field trials from 1990–1998, to determine safe plantback periods for susceptible crops to label rates of Lontrel applied in the previous year.

Sites were located in South Australia (SA) at Moonta, Hamley Bridge, Halbury (two trials) and in Victoria at Rupanyup (two trials).

Lontrel was applied to wheat or barley to simulate typical winter crop use. Treatments were applied early (at 3–4 leaf crop stage), late in the season (at late nodding to head apparent crop stage) or at both crop stages. Late applications were made to try to simulate potential worst case use, to induce injury in the crops sown the following year.

Lontrel was applied with an Azo precision gas powered small plot sprayers (or similar) at 100 L ha^{-1} spray volume, via flat fan nozzles in a single pass. Trials were randomised complete block designs with three or four replicates. Plots were 4 × 30 m or larger.

Rainfall and stubble management were monitored at each site. Rainfall was measured either on-farm, or at the nearest post office weather station and compared to the 100 year average rainfall for that area. Stubble management was either removal through tillage or burning, or retained after harvest. Table 1 shows the rainfall and stubble management regimes used in each trial.

Table 1. Rainfall data and stubble management regime for Lontrel plantback trials.

Trial	Stubble type	Stubble management	Rain (mm) from application to planting	Rain vs. 100 y average
Moonta (SA)	Barley	Removed	307	>
Hamley Bridge (SA)	Barley	Removed	449	>
Halbury (SA)	Barley	Retained	592	>
Halbury (SA)	Barley	Burnt / Retained	592	>
Rupanyup (Vic)	Wheat	Retained	307	<
Rupanyup (Vic)	Wheat	Retained	307	<

Susceptible crops including field pea (*Pisum sativum* L.), barrel medic (*Medicago truncatula* Gaertn.), snail medic (*Medicago scutellata* (L.) Mill.), vetch (*Vicia sativa* L. ssp. *sativa*), faba bean (*Vicia faba* L.), woollypod vetch (*Vicia villosa* Roth ssp. *eriocarpa* (Hausskn.) P.W.Ball), chickpea (*Cicer arietinum* L.) and Persian clover (*Trifolium resupinatum* L.) were assessed for injury 2–8 weeks after emergence, using a percent visual subjective assessment where 100 equalled complete crop loss. Injury was considered unacceptable if scored at more than 10%. These results are shown in Table 2 with the shaded areas showing unacceptable injury.

Harvest yields were taken from field pea and faba bean trials. Yields were only taken in trials where more than 10% injury was observed at label rates of Lontrel.

Table 2. Crop injury ratings (% visual) after Lontrel application in the previous season, taken from visual injury ratings in sensitive crops.

Site	Moonta	Hamley Bridge	Halbury	Halbury	Halbury	Halbury	Moonta	Hamley Bridge	Rupanyup	Rupanyup
Trial No.	915022PN	915040PN	975016PN	975016PN	975017PN	975017PN	915022PN	915040PN	983021DG	983021DG
Crop	**Field pea**						**Chickpea**			
Variety	Dun	Greenfeast	Alma	Alma	Alma	Alma	Amethyst	Amethyst	Dooen	Dooen
Soil type	Sl	Rbe	Rbe	Rbe	Rbe	Rbe	Sl	Rbe	Wc	Wc
Assess time	47 DAP	45 DAP	51 DAP	51 DAP	51 DAP	51 DAP	47 DAP	45 DAP	54 DAP	54 DAP
PBP (months)	**8.5**	**10**	**9**	**11**	**9**	**11**	**8.5**	**10**	**8**	**9.5**
Lontrel rate (mL ha^{-1})										
0	0	0	0	0	0	0	0	0	0	0
75	3.3	0	–	–	–	–	0	0	–	–
150	3.3	0	0	0	0	0	1.7	0	0	0
300	10	0	0	0	0	0	1.7	3.3	0	0
600	13	0	0	0	0	0	0	0	0	0
1200	33	0	–	–	–	–	16	0	–	–
LSD (P=0.05)	11	0	0	0	0	0	8.5	11.6	0	0

PBP = plantback period; DAP = days after planting; Sl = Sandy loam; Rbe = Red brown earth; Wc = Wimmera clay.

Table 2 (continued). Crop injury ratings (% visual) after Lontrel application in the previous season, taken from visual injury ratings in sensitive crops.

Site	Rupanyup	Rupanyup	Hamley Bridge	Hamley Bridge	Moonta	Moonta	Moonta	Hamley Bridge
Trial No.	983022DG	983022DG	915040PN	915040PN	915022PN	915022PN	915022PN	915040PN
Crop	**Faba bean**			**Vetch**		**Medic**		
Variety	Ascot	Ascot	Fiord	Languedoc	Namoi	Kelson	Kyambro	Paraggio
Soil type	Wc	Wc	Rbe	Rbe	Sl	Sl	Sl	Rbe
Assess time	126 DAP	126 DAP	45 DAP	45 DAP	47 DAP	47 DAP	47 DAP	45 DAP
PBP (months)	**7**	**9**	**10**	**10**	**8.5**	**8.5**	**8.5**	**10**
Lontrel rate (mL ha^{-1})								
0	0	0	0	0	0	0	0	0
75	–	–	0	0	0	0	0	0
150	0	1.3	0	6.7	0	0	0	0
300	0	2.5	0	1.7	0	0	0.6	0
600	20	9.3	0	0	9.2	0	0	0
1200	–	–	0	0	24.2	0	6.7	0
LSD (P=0.05)	3.1	3.1	0	10.9	11	9	11.6	0

PBP = plantback period; DAP = days after planting; Sl = Sandy loam; Rbe = Red brown earth; Wc = Wimmera clay.

Unacceptable yield effects were considered to have occurred either where yield was (statistically) significantly less than untreated control (P=0.05) or numerically less than or equal to 90% of untreated control. These results are show in Table 3 with the shaded areas showing unacceptable yield reduction.

RESULTS AND DISCUSSION

All trials showed that Lontrel could be safely applied the year before planting sensitive crops. This was irrespective of rate (up to 300 mL ha^{-1}) or stubble management regime, provided the minimum nine month plantback period was observed.

Lontrel rate and plantback time Tables 2 and 3 show that for all crops, rates of Lontrel up to 300 mL ha^{-1} were safe, provided a nine month plantback period was observed. Rates of twice (600 mL ha^{-1}) and four times (1200 mL ha^{-1}) the highest label rate were also safe to apply before planting sensitive crops in some trials.

Stubble management regime Stubble retention did not increase safe plantback period (see trial 975017PN where stubble was either retained or removed). Faba beans were injured at Rupanyup (trial 983022DG) where stubble was retained. However, this trial did not have the corresponding stubble removed plots. This trial showed that injury occurred where 600 mL ha^{-1} Lontrel was applied or where 300 mL ha^{-1} was applied and then crops were planted in seven months (less than label recommended time of nine months).

English research by Dow AgroSciences has also shown that residues of Lontrel can remain on cereal or canola stubble after application of high rates of clopyralid. In 1997, trials were conducted on canola (Butler 1999, unpublished data) and wheat (Butler 2000, unpublished data) which showed that significant residues could remain in crop stubble and be released by disturbance such as tillage.

Rainfall Four of the six sites had more than 100 year average rainfall for the duration of the trials. (In two trials this was only slightly higher than average). This may have led to greater breakdown of Lontrel than if average rainfall had occurred.

Though not thoroughly tested in this series of trials, previous experience has shown that dry conditions over summer in southern Australia are where symptoms of Lontrel carryover are more likely.

To ensure the safe planting of sensitive crops, the following label statements will be added to the new Lontrel label.

Plant back periods Residues in the straw of treated crops can affect the establishment of subsequent

Table 3. Chickpea, faba bean and field pea yield after Lontrel application in the previous season (t ha^{-1}).

Site	Stubble management	Halbury	Halbury	Halbury	Halbury	Rupanyup	Rupanyup
Trial No.		975016PN	975016PN	975017PN	975017PN	983022DG	983022DG
Crop		**Field pea**				**Faba bean**	
Variety		Alma	Alma	Alma	Alma	Ascot	Ascot
Soil type		Rbe	Rbe	Rbe	Rbe	Wc	Wc
Assess time		Harvest	Harvest	Harvest	Harvest	Harvest	Harvest
PBP (months)		**9**	**11**	**9**	**11**	**7**	**9**
Lontrel rate (mL ha^{-1})							
0	Retained	–	–	2.48	2.26	0.85	0.74
150	Retained	–	–	2.56	2.46	0.76	0.7
300	Retained	–	–	2.56	2.59	0.66	0.67
600	Retained	–	–	2.38	2.5	0.28	0.37
0	Removed	1.69	1.54	2.34	2.24	–	–
150	Removed	1.72	1.61	2.41	2.46	–	–
300	Removed	1.61	1.68	2.57	2.48	–	–
600	Removed	1.63	1.52	2.42	2.27	–	–
LSD (P=0.05)		0.24	0.24	0.29[1]	0.39[2]	0.19	0.19

[1] LSD for stubble retained trial 975017PN.
[2] LSD for stubble removed trial 975017PN.
Rbe = Red brown earth; Wc = Wimmera clay.

susceptible crops. Lontrel is broken down by microbes in soil and is faster where warm, moist conditions prevail. It may also persist in crop stubble from one season to the next under dry conditions. Where dry conditions have occurred from the time of application to planting of the subsequent crop Dow AgroSciences recommends.

- Conduct a field bioassay – plant a small area of the susceptible crop four to six weeks before desired planting date and observe for any symptoms of injury.
- Stubble – ensure that harvesters effectively spread crop stubble and do not leave a concentrated 'header trail' after harvest. Burn (if legal in the area), bale and remove or incorporate stubble to reduce the possibility of Lontrel residue from stubble affecting the subsequent crop. Incorporate stubble more than two months prior to planting susceptible crop and preferably soon after harvest of the crop treated with Lontrel 750SG.
- Timing – spray cereals before the nodding stage and canola before the eight leaf stage commences, in the preceding winter crop. This allows greater time for soil breakdown to occur.

CONCLUSIONS

Lontrel at up to 300 mL ha^{-1} applied in the preceding crop with plantback periods of nine months, allowed safe planting of susceptible legume crops. This validates the current Lontrel label. Stubble management had little effect in this series of trials on safe plantback period.

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