

Persistence of the herbicide clopyralid in Eyre Peninsula soils

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Location
Minnipa
Minnipa Agricultural Centre, S2

Rainfall
Av. Annual: 325 mm
Av. GSR: 241 mm
2021 Total: 406 mm
2021 GSR: 248 mm

Soil type
Red sandy loam

Paddock History
2020: Wheat
2019: Pasture
2018: Barley

Location
Poochera
P Carey

Rainfall
Av. Annual: 326 mm
Av. GSR: 247 mm
2021 Total: 283 mm
2021 GSR: 143 mm

Paddock History
2020: Volunteer pasture
2019: Wheat
2018: Volunteer pasture

Soil type
Grey highly calcareous sandy loam

Key messages

- **Clopyralid herbicide carryover may harm some legumes - a sensitivity ranking of species to the herbicide has been established.**
- **Clopyralid carryover from 2020 to early 2021 was significantly lower than the previous season at four EP sites and was unlikely to affect legume crops.**
- **Higher rainfall was the likely reason for more rapid clopyralid dissipation in the 2020-21 season than the previous season.**

Why do the trial?

The overall aims of this work are to determine the persistence of clopyralid herbicides over multiple seasons in different soil types and whether soil borne residues will injure subsequent crops.

Clopyralid has been identified by growers as a potential cause for plant-back issues constraining crop rotations on the Eyre Peninsula. It is difficult for growers and advisors to predict whether clopyralid residues will cause issues beyond the “label” plant-back period, because its behaviour depends on numerous site-specific factors, including soil (texture, chemistry, organic matter, microbial activity), stubble and climatic conditions. This is the second season of measuring clopyralid persistence in soils of the Eyre Peninsula. In the previous season (EPFSS 2020, p. 107) we found clopyralid residues at all sites 6 months after application (i.e. in Jan 2020) in the order of 2-5 ng/g (i.e. 0.002-0.005 mg/kg). Comparison of these concentrations to toxicity thresholds that we had previously derived for crop seedlings suggested a potential risk of injury to field pea and lentil crops. Here we report the persistence of clopyralid applied in the 2020 crop through to sowing of the 2021 crop at four different sites on the Eyre Peninsula and compare these results to the previous season.

How was it done?

The persistence of clopyralid was measured at four field sites during the 2020 growing season through until mid-2021. Site details, including soil characteristics and herbicide applications are provided in Table 1.

Four soil samples at two depths: 0-10 cm and 10-30 cm comprising of homogenised sub-samples were taken from quarter grids within a 100 m by 100 m georeferenced grid at participating farmer paddocks prior to sowing the 2020 winter crop (May 2020). Repeated soil sampling occurred throughout 2020 and 2021 after the in-crop application of clopyralid according to the following schedule: 1, 7, 21, 42, 84, 168, 364 days (d) after herbicide application. Soil samples were refrigerated and transported to NSW DPI, where they were dried at 40°C and then stored frozen until analysis for herbicide residues. Herbicides were extracted from soils, derivatised and analysed via GC-MS, with spike-recoveries for each soil type to ensure satisfactory sensitivity, accuracy and precision. Sample analysis results are presented for the samples taken 168 d after application, which were taken in January 2021.

What happened?

Six months after clopyralid application, the average clopyralid concentration in topsoil (0-10 cm) at three of the four sites was below 1.0 ng/g, which is the limit of quantification of the analytical method (Table 3). Residues were only consistently detected at low levels (average of 1.1 ng/g) at the SA3 Minnipa site. These values are significantly lower than the levels of clopyralid in samples taken at a similar time in the previous season, 6 months after application in 2019 (Table 3). Concentrations of clopyralid in the 10-30 cm soil depth were also below the limit of quantification (< 1.0 ng/g).

Table 1. Site locations, soil type and cropping details.

Site	Location	Soil type	Product	Date of Application	Product Rate (L/ha)
SA1	Minnipa	Red loam	Lontrel® Advanced 600	23 June 2020	0.04
SA2	Poochera	Grey alkaline sandy loam	Lontrel® Advanced 600	16 July 2020	0.03
SA3	Minnipa	Sand	Lontrel® Advanced 600	6 July 2020	0.045
SA4	Kimba	Sand	Lontrel® Advanced 600	16 July 2020	0.1

Table 2. Preliminary phytotoxicity dose thresholds (ng/g) for 20% shoot biomass reduction (ED20) for different crop species growing in Minnipa sandy loam spiked with clopyralid. Thresholds are for 21 d old seedlings (EPFSS 2020, p. 108).

Species	Clopyralid concentration (ng/g)
Lentil	3.4
Field pea	1.9
Lupin	54
Chickpea	6.2
Faba bean	25

Table 3. Concentration of clopyralid in topsoil (0-10 cm) at different sites taken in January 2020 (previous season results) and January 2021 (this season results), at approximately 6 months after clopyralid application.

Year of soil sample	ID	Location	Clopyralid application date	Clopyralid application rate (g/ha)	Rainfall 0-180 d post-spray (mm)	Mean clopyralid concentration @ 180d after application (ng/g) (n=3)	Higher risk crops
2020	SA1	Minnipa	25 June 2019	45	120	4.2	Lentil, Field pea
2020	SA2	Poochera	25 June 2019	30	75	3.8	Lentil, Field pea
2020	SA3	Minnipa	23 July 2019	27	108	4.9	Lentil, Field pea
2020	SA5	Mt Cooper	4 July 2019	24	117	3.3	Field pea
2021	SA1	Minnipa	23 June 2020	40	204	<1.0	-
2021	SA2	Poochera	16 July 2020	18	217	<1.0	-
2021	SA3	Minnipa	6 July 2020	27	158	1.1	-
2021	SA4	Kimba	16 July 2020	60	214	<1.0	-

The clopyralid concentrations in the January 2021 soil samples were lower than all legume toxicity thresholds (Table 2) and were unlikely to affect any crops during the 2021 season. This is in contrast to the clopyralid concentrations detected in the January 2020 samples, which may have impacted lentil or field pea seedlings sown at those sites.

What does this mean?

The results from two seasons of monitoring clopyralid residues in the summer fallow prior to sowing demonstrate the dominant influence that rainfall has on dissipation of herbicides with residual properties like clopyralid. In the 2020-21 season, rainfall was 50-100% higher than the previous

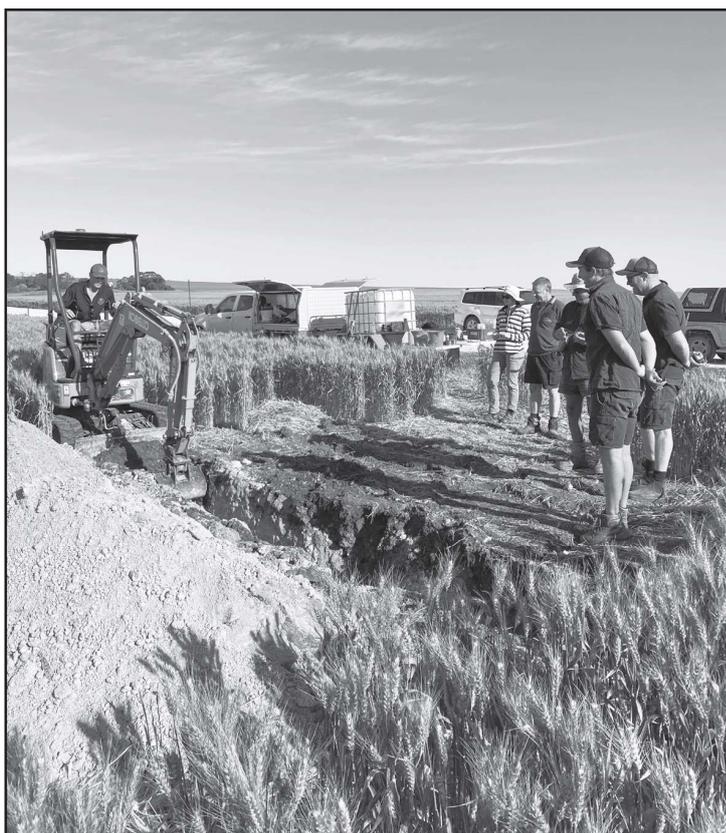
season at each of the sites. This meant that although residue levels were still detectable at 84 d after application (data not shown), residues had fully dissipated to negligible levels by 168 d after application.

This data reinforces product labels that emphasise the importance of rainfall, particularly in the summer months, for sufficient clopyralid breakdown to ensure protection for subsequent crops. Our data also shows that soil testing for herbicide residues can increase confidence in the decision-making process, particularly if crop toxicity thresholds are available for representative soil types. More information and advice for soil and plant testing for herbicide residues

will be provided at the conclusion of this project in April 2022, with details available on the Soil CRC Website (see below for weblink).

Acknowledgements

This work has been supported by the Cooperative Research Centre for High Performance Soils whose activities are funded by the Australian Government's Cooperative Research Centre Program, as part of the 'Improved management of herbicide residues in soil' Project (Project 4.2.001). More information https://soilcrc.com.au/current-projects/#project_4_2_001 Thanks to Lee Kearney, Terry Rose, Scott Petty, Kelvin Spann, Ian Richter and Katrina Brands for technical support.



Digging a soil pit at Brimpton Lake for soil characterisation, 2021.



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