SIMAZINE "TOP UP" FOR WILD RADISH CONTROL IN LUPINS

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Summary. Simazine residue data provided the basis for the timing of a post emergence "top up" application to wild radish, *Raphanus raphanistrum*, infested lupins. The object was to restore herbicide lost since the initial pre-emergence application and to avoid crop phytoxicity. Soil analysis showed that 4-5 weeks was a good approximation of the half-life of simazine at the study site. The "top up" spray reduced both radish plant numbers in the crop and contamination in the grain, without reducing grain yield.

INTRODUCTION

Wild radish is not controlled adequately in lupins with any herbicide now used. Even though simazine and simazine+atrazine mixtures can substantially reduce wild radish populations, large areas of otherwise suitable lupin growing land are so heavily infested that survivors may still reduce grain yield, interfere with harvesting, and contaminate grain. Crop phytoxicity prevents growers from increasing the rate of herbicide in order to improve weed control.

There are two hypotheses regarding the origin of the survivors: firstly, wild radish emerges several weeks after the crop is sown by which time simazine has degraded to a sublethal level; and secondly, when the weed emerges with the crop it avoids the simazine that has become unevenly distributed in the soil. Simazine applied as a post-emergence spray has the potential to control wild radish that survives a pre-emergence spray.

This paper reports the results of a study on wild radish in lupins where residue data was used to estimate the half-life of simazine, so that the herbicide loss could be restored with a post-emergence application of half the initial pre-emergence rate.

METHODS

Simazine degradation. At Wongan Hills and Avondale in 1983 and 1984, plots were treated with 1 and 5 kg a.i. ha^{-1} and the herbicide incorporated by hand raking. Samples were taken at 1, 3, 8, 16, 32, ...256 days after application to generate an annual breakdown pattern.

At Goomalling in 1986, a plot was treated with 0.75 kg ha^{-1} and the herbicide incorporated by blending in a concrete mixer. Samples were taken weekly for about 14 weeks as degradation during early crop growth was of prime interest.

Simazine concentration was determined by methanol extraction and gas chromatography (1). Results are expressed as a percentage of the simazine applied to the soil.

Simazine "top up' experiment. A field trial was established at Goomalling, W.A. (approx. 120 km N.E. of Perth) in 1986 on a yellow loamy sand (pH 6.1 (water); 65% coarse sand, 22% find sand, 1% silt, 12% clay) using a split plot design with three replications, each plot being 5.7x30 m. The two main treatments were: (a) Lupins sown into dry weed free soil on May 7; and (b) Lupins sown into moist weed free soil on May 28 following 2 L ha^{-1}

Spray.Seed[R] on May 26. The sub-treatments were the herbicides shown in Table 1. Post-emergence sprays (PE) were applied at four week intervals after seeding.

Broad-leaved weeds were counted 11-13 weeks after the crop was sown and grass weeds were sprayed post-emergence with fluazifop. After harvest, wild radish seed pods were removed from the grain and calculated as a percentage (w/w) of the uncleaned grain. Grain yields shown in Table 1 are clean grain yields.

RESULTS AND DISCUSSION

Simazine degradation. The results are shown in Fig. 1. Although it is generally accepted that simazine degradation follows first order kinetics, the climatic variation at any site, means that a simple exponential curve will never be more than an approximation. (See Walker *et al.* (2, 3) who have developed more complex models). Given that lupins are normally sown in May at the break of the season, the actual values shown in Fig. 1 could be more typical than the generalised curve. Degradation in warm, moist soil would be rapid, perhaps slowing if a dry period followed, and slower in winter as soil temperatures fall. Nevertheless, all data indicates that a half-life of 4-5 weeks is a good approximation and will be sufficiently accurate for setting "topping up" intervals.

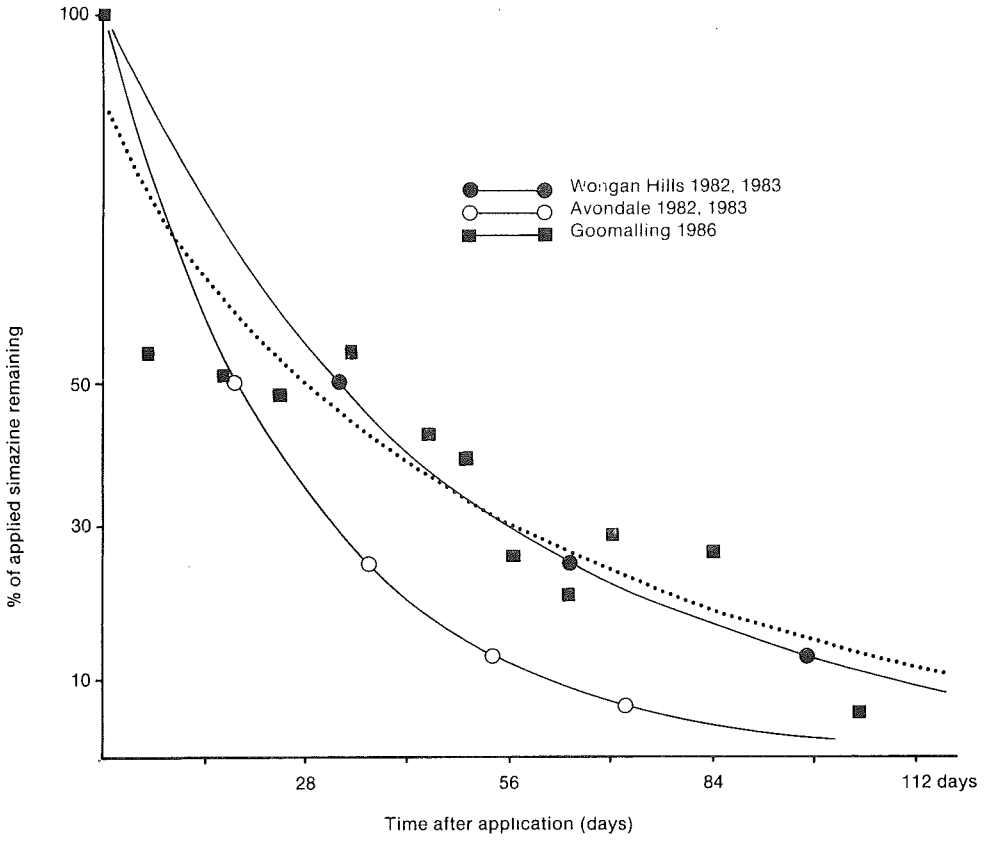

Figure 1. Degradation curves for simazine at Avondale in 1982 and 1983, Wongan Hills in 1982 and 1983, and Goomalling in 1986. Curves for Avondale and Wongan Hills are based on the mean of six replicates; the curve for Goomalling is based on the actual data points shown. The half-life of simazine was: Avondale, 18 days; Wongan Hills, 32 days; Goomalling, 39 days.

Simazine "top up" experiment. All herbicides substantially reduced wild radish in the lupins (Table 1). Simazine applied pre-seeding was less effective in the wet sown lupins than that applied to the dry sown crop. There is no clear explanation for the relativity poor efficacy of simazine applied to the moist soil, as it is usually more effective in moist soil than when it is applied to dry soil. Topping up with simazine on the wet sown crop further reduced the wild radish population and was equally as effective as the simazine plus atrazine pre-seeding herbicide. No significant difference was detected between the herbicides applied to the dry sown crop even though the radish seedling counts are in the same ranked order as for wet sown lupins where "top up" was significantly better than the simazine applied immediately before seeding.

Table 1. Effect of planting time and various simazine applications on wild radish density, lupin grain yield, and wild radish contamination of the lupin grain[a]

Treatment	Radish density		Lupin grain yield	Radish contamination	
	Dry sown	Wet sown		Dry sown	Wet sown
(g/ha)	(plants/m^2)		(kg/ha)	(% w/w)	
Nil	28.0 a	20.0 b	1199 a	14.9 b	27.2 a
Simazine 750 IBS[b]	2.4 def	6.7 c	1779 c	1.6 cde	4.8 c
Simazine 375 + atrazine 375 IBS	2.5 def	4.0 cde	1775 c	3.4 c	2.9 cd
Simazine 750 IBS + 375 PE[c] ("top up")	1.7 def	2.5 def	1800 c	0.5 de	0.8 de
Simazine 750 IBS + 375 PE (multiple)	0.5 f	1.1 f	1496 D	0.4 e	0.9 de

[a] Values followed by the same letter do not differ significantly using Duncan's Multiple Range Test (P = 0.05).
[b] IBS: immediately before seeding
[c] PE: post-emergence

All herbicides increased lupin grain yields, and lupins sprayed with multiple post-emergence sprays yielded less than the other herbicides treatments. This is most likely a consequence of the last spray being applied close to flowering and thus interfering with grain initiation, although another possible explanation is that it is due to the cumulative herbicide residues. Grain yields from the early dry sown lupins were higher than the later wet sown crop, but only the mean yields from both planting times are shown in Table 1 because the response to the herbicides did not differ with planting time.

The most interesting result from this study is that pre-seeding herbicides reduced wild radish contamination in the grain, and contamination was further reduced by a "top up" spray. Data for the dry sown lupins show that even though "topping up" did not significantly reduce the wild radish density in the crop when compared to the pre-seeding herbicide treated lupins, "topping up" resulted in significantly less wild radish in the grain than the lupins sprayed with simazine plus atrazine before seeding. Thus, while "topping up" may not kill wild radish plants it may interfere with the growth and development of the weed sufficiently to reduce seed production. Visual

assessments of weed growth shortly before harvest indicated that topping up was particularly effective in reducing radish where the lupins were sown wet. The data show that it was more effective than the pre-emergence simazine but no significant (P=0.05) benefit over simazine plus atrazine was detected.

Two possible explanations for the effect of "top up" on radish in lupins are that the post-emergence spray may not only restore the simazine lost through degradation, but is also likely to produce a more even distribution of simazine in the soil surface.

This study shows that a post-emergence "top up" with simazine more effectively reduces wild radish plant density and contamination of the grain than a single application at seeding. The "top up" appeared to be particularly effective on lupins sown into moist soil after emerged weed populations had been controlled with paraquat/diquat. The reduction in wild radish contamination achieved with the "top up" which would cost $4/ha would save the farmer approximately $10/tonne in dockage.

The "top up" strategy relies on a knowledge of the half-life of simazine and an understanding of the emergence and survival of wild radish for it to be successful. While these aspects were all studied as part of this trial, it is necessary to generate data from a wide range of soils and climatic regions in order to determine whether the technique will be an economically feasible commercial practice.

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REFERENCES

1. Byast, T.H., Cotterill, E.G. and Hance, R.J. 1977. Weed Research Organisation Technical Report No. 15.
2. Walker, A. and Barnes, A. 1981. Pestic. Sci. 12, 123-132.
3. Waler, A. *et al*,. 1983. Weed Res. 23, 373-383.