ACTIVITY OF TWO DIFFERENT FORMULATIONS OF 2, 4, 5-T/PICLORAM ON GORSE AND RADIATA PINE

DAVID PREEST and NOEL DAVENHILL

Forest Research Institute, Private Bag, Rotorua

SUMMARY

Five small-plot trials (3 on gorse (*Ulex europaeus*) and 2 on radiata pine (*Pinus radiata*)) designed to compare the performance of two different commercial formulations of 2,4,5-T-plus-picloram are described. It had been conjectured that because of formulation changes the newer double-strength formulation (DS) might be inferior to the older single-strength formulation (SS). The trials provided no evidence that DS gave inferior gorse control or caused more tree growth suppression than SS when applied at equivalent active ingredient rates.

INTRODUCTION

For many years a product¹ containing 200 g/litre of 2,4,5-T iso-octyl ester and 50 g/litre of picloram potassium salt was marketed for woody weed (principally gorse) control. In 1982, for reasons associated with the fire safety of the stored product, and manufacturing and marketing policy, it was replaced with a double strength product² containing 400 g/litre of 2,4,5-T butyl ester and 100 g/litre of picloram amine salt.

Early work at the Forest Research Institute, Rotorua had indicated that the iso-octyl ester of 2,4,5-T was significantly more effective in killing young gorse seedlings and less damaging to radiata pine seedlings than the butyl ester (Preest 1979). The superiority of the iso-octyl compared with the butyl ester appeared to be confirmed by trials on older gorse by Balneaves (1982) in Canterbury. Furthermore, Zabkiewicz and Gaskin (1979) showed that whereas the iso-octyl ester was less readily taken up through the gorse cuticle than the butyl ester, it was translocated much more readily towards the roots, a prime requisite of a good, foliar-applied gorse herbicide. For these reasons misgivings were felt about the efficacy of the new DS product relative to SS, and trials were set up to compare the two.

METHODS

There were five trials. Three were on gorse: Trial I established in autumn 1982 at Galatea, 50 km south-west of Rotorua; Trial II in late spring 1982, also at Galatea; Trial III, at Rotokawa on the shores of Lake Rotorua, included treatments in both summer and autumn 1983. The fourth and fifth were tolerance trials laid down in early autumn (Trial IV) or late spring (Trial V) on radiata pine seedlings planted in Owata Nursery as 1/0 stock the previous winter. Each plot contained nine trees. All five trial sites had light, free-draining pumice soils. Application was in two passes of 150 litres/ha each by precision boom sprayer using Spraying Systems 730077 Flat Fan nozzles and operated at 276 kPa. The herbicide rates used are shown in Tables 1–4 as total active ingredient (i.e. 2,4,5-T plus picloram). In the gorse trials the maximum rates used were half those recommended by the manufacturer, or less, so that any differences in herbicidal effectiveness would be more readily apparent. In the tree tolerance trials the maximum rates used were at least twice those normally considered selective for radiata pine. The experimental designs were all randomised block, three replications. In the gorse trials blocking was on the basis of gorse vigour (height) and ground cover density.

All three gorse trials were assessed subjectively by estimating percentage foliage brown-off at various times; additionally, in two trials, by estimating percentage of stems still having green tissue or showing regrowth; and in one trial by estimating

¹IWD "Tordon 520 Brushkiller": identified as SS in this paper.

²IWD "Tordon Brushkiller DS": identified as DS in this paper.

Proc. 38th N.Z. Weed and Pest Control Conf.

percentage stem-length die-back. Two to four persons were variously involved in scoring at different times. For each plot the scores were averaged to give a plot mean. Height increment over a 4-month period in Trial IV and over a 6-month period in Trial V was used to measure tree response. There was no tree mortality or significant stem distortion.

All percentage measures were arcsin-transformed before statistical analysis. All the results were subjected to analysis of variance (F test) to determine if there were significant product (SS vs. DS) differences, or interactions, overall; and the differences between the individual treatment means were subjected to the SNK test ($p=0.05$ level).

Trial I — Galatea

The treatments were applied on 19.3.82 to very dense one-year old, 10-45 cm gorse of seedling and coppice origin arising after crushing and burning the previous summer and autumn. The foliage was mature and hard. Although much later in the year than would be normal in practice, it was decided to proceed with a trial at this late stage to get an early indication of any difference between the products. The plots were 2×5 m.

TABLE 1: Trial I: Foliage brown-off of young seedling and coppice gorse treated with SS and DS at Galatea.

Product	Rate (kg ai/ha)	% foliage brown-off		
		5 months	6 months	15 months
SS	0.625	37.8 b	47.8 cd	37.2 a
	1.250	53.3 a	59.4 bc	50.0 a
	1.875	65.6 a	71.7 ab	47.2 a
	2.500	67.8 a	75.0 a	57.8 a
DS	0.625	27.8 b	36.7 d	40.0 a
	1.250	30.6 b	37.8 d	41.1 a
	1.875	58.9 a	63.9 ab	55.6 a
	2.500	65.6 a	66.1 ab	51.7 a

Trial II — Galatea

The treatments were applied on 7.12.82 to dense seedlings and coppice regrowth gorse arising after crushing and burning approximately 3 years previously. The gorse was 60-150 cm tall, soft and susceptible when treated. The plots were 5×7 m overall, the net sprayed area of each plot was 4×7 m.

TABLE 2: Trial II: Foliage brown-off, stem-length die-back, and stem resprouting following the application of SS and DS each at 2.5 kg ai/ha to 3-year-old gorse of seedling and coppice origin at Galatea.

Product	% foliage brown-off		% stem-length die-back	% stems resprouting
	7 weeks	6 months	6 months	11 months
SS	9.45	99.3	95.6	2.3
DS	93.0	99.3	95.6	2.2

Trial III — Rotokawa

The gorse in this trial differed from the other two in that it was almost entirely of coppice origin, being present in an old field and subjected to periodic mowing over several years previously. There were two treatment dates. At the time of the first spraying (12.1.83) the coppice was approximately $1\frac{1}{2}$ years old and 15-75 cm tall, new season's growth was almost complete and beginning to harden off. By the second treatment (31.3.83) foliage growth was complete and fully hardened off.

TABLE 3: Trial III: Foliage brown-off and stems green or regrowing following the application of SS and DS at 2.5 kg ai/ha on two different dates to coppiced, mown gorse at Rotokawa.

Product	Application date	% foliage brown-off		% stems	
		4 months	11 months	green or regrowing 8.11.83	regrowing 21.12.83
SS	12.1.83	92.8 a	—	3.1 b	2.0 ab
	31.3.83	—	61.7 b	90.6 a	10.8 a
DS	12.1.83	95.0 a	—	0.2 b	0.5 b
	31.3.83	—	77.5 b	78.9 a	4.5 ab

Trials IV and V — Owahata Nursery

The trees in Trial IV averaged 79 cm in height and were actively growing when treated on 5.3.82. Those in trial V averaged 32 cm when treated on 1.12.82. Both sites were kept weed-free.

TABLE 4: Trials IV and V: Height increment responses of radiata pine to SS and DS.

Product	Trial IV		Trial V	
	Rate (kg ai/ha)	4-month height increment (cm)	Rate (kg ai/ha)	6-month height increment (cm)
SS	0.5	13.4 b	0.5	54.7 ab
	1	10.4 bc	1	49.6 ab
	2	4.5 de	2	47.3 ab
	3	1.8 e	4	30.8 c
DS	0.5	13.0 b	0.5	56.9 ab
	1	7.9 cd	1	58.8 a
	2	5.2 de	2	50.0 ab
	3	3.8 e	4	41.8 b
Untreated	—	18.4 a	—	56.4 ab

RESULTS

Results from Trial 1 (Table 1), scored 5 and 6 months after treatment, showed consistently higher brown-off from SS than DS, rate for rate, although the differences between equivalent rates were only significant in one instance. Overall, SS was significantly better ($p < 0.01$) at both these assessment dates. Ten months later, however, there was no consistent pattern of superiority, and there were no significant differences, either overall or between equivalent ai rates. The *product × rate* interaction was not significant.

In Trial II (Table 2) none of the assessments indicated any product differences of statistical or practical significance.

In Trial III (Table 3) gorse control was, overall, slightly better with DS, although the differences between results of treatments applied on the same date were not significant. There were highly significant differences due to treatment date ($p < 0.01$) in each of the stem regrowth measures, but no significant *product × treatment date* interaction, indicating that both SS and DS were behaving similarly with respect to season of application.

In the first pine tolerance trial (Trial IV), the differences between SS and DS either overall or at equivalent rates were not significant (Table 4). In the second pine tolerance trial (Trial V) DS caused significantly less growth depression than SS overall ($p < 0.05$),

and also less growth depression at each equivalent rate, although the difference was only significant at the highest rate. In neither pine tolerance trial was the *product* $\times$ *rate* interaction significant.

DISCUSSION AND CONCLUSION

Despite prior evidence that changing from the iso-octyl to the butyl ester of 2, 4, 5-T could have had a deleterious effect, these trials did not show that gorse control by DS was less satisfactory than by SS, or that DS depressed tree growth more. Any loss in activity which could have been occasioned by this change may have been compensated for by changing from the potassium to the amine salt of picloram, or by other proprietary formulation changes not made public.

ACKNOWLEDGEMENT

We acknowledge the data-processing assistance of Dr Michael Hong, Biometrician, Forest Research Institute.

REFERENCES

- Balneaves, John M., 1982. Response of mature gorse to different esters of 2, 4, 5-T and fenoprop and picloram. *Proc. 35th N.Z. Weed and Pest Control Conf.*: 141-144.
- Preest, David, 1979. Ester formulation and surfactant affect response of radiata pine and gorse seedlings to 2,4,5-T. *N.Z. J. For. Sci. 9 (1)*: 44-52.
- Zabkiewicz, J.A. and Gaskin, R.E., 1979. Uptake and translocation of 2,4,5-trichlorophenoxy esters by gorse. *Proc. 32nd N.Z. Weed and Pest Control Conf.*: 314-318.