RESPONSE OF MATURE GORSE TO DIFFERENT ESTERS OF 2,4,5-T AND FENOPROP AND PICLORAM

JOHN M. BALNEAVES

Forest Research Institute, Rangiora

SUMMARY

Three esters of 2,4,5-T and one of fenoprop were applied at 5.4 kg/ha to mature gorse (*Ulex europaeus*) in North Canterbury. Fenoprop butyl ester killed all stems and 56% of root crowns; 2,4,5-T iso-octyl ester killed 78% of stem tissue and 10% of root crowns; 2,4,5-T butyl and butoxyethanol esters killed 63-75% of stem tissue and no root crowns.

The addition of picloram improved the stem tissue kill when added to butoxyethanol and iso-octyl esters of 2,4,5-T but not with the butyl ester. Picloram increased the root crown kill when added to fenoprop, 2,4,5-T iso-octyl and butoxyethanol esters but not when added to 2,4,5-T butyl ester.

INTRODUCTION

The use of phenoxy herbicide 2,4,5-T has long been the basis of gorse control in New Zealand. Recent work (Zabkiewicz and Gaskin 1979; Preest 1979) indicates that there are major differences between the performance of different ester formulations on gorse.

Zabkiewicz and Gaskin (1979) studied uptake and distribution within gorse plants of 2,4,5-T butyl and iso-octyl ester, 2,4,5-T iso-octyl ester plus picloram and fenoprop butyl ester. Percentage uptake varied between 9% (iso-octyl ester) and 89% (fenoprop butyl ester). Uptake of iso-octyl ester was increased to 33% by the addition of picloram. Translocation out of the treated zone was poor except for the fenoprop butyl ester (79.8%). This formulation gave a good distribution of active ingredient throughout the stem and foliage but none appeared in the roots. However, the iso-octyl ester plus picloram formulation gave some distribution through the plant as well as 6.4% in the roots.

These results showed that uptake and translocation of these herbicides in gorse is formulation-dependent. Similar variation in response to different formulations was noted by Preest (1979) in field trials with seedling gorse. The suggestion was made that even better gorse control might be obtained if fenoprop plus picloram was used instead of 2,4,5-T.

Trials were established in Ashley Forest (North Canterbury) to test this proposal under field conditions and to determine the effect of added picloram to fenoprop butyl ester in comparison to three esters of 2,4,5-T with and without picloram.

METHOD

A series of 10 m² plots were established at Mt. Thomas, Ashley Forest in 1978 and repeated in another set of plots in 1979. In both instances spraying was undertaken at the optimum seasonal growth stage of the gorse plant; that is, during the spring flush when the new growth was 5-7 cm in length (Balneaves, 1978). The gorse had established following a burn 6 years before and was 1.2 m tall growing from closely spaced individual stems.

The four ester formulations tested were the butyl, butoxyethanol and iso-octyl esters of 2,4,5-T and fenoprop butyl ester. A single rate of each equal to 5.4 kg/ha was applied both with and without 0.75 and 1.5 kg/ha picloram as a potassium salt in water made up to 330 litres/ha.

All spraying was carried out using a CO₂ boom spray unit fitted with 730077 nozzles at 205 kPa. There were 5 replications/treatment/annum.

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The final results of the treatments were evaluated by establishing a 5.4 m transect running diagonally across each 5 x 2 m plot. Gorse stems were harvested at 10 cm intervals (or nearest point) along the transect line to give 45 samples/replication. The stems were cut off at ground level 18 months after application of the herbicide and cut into 20 cm lengths to determine the amount of stem kill noting presence or absence of green tissue. Root crowns of all stems were also examined to determine whether they were alive by noting presence of green tissue or in some cases presence of coppice buds.

RESULTS AND DISCUSSION

The assessment of individual stems enabled a profile to be established whereby it was possible to illustrate which portions of the gorse were still alive 18 months after spraying (Fig. 1). Results for the treatments in each trial were similar ($P < 0.01$) using the Chi-square test.

Effect on stem tissue

The most obvious feature is the difference due to formulation. The effect of the butyl ester formulation of 2,4,5-T was very variable; in some instances cutting tests revealed that only the top 20 cm portion of the stem was dead whereas in other instances the stem tissue was dead to ground level. The addition of picloram did very little to improve the quantity of dead stem tissue or to reduce the variation that occurred between individual gorse stems. The butoxyethanol ester formulation gave slightly better control of gorse than the butyl ester which is contrary to Matthews (1950) but supports Bell (1961). There was a general improvement in stem kill with increasing amounts of picloram additive.

There was little difference between the iso-octyl and butoxyethanol ester formulations but the former was more effective than the latter when picloram was added. This confirms the work of Thompson (1973). The fenoprop butyl ester caused 100% stem mortality both with and without picloram.

Analysis of stem tissue mortality indicated no significant differences between butoxyethanol and iso-octyl ester formulations at the 5% level. Significant differences did occur, between the butyl ester and the iso-octyl ester formulations and again between the fenoprop butyl ester and iso-octyl or butyl ester formulations. The addition of picloram at the two rates increased stem tissue mortality significantly for the iso-octyl and butoxyethanol ester formulations only.

Effect on root crowns

Root crown mortality following fenoprop butyl ester application was markedly greater than with the 2,4,5-T esters and was further increased by the addition of picloram. Only the highest rate of picloram resulted in complete root crown mortality (Table 1).

Significant differences between the butyl and butoxyethanol esters occurred only when the higher rate of picloram was added. The iso-octyl ester formulation resulted in a significantly greater number of root crowns killed when compared with the previous two formulations.

TABLE 1: Percentage of root crowns killed.

Formulation	No additive	+ 0.75 kg/ha picloram	+ 1.5kg/ha picloram
butyl ester	0 a ¹ (a) ²	0 a (a)	0 a (a)
butoxyethanol ester	0 a (a)	3 a (a)	18 b (b)
iso-octyl ester	10 b (a)	24 b (b)	39 c (c)
fenoprop butyl ester	56 c (a)	74 c (b)	100 d (c)

A Chi-squared test was used vertically ¹ and horizontally ² between treatments.

Fig. 1. Classification of stem tissue 18 months after spraying (mean of two spraying times).

The analysis also indicated that there were significant differences in the numbers of root crowns killed between additive rates of picloram within the 2,4,5-T iso-octyl and fenoprop butyl ester formulations. Significant differences also occurred in the 2,4,5-T butoxyethanol ester formulation between the 0.75 kg/ha and 1.5 kg/ha picloram additive.

CONCLUSIONS

1. The butyl ester formulation of 2,4,5-T gave least stem kill of gorse (63%) when compared with butoxyethanol ester (75%) iso-octyl ester (78%) and fenoprop butyl ester (100%). The difference between the butyl and butoxyethanol ester was not significant.
2. Effectiveness of the formulations as measured by root crown mortality indicated that the fenoprop butyl ester was greatly superior (56% kill) to 2,4,5-T iso-octyl ester (10% kill), and the 2,4,5-T butoxyethanol and butyl esters (0% kill).
3. Picloram, in the form of potassium salt, did not significantly improve stem tissue kill when added to butyl ester at two rates (65% and 67% mortality respectively v. 63%). However, it did significantly improve the performance of butoxyethanol ester (83% and 93% v. 75%) and iso-octyl ester (90% and 100% v. 78%).
4. The addition of picloram enhanced the root crown kill of three of the formulations, viz., fenoprop butyl ester increased from 56% to 74% and 100%, 2,4,5-T iso-octyl ester increased from 10% to 24% and 39%, and 2,4,5-T butoxyethanol ester increased from 0% to 3% and 18%. Addition of picloram to the 2,4,5-T butyl ester had no effect; all root crowns were alive and coppice sprout buds were evident.

The objective of spraying mature gorse in forestry operations, within the South Island at least, is to desiccate the gorse stem to facilitate a hot clean burn leaving the site free of residual gorse stick. Recent information (Balneaves, 1981) indicates that failure to do so reduces efficiency of follow-up herbicide treatment, increases costs of establishing a forest crop, and allows regrowth from the root crowns to compete with the radiata pine seedlings for the site resources. Although other factors influence the effectiveness of these operations it is nevertheless quite clear from this work and that of Zabkiewicz and Gaskin (1979) that a big variation in the success of operations may be dependent on the herbicide formulation used. It would appear that a reduction in variation of results should be possible by the use of fenoprop butyl ester and picloram. It is interesting to note that the butyl ester of fenoprop was superior to the iso-octyl ester of 2,4,5-T. Other ester formulations of fenoprop (the iso-octyl for instance) may even be more effective against gorse and are certainly worthy of investigation.

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