Studies on rubber vine (*Cryptostegia grandiflora*): III Basal bark application of phenoxyalkanoic acid herbicides

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Summary

Rubber vine (*Cryptostegia grandiflora*) is a serious weed of grazing lands in north Queensland. A research programme aimed at improving existing recommendations for chemical control of rubber vine was commenced in 1977 and this paper presents data from two glasshouse trials. In one trial, dicamba acid and dicamba, 2,4-D, 2,4,5-T and triclopyr ester formulations (but not dichlorprop or fenoprop ester formulations) were very effective against rubber vine when applied as solutions in diesel distillate to the basal section of the stem. Adding dibutyl phthalate to these solutions did not affect the results. In a second trial, basal bark application of picloram, dicamba and 2,4,5-T acids and 2,4,5-T ester solutions in diesel distillate, with and without 1% calcium dodecylbenzenesulphonate wetting agent, were effective. Picloram and dicamba were more effective than 2,4,5-T, while a 2,4,5-T ester formulation was more effective than 2,4,5-T acid. Addition of the wetting agent was without effect.

Introduction

Rubber vine (*Cryptostegia grandiflora* R.Br.) is a serious weed of grazing lands in north Queensland. Concern about its presence and spread was expressed before 1923 (White, 1923) and has continued to be expressed to the present (Caltabiano, 1973). Declaration of rubber vine as a noxious weed occurred in 1955 under the *Stock Routes and Rural Lands Protection Acts* and has led to a greater awareness of the problems that it causes. Many landholders regard currently-available chemical control methods as unreliable or prohibitively expensive.

Under these circumstances, a research programme aimed at achieving more reliable chemical control of rubber vine was commenced in 1977 (Harvey, 1981). This paper reports the results of two glasshouse trials which are part of this programme.

Materials and methods

Rubber vine seedlings were grown in a glasshouse in individual nursery seedling tubes (7 cm high × 4.5 cm diameter) using commercial potting mixes. Freshly-collected rubber vine seed has a germination rate greater than 95%, and at summer temperatures (33°C day/20°C night) germination is complete within seven to ten days. Plants used in these experiments were approximately nine months old, about 30 cm tall with basal stem diameter of 0.5 cm.

The following herbicides were used in these trials: 2,4-D, as the ethyl ester (as Farmco D-80); 2,4,5-T as the acid and mixed butyl/isobutyl esters (as Farmco T-80); dichlorprop as the iso-octyl ester; fenoprop as the butoxyethyl and mixed butyl/isobutyl esters (as Farmco TP-70); dicamba as the acid and furfuryl ester; picloram as the acid, and triclopyr as the ethyleneglycol butyl ether (EGBE) ester (as Dowco 233, M 4021).

Trial 1 The eight herbicide esters and one oil-soluble acid formulation listed in Table 1 all dissolved in diesel distillate at 5% and 2% a.e. concentrations with and without 1% dibutyl phthalate, were applied in 10-microlitre droplets to the basal 2.5 cm of stem of 1600 rubber vine seedlings. Four diesel distillate controls, also with and without 1% dibutyl phthalate, were included.

The experimental design was a randomized block design with 40 treatments (8 herbicides × 2 concentrations + 4 diesel distillate controls × 2 factors, with and without 1% dibutyl phthalate), five replicates and ten plants per plot. Treatments were assessed four months after application, by which time those plants not killed by the treatments were showing early signs of recovery.

Plant counts were converted to percentage mortality figures and the data subjected to analysis of variance and a factorial analysis using inverse sine transformed data.

Trial 2 2,4,5-T butyl/isobutyl esters, 2,4,5-T acid, dicamba acid and picloram acid in diesel distillate, with and without 1% wetting agent (calcium dodecylbenzenesulphonate) were applied as 10-microlitre droplets to the basal 2.5 cm of stem of 768 rubber vine seedlings at

Table 1 Herbicides used in Trial 1 and results, in ranked order

Treatments	Mortality (%)[1]	Arcsine transformed data
dicamba acid, 5%	100	1.5708
dicamba, furfuryl ester, 5%	100	1.5708
triclopyr, EGBE ester, 5%	100	1.5708
2,4-D, ethyl ester, 5%	100	1.5708
dicamba acid, 2%	100	1.5708
dicamba, furfuryl ester, 2%	100	1.5708
triclopyr, EGBE ester, 2%	100	1.5708
2,4-D, ethyl ester, 2%	99.2	1.4806
2,4,5-T, butyl/isobutyl esters, 5%	99.2	1.4806
2,4,5-T, butyl/isobutyl esters, 2%	99.2	1.4806
fenoprop, butoxyethyl ester, 5%	98.2	1.4613
fenoprop, butyl/isobutyl esters, 5%	98.8	1.4613
fenoprop, butoxyethyl ester, 2%	91.2	1.2698
fenoprop, butyl/isobutyl esters, 2%	80.8	1.1172
dichlorprop, iso-octyl ester, 5%	70.5	0.9968
dichlorprop, iso-octyl ester, 2%	51.0	0.7955
diesel distillate	0.7	0.0823
L.S.D. 1%		0.3475
5%		0.2620

[1] There were no differences between treatments with and without dibutyl phthalate, so the data were lumped to give five replicates of 20 plants per treatment. Mortality figures given are the mean values of the five replicates.

concentrations of 5%, 1%, 0.5% and 0.1% a.e.

The experimental design was a randomized block design with 32 treatments (4 herbicides × 4 concentrations × 2 factors, with and without wetting agent), four replicates and six plants per plot.

Assessment and analysis were the same as for Trial 1, except that untransformed data were used in the analyses.

Results

Results of the analyses of variance of data in Table 2 were: (i) the wetting agent had no significant effect on the results; (ii) 2,4,5-T ester was more effective than 2,4,5-T acid ($P < 0.05$); and (iii) picloram and dicamba acids were more effective than 2,4,5-T acid ($P < 0.01$).

Discussion

The results given in Table 1 are interesting in that they are consistent with data from field trials (Harvey, unpublished data), except that the much larger number of plants which can be managed in the glasshouse has allowed the emergence of statistically significant differences, whereas the differences in the field results were not statistically signficant. The only other important difference between field trials and glasshouse trials is that in the glasshouse trials very small volumes (10 microlitres) of concentrated (5%) herbicides are used, while larger volumes (approximately 50 microlitres) of more dilute (0.5 to 1.0%) solutions are used in the field.

From Table 1 it can be seen that 2,4-D, 2,4,5-T, dicamba and triclopyr are very effective against rubber vine, while the propionic acid analogues of 2,4-D and 2,4,5-T (i.e. dichlorprop and fenoprop) are not.

Robertson (1965) reported 'rumours' that phthalic acid and dimethyl phthalate enhanced bark penetration and hence, it is implied, the efficacy of basal bark herbicide treatments. These rumours persist and were the reason for the inclusion of dibutyl phthalate treatments in this experiment. The results of these treatments are not reported separately as the dibutyl phthalate was found to be absolutely without effect, a conclusion similar to that of Robertson (1965) and Beger (1969).

Similarly, addition of the wetting agent calcium dodecylbenzenesulphonate to the herbicide solutions in diesel distillate in Trial 2 was without effect.

The greater phytotoxicity of picloram and dicamba over 2,4,5-T shown in Table 2 was expected, as picloram and dicamba are generally known to be very effective arboricides. The greater efficacy of 2,4,5-T ester over the acid is interesting in that it parallels the results obtained with foliar applications of 2,4-D ester and 2,4-D acid formulations to rubber vine (Harvey, 1981). However, the data obtained in these experiments allow no explanation of these results.

References

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Table 2 Herbicides used in Trial 2 and results

Chemical	Concentration (% a.e.)	Mortality (%) Without wetting agent	Mortality (%) With wetting agent
2,4,5-T	5	96	88
butyl/isobutyl esters	1	42	50
	0.5	13	13
	0.1	0	4
2,4,5-T acid	5	83	92
	1	8	17
	0.5	4	8
	0.1	0	0
picloram acid	5	96	96
	1	46	71
	0.5	0	17
	0.1	4	13
dicamba acid	5	96	100
	1	54	38
	0.5	38	38
	0.1	0	4