A SUMMARY OF INVESTIGATIONS WITH PICLORAM ON CERTAIN SCRUB WEEDS

R. W. MOFFAT

Ivon Watkins-Dow Ltd., New Plymouth

Summary

Investigations with picloram on sweet brier (*Rosa rubiginosa*), gorse (*Ulex europaeus*), blackberry (*Rubus fruticosus*), broom (*Cytisus scoparius*), inkweed (*Phytolacca octandra*) and tutsan (*Hypericum androsaemum*) are reviewed. Picloram used alone or in combination with 2,4,5-T or 2,4-D has given an improved degree of control over the standard phenoxyacetic recommendation for the weeds concerned. The combination of either 2,4-D or 2,4,5-T with picloram is superior to picloram when used alone on a cost efficiency basis. The granular formulation of picloram shows equal activity to the spray formulations against sweet brier and is without doubt the most promising herbicide used to date on this weed. Evidence is presented on soil residue studies with picloram.

INTRODUCTION

SINCE its introduction into New Zealand in 1963, the new systemic herbicide, picloram, formerly known as "Tordon"*, has shown outstanding activity on a wide range of perennial weeds which have presented problems for control by the phenoxyacetic group of herbicides. Owing to the perennial habit of most of the weeds evaluated and the prolonged activity of picloram in plant tissue, a considerable time lapse is necessary after treatment before final assessments can be made. Because of this, a large number of field trials containing picloram are still under observation and only interim results of these have been obtained. As far as the major scrub weeds are concerned, final conclusions have been drawn in a number of trials and this paper is concerned with summarizing the results of these and recording any variations which may have occurred with current trials.

It became obvious at a very early stage of screening that picloram offered great potential in the control of many perennial scrub weeds and the emphasis of early investigations was on this field. However, the versatility of the herbicide has been such that it has shown considerable promise in the selective control of annual and perennial broadleaf weeds in cereals, linseed and brassica crops. This paper will be confined to its use on scrub weeds.

For various reasons as reported by Foreman (1964), mixtures of 2,4-D and 2,4,5-T with picloram, which are commercially available in New Zealand, have been compared with picloram alone and the standard phenoxyacetic compounds recommended for the particular weed studied.

The method of application was high volume spraying to complete coverage of foliage and stems. The amount of spray mixture applied per individual plot was either 10 or 15 gal, and unless

* Trade Mark of the Dow Chemical Company, U.S.A.

otherwise stated treatments are referred to in terms of active ingredient per 100 gallons of water. Ratings referred to are based on a 0-10 visual scale (10 being the maximum effect, 0 being the nil effect level); the values quoted are the means of the visual ratings of two or more persons.

SWEET BRIER (*Rosa rubiginosa*)

Sweet brier, which has become a serious threat to hundreds of thousands of acres of tussock country in the South Island, has been a very difficult weed to control with herbicides. The standard treatment has been the ester of 2,4,5-T applied in water as an overall foliage spray or preferably in diesel as a basal spray. This treatment has generally given a satisfactory top kill but resprout growth which has often occurred has necessitated retreatment. Recent trials have indicated that, though 2,3,6-TBA and dicamba because of their powers of translocation are relatively more efficient than 2,4,5-T as coverage sprays on sweet brier, their herbicidal efficiency is not sufficiently strong to ensure reliable results (Dingwall, 1964). Fenuron pellets have been effective under certain soil and moisture conditions but have proved rather unreliable with larger bushes where applications have been soon followed by prolonged hot, dry weather.

In a trial laid down in the spring of 1963, all treatments were applied as a high volume spray, with the exception of two, which were applied as granular formulations. The sweet brier was leafless but the leaf buds were just breaking. The age of the bushes was estimated between 5 and 10 years and had from 3 to 30 stems per bush. The height of the bushes ranged from 2 to 8 ft. Ratings of regrowth suppression were made 15 months after treatment (Table 1).

TABLE 1: RATINGS OF SWEET BRIER REGROWTH SUPPRESSION

<i>Chemical</i>	<i>Overall Foliage Spray (lb a.i./100 gal)</i>	<i>Regrowth Suppression</i>
2,4,5-T (ester) 2.4		5.0
Dicamba 1.2		5.5
Picloram 0.35/2,4,5-T (ester) 1.2		9.0
Picloram 0.35/2,4,5-T (amine) 1.2		9.5
Picloram 0.7		9.5
GRANULAR APPLICATION		
	<i>(g a.i./6 in. basal diam.)</i>	
Fenuron 10.0		4.5
Picloram 1.5		10.0

All treatments containing picloram gave almost complete control. Surviving plants in the fenuron treatment were still showing foliage symptoms of the herbicide, but it appears that these will recover. Resprout growth in the 2,4,5-T treatment was fresh and vigorous. When used in combination with picloram there was no difference in the result between the ester and amine form of 2,4,5-T. A mixture of 2,4,5-T and picloram is superior to picloram alone on a cost efficiency basis. More recent work with picloram as a granular

formulation has indicated that a rate of 1 g of active ingredient per 6 in. basal diameter gives acceptable control of recently established adult plants. Some grass damage has occurred with the use of picloram as a granule but has been of a temporary nature only, with the grass fully recovered by the next season.

Without doubt, picloram is the most outstanding herbicide used to date in the sweet brier control field and has the added advantage that the granule formulation with its ease of application has shown activity equal to that of spray formulations.

GORSE

(*Ulex europaeus*)

Gorse is undoubtedly one of the most widespread and aggressive woody weeds in New Zealand, and repeat treatments of 2,4,5-T are generally necessary to obtain a complete kill. Trials with picloram commenced in the spring of 1963. The following is a summary of results obtained from four trials, three in Taranaki and one in North Canterbury. The four trials were laid down in the period August/October, 1963, under widely varying growth conditions. The stage of growth varied from pre-flowering to post-flowering of the plant.

Fig. 1: Mean response of gorse to picloram and 2,4,5-T.

Mean responses were evaluated at intervals through to eighteen months after application for the four trials (Fig. 1). The amine salt of 2,4,5-T in these four trials was not as active on gorse as the ester of 2,4,5-T. The mixture of picloram and the amine salt of 2,4,5-T significantly improved the result obtained over the use of picloram alone. The addition of 1 lb of 2,4,5-T almost doubled the final kill obtained with picloram when used alone. A suggested explanation for the additive effect of the combination of picloram and 2,4,5-T is that the 2,4,5-T provides the initial foliage and upper stem kill, leaving the more residual picloram to move down to the crown and root system where it prevents resprouting and completes the final kill.

Both formulations of 2,4,5-T reached their peak of regrowth suppression 10 to 12 months after treatment, and then commenced to deteriorate. The picloram treatment at 0.35 lb held on longer

but was insufficient to give an acceptable degree of resprout suppression. By contrast, the mixture retained its outstanding degree of stem kill from this time on until complete dehydration and breakdown of plant tissue had occurred.

Both picloram at 0.7 lb/100 gal and the mixture of picloram at 0.35 lb and amine 2,4,5-T at 1.0 lb/100 gal have given excellent control of gorse but on a cost efficiency basis the mixture is the preferred treatment. This rate of application could be varied according to the growth stage and susceptibility of the gorse during the spraying season.

BLACKBERRY

(*Rubus fruticosus* complex)

In certain parts of New Zealand, particularly on the East Coast of the North Island, considerable difficulty is experienced in controlling blackberry with the esters of 2,4,5-T. A summary is given below of two trials conducted in Hawke's Bay in areas where 2,4,5-T was known to be only partially effective.

TRIAL I

Treatments were made in mid-October when fresh active growth was present prior to flower bud formation. Ratings for regrowth suppression were made one year after treatment (Table 2).

TRIAL II

Treated mid-February when 20% of the bushes had reached the mature fruiting stage with the remainder carrying red fruit. These were rated for regrowth suppression eleven months after treatment (Table 2).

TABLE 2: RATINGS OF BLACKBERRY REGROWTH SUPPRESSION

Treatment (lb a.i./100 gal)	Regrowth Suppression	
	Trial I	Trial II
Amitrole-T 4.0	7.0	5.0
Picloram 0.35	6.0	9.5
Picloram 0.35/2,4,5-T 1.0	9.5	9.0
Picloram 0.18/2,4,5-T 0.5	—	8.5
2,4,5-T (ester) 1.0	3.0	2.0

In Trial I the time of application for 2,4,5-T was earlier than normally recommended but such was not the case in Trial II. The results of the 2,4,5-T treatments were typical of those achieved in the field, namely, a satisfactory cane kill in the first six months, but vigorous resprout activity in the following season. Both the amine and ester forms of 2,4,5-T gave comparable results. Amitrole-T has given better results than 2,4,5-T in these areas in the past but variable results have been obtained with different growth types of blackberry. In these trials the use of picloram alone or with the amine salt of 2,4,5-T greatly improved the final kill. The excellent control obtained with picloram alone at 0.35 lb in Trial II is atypical, the result obtained in Trial I being more normal. Generalizing, the statement can be made that, when used alone, the amount of picloram required is twice that applied in conjunction with 2,4,5-T to give a comparable stem and root kill.

Results of trials in other parts of the country have not yet been as conclusive, but in areas where a problem of tolerance to 2,4,5-T exists, a mixture of picloram 0.35 lb and 2,4,5-T at 1.0 lb certainly warrants investigation.

BROOM
(*Cytisus scoparius*)

Broom showing considerable regrowth potential to 2,4,5-T in the drier areas of the South Island has proved to be highly susceptible to picloram.

A summary of two trials laid down in October and November in North Canterbury is given. In both cases the areas treated were mature stands just breaking into flower with fresh growth strongly evident. Assessments of regrowth suppression were made one year after treatment (Table 3).

TABLE 3: RATINGS OF BROOM REGROWTH SUPPRESSION

<i>Treatment</i> (lb a.i./100 gal)	<i>Regrowth Suppression</i>
2,4,5-T (ester) 1.0	5.8
2,4,5-T (amine) 1.0	5.9
Picloram 0.35	9.8
Picloram 0.35/2,4,5-T 1.0	10.0
Picloram 0.35/2,4-D 1.33	10.0

The two mixtures containing picloram gave complete kills while the picloram alone treatment was slightly inferior. More recent trials have indicated that this type of broom has been successfully controlled with mixtures of picloram at 0.25 lb and 2,4-D at 1 lb. Broom appears more difficult to control with picloram when in the immature "whippy" stage.

INKWEED
(*Phytolacca octandra*)

The following trial is typical of the results obtained with picloram when used in comparison with standard treatment. The trial was laid down in late January and ratings of regrowth suppression made 22 weeks later (Table 4).

TABLE 4: RATINGS OF INKWEED REGROWTH SUPPRESSION

<i>Treatment</i> (lb a.i./100 gal)	<i>Regrowth Suppression</i>
2,4-D (ester) 2.0	6.8
Dicamba 1.0	3.3
Picloram 0.18	5.7
Picloram 0.35	8.2
Picloram 0.18/2,4-D 0.7	8.7
Picloram 0.35/2,4-D 1.3	9.8

The results in Table 4 demonstrate the effectiveness of picloram against inkweed and the improvement in the cost efficiency when the mixture of picloram and 2,4-D amine is used in place of picloram alone.

The present recommendation of the mixture of picloram 0.25 lb and the amine salt of 2,4-D at 1 lb has given satisfactory field user results.

TUTSAN
(*Hypericum androsaemum*)

Tutsan, a localized problem weed, has not been satisfactorily controlled with 2,4,5-T. In one trial ratings for regrowth suppression were made nine months after treatment (Table 5).

TABLE 5: RATINGS OF TUTSAN REGROWTH SUPPRESSION

<i>Treatment</i> (lb a.i./100 gal)	<i>Regrowth Suppression</i>
2,4,5-T (ester) 1.0	0.0
Picloram 0.25	2.5
Picloram 0.5	9.0
Picloram 0.25/2,4,5-T 1.0	4.0
Picloram 0.5/2,4,5-T 1.0	9.0
Picloram 0.5/2,4-D 1.9	6.0

Results indicate that picloram is particularly active on this weed. 2,4,5-T gave satisfactory initial brown-off but the regrowth in the following spring was complete. There was no difference in the result with picloram 0.5 lb and the mixture containing an additional 1 lb of 2,4,5-T. The 2,4,5-T combination was superior to the 2,4-D mixture when picloram was used at equivalent rates.

SOIL RESIDUE STUDIES

In view of the versatility of picloram as a herbicide, including its possible use on arable country, the need for precise data on its residual life in the soil and crop sensitivity is fully appreciated.

Investigations have been conducted over the past twelve months and the data from one trial presented in this paper indicate the levels of legume suppression involved.

The herbicides were applied to a runout perennial ryegrass (*Lolium perenne*)/white clover (*Trifolium repens*) sward. Soil samples were collected nine months after treatment and divided to give the following layers: 0-2 in., 2-4 in., 4-6 in. These were oversown with white clover and rated six weeks later for seedling emergence and vigour (Table 6).

TABLE 6: RATINGS OF CLOVER VIGOUR ON TREATED SOIL

<i>Treatment</i> (lb a.i./acre)	<i>Clover Vigour</i>			<i>Field Site</i>
	<i>Pot Trial</i> 0-2 in.	2-4 in.	4-6 in.	
Control	9.9	9.7	9.9	10.0
2,4-D (amine) 1.5	10.0	10.0	10.0	10.0
Picloram 0.35	9.7	9.9	9.6	2.2
Picloram 0.35/2,4-D 1.3	10.0	9.9	9.8	2.3
Picloram 0.7	7.7	8.1	8.0	0
Picloram 1.4	7.9	7.9	6.4	0
Dicamba 2.0	—	—	—	2.3

Ratings are also given for clover vigour made on the trial site at the time of sampling (10, normal stand, no suppression, 0, plants eliminated, maximum effect).

On the basis of these ratings, there is no discernible effect of residues up to 0.35 lb per acre of picloram alone or the picloram/2,4-D mixture ten months after application. The two higher rates of picloram gave a retardant effect evident as suppressed leaf development. Apart from the picloram treatment at 1.4 lb per acre where there was a tendency for greater damage at the 4-6 in. level, the residues appear to be evenly distributed throughout the soil. On comparing the visual ratings in the field with those taken from the potted soil, it is obvious from work of this nature that fresh seed of the susceptible species must be introduced to the areas under test to give an accurate picture.

It will be appreciated that the rates used in this trial are considerably higher than those envisaged for use in annual weed control. Further studies of this nature are continuing.

CONCLUSIONS

Picloram has shown superior herbicidal activity over the standard phenoxyacetic compounds recommended for sweet brier, gorse, broom, blackberry, inkweed and tutsan. The combination of picloram with either 2,4-D or 2,4,5-T has given greater cost efficiency than the use of picloram alone. The rates of either herbicide used in the mixture are sub-lethal when used alone but when applied in combination give a high degree of permanent kill.

The granule formulation of picloram is showing outstanding promise for the control of sweet brier in particular, and other difficult-to-kill woody perennial weeds.

Picloram is undoubtedly persistent both on plant tissue and soil. Investigations on the residual effects of picloram are continuing and it is felt that the great potential of picloram as a herbicide will far outweigh any possible inconveniences associated with its use.

ACKNOWLEDGEMENTS

The author is indebted to Dr G. W. Mason for assistance in the preparation of this paper and to staff of the Research and Development Department, Ivon Watkins-Dow Ltd., for assistance with the trials.

REFERENCES

- Dingwall, A. R., 1964: *Proc. 17th N.Z. Weed & Pest Control Conf.*: 16-8.
Foreman, M. S., 1964: *Proc. 17th N.Z. Weed & Pest Control Conf.*: 74-8.