

FIELD RESULTS WITH "TORDON"* ON GORSE

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Summary

Results obtained from field trials with "Tordon" when applied as a high volume application to gorse (*Ulex europaeus*) are discussed. Interim results indicate that "Tordon" is very active against gorse and appears capable of giving a high level of complete kill under a variety of conditions. "Tordon" applied at 0.7 lb active ingredient per 100 gal has proved consistently superior to a standard treatment of 1 lb 2,4,5-T per 100 gal when applied to gorse at different growth stages and under varying climatic conditions.

Results obtained from a mixture containing 0.35 lb active ingredient of "Tordon" plus 1 lb active ingredient of an amine salt of 2,4,5-T per 100 gal of water are also discussed. This mixture has given results generally superior to those obtained with "Tordon" alone. The herbicidal efficiency of the mixture as well as the probable improvement in cost efficiency when compared with "Tordon" alone would appear to make it the preferred treatment at this stage.

INTRODUCTION

RESULTS obtained from preliminary trials with "Tordon" (4-amino-3,5,6-trichloropicolinic acid) in New Zealand (Pengelly, 1963) indicated that this herbicide should be evaluated as an alternative to 2,4,5-T for the control of many woody weeds. As gorse (*Ulex europaeus*) is recognized as one of the most widespread and aggressive of the woody weeds in New Zealand, trials were commenced on this species in the spring of 1963.

Evidence reported from overseas (Dow "Tordon" Bulletin, 1963) indicated that "Tordon" causes a slower rate of brown-off than commonly used phenoxyacetic herbicides. Furthermore, because "Tordon" is a rather complex chemical to manufacture, the cost of initial commercial formulations might be expected to be comparatively high. For these reasons, it was decided to investigate the effectiveness of combinations of "Tordon" and 2,4,5-T. The object of these investigations was to try to determine a ratio of "Tordon" and 2,4,5-T which would give an acceptable rate of brown-off and achieve a high percentage of complete kill at a more economic cost than possible with "Tordon" alone.

EXPERIMENTAL

Treatments were applied as 10 or 15 gal mixes by means of conventional high-pressure equipment operating at about 250 lb/sq. in. to typical populations of gorse. Spraying was to full coverage and just to the point of run-off. This technique is strictly comparable to normal field application by a skilled operator.

Treatments are referred to in terms of pounds of active ingredient per 100 gallons of water. This is in line with standard recom-

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recommendations for high-pressure gun application where 2,4,5-T is generally diluted in the proportion of 1:300, giving a rate of 1.2 lb active ingredient per 100 gal.

Ratings given are based on a 0 to 10 visual scale (10 being the maximum effect and 0 the no-effect level); the values quoted are the means of the observations of two or more persons.

A blended non-ionic surfactant (Multi-film X-77) was used in all treatments at the rate of ½ to 1 pint per 100 gal of spray mix.

The amine salt formulation of 2,4,5-T employed in these trials is the triethylamine, and the ester formulation is the butoxyethanol ester. "Tordon" was applied as the potassium salt.

The mixture of "Tordon" and 2,4,5-T quoted in this paper consists of the potassium salt of "Tordon" and the triethylamine salt of 2,4,5-T. Although it is acknowledged that, by themselves, water-soluble salts of 2,4,5-T are considerably less active than oil-soluble esters when applied at comparable rates, such esters are physically incompatible with commercially available formulations of "Tordon". The use of amine salts of 2,4,5-T and "Tordon" will therefore be necessary for these mixtures if developed commercially.

RESULTS

A series of trials has been conducted in North Taranaki to investigate the effects of time of application on various treatments of "Tordon" and 2,4,5-T, alone and in mixtures. Discussion will be confined to the first three trials because insufficient time has elapsed for valid comparisons to be drawn from the remainder. Details of the three trials are set out in Table 1.

TABLE 1: DETAILS OF THREE TRIALS

| <i>Date of Treatment</i> | <i>Height of Gorse</i> | <i>Stage of Growth</i> | <i>Estimated Susceptibility to Normal Rates of 2,4,5-T Ester</i> |
|--------------------------|------------------------|--|--|
| August 23, 1963 | 4 to 7 ft mature | Just emerging from dormancy; pre-flowering; no soft tissue | Not susceptible |
| Sept. 26, 1963 | 3 to 5 ft; seedling | Making vigorous growth; post-flowering; substantial soft growth | Very susceptible |
| October 25, 1963 | 3 to 6 ft, mature | Making vigorous growth; post-flowering; approaching full soft growth | Moderately susceptible |

Of the treatments employed, discussion will be confined to those which are regarded as either effective or relevant to this paper. These, together with details of application, are set out in Table 2.

Plot sizes and rates per acre vary according to the density of the gorse present, but at all times comparison between rates of toxicant per 100 gal provides a constant standard for evaluations. Results obtained are shown in Table 3.

TABLE 2: DETAILS OF APPLICATIONS IN THREE TRIALS

| Treatment (lb/100 gal water) | Estimated Volume Reqd. per acre of Actual Gorse (gal) | | | Estimated A.I. Applied per acre of Actual Gorse (lb) | | |
|--|--|-------|------|---|---------------|---------------|
| | Aug. | Sept. | Oct. | Aug. | Sept. | Oct. |
| 2,4,5-T (amine) 2.0 | 400 | 300 | 500 | 8.0 | 6.0 | 10.0 |
| 2,4,5-T (butoxyethanol ester) 1.0 | 400 | 300 | 500 | 4.8 | 3.6 | 6.0 |
| "Tordon" 0.7 | 400 | 300 | 500 | 2.8 | 2.1 | 3.5 |
| "Tordon" + 2,4,5-T amine 0.35 + 1.0 | 400 | 300 | 500 | 1.4+ 4.0 | 1.125+ 3.0 | 1.875+ 5.0 |

The triethylamine salt of 2,4,5-T at 2.0 lb per 100 gal has not given acceptable control except in the September trial. The reasons for its excellent performance in this trial are not clear, and it can only be assumed that this younger gorse was particularly susceptible at the time of treatment. The regrowth potential from this treatment is regarded as very high in the August and October trials.

The butoxyethanol ester of 2,4,5-T at 1.0 lb per 100 gal has given fairly typical control when its performance is measured against the estimated susceptibility of this toughened gorse. The disappointing results obtained in the October trial are probably due to the combined effects of a sandy low fertility soil, severe moisture stress following treatment, and exposure to salt-laden westerly winds. The regrowth potential from this treatment is regarded as high in the August and October trials and slight in the September trial.

The potassium salt of "Tordon" at 0.35 lb per 100 gal has given marginal control in the August and September trials but has given outstanding results in the October trial. Spindly regrowth is already evident from the August treatment and to a lesser extent from the September treatment. There is no immediate prospect of regrowth from the October treatment. The potassium salt of "Tordon" at 0.7 lb per 100 gal has given outstanding control of gorse after 30 weeks. This appears equally the case for gorse susceptible to the butoxyethanol ester of 2,4,5-T or otherwise. There is no evidence of regrowth from this treatment in any of the three trials.

The potassium salt of "Tordon" at 0.35 lb together with the triethylamine salt of 2,4,5-T at 1.0 lb per 100 gal appears to be the most consistently effective treatment when both brown-off and stem kill are considered. The rate of brown-off has been more rapid than with other treatments, and the stem kill after 30 weeks has been superior except in the October trial in which trial "Tordon" alone at 0.7 lb per 100 gal has proved slightly superior. There is no evidence of regrowth nor immediate prospect of this in any of the three trials.

Two further trials are being conducted on mature gorse at Oxford, North Canterbury. Treatments were applied on October 6 and November 12, 1963. Under the more rigorous climatic and fertility conditions obtaining in these trials, both "Tordon" at 0.7 lb per 100 gal and the "Tordon" + 2,4,5-T mixture have given results strictly comparable with those obtained in North Taranaki. No regrowth was evident from these treatments at the last inspection made at the end of May, 1964.

TABLE 3: RESULTS OF THREE TRIALS
(0-10 Scale)

| Treatment (lb/100 gal) | August Trial | | September Trial | | October Trial | | Mean Response |
|---------------------------------------|--------------|-----------|-----------------|-----------|---------------|-----------|---------------|
| | Brown-off | Stem Kill | Brown-off | Stem Kill | Brown-off | Stem Kill | |
| RESPONSE AFTER 20 WEEKS | | | | | | | |
| 2,4,5-T (amine) 2.0 | 6.7 | 2.8 | 9.5 | 6.7 | 5.0 | 2.5 | 5.5 |
| 2,4,5-T (butoxyethanol ester) 1.0 | 7.1 | 3.8 | 9.6 | 6.9 | 6.8 | 2.6 | 6.1 |
| "Tordon" (potassium salt) 0.35 | 5.8 | 3.8 | 8.2 | 4.0 | 7.9 | 5.4 | 5.9 |
| "Tordon" (potassium salt) 0.7 | 8.1 | 4.3 | 9.5 | 7.2 | 8.6 | 4.5 | 7.0 |
| "Tordon" + 2,4,5-T (amine) 0.35 + 1.0 | 9.0 | 6.3 | 9.8 | 7.4 | 9.5 | 7.8 | 8.3 |
| RESPONSE AFTER 30 WEEKS | | | | | | | |
| 2,4,5-T (amine) 2.0 | 6.1 | 3.9 | 9.2 | 8.5 | 5.3 | 2.2 | 5.9 |
| 2,4,5-T (ester) 1.0 | 7.9 | 6.2 | 9.7 | 7.9 | 6.8 | 3.6 | 7.0 |
| "Tordon" (potassium salt) 0.35 | 7.6 | 5.2 | 8.2 | 5.1 | 9.1 | 9.1 | 7.4 |
| "Tordon" (potassium salt) 0.7 | 9.8 | 5.8 | 9.5 | 8.6 | 9.6 | 9.3 | 8.8 |
| "Tordon" + 2,4,5-T (amine) 0.35 + 1.0 | 9.3 | 8.2 | 9.8 | 9.0 | 9.5 | 8.3 | 9.0 |

Additional trials are being conducted to investigate the performance of "Tordon" and the "Tordon" + 2,4,5-T mixture when applied to gorse by mistblower and fixed-wing aircraft. It is not possible to anticipate final results from these experiments, but observations to date confirm that both "Tordon" and the mixture are considerably more active than the butoxyethanol ester of 2,4,5-T, even when applied by these methods. The degree of stem kill of gorse obtained with "Tordon" and "Tordon" + 2,4,5-T mixtures, compared with standard 2,4,5-T treatments, tends to confirm overseas findings with "Tordon" on woody species that this new herbicide is generally more persistent and more mobile than phenoxy compounds in plant tissue such as gorse.

DISCUSSION

Expectations that "Tordon" when applied alone would not result in an acceptable rate of brown-off on gorse have not been supported in these trials. On these grounds alone, the need for a mixture of "Tordon" and 2,4,5-T might therefore not be justified. However, a rather unexpected outcome of the trials has been the outstanding stem kill efficiency of the mixture. The triethylamine salt of 2,4,5-T when applied at twice the rate employed in the mixture has failed to consistently control gorse, and "Tordon" alone at the same rate used in the mixture has also proved inadequate in two out of three instances. In combination, however, these two ingredients have proved superior to all other treatments in two out of three trials, and only very slightly inferior in speed of stem kill in the third. It would appear that the two ingredients in the mixture act in at least an additive and cumulative fashion and are clearly complementary.

CONCLUSIONS

It is obvious from the investigations so far conducted that "Tordon" can be regarded as a probable alternative to 2,4,5-T for the control of gorse in New Zealand. Unfortunately, sufficient time has not yet elapsed to justify drawing final conclusions, but evidence to date clearly indicates the superior activity of "Tordon" over the butoxyethanol ester of 2,4,5-T.

A mixture containing 0.35 lb of "Tordon" plus 1.0 lb of an amine salt of 2,4,5-T per 100 gal has proved generally superior to all other treatments applied in these trials. Quite apart from economic considerations, the herbicidal efficiency of this mixture would at this stage appear to make it a preferred treatment over "Tordon" alone.

From the results obtained in this series of experiments, it would appear desirable to investigate alternative concentrations of "Tordon" and 2,4,5-T in order to obtain the most cost efficient "Tordon" content. Under conditions of vigorous growth such as those encountered in the October trial, it is possible that reduced rate of "Tordon" would provide adequate control.

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