MOVEMENT OF HERBICIDE EFFECTS WITHIN GORSE PLANTS

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Summary

Picloram had a much more severe effect on foliage protected from spray than had 2,4,5-T, dicamba or diquat when the herbicides were applied to the rest of the bush. Diquat significantly reduced the effect of 2,4,5-T on protected gorse foliage. Protected upper branches were more severely affected than lower branches by most herbicides. The effect on protected gorse foliage of all herbicides except diquat was greater in summer than in winter.

INTRODUCTION

Despite its wide use and well established effectiveness as a gorse herbicide 2,4,5-T has a rather limited capacity to penetrate the hard cuticle of mature gorse and is recognised as one of the least mobile of the translocated herbicides (Leonard and Yates, 1959). Consequently considerable care is necessary in the application of 2,4,5-T as any part of the gorse plant missed or inadequately covered usually survives, resulting in the eventual recovery of the treated plant.

Although the mobility and persistance of the more recently developed systemic herbicides — picloram and dicamba — are known to be considerably superior to those of 2,4,5-T, little information has been available about the capacity of these materials to move in lethal amounts into inadequately treated parts of the gorse plant, or about the extent to which this could compensate for incomplete cover of the target plant.

Conversely, while the contact herbicide diquat, in combination with 2,4,5-T, has greatly accelerated the initial desiccation and breakdown of gorse, there are indications that the rapid browning induced by the diquat fraction may further inhibit the already limited movement of 2,4,5-T into and within the treated plant, resulting in increased recovery growth (Thompson 1973).

The project described in this report was undertaken to obtain more precise data about these factors than could be obtained from the normal spraying trial.

METHOD

Following a pilot study to establish the practicality of the technique, two trials were laid down on an infestation of scattered gorse in the Paeroa district. On bushes of approximately equal size (1.3 to 1.6 m high) three third order accessory branches (one each from the upper, middle and lower part of each bush) were covered by waterproof bags to protect them from treatment and tagged for identification. Bushes were then sprayed to runoff with the appropriate herbicide solutions. Protecting bags were removed after the bushes were dry.

TABLE 1: EFFECT OF HERBICIDES ON TREATED AND PROTECTED GORSE TREATMENTS APPLIED 2.5.73

Treatments (kg/4000 litres)	Treated parts: Original growth 30.10.73	Treated parts: Original growth 2.5.74	Treated parts: Regrowth 30.10.73	Treated parts: Regrowth 2.5.74	Protected branches: Original growth 30.10.73	Protected branches: Original growth 2.5.74	Protected branches: Regrowth 30.10.73	Protected branches: Regrowth 2.5.74
picloram 0.50	3.7	6.7 abAB	2	13	2.7	7.7 aA	7	20
dicamba 0.75	1.7	1.7 dC	43	100	1.0	1.1 cdBC	89	100
diquat 0.60	8.0	8.0 aA	33	90	1.0	1.0 dC	100	100
picloram 0.50 + 2,4,5-T 2.0	3.7	7.3 abAB	0	13	2.9	7.8 aA	0	19
dicamba 0.75 + 2,4,5-T 2.0	3.0	5.0 bcBC	0	57	1.4	1.4 bB	29	100
diquat 0.60 + 2,4,5-T 2.0	7.7	8.0 aA	3	73	1.0	1.0 dC	100	100
2,4,5-T 2.0	3.3	3.7 cdBC	3	60	1.3	1.3 bB	60	100
2,4,5-T 4.0	4.3	7.3 abAB	0	23	1.4	1.7 bB	19	100
C V %		25.0				11.0		

TABLE 2: EFFECT OF HERBICIDES ON TREATED AND PROTECTED GORSE TREATMENTS APPLIED 14.12.73

Treatments (kg/4000 litres)	Treated parts: Original growth 15.5.74	Treated parts: Original growth 10.1.75	Treated parts: Regrowth 15.5.74	Treated parts: Regrowth 10.1.75	Protected branches: Original growth 15.5.74	Protected branches: Original growth 10.1.75	Protected branches: Regrowth 15.5.74	Protected branches: Regrowth 10.1.75
picloram 0.50	7.3	10.0 aA	0	0	6.9	10.0 aA	0	0
dicamba 0.75	4.0	6.7 cC	0	83	2.1	3.0 dDE	0	100
diquat 0.60	6.7	7.0 cC	5	50	1.0	1.0 eF	100	100
picloram 0.50 + 2,4,5-T 2.0	8.0	10.0 aA	0	0	6.2	10.0 aA	0	0
dicamba 0.75 + 2,4,5-T 2.0	8.0	9.0 bB	0	0	4.0	5.9 bB	0	76
diquat 0.60 + 2,4,5-T 2.0	7.7	8.3 bBC	0	10	1.6	1.7 eEF	0	96
2,4,5-T 2.0	8.0	9.0 bB	0	0	3.4	4.2 cCD	0	72
2,4,5-T 4.0	8.0	9.0 bB	0	0	4.6	5.7 bBC	0	56
C V %		9.5				11.1		

Assessment scales: Original growth (growth present at treatment): 1 = no effect, 10 = apparently dead.
Regrowth: percent of new growth on untreated bushes.

The herbicide treatments compared were (kg in 4000 litres water): picloram potassium salt 0.50, dicamba methyl ester 0.75, diquat 0.60, each with and without 2,4,5-T butoxyethanol ester 2.0 and in addition 2,4,5-T 2.0 and 4.0 without additive. Treatments were applied to different bushes on 2.5.73 and 14.12.73 and were replicated three times in each trial.

Treatment effects on both treated and protected parts of each bush were assessed at approximately three month intervals during the year following treatment. At each inspection original growth (growth present at treatment) was assessed on a 1 (no effect) to 10 (apparently dead) scale. Regrowth (if occurring at time of assessment) was estimated as percent of normal.

RESULTS

Tables 1 and 2 summarise assessments of treatment effect made approximately six and twelve months after herbicide application. Table 3 compares the effect of herbicides on protected upper and lower branches of treated gorse plants.

DISCUSSION

When applied in May all herbicides, with the exception of diquat, were considerably less active than in December against both treated and protected parts of the gorse plant. At the late autumn application only diquat completely browned treated foliage and no treatment prevented regrowth in the following summer. Only picloram had any appreciable effect on protected branches when applied in May.

The limited ability of 2,4,5-T to move in lethal amounts within the gorse plant was apparent. Even under the most favourable conditions of December application the effect of this herbicide on protected growth was confined to the desiccation of immature actively growing foliage. Hard mature spines and green bark were usually little affected and regrowth, although reduced, was vigorous.

Although fairly active in summer on treated gorse, dicamba, at the rate used, showed little capacity to desiccate protected foliage and had practically no effect on the level of regrowth on either treated or untreated parts of the plant. As an additive, dicamba did not significantly increase the effect of 2,4,5-T on the treated gorse at either application time, but it significantly improved desiccation of protected foliage when applied in December. However, it did not materially aid in regrowth suppression at either time of treatment.

TABLE 3: EFFECTS OF HERBICIDES ON PROTECTED UPPER AND LOWER GORSE BRANCHES

Herbicide applied		*2/5/73*		*14/12/73*	
Assessed		*2/5/74*		*10/ 1/75*	
Branches		*Upper*	*Lower*	*Upper*	*Lower*
Treatment (kg/4000 litre)					
picloram	0.50	8.7	7.0	10.0	10.0
dicamba	0.75	1.0	1.1	3.0	2.3
diquat	0.60	1.0	1.0	1.0	1.0
picloram	0.50 + 2,4,5-T 2.0	9.0	6.7	10.0	10.0
dicamba	0.75 + 2,4,5-T 2.0	1.7	1.0	8.0	5.0
diquat	0.60 + 2,4,5-T 2.0	1.0	1.0	2.3	1.0
2,4,5-T	2.0	1.7	1.0	7.0	3.0
2,4,5-T	4.0	2.3	1.3	9.7	3.7

Assessment scale: 1 = no effect, 10 = apparently dead.

In both trials 2,4,5-T seemed superfluous as an adjunct to picloram; the combination giving no improvement over picloram alone in dessication or regrowth suppression at either time of treatment. Picloram showed a much greater capacity than any other material to move in lethal amounts within the gorse plant so that its effect on protected branches was usually at least as severe as, and generally indistinguishable from, that on treated parts.

As an additive to 2,4,5-T applied in May, diquat very significantly improved the desiccation of treated gorse compared with 2,4,5-T alone, but gave no advantage in December. At both times of treatment it significantly reduced the desiccant effect of 2,4,5-T on protected foliage and allowed an increase in the amount of regrowth following summer treatment.

Table 3 shows that protected branches near the top of treated gorse bushes were more severely affected by most treatments than were branches located at the base of the plant. Exceptions were diquat which had no effect at either time of treatment and picloram which killed all protected foliage when applied in December. The greatest differences in effect between upper and lower branches were noted in plants treated with 2,4,5-T in summer.

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