NOTE

SEASONAL GROWTH OF GORSE AND ITS SUSCEPTIBILITY TO 2,4,5-T AND 2,4,5-T/PICLORAM

JOHN M. BALNEAVES*

Abstract

A trial was established to determine the effectiveness of spraying mature gorse (Ulex europaeus) *with 2,4,5-T and 2,4,5-T/picloram at monthly intervals over 12 months.*

The effectiveness depended on the stage of growth at the time of herbicide application. Optimum results occurred when gorse flowering was completed, most seed pods were fully developed, and a new flush of foliage had grown to about 2.5 cm in length. As new foliage grew and matured so the duration of control was reduced. The duration of control did not differ between herbicides.

The pattern of regrowth was related to time of spraying and is a further reflection of the initial spray effectiveness. After the October, December, and January applications, regrowth occurred only as basal sprouts. At all other times, regrowth occurred on all sections of the desiccated stems from the base of the bush to the previous terminal point of the bush.

INTRODUCTION

Control of gorse during the establishment and early stages of forest stand development is important (Balneaves *et al.*, 1977).

Chavasse and Davenhill (1973a, b) and Chavasse and Fitzpatrick (1973) described results of a "small plot" trial near Rotorua in which total eradication of gorse was achieved with the use of a multiple spray treatment after burning. The success of this treatment depends on a hot burn which will consume all stick material and leave the site clean. To achieve this in many areas it is necessary to either spray or crush gorse to facilitate burning (Balneaves and Valentine, 1976).

Wendelken (1966) described results of pre-planting gorse-eradication work in Wellington Conservancy. This involved a pre-burn spray application followed by a post-burn application of 2,4,5-T. As a result of this work the cost of establishment and management of the radiata pine crop, up to the

*Forest Research Institute, P.O. Box 31-011, Christchurch.

second-pruning lift, was halved. Wendelken suggested three areas which needed thorough investigation:

(1) Timing of weedicide application in relation to vegetational development stages.

(2) Use of multiple application and chemicals.

(3) Timing of burning in relation to time since spraying, and in advance of planting.

This note describes results of a trial in which timing of herbicide application was related to vegetative development of gorse.

METHOD

A total of one hundred and fifty 5 m × 2 m plots, each with a 1 m pathway surround, was laid out in an area of mature (4 years since previous burn) gorse in North Loburn adjacent to Ashley Forest. The gorse was 1.0 to 1.5 m tall.

Spraying was carried out each month from June 1975 to May 1976 (except for November 1975). The stage of development of gorse was recorded at each spraying time. There were six replicates in a fully randomised design.

Two chemicals were used:

(1) 5.4 kg of 2,4,5-T/ha (360 g/litre as the butyl ester).

(2) 2.0 kg 2,4,5-T and 0.5 kg picloram/ha (200 g 2,4,5-T/litre as the iso-octyl ester and 50 g picloram/litre as the potassium salt).

These chemicals were made up with water to a total volume equivalent to 330 litres of water/ha, and applied as a spray using the FRI precision spray unit described by Sanderson (1974). The sprays were applied in a double pass.

Assessments of gorse desiccation and regrowth were carried out at monthly intervals until December 1976 when the gorse was cleared by fire.

Assessment of desiccation was recorded on a 0-5 scale as follows:

0 = Vigorous healthy gorse
1 = Slight browning of upper foliage
2 = General browning of upper foliage
3 = Browning of all foliage; all stem tissue still green
4 = Base of woody stem still green
5 = 100% browning of foliage and stem tissue.

Regrowth was assessed as light, moderate, or prolific, and location on the plant was noted. These categories are subjective; a more quantitative assessment technique is currently being devised.

RESULTS

Stage of Growth at Each Spraying Date

A description of the condition of the gorse at the time of each spraying is given in Table 1.

TABLE 1: STAGE OF GROWTH AT EACH SPRAYING DATE

Month	*Comment*
18 Jun. 1975	No foliage growth. Prolific flower buds; a few flowers.
18 Jul. 1975	No foliage growth. Prolific flowers; numerous buds.
14 Aug. 1975	No foliage growth. Full flower.
16 Sep. 1975	Commencement of new foliage growth. Few flowers; mainly seed pods forming.
14 Oct. 1975	Prolific new foliage growth (up to 2.5 cm long). Seed pods fully developed; a few flowers.
16 Dec. 1975	Vigorous new growth, soft to grasp (up to 30 cm in length). Seed pods ripening or ripe.
14 Jan. 1976	New growth maturing. Seed pods opened and seed dispersed.
18 Feb. 1976	New growth matured (spiny to grasp).
19 Mar. 1976	New growth matured. Flower buds forming.
14 Apr. 1976	Mature foliage only. Few flowers; prolific flower buds.
20 May 1976	Mature foliage only. 50% flowers; 50% flower buds.

Period of Desiccation and Appearance of Regrowth After Spraying

Figure 1 summarises observations on duration of control (that is, length of time between date of spraying and appear-

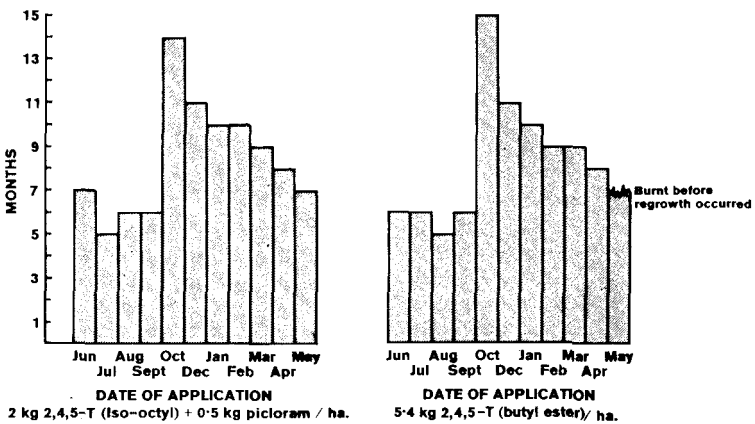

FIG. 1: *Duration (months) of control of gorse growth from time of spraying.*

ance of fresh regrowth) for each treatment. Three main points emerged:

(1) Duration of control depended on the stage of growth when the herbicide was applied. The optimum time for spraying gorse was when the flowering had been completed, seed pods were well developed, and the new flush of foliage growth had reached about 2.5 cm in length.

(2) The application of 2,4,5-T (butyl ester) gave an optimum 14 months' control when applied at the growth stage described in (1) above. For the period June to September inclusive, control was very short-lived (5 to 6 months). From December to May there was a general decline in duration of control, dropping to a low 7 months after the May application.
When applied at the growth stage described in (1) above, 2,4,5-T (iso-octyl)/picloram gave 13 months' control. There were no significant differences between herbicide treatments in regard to duration of control; most results were identical in this respect.

(3) Pattern of regrowth after spraying is significant. In the June-September series, regrowth occurred initially from the upper 15 cm of the desiccated stem and in some instances from the very terminal point of the plant. By December 1976 regrowth occurred from all portions of the desiccated stems.
After the October, December, and January applications, regrowth occurred from the base of the desiccated stem, extending no further than 30 cm up from ground level. From February to April inclusive, applications of 2,4,5-T and 2,4,5-T/picloram resulted in decreasing effectiveness (as winter approached). The reaction of the gorse plant to application of these chemicals at this time was similar to that for the period from June to September. Control was short-lived, with regrowth occurring both as basal sprouts and from all sections of the desiccated stem.

(4) Under the conditions of this trial there was insufficient chemical to eradicate the gorse with one application and regrowth occurred after all treatments.

DISCUSSION

Seasonal growth of gorse influences uptake and translocation of chemicals.

The optimum control of gorse was achieved at a stage when fresh growth had just commenced. As the foliage matured,

the duration of control decreased. In contrast, Crafts (1964) and Hull (1967) stress that, for effective treatment of woody plants and trees, it is important to wait until the foliage is mature and exporting assimilates

The amount of regrowth after treatment and, more especially, its position on the stem give some indication of degree of uptake of chemical through the cuticle and the amount translocated within the plant. For example, in the June-September series the occurrence of regrowth initially from the upper 15 cm and the terminal point of the desiccated stem suggests that uptake and translocation of material at this time were negligible — insufficient to cause stem mortality.

At the time of new shoot growth the epidermis becomes more permeable and uptake of chemicals is greatly enhanced. At this stage of growth the phloem is very active and this ensures better translocation of material around the plant.

In addition, by October the gorse plant had been through a winter period, had flowered and produced seed, and, while seed pods may have been mature at time of commencement of spring growth, the plant had hardly had time to replenish its reserves. It is suspected that plant resistance at this particular growth stage may be low (Balneaves *et al.*, 1977).

Active root growth at time of treatment has also been suggested to improve herbicide translocation (Zabkiewicz, 1977). Sutton (1969) claimed that trees have no inherent periodicity in root growth activity and yet many references he cited indicate that root activity is at a peak just prior to and during early spring flush. As terminal shoot growth continues on into the spring and summer so there is a decline in tree root activity. References to similar data for gorse could not be found. Because gorse does not have a conventional flowering cycle — *i.e.*, flower in the spring, set seed in the summer, mature in the autumn — its physiological activity (and its root activity) may differ from that of other woody plants. Root growth is, of course, also dependent on ample soil moisture and Thompson (1975) has correlated gorse kill with this factor. In the present trial soil moisture was adequate in all seasons.

In some districts, where soil types and climates allow a longer growing season, effective results may be obtained from applications later into the spring and summer than was optimal in this experiment.

ACKNOWLEDGEMENTS

I would like to thank C. G. R. Chavasse, Dr J. M. Valentine, and Dr J. A. Zabkiewicz for their constructive criticism of the original draft of this Note .

REFERENCES

Balneaves, J. M.; Valentine, J. M., 1976. The influence of pre-burn treatments on burning results in gorse and gorse/bracken. *N.Z. For. Serv., For. Res. Inst., For. Establ. Rep. No. 86* (unpubl.).

Balneaves, J. M.; Fraser, T.; Calderon, S., 1977. Gorse control: Pt. I. A test of three multiple herbicide regimes. Pt. II. Financial evaluation of multiple spray regime for gorse control. *N.Z. For. Serv., For. Res. Inst., For. Establ. Rep. No. 113* (unpubl.).

Chavasse, C. G. R.; Davenhill, N. A., 1973a. Control of established gorse by multiple chemical treatments. *N.Z. For. Serv., For. Res. Inst. Res. Leaflet No. 36.*

————; ———— 1973b. A review of chemical control of bracken and gorse for forest establishment. *Proc. 26th N.Z. Weed & Pest Control Conf.*: 2-6.

Chavasse, C. G. R.; Fitzpatrick, J., 1973. Weed control in forest establishment in New Zealand. *Proc. 4th Asian-Pacific Weed Sci. Soc. Conf.*: 267-73.

Crafts, A. S., 1964. Herbicide behaviour in the plant. Pp. 75-110 *in* Audus, L. J. (ed.) *The Physiology and Biochemistry of Herbicides.* Academic Press, London and New York.

Hull, H. M., 1967. Uptake and movement of herbicides in plants. *Proc. Symp. on Herbicides and Vegetation Management in Forests, Ranges and Non-crop Lands.* Oregon State University.

Sanderson, H., 1974. The FRI precision sprayer for herbicide trials. *N.Z. For. Serv., For. Res. Inst., For. Establ. Rep. No. 53* (unpubl.).

Sutton, R. F., 1969. Form and development of conifer root systems. *Tech. Comm. No. 7, Commonw. For. Bureau.* Oxford, England.

Thompson, A., 1975. *A Review of Gorse* (Ulex europaeus) *Studies by the Weed Science Group.* Ruakura Agricultural Research Centre 1972-1975.

Wendelken, W. J., 1966. Site preparation for afforestation. *Proc. 19th N.Z. Weed & Pest Control Conf.*: 140-4.

Zabkiewicz, J. A., 1977. Factors affecting uptake and translocation of chemicals by gorse. *N.Z. For. Serv., For. Res. Inst., Tree Physiology Rep. No. 30* (unpubl.).