EFFECTIVENESS OF METHYL BROMIDE, DAZOMET, AND METAM IN ERADICATING OXALIS LATIFOLIA

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Summary

Methyl bromide and dazomet (85% wettable powder) at 1.11, 1.67, 2.22 and 3.33 lb per 100 sq. ft, and metam at 0.56, 0.83, 1.11 and 2.22 lb active ingredient per 100 sq. ft, were each tested for eradicating *Oxalis latifolia* H.B.K. from light pumice nursery soil. After 11 months no living *Oxalis* could be found on any of the plots treated with methyl bromide, but neither dazomet at even 3.3 times the recommended minimum rate nor metam at 4.4 times the recommended minimum rate gave complete control.

INTRODUCTION

INFESTATION OF SOILS by the bulbous species of *Oxalis* seriously limits their use for nursery and other purposes. Because of its great powers of regeneration through the development, proliferation, and dispersal of bulbs, bulb scales, and bulbils, complete eradication of this weed requires the death of all such parts. Cultivation only accentuates the problem by breaking up and dispersing these viable portions without killing them. Esler (1962) found that weekly defoliation over several seasons was necessary to kill individual plants. But as dormant bulbs and bulbils can exist in the soil for several years, these would ensure survival of the weed; to be effective, cultivation or defoliation by mechanical means, or by contact sprays, would need to be pursued relentlessly for many years.

Esler also found that burial to a depth of 9½ in. was partially effective but that burial to greater depths was needed to ensure the eventual death of all bulbs and bulbils. The impracticability of ensuring burial of all regenerative parts to a depth of 12 in. or so over a large area renders this method unworkable.

Translocatable hormone weedicides have been found to kill only those bulbs and bulbils that are actively developing and towards which there is a strong flow of metabolites or nutrients (Jackson, 1960, 1961). Frequently the chemical is diverted to newly developing leaves, inflorescences and bulbils in the axils of the bulb scales without affecting the stem apex within the bulb. Mature or dormant bulbils are largely unaffected. Of four hormone weedicides tried, Jackson (1961) found that the best, 2,4,5-T, killed up to 50% of the bulbs; 2,4-D severely damaged the bulbs but did not achieve a complete kill of any; MCPA and MCPB had very little effect on the underground parts. Even if more effective hormone-type sprays are found, these will not be likely to affect dormant bulbs or dormant detached bulbils lying beneath the soil, and repeated spraying for a number of years would be necessary.

Chemicals of the soil sterilant type are generally recommended as providing the best means of controlling *Oxalis* spp. Although they are usually expensive to use, the possibility of achieving complete eradication with a single application may make their use more

economic than the repeat treatments mentioned above. The three chemicals most commonly advocated are methyl bromide, dazomet and metam (Matthews, 1960). It was decided to compare the effectiveness of these three.

Fig 1: Layout of plots and treatments. Figures denote rates of application of sterilant in lb per 100 sq. ft.
(DMTT = Dazomet, SMDC = Metam)

LOCATION, SOIL CONDITIONS, AND LAYOUT OF TRIAL

An area of abandoned garden adjacent to the Forest Research Institute nursery at Whakarewarewa was used for the trial. This had lain unused for many years but had been cultivated intermittently to destroy rank weed growth. The soil, a very light sandy silt derived from pumiceous ash, was heavily infested with the bulbs and bulbils of the pale-flowered form of *Oxalis latifolia* H.B.K. (Esler, 1962), and also with the seeds and vegetative propagules of many other plants, including dock (*Rumex* spp.), sorrel (*Rumex* spp.), plantain (*Plantago* spp.), *Lotus major*, cocksfoot (*Dactylis glomerata*), white and red clover (*Trifolium* spp.).

Approximately half an acre was rotary-hoed to a depth of 6 to 8 in. and then left undisturbed for 14 weeks. By this time (mid-February, 1961), germination of the *Oxalis* bulbs throughout the site was prolific and uniform, and growth vigorous. Within this it was possible to select a treatment area such that there was almost no discernible variation in *Oxalis* regrowth throughout. At the time of treatment the plants were in full leaf and flowering had commenced.

Twenty-four 12 ft × 4 ft uncovered wooden frames of the type used for shading in the nursery were laid out in two ranks and the treatments allocated systematically* as shown in Fig. 1. The area enclosed by each frame formed a treatment plot with a net area of 45 sq. ft. The soil of all plots in one rank was dug over by spade to a depth of 8 to 10 in. immediately before treatment.

MATERIALS USED AND THEIR APPLICATION

The materials used, rates of application and costs are shown in Table 1.

Each of the plots treated with methyl bromide was covered beforehand with a sheet of 200 gauge, 6 ft wide, black agricultural polyethylene film, the edges overhanging the frames being buried in the soil outside. Liquid methyl bromide in 1 lb canisters was released (by means of plastic tubing inserted under the sheeting) into a half-litre beaker set in the centre of each plot.

Both the dazomet and metam were added to water and applied with a watering can. The metam for each plot was divided into two equal portions, which were applied two days apart. Considerable care was taken to apply both of these chemicals evenly over each plot and both were well watered in with a lawn sprinkler immediately after each application. All treatments were applied in the late afternoon.

To ensure the maximum effectiveness of the gases produced, the plots treated with dazomet and metam were covered with plastic sheeting in the same manner as the methyl bromide plots. The sheets were temporarily drawn back on the days following application of both these treatments and a second watering was given.

All covers remained in place for four weeks.

WEATHER AND SOIL CONDITIONS

The weather was generally fair and warm both before treatment and for about a fortnight afterwards. Light rain, totalling 0.73 in. and not exceeding 0.4 in. on any one day, fell on six days during the 17 days preceding treatment. The soil, being very free draining, was barely moist at the time of treatment. During the fortnight

* Although the use of a non-random design has precluded statistical analysis, the results seemed sufficiently consistent and conclusive to justify reporting.

TABLE 1: MATERIALS, RATES OF APPLICATION, AND COSTS

Material	Bulk Cost per lb (June, 1962)	Rate of Application (lb) per 100 sq. ft	Cost per 100 sq. ft £ s. d.	Cost per acre £
Methyl bromide	4s. 9d.	1.11*	5 3	115
		1.67	7 11	172
		2.22	10 6½	230
		3.33	15 10	345
Dazomet	14s. 0d. (85% wettable powder)	1.11*	15 6½	339
		1.67	1 3 4	508
		2.22	1 11 1½	678
		3.33	2 6 8	1,016
Metam (3.7 lb active ingredient/gal)	9s. 1½d. (active ingredient)	0.56*	5 1	110
		0.83	7 7½	166
		1.11	10 1½	221
		2.22	1 0 3	442

* Approximately the minimum rates (of 1, 1, and ½ lb respectively per 100 sq. ft.) recommended by the Dept. of Agriculture and the distributors.

TABLE 2: OBSERVATIONS ON OXALIS REGROWTH

Date	Methyl bromide		Dazomet		Metam	
	Rate (lb per 100 sq. ft)	Oxalis regrowth Plot not dug freshly dug	Rate (lb per 100 sq. ft)	Oxalis regrowth Plot not dug freshly dug	Rate (lb per 100 sq. ft)	Oxalis regrowth Plot not dug freshly dug
Apr. 13, 1961	1.11	Nil	Nil	1.11	Light	Light- mod.
	1.67	Nil	Nil	1.67	Light	mod. Light-
	2.22	Nil	Nil	2.22	Nil	mod.
Nov. 6, 1961	3.33	Nil	Nil	3.33	Nil	1.11
	1.11	Nil	Nil	1.11	Mod.	2.22
	1.67	Nil	Nil	1.67	Mod.	0.56
Jan. 15, 1962	2.22	Nil	Nil	2.22	Mod.	0.83
	3.33	Nil	Nil	3.33	Light	1.11
	1.11	Nil	Nil	1.11	Sparse	2.22
	1.67	Nil	Nil	1.67	Abund.	0.56
	2.22	Nil	Nil	2.22	Abund.	0.83
	3.33	Nil	Nil	3.33	Abund.	1.11
	1.11	Nil	Nil	1.11	Sparse	2.22
	1.67	Nil	Nil	1.67	V. abund.	V. abund.
	2.22	Nil	Nil	2.22	Abund.	Abund.
	3.33	Nil	Nil	3.33	Light	Light
					Sparse	Sparse

ABUNDANCE CLASSIFICATION

Nil: no infestation evident.
 Nil*: one or two leaves near periphery of plot.
 Sparse: 1 to 4 centres of infestation on whole plot.
 Light: 5 to 20 centres of infestation on whole plot.
 Moderate: 21 to 50 centres of infestation on whole plot.
 Abundant: Over 50 centres of infestation on whole plot.

after treatment, soil temperatures 4 in. below ground level varied as follows:

Daily maxima, 70° to 86°F; mean 78°F

Daily minima, 61° to 71°F; mean 67°F

RESULTS

Observations on *Oxalis* regrowth are summarized in Table 2.

After almost 11 months no germination of *Oxalis* bulbs or bulbils had taken place and no dormant bulbs or bulbils could be found in the soil of any of the methyl bromide-treated plots, but only the heaviest applications of dazomet and metam came within sight of achieving total eradication. All three materials, at each of the rates used appeared to give complete control of all the other weed species present.

CONCLUSIONS

- (1) Only methyl bromide gave complete control of *Oxalis latifolia* after one application at the lowest recommended rate.
- (2) Methyl bromide appeared to sterilize the soil of all other weed seeds and vegetative propagules present.
- (3) At the lowest rate (1.11 lb/100 sq. ft or 484 lb/ac) methyl bromide is far cheaper than effective rates of dazomet or metam for *Oxalis* eradication in light pumiceous soils.
- (4) Neither dazomet at 3.3 times the recommended minimum rate nor metam at 4.4 times the recommended minimum rate is completely effective. Presumably even heavier applications would be needed under normal (non-covered) conditions to achieve total eradication with a single treatment.
- (5) Digging immediately before the treatments did not improve their effectiveness. If anything, during the early stages, the regrowth appeared slightly sooner on the freshly dug plots treated with dazomet and metam.

REFERENCES

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