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VEL 5026 — A NEW HERBICIDE FOR NON-SELECTIVE WEED CONTROL

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Summary

A new, relatively soluble, low toxicity herbicide, VEL 5026, was tested in eighteen trials for non-selective weed control. Although root-absorbed, VEL 5026 showed post-emergence activity at 5 to 10 kg/ha against a wide range of grass and broadleaf weeds, including some resistant to karbutilate and bromacil. Paspalum species required 12 to 16 kg/ha. Soil residues provided pre-emergence weed control for 4 to 8 months. Plants treated during active vegetative growth prior to rain were most susceptible. Where rank growth or mature broadleaf weeds were encountered, the result could be enhanced by adding an amitrole-T/2,2-DPA mixture. VEL 5026 was toxic to small pine trees at 4 kg/ha.

INTRODUCTION

A residual, root absorbed herbicide (sterilant) is essential for long term, non-selective weed control (McFarlane 1967). Usually the sterilant is mixed with a foliar-absorbed herbicide, but some of the more soluble sterilants such as bromacil (Ward 1964), karbutilate (Palmer *et al* 1972) and thiazafluron (Patterson and Rae 1974) have sufficient post-emergent activity to be used alone, notwithstanding some limitations. Bromacil and thiazafluron are very residual but do not control paspalum, which is considered to be a major problem weed on railway tracks (Kennedy 1972). Karbutilate controls paspalum but is less residual than bromacil and not very effective on tall fescue, docks, dandelion, sorrel and couch (Palmer *et al* 1972).

In the search for a herbicide which showed greater activity than karbutilate on some of these weeds, plus activity on paspalum, a new relatively soluble (3000 ppm), low toxicity (oral LD50 = 1400 mg/kg) herbicide, VEL 5026, was tested. The preliminary results of eighteen field trials, laid during the winter and spring of 1974 and summer 1975 in Taranaki and mid-Canterbury, are presented. Because a number of the trials are still in progress, some of the results are only preliminary, particularly with respect to residual activity.

METHOD

Two or three replicates of each treatment (plus 0.2% nonionic surfactant) were applied with a precision sprayer using fan nozzles applying 320 litres/ha. Each plot was 5 x 2 m or multiples of, and rates of VEL 5026 varied from 1 to 16 kg/ha. Suitable roadside or railway track margins were chosen as sites.

Whole plots and individual species were rated on a 0 to 10 scale for "brownout", final kill and regrowth suppression, with 0 = no effect and 10 = complete kill. A rating of 8 or more was considered desirable. A logarithmic time scale was used in the graphical presentation to emphasise the brownout evaluations.

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For leaching and residue studies, 20 cm deep x 5 cm diameter cores were bioassayed longitudinally with turnips. Ratings from 0 = no symptoms to 2 = complete leaf necrosis, were used to graph a soil residue profile. The effects of organic matter on persistence; and foliar versus root activity, were investigated in pot trials.

RESULTS AND DISCUSSION

Herbicidal Activity

Figure 1 is typical of the non-selective weed control achieved with a spring application of VEL 5026. Treated plants became limp after 10 to 20 days and died back progressively from the leaf tips, turning greyish-black or brown. The maximum effect which showed after about one month was indistinguishable from karbutilate. In this trial, the addition of a mixture of 2,2-DPA: amitrole-T 1.5:1 at 6 kg/ha improved the initial brownout by about 30%. However, the final post-emergent activity was similar for all treatments except simazine, which is notably weak alone (McFarlane 1967). VEL 5026 and karbutilate both provided 6 months control of browntop and yarrow. By comparison, the 2,2-DPA/amitrole-T mixture alone failed to control regrowth or seedlings after two months

Fig. 1: An example of non-selective weed control with Vel 5026.

Weed Susceptibility

Table 1 shows the rate of VEL 5026 at which various species were controlled post-emergence, or were prevented from establishing pre-emergence. In comparison with other sterilants, VEL 5026 was

- (a) equal in activity to karbutilate on paspalum. Season-long control was achieved on sandy railway tracks, but regrowth occurred in the same season on sites with high OM or on roadsides where large, deep-rooted plants occurred. Repeat sprayings with reduced rates over a number of years, as suggested by Kennedy (1972) and Palmer *et al* (1972) is being investigated.

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- (b) more active than karbutilate on tall fescue, prairie grass, plaintains, catsear, dandelions and couch.
- (c) less active than karbutilate on cocksfoot and showed little activity on field speedwell, bracken (*Pteridium* spp.) and greater bindweed (*Calystegia sepium*).

VEL 5026 also controlled a wide range of seedling broadleaf weeds at 0.25 to 0.5 kg/ha in crop selectivity trials and few crops showed adequate tolerance. One year old radiata pine (*Pinus radiata*) trees were not tolerant to more than 4 kg/ha applied around their base, while overseas trials reported young orchard trees damaged by 1 to 2 kg/ha (Velsicol Chemical Corp bulletin).

TABLE 1: WEED SPECIES SUSCEPTIBILITY TO VEL 5026
(4 to 8 months control)

	Rates of VEL 5026 kg/ha	
	3-5	8-10
GRASSES		
barley grass (<i>Hordeum</i> spp.)	XX	XX
barnyard grass (<i>Echinochloa crus-galli</i>)	XX	XX
browntop (<i>Agrostis tenuis</i>)	X	XX
cocksfoot (<i>Dactylis glomerata</i>)	0	X
couch (<i>Agropyron repens</i>)	0	XX
Indian doab (<i>Cynodon dactylon</i>)*	—	X (16)
kikuyu (<i>Pennisetum clandestinum</i>)	0	XX (12)
Mercer grass (<i>Paspalum distichum</i>)	0	X (16)
paspalum (<i>P. dilatatum</i>)	0	XX
poa annua (<i>Poa annua</i>)	XX	—
prairie grass (<i>Bromus unioloides</i>)	XX	XX
ratstail (<i>Sporobolus africanus</i>)	X	XX
ryegrass (<i>Lolium</i> spp.)	XX	XX
summer grass (<i>Digitaria sanguinalis</i>)	XX	—
sweet vernal (<i>Anthoxanthum odoratum</i>)	XX	XX
tall fescue (<i>Festuca arundinacea</i>)	X	XX
Yorkshire fog (<i>Holcus lanatus</i>)	XX	XX
BROADLEAF WEEDS		
Canada thistle (<i>Cirsium arvense</i>)*	—	XX
catsear (<i>Hypochaeris radicata</i>)	X	XX
cleavers (<i>Galium aparine</i>)	XX	XX
clovers (<i>Trifolium</i> spp.)	XX	XX
creeping buttercup (<i>Ranunculus repens</i>)*	0	X
dandelion (<i>Taraxacum officinale</i>)	X	XX
gorse (15 cm) (<i>Ulex europaeus</i>)	XX	—
hawkbit (<i>Leontodon taraxacoides</i>)	X	XX
plantains (<i>Plantago</i> spp.)	X	XX
prostrate amaranthus (<i>Amaranthus deflexus</i>)*	0	—
Scotch thistle (<i>Cirsium vulgare</i>)	—	XX
sheep sorrell (<i>Rumex acetosella</i>)	XX	XX
speedwell (<i>Veronica arvensis</i>)	0	X
wireweed (<i>Polygonum aviculare</i>)	XX	XX
yarrow (<i>Achillea millefolium</i>)	—	XX

- XX = well controlled (8 to 10 rating).
 X = plant vegetation well suppressed (5 to 8).
 0 = unacceptable (1 to 5).
 — = not applied at this rate.
 * = rate requires confirmation.
 (12) or (16) = rate necessary for established plants or high OM soil.

Time of Application

Initial pot trials using wheat plants showed VEL 5026 to be almost entirely root absorbed. In field trials, although some foliar activity was observed from treatments during dry summer periods, rain was necessary to wash VEL 5026 into the root zone for maximum control. Timing of application was therefore important, as plants were most susceptible when growing actively during moist conditions. Figure 2b shows the relatively poor control obtained from an August application of VEL 5026 to dormant paspalum, compared with the excellent control shown in Figure 2c, obtained from VEL 5026 applied two months later on the same site, as new growth began. Figure 2c also demonstrates the weakness of bromacil and the 2,2-DPA/amitrole-T mixture as a spring application, on paspalum.

KEY See Figure 1. B = bromacil

Fig. 2: Control of paspalum and tall fescue with VEL 5026.

One of the limitations of karbutilate is its relatively short period of maximum activity — from late spring until early summer (Palmer *et al* 1972). VEL 5026 appeared to possess greater flexibility in this regard. It was superior to karbutilate in early spring on tall fescue (Fig. 2a); and in early autumn on paspalum (Fig. 2d), although VEL 5026 was similar to karbutilate on both these species in spring (eg Fig. 2c).

Soil Type

Organic matter (OM) affected the activity of VEL 5026. In one pot trial a half-life of 75 days was established on a sand/loam mixture (3% OM) but this was reduced to 40 days on a brown loam (15% OM). In crop selectivity trials with VEL 5026 at 1 to 4 kg/ha, twice the dose rate was required for silt-loams and up to three times for peats, to achieve an effect comparable to a sandy loam.

Leaching and Persistence

The bioassays of soil profiles in Figure 3 indicate VEL 5026 leached readily through the soil profile and leaching was probably the main factor affecting its persistence. The depth to which it leached and its persistence, depended on the initial rate and the amount of rain. After 3 weeks, with 79 mm rain, VEL 5026 at 8 kg/ha was detectable to 20 cm. After 22 weeks and 463 mm rain, 8 kg/ha was just detectable

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in the top 10 cm, whereas 12 kg/ha was abundant. Residues from 16 kg/ha, on the other hand, were still present after 31 weeks, although applied in early spring and receiving 919 mm rain. Figure 3 also illustrates that karbutilate had similar mobility in the soil to VEL 5026, although perhaps less residual; whereas bromacil was considerably more persistent than either. The bioassays correlated well with the field ratings for residual weed control, which was least from winter applications encountering high rainfall and greatest when made prior to dry periods.

Fig. 3: Residues of VEL 5026 in soil profiles 3, 10, 22 and 31 weeks after application.

Foliar Absorbed Additives

The addition of a foliar-absorbed herbicide was found to be most beneficial where the growth was slow and rank, or where broadleaf weeds abounded. If treated plants were growing actively, a similar degree of control was usually achieved by replacing the foliar active herbicides in the mixture with an increased rate of VEL 5026. In one trial, VEL 5026 reduced the activity of 2,2-DPA/amitrole-T on paspalum by 40%. Alternating applications of 2,2-DPA/amitrole-T in autumn followed by VEL 5026 in spring, as well as VEL 5026 mixtures, are being evaluated at present, particularly for paspalum control.

CONCLUSION

VEL 5026 is a broad spectrum, non-selective root absorbed herbicide with excellent post-emergent activity and residual characteristics intermediate with other sterilant materials. It gives useful control where paspalum, tall fescue, prairie grass and weeds of the dandelion group occur. Its propensity to leach through the soil and its toxicity to trees and crops restricts its use to non-crop areas, roadsides and railway tracks.

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