CONTROL OF INSECTS IN SEEDLING FIELD BRASSICAS WITH PHORATE GRANULES

E. A. UPRITCHARD and O. L. PARK

Ivon Watkins-Dow Ltd, New Plymouth

Summary

Phorate granules at 1 kg/ha applied as a furrow treatment with brassica seed effectively controlled adult weevils, dominantly *Hyperodes bonariensis* in field brassica seedlings, resulting in increased plant numbers and increased fresh weight yield of crop. Phorate also suppressed aphids during early development of the crop and gave good control of springtails (*Bourletiella* spp).

INTRODUCTION

Poor establishment of some crops, especially summer and autumn sown brassicas and ryegrass (*Lolium* sp) is well known to farmers in the drier arable areas of the South Island. Lowe (1956) quoted surveys showing about half of all brassica plantings suffered moderate to severe damage by insects, chiefly springtails (*Bourletiella* spp), weevils (*Hyperodes bonariensis* and *Irenimus* spp [*Catoptes*]), and grass grub beetles (*Costelytra zealandica*). Lowe (1958) also named 10 insects observed damaging seedling brassicas under practical field conditions. French and Douglas (1967) assessed insecticide sprays for control of weevils, springtails, nysius (*Nysius huttonii*), and grass grub beetles, but results were variable.

Since the banning of organochlorine insecticides, parathion-methyl spray has become the accepted commercial standard for insect control in seedling crops, but high mammalian toxicity and the need for an application permit prompted research into alternative compounds. Granular applications of phorate showed most promise in initial trials and because of advantages in ease of application and relative safety, phorate was selected as the standard for further trials.

This paper presents results from 10 trials laid down in Canterbury during January, February and March of 1974, 1975 and 1976 to assess phorate granules and several other candidate compounds for control of weevils in germinating brassicas. Assessment of the control of nysius, springtail and aphids was also made where these insects occurred.

METHOD

Ten trials of 1 - 4 replicates were laid down, using standard calibrated coulter drills and planting methods, to treat plots 1 to 3 drill widths (2 - 6 m) wide and not less than 10 m long. All treatments were applied as granules in mixture with seed or fertiliser as a furrow treatment with the seed at 150 - 180 mm row spacing. Untreated 2 m wide buffer strips were left between plots in the three single replicate trials, Nos. 2, 3, and 4. Soft turnips (*Brassica rapa*) were planted in all trials and were sown in combination with rape (*Brassica napus*) in two trials and ryegrass in one trial.

Paddocks were selected for trials on the basis of lifting larger clods or lumps of trash randomly from the finally prepared paddock and examining the soil surface and clod or trash for weevils and other insects. If one or more weevils could be found on each inspection, the paddock was considered to be severely infested. The presence of other insects was also noted. Crop response was assessed by counting the number of seedlings in 15 - 30 randomly selected 1 m lengths of row per plot (taken as $0.15\,m^2$) in all 10 trials. Insects were assessed in Trial 2 by hand sieving and sorting 60 bulked core samples per plot totalling $0.12\,m^2$ (50 mm deep) and in Trial 10 by lifting 10 pieces of uniformly-sized clod or trash (taken as 80 mm diameter) totalling $0.05\,m^2$ per plot and counting insects on the surface of the soil and clod or for springtails by visually counting insects jumping onto a $0.09\,m^2$ white card placed on the ground at 10 random locations.

Single replicate trials were analysed by a *t* test on the standard error of the means, and multi-replicate trials by analysis of variance. Phorate 1.0 kg/ha and untreated were common to all trials and a separate analysis, removing between trial variation, was made using trials as replicates, for both plant counts and fresh weight (FW) yield.

RESULTS AND DISCUSSION

Insects collected from trial sites and not already identified in the text are dung beetle (*Cercyon analis*), Victoria weevil (*Desianthia diversipes lineata*) and subterranean clover weevil (*Listrodes delaiguei*), and cabbage aphid (*Brevicoryne brassicae*).

In Trial 1, phorate 1.0 kg/ha (298 000 plants/ha) gave a 7450% increase in plant numbers over untreated (4000 plants/ha). This figure has been excluded from the '% relative to untreated' column in Table 1 to keep the figures realistic. Results are presented in Table 1.

Chemical treatment

Phorate 1.0 kg/ha significantly increased plant numbers compared to untreated in all trials, and this closely related to significant yield increases in the five trials harvested ($P < 0.01$).

In other treatments, assessed by plant counts only, phorate 2.0 kg/ha and terbufos 1.0 kg/ha were not significantly different to phorate 1.0 kg/ha, but significantly higher than untreated ($P < 0.01$). Fensulfothion was significantly higher than untreated but significantly lower than phorate and terbufos. Ethaprophos 1.0 kg/ha, and treatments of chlorpyrifos 1.0 kg/ha, diazinon 2.0 kg/ha and chlorpyrifos EC 0.6 kg/ha (sprayed after sowing) not included in Table 1, were seldom significantly better than untreated.

TABLE 1: PLANT COUNTS; FRESH WEIGHT YIELDS; INSECT COUNTS;

TRIAL NUMBERS			2 – 10		1 – 10		3,4,5,7 & 10		2			10			5
WEEKS AFTER TREATMENT			4 – 11		4 – 11		9 – 12		4			4			6
RESPONSE FACTOR RATED			PLANTS/HECTARE				FW YIELD		INSECTS / m^2						% PLANTS INFESTED WITH APHIDS
			% relative to untreated		1000's		kg/ha (1000's)		Nysius	Dung beetle	Weevils	Springtails	Dung beetle	Weevils	
TREATMENT		kg/ha	n		n		n								
phorate	20G	1.0	9	187	10	304	5	17.2	195	51	25**	1.1	220	40	18*
phorate	20G	2.0	3	211					153	51	9**				
terbufos	20G	1.0	3	187					220	34	59*				
ethoprophos	20G	1.0	5	124											
fensulfothion	5G	1.0	2	164											
untreated		–	9	100											
untreated actual		–		133	10	137	5	9.1	280	76	102	59	240	260	58
CV %						21		13				13	5	13	
LSD 5%						89		2.9	NS	NS		11	NS	80	
1%						126		4.9				19		132	

n = number of trials : t test = *0.05 **0.01

Phorate and terbufos 1.0 kg/ha gave significant reductions in weevil populations but not nysius. Phorate 1.0 kg/ha also significantly reduced springtail and aphid populations.

Dung beetles were not affected by any treatment.

General

Weevils were dominant in all trials, though nysius, springtails and dung beetle were invariably present in low numbers. Little is known about the life cycle of dung beetle, but it does not appear to affect seedling crops.

Quantifying insect populations proved difficult, hand sorting with sieves being accurate but time consuming. Clod or trash examination gave a useful quick reading and could be developed as an evaluation technique, although the estimate would be conservative as insects below the soil surface are not taken into account.

Weevils

Stem weevil was by far the most abundant in the trials and is therefore suspected of causing the most damage. *Irenimus* spp and Victoria weevil were less common and subterranean clover weevil was relatively rare.

In practice, paddocks in the first crop out of permanent pasture or lucerne carried highest weevil populations. Since brassicas are normally planted as the first crop after permanent pasture in drier arable areas, it is not surprising that they are regularly attacked. Weevil densities found in Trials 2 and 10 of 102 and 260/m^2 were found in paddocks initially selected on the basis of one or more weevils per clod. It is interesting to note that a normal turnip planting rate of 400 - 500 g/ha gives a theoretical density of 187 000 - 235 000 plants/ha (470 $\pm$ 8 seeds/g). Plant counts for phorate 1.0 kg/ha ranged from 130 000 - 170 000/ha (5 trials) to over 500 000(2 trials).

Nysius

Nysius was only observed in large numbers in Trial 2, but the numbers were at a marginal level to cause significant damage, inferred by Trought (1975) to be about 200/m^2. Rapid re-invasion of small plots by this highly mobile insect is a problem in assessing control and more critical trials are needed to determine control of nysius. Field observation of nysius damage indicated most noticeable feeding in strips along fencelines adjacent to lucerne or pasture hay paddocks.

Springtails

A high level of springtail control was obtained with phorate 1.0 kg/ha but the evaluation technique only gave comparative results between treatments and not as an estimate of actual populations. Cleland (1955) defined numbers as low as 180/m^2 as potentially damaging to seedling brassicas.

Aphids

Cold weather prevented aphid populations building up sufficiently to give conclusive results, but there were strong indications that phorate 1.0 kg/ha would give useful protection for young plants up to 5 weeks after planting.

Fungi

Captan coated seed was compared to inert coated and uncoated seed in 5 trials to check the possible effect of 'damping off' on seedling emergence. There were no differences in any of the trials, but *Rhizoctonia solani* has been isolated as a cause of crop failure, normally associated with damp conditions.

Ryegrass

Ryegrass emergence was also assessed in one trial and weevils caused a similar degree of suppression as in brassicas, untreated plant populations being 193 000/ha and phorate 1.0 kg/ha phorate treated populations 299 000/ha. Trought (1974) showed a similar response with phorate 1.0 kg/ha on 'Tama' ryegrass.

Management practices

Observation of commercial sowings indicate early plantings (November - January) were more severely attacked than late (February - March) suggesting late planting may minimise damage. French and Douglas (1967) suggest plants withstand damage better under moist active growth conditions. These and other management practices such as type and frequency of cultivation need further evaluation.

CONCLUSIONS

Granule formulations of phorate (1.0 kg/ha) applied as a furrow treatment at sowing gave significant protection to seedling brassicas and ryegrass against insect attack, especially weevils. This increase in plant populations was associated with a corresponding increase in fresh weight crop yield.

Insects cause serious damage to summer and early autumn sown brassicas and ryegrass. Stem weevil appears to be the most serious pest, particularly after a perennial crop. Other insects occur less regularly but can severely damage seedlings where they occur in large numbers.

For any insect control programme to be successful a full understanding of life cycles and feeding habits is essential. This information is not available for most of the species concerned and undoubtedly limits effective use of insecticides and management practices to reduce insect damage to seedling crops.

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