FURTHER DEVELOPMENT OF INSECTICIDAL SEED TREATMENTS FOR THE CONTROL OF SOLDIER FLY

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Summary

Three trials are reported in which seed treatments on ryegrass (*Lolium* sp) were tested for their ability to control soldier fly larvae (*Inopus rubriceps*), enhance seedling establishment and increase grass production. Some seed treatment formulations at low rates of insecticide were shown to be effective in reducing soldier fly populations and increasing ryegrass production in pot trials, however a field trial showed up establishment problems. The method requires further development to be fully effective in the field.

INTRODUCTION

Systemic insecticides have proved effective in controlling soldier fly larvae (Dixon and Grimmer 1973; Dixon *et al* 1974; Mackay and Rowe 1973). Drilling the systemic insecticide with the seed was more effective than broadcasting when low rates were used, but this was not so at higher rates (Dixon *et al* 1974). Mackay *et al* (1974) found that paraquat treatment of existing pasture before drilling the fertiliser, seed and insecticide was more effective than drilling into existing pasture; and more soldier fly larvae were found on the roots of establishing ryegrass on paraquat treated areas than on non-paraquat treated areas. This indicated that the larvae tend to move onto the establishing seedlings in the absence of any other suitable root material. These factors indicated that the placement of the insecticide in the root zone of the establishing seedling was worth further investigation. Dixon and Parr (1975) reported that seed treatments were successful in reducing soldier fly larval populations in a pot trial.

EXPERIMENTAL METHODS

Trial 1, a field trial, was laid down in May 1976, near Matangi, Hamilton, on Eureka sandy clay loam. Prior to drilling, the area was hard grazed and sprayed with 0.42 kg/ha of paraquat and 0.20 kg/ha 2,4-D. 'Grasslands Ariki' ryegrass seed was sown at the rate of 12.5 kg/ha and reverted superphosphate at 227 kg/ha. Insecticide treatments are listed in Table 1. The seed treatments were sown through the seedbox and the granular treatments were mixed with the fertiliser and drilled. A Duncan triple disc drill was used and the area was rolled after drilling. There were thirteen treatments, replicated six times in a randomised block design with a plot size of 20 x 2.5 m.

The treatments using Prillcote coated seed had the insecticide

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incorporated in the Prillcote. One treatment had an additive incorporated to facilitate slow release of the insecticide. The dressed treatments had the seed coated with insecticide using an adhesive of 1% methyl cellulose.

Plant vigour was assessed visually at four intervals up to 50 days from planting using an open ended scale. Larval numbers were assessed by taking seven 7.6 cm dia. soil cores to a depth of 15 cm from each plot 10 weeks after drilling. Larval numbers were not assessed on isofenphos seed treatments with rates of 1.0-2.0 kg/ha because of an obvious lack of plant numbers.

Trial 2, a glasshouse pot trial, used the same treatments as trial 1, except that the granular treatments were omitted (Table 2). The soil was a commercially sterilised loam. 'Ariki' seeds (30/pot) were sown in pots having a surface area of 200 cm² and 150 large soldier fly larvae were introduced at the time of sowing. There were four replicates of each treatment in a randomised block design. The trial was conducted over a 22 week period during which five foliage cuts were taken. Seedlings that emerged were counted until seedling emergence had ceased, then they were thinned to 10/pot. At the end of the trial the soil from the pots was washed so that the number of larvae, plants and tillers could be counted and roots and remaining foliage weighed.

Trial 3, a screenhouse pot trial, followed the same method as trial 2, differing only in that the surface area of the pots was 270 cm², with 150 medium sized soldier fly larvae and 30 'Grasslands Ruanui' ryegrass seeds per pot. The dressed treatments were commercially prepared using a water soluble adhesive. Treatments are listed in Table 3.

RESULTS

Trial 1

The results from trial 1 are presented in Table 1. Bendiocarb and carbofuran granules significantly reduced the number of larvae below that in the controls. Both the bendiocarb granular and seed treatments and carbofuran granular treatments had significantly higher vigour scores than the controls.

In a separate analysis a *t*-test on the Prillcote and untreated controls showed that the Prillcote treatment was significantly ($P < 0.05$) reduced in vigour score. A further analysis, on the mean vigour score, showed a significant ($P < 0.01$) reduction in score with increasing rate of isofenphos (excluding the change from 0.0 to 0.5 kg/ha).

Trial 2

The results of trial 2 are presented in Table 2. Isofenphos and bendiocarb treatments significantly reduced the number of larvae compared to the controls. There was a significant ($P < 0.05$) general decline in larval numbers with increasing rate of isofenphos, a reduction of 11% for every 0.5 kg/ha increase in rate.

Linear comparisons showed isofenphos Prillcoate treatments had significantly ($P < 0.01$) less larvae than the bendiocarb dressed treatments. Also a similar analysis showed isofenphos to significantly

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TABLE 1

Trial 1: Field trial evaluation of insecticidal seed treatments and granular formulations for control of soldier fly larvae. Mean plant vigour scores and larval assessments.

Seed treatment	Insecticide	Formula- tion	Rate kg/ha	Mean plant vigour score	No. Larvae/m ²
Prillcote	—	—	0.0	1.9 cdeCD	1856aA
Prillcote	isofenphos	EC	0.5	2.9 bcC	1206 bcdABC
Prillcote	isofenphos	EC	1.0	2.0 cCD	
Prillcote	isofenphos	EC	1.5	1.3 deD	
Prillcote	isofenphos	EC	2.0	0.9 eD	
Prillcote	isofenphos	Tech	1.0	1.2 deD	
Prillcote	isofenphos	Tech + A [†]	1.0	1.9 cdeCD	
Dressed	bendiocarb	WP	1.0	4.6 aA	1434 abcAB
Dressed	bendiocarb	WP	2.0	4.4 aAB	1345 bcdABC
Untreated	bendiocarb	G	2.0	4.9 aA	944 deBC
Untreated	bendiocarb	G	2.0	4.8 aA	834 eC
Untreated	phorate	G	3.0	3.3 bBC	1053 cdeBC
Untreated	—	—	0.0	2.9 bcC	1584 abAB

EC = emulsifiable concentrate

Tech = technical material

[†]A = additive

WP = wettable powder

G = granule

TABLE 2

Trial 2. Pot trial evaluation of insecticidal seed treatments. Plant production and larval assessments.

Seed treatment	Insecticide	Rate kg/ha	Tillers/ plant	Dry matter g/pot	Root weight g/pot	larvae/ pot
Prillcote	—	0.0	4.6cdBC	1.4dC	0.9cCD	98aA
Prillcote	isofenphos*	0.5	7.3abA	3.7bcAB	2.3abAB	36cdeDE
Prillcote	isofenphos*	1.0	7.9aA	4.4aA	3.1aA	33deDE
Prillcote	isofenphos*	1.5	7.4abA	3.9abAB	2.1bAB	30deDE
Prillcote	isofenphos*	2.0	6.5abAB	3.7abAB	1.8bBC	25eE
Prillcote	isofenphos**	1.0	7.4abA	3.3bcB	2.1bAB	45bcdCD
Prillcote	isofenphos+	1.0	6.7abAB	4.0abAB	3.5abAB	34cdeDE
Dressed	bendiocarb†	1.0	6.0bcAB	3.0cB	1.9bABC	61bBC
Dressed	bendiocarb†	2.0	5.9bcAB	3.3bcB	2.0bAB	50bcCD
Untreated	—	0.0	3.5dC	1.0dC	0.6cD	91aAB

At the completion of the trial the number of larvae per pot was correlated with (i) the dry matter production $r = -0.76^{***}$ (ii) the root weight $r = -0.45^{***}$ and (iii) the mean number of tillers per plant $r = -0.51^{***}$.

* emulsifiable concentrate

** technical material

+ technical material plus additive

† wettable powder

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($P < 0.01$) lower seedling emergence at 19 days from planting, but at 30 days there was no difference between treatments. The Prillcote had no effect on seedling emergence.

Trial 3

The results from trial 3 are presented in Table 3. Both the Prillcote and dressed isofenphos treatments at 1.0 kg/ha significantly reduced larval numbers compared to the controls. A linear comparison showed that the insecticide was significantly ($P < 0.01$) more effective when associated with the Prillcote than when associated with the dressed treatment.

TABLE 3
Trial 3. Pot trial evaluation of insecticidal seed treatments. Plant production and larval assessments.

Seed treatment	Insecticide	Rate kg/ha	Tillers/plant	Dry matter g/pot	Root weight g/pot	larvae/pot
Untreated	—	0.0	5.4cB	1.6cB	0.7bB	62aA
Prillcote	—	0.0	8.1 bcAB	2.8bcAB	1.1abAB	39abAB
Dressed isofenphos		0.5	6.3cB	1.7bcB	0.6bB	54abA
Prillcote isofenphos		1.0	11.5aA	4.4aA	1.6aA	2dC
Dressed isofenphos		1.0	6.4cB	2.0bcB	0.7bB	16cB
Prillcote isofenphos		2.0	7.9bcAB	3.0bAB	1.3abAB	18bcAB
Dressed bendiocarb		0.5	7.1cAB	2.7bcAB	1.1abAB	43abAB
Dressed bendiocarb		1.0	5.6cB	1.9bcB	0.9bAB	41abAB
Untreated (no larvae added)		0.0	11.0abA	4.3aA	1.0bAB	

At the completion of the trial the number of larvae per pot was correlated with (i) the dry matter production $r = -0.55^{***}$ and (ii) the number of tillers per plant $r = -0.61^{***}$.

DISCUSSION AND CONCLUSIONS

Dixon and Holland (1977) reported that both carbofuran and isofenphos at 2 rates (kg/ha) as seed treatments were effective in controlling soldier fly larvae in a field trial. The activity of the insecticide was independent of the three coating methods used, which were: (i) commercially prepared Prillcote, (ii) commercially prepared seed plus fertiliser granules and (iii) an experimentally prepared 1% methyl cellulose solution. A 67% larval mortality was obtained in the isofenphos and a 50% mortality with carbofuran, the larval mortality being independent of the two rates used. No phytotoxic symptoms were encountered with these two chemicals in any of the coating methods.

The trials reported in this paper show that Prillcote, when combined with isofenphos can exhibit phytotoxic symptoms in field and pot trials. This was indicated by a reduction of plant numbers and a lack of plant vigour in the field and retarded seedling emergence in a pot trial. The activity of the insecticide was also affected by the

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coating method, the Prillcote being superior to the dressed treatments in trial 3.

Jeffs (1973) showed that the adhesive used on cereal seeds interacted with the fungicide to decrease germination in some cases. Graham-Bryce (1973) stated that excessive adhesion to the seed may decrease the effectiveness of the insecticide.

The trials reported in this paper point towards coating-insecticide interactions and insecticide release problems. This was shown by poor seedling establishment and low larval mortality in some cases.

In view of the past successes by Dixon and Holland (1977) and in other unpublished trials, further development of insecticidal seed treatment of ryegrass seeds for the control of soldier fly larvae should proceed. It is probable that some change has been made in the Prillcote-insecticide preparation which has adversely affected seedling growth. This would explain the difference in the results of the trials reported here and those reported by Dixon and Holland (1977).

It appears that pot trials can be used as an indicator of field responses and hence should be employed to aid the development of insecticidal seed treatments.

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