CHEMICAL CONTROL OF GRASS GRUB IN THE SOUTHERN NORTH ISLAND: RESULTS OF 1977-1979 TRIALS

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SUMMARY

A series of trials investigated rates of insecticide, types of insecticide and method of application for grass grub (*Costelytra zealandica*) control on southern North Island dairy farms. The main findings were: results were extremely variable which must affect farmer confidence in chemical control of grass grub; when insecticides were broadcast it was important that a high rate be used; and when insecticide (fensulfothion) was drilled into pasture rate of application in the range 0.55 — 3.0 kg/ha did not affect the result.

INTRODUCTION

Traditionally grass grub control in the southern North Island has involved broadcast applications of fensulfothion in autumn when the grubs are large and close to the surface. The research reported here was designed to evaluate the efficacy of alternative application techniques and chemicals at a range of times.

METHODS

The trials were laid out in randomised block designs. The chemicals evaluated were: fensulfothion 5% granules; diazinon 20% granules and 80% emulsifiable concentrate; ethoprophos 20% granules and isazophos 60% emulsifiable concentrate. Broadcast treatments were applied using a Sisis lospread fertiliser spreader; drilled treatments were applied with a Duncan triple disc drill and the jet squirt apparatus was constructed following instructions given by Trought and Wood (1970).

All the trials were carried out on dairy farms. In Taranaki all the trials were on Egmont soil, on or near the Taranaki Agricultural Research Station. At Colyton (Manawatu) the soil type was Manawatu Silt Loam, at Norsewood the soil type was Matamau-Kopua and at Dannevirke it was Matamau soil. Soil moistures at application of the trials reported here ranged from 5%—50%.

All treatments were replicated four times except for the jet squirt trials, in which each treatment was replicated eight times. In experiment one (insecticide x rate x time of application), all treatments were broadcast except for one that was jet squirt. The chemicals used were fensulfothion, diazinon and ethoprophos at 1.1 and 2.2 kg/ha applied in February and April (6/2/77, 7/4/77, 7/2/78 and 4/4/78) for two years (i.e. each plot received the same treatment in both years). The trial was sampled on 26/6/77 using 20 10 cm diameter soil cores per plot and on 10/7/78 by taking one 1 x 0.14 m plough strip per plot. All the plots were 6 x 8m.

In experiment two diazinon was applied by jet squirt at 2.2 kg/ha as an emulsifiable concentrate, in 200 litres water/ha, on three sites and at monthly intervals for 6 months. Plots were all 4.5 x 8m. The trial was sampled on 1-5/8/78 by taking one 1 x 0.14m plough strip per plot. Actual application dates were: Colyton and Norsewood, 12/12/77, 17/1/78 13/2/78, 23/3/78, 20/4/78 and 31/5/78; Normanby 15/12/77, 18/1/78, 10/2/78, 21/3/78, 18/4/78, 1/6/78.

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In experiment three the emulsifiable concentrates of isazophos and diazinon were compared using the jet squirt technique at Dannevirke. The trial was laid down on 15/5/79 and was sampled with eight 14.5 cm spade spits per plot on 4/7/79. Plots were 4.5 x 8m.

Experiment four compared fensulfothion at four rates (0.55, 1.1, 1.65, 3.0 kg/ha), drilled at a depth of 2.5 cm in plots 3 x 8m at Normanby on 27/3/79. The trial was sampled with eight 14.5 cm spade spits/plot on 7/6/79.

All data were transformed for analyses and the presented data are all back transformed.

RESULTS

Experiment 1: The results of this experiment are shown in Table 1. The best results were obtained with late applications of diazinon (broadcast) at both rates and with ethoprophos at the high rate and at both times, in 1977. In 1978 ethoprophos did not lower grass grub numbers significantly but the early application of fensulfothion at the high rate and the late application of diazinon at the same rate significantly affected the grass grub populations. The main point from Table 1 is the variability of the results, both within years and between years.

TABLE 1: Results of experiment 1. Insecticide by rate by time of application.

Chemical	Rate kg/ha	Application time	Numbers of grass grub/m ² 1977	1978
untreated			130 a A	71 a A
fensulfothion	1.1	February	65 ab AB	83 a A
		April	64 ab AB	33 a A
	2.2	February	70 ab	3 b
		April	69 ab AB	32 a A
diazinon	1.1	February	102 ab AB	138 a
		April	62 b AB	71 a A
	2.2	February	76 ab A	34 a A
		April	28 c B	3 b B
	2.4 (jet squirt)	February	73 ab AB	111 a A
		April	73 ab AB	35 a A
ethoprophos	1.1	February	111 ab A	63 a A
		April	73 ab AB	60 A
	2.2	February	61 b AB	53 a A
		April	54 b AB	35 a A

Coalesced data

(1) Rate	Number of grass grub/m ²		(2) Time	Number of grass grub/m ²	
	1977	1978		1977	1978
1.1 kg/ha	77 a A	68 a A	February	79 a A	41 a
2.2 kg/ha	57 b A	17 b B	April	50 b B	29 a

In footnotes to Table 1 coalesced data for rate of insecticide and for time of application are shown. In both years the higher rate of insecticide significantly lowered grass grub numbers ($P \leq 0.05$). The effect of time of application was less clear cut. The late application was more effective ($P \leq 0.01$) in 1977 but there was no significant difference in 1978.

Experiment 2: In Table 2 the data from the time of application of diazinon by jet squirt trial was shown. At Normanby and Norsewood the treatments had no significant effect on the grass grub populations. The April and to a lesser extent, the March applications at Colyton provided effective grass grub control.

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TABLE 2: Experiment 2: Jet squirt evaluation of diazinon (2.2 kg/ha).

Treatment time	Colyton	No. grass grub/m ²	
		Normanby	Norsewood
untreated	102 ab A	59 a	242 a
December	66 ab AB	76 a	217 a
January	133 a A	63 a	196 a
February	137 a A	30 a	213 a
March	31 bc AB	23 a	153 a
April	17 c B	26 a	187 a
May	77 ab AB	50 a	192 a

Experiment 3: The data from the trial comparing isazophos and diazinon applied jet squirt are shown in Table 3. From this it can be seen that isazophos was slightly more effective than diazinon although the differences were not statistically significant.

Experiment 4: In Table 4 the effects of the four rates of fensulfothion drilled for grass grub control are shown. All four rates significantly lowered the grass grub populations with respect to the control plots.

DISCUSSION

The most outstanding feature of the data presented here is its variability which has practical implications for farmers attempting to control grass grub with insecticides. On a range of southern North Island soil types the method used here gave reductions in grass grub numbers ranging from 41-79% in the first year of experiment 1, using the standard broadcast treatments of fensulfothion, diazinon and ethoprophos at 2.2 kg/ha (Table 1). Autumn jet squirt applications (March-April-May) gave 12-83% reductions in grass grub numbers (Tables 2 and 3). This variability in control could not be accounted for by differences in soil moisture at application.

The importance of using a high rate of insecticide for broadcast treatments is apparent from the data in Table 1. This contrasts with farmer practice which is to use lower rates to minimise costs. The lack of carryover effect of many of the treatments from one year to the next in experiment 1 stresses the point that with the organophosphorous insecticides any control obtained is for the current year only, but applications at the higher rate for two consecutive years resulted in an average reduction of 76% in 1978.

TABLE 3: Experiment 3. Comparison of isazophos with diazinon applied by jet squirt for grass grub control in the Dannevirke area.

Chemical	Rate kg/ha	Mean number of grass grub/m ²
untreated		222
isazophos	2.2	150
diazinon	2.2	195
MSD 5%		106

TABLE 4: Experiment 4: Rates of fensulfothion drilled for grass grub control.

Treatment	Rate kg/ha	Grass grub/m ²
untreated		71 a
fensulfothion	0.55	32 b
	1.1	40 b
	1.65	30 b
	3.0	31 b

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The jet squirt trials (expts. 2 and 3) and the jet squirt treatment in experiment 1 suggest that the technique does not really have a place for the application of diazinon in the southern North Island, as it was ineffective except at Colyton. Why the autumn treatments at Colyton should be effective is not obvious. Isazophos was more effective than diazinon in the one trial where it was used (Table 3) and may warrant further investigation.

The use of drills to apply insecticide has been increasing since this allows the rate of insecticide application to be reduced with consequent cost savings. In experiment 4 (Table 4) the rate of insecticide did not affect the level of control, even as low as 0.55 kg/ha, which is only 25% of the recommended surface broadcast rate. At current prices this would be \$23/ha against \$92/ha for chemical alone. Isazophos was drilled at 3 rates by O'Connor and Hart (1976) who found that 0.5 kg/ha rate was not as effective as 1.0 and 1.5 kg/ha.

CONCLUSIONS

Three general points can be extracted for the trials discussed in this paper:

- (a) control of grass grub using the available insecticides and methods of application is variable.
- (b) when insecticides are broadcast the rate of application is important.
- (c) when insecticide (fensulfothion) is drilled into the ground rate is less important.

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