CONVENTIONAL AND MICROENCAPSULATED SPRAY AND BAIT FORMULATIONS FOR PORINA CONTROL

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SUMMARY

A simple sampling method was developed to estimate live porina (*Wiseana* spp) numbers on small plots. Foliar sprays with standard chemicals at recommended rates against mature caterpillars gave 44% control in the first year's trials and 80-95% control in two subsequent years. Microencapsulated (micro-) parathion-methyl gave equivalent control to fenitrothion EC. Water resistant baits consisting of lucerne meal: sawdust: wool wax alcohols (2:3:5), and containing 5-10% fenitrothion, gave 64-84% control when applied at 10 kg/ha. This gave a bait density of about 1 particle/12.5 cm². The occurrence of frosts either before or directly after application had no influence on control at the site studied.

INTRODUCTION

Chemical control of porina caterpillar is recommended when pasture damage becomes obvious and infestations are in the order of 20-40/m² (Savage and French 1981). Because of the transient nature of the currently recommended organophosphate insecticides and the intermittent feeding behaviour of the pest, porina control exceeding 80% cannot be guaranteed (Pottinger 1977).

Improved control might be expected therefore with more persistent insecticides or formulations applied either as broadcast foliar sprays or in bait form. Baits would also be preferable to sprays for aerial application to hill country areas where frequent windy conditions can be encountered (Kain *et al* 1978). Unprotected kibble wheat baits applied at 10 hill country sites at rates which were cost-competitive with conventional foliar treatments gave 42-83% control (Carpenter 1982).

This study reports results of trials between 1977 and 1981 in which a range of insecticide formulations and water-resistant baits were tested against mature porina caterpillar.

METHODS

Trial design and assessment

Trials were carried out during June/July in 1977, 1980 and 1981 at St Andrew's Golf Course in Hamilton, where there has been a continuing porina problem.

Design and assessment were similar for each trial. Plots (1.5 m²), each surrounded by a 0.5 m buffer strip, were set out in two blocks in areas where the grass was about 5 cm long. At 1-2 weeks before the initial treatment applications, a population assessment was taken for each plot by counting surface tunnels and holes. Plots were assigned to four treatment replicates (two per block) on the basis of these estimates so that each treatment contained plots with a similar range of caterpillar numbers.

About a month after the final treatment applications, assessment of live caterpillar numbers on each plot was made by a method similar to that outlined by Savage and French (1981). A Ryan turf cutter, set to a 4 cm depth, was used to cut the turf on each plot into 1.5 x 0.3 m strips. The strips were removed and the exposed surface swept to remove loose dirt and to fill the porina holes. Polythene was placed on the soil surface and the turf replaced. After 3-4 days, the turf and polythene were removed and the newly cleared porina holes counted as live porina remaining per plot. In 1980 and 1981, a visual assessment of treatment effects was also made before cutting the turf strips.

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The trial results were assessed by an analysis of variance of the log transformed data.

Chemicals and application techniques

Chemicals, formulations and rates used in each trial are given in the appropriate tables in the text.

In 1977, granules were applied with a hand shaker and the foliar treatments applied, in 400 litres/ha of water, with a 'Solo' back pack single fan jet spray (2 passes/plot). In subsequent trials, foliar treatments were applied in 200 litres of water/ha with a 'Mystifier' knapsack sprayer equipped with a 2 m boom containing five 730154 fan nozzles operated at 172 kPa. Baits were applied with a hand shaker.

Bait preparation

Bait formulations consisted of 2:3:5 lucerne meal: sawdust (carrier): wool wax alcohols (mp 65 °C). The latter material, a reasonably hard solid at normal temperature, allowed free flowing baits to be prepared and gave water protection to the particles.

Baits were prepared by melting the wool wax alcohols on a water bath and stirring in the insecticide, lucerne meal and sawdust (8-16 mesh). After cooling, the mixture was blended in a Waring blender for several minutes, then sieved. The 8-36 mesh fraction was used for the trials. Baits were prepared with both EC and microencapsulated fenitrothion formulations.

Larger sprayed areas and carryover effects

In 1981, nine larger areas (40 x 6 m) spread over four locations on the golf course fairways, were sprayed with fenitrothion EC (1.2 kg ai/ha) using a vehicle-mounted spray boom. An equal number of similar unsprayed areas were also marked out. Treatment effects were assessed visually at 1 month after application, and by point analysis (400-600/plot) at 1, 2 and 12 months after application.

Weather during trials

The 1977 trial started during a period of frosts. The daily grass minimum temperature varied between 0 and -5.4 °C on 8 of the 12 evenings following application. A week of milder temperatures followed. In 1980, there were 8 successive frosts (-0.2 to -7.5 °C) during the 13-20 June pre-treatment period which was followed by 6 days of milder temperatures with occasional rain. In 1981, mild temperatures prevailed for about a week prior to 20 June. This was followed by six successive hard frosts (-3.4 to -6.9 °C) and then 14 days of milder temperatures.

TABLE 1: Summary of spray and granule treatments and effects on mature porina caterpillars for applications on 5 July 1977.

Chemical	Rate (kg ai/ha)	Control* (%)
diazinon 80 EC	1	44
diazinon 20 G	1	45
dieldrin 50 WP	1	32
difluron 25 WP	0.02	22
cypermethrin 40 EC	0.08	26
cypermethrin 0.4 G	0.1	0
permethrin 50 EC	0.1	10
permethrin 20 micro	0.12	15

* % reduction in larval population of treated plots compared with untreated plots. The average population in untreated plots was 29/m².

RESULTS AND DISCUSSION

The pre-treatment sampling procedure proved a satisfactory way of assigning plots to the respective treatments. In 1977, there was a good correlation ($r = 0.9$) between the estimated and actual porina numbers in untreated plots. The former method

underestimated the caterpillar population by about 20%. In 1980 and 1981, the pre-treatment estimates were 40 to 50% lower than the actual porina numbers found in untreated plots. The post treatment visual ranking of plots for porina activity successfully showed up the same treatment differences as the live caterpillar method and the two methods were well related in both the 1980 and 1981 trials.

Table 1 summarises the results of the 1977 field trial. Generally poor control was obtained with all treatments. These included 1 kg ai/ha diazinon EC, a recommended treatment. The poor control with the insect growth regulator, difluron, was not unexpected, since the application was made against a mature porina population and the month interval between application and assessment was too short for a high proportion of the population to undergo a moult. Bioassays have shown that porina fed with this chemical fail to survive the moult (authors' unpublished data). The resistance of porina to synthetic pyrethroids is now well documented (du Toit *et al* 1978; Jordan and Chang 1981). The reasons for the low control with diazinon were not established.

In the 1980 spray trial all treatments except micro-diazinon gave high levels of control. Micro-parathion-methyl gave equivalent control to fenitrothion EC. It was thought that the high control achieved in this trial possibly reflected the fact that the application was made at an ideal time to stimulate caterpillar feeding, i.e., after a week or so of heavy frosts and just before 6 days of mild weather. A comparison was therefore made, in the 1981 trial, between EC and micro-fenitrothion applied at different times over a 9-day period both before and after heavy frosts.

TABLE 2: Summary of spray and bait treatments and effects on mature porina caterpillars for applications on 20 June 1980.

Chemical and formulation	Insecticide rate (kg ai/ha)	Bait rate (kg/ha)	Porina activity**	Control* (%)
diazinon 80 EC	1	—	1.9	80
diazinon 20 micro	1	—	2.4	49
parathion-methyl 21 micro	1	—	1.5	91
fenitrothion 60 EC	1	—	1.3	87
fenitrothion 60 EC	2	—	1.0	97
fenitrothion 5% bait (EC)	0.5	10	1.6	84
fenitrothion 5% bait (EC)	1	20	1.5	84
fenitrothion 10% bait (EC)	1	10	2.1	74
fenitrothion 28 micro	1	—	1.0	97
fenitrothion 28 micro	2	—	1.5	98
fenitrothion 5% bait (micro)	1	20	1.8	90
untreated	0	0	2.9	0

* As for Table 1. The average population in untreated plots was 47/m².

** Mean visual score of 3 observers at 18 days after application using following categories: 3 - many recent holes, casts, considerable herbage damage; 2 - intermediate number of holes and damage; 1 - few holes, minimal damage.

The results (Table 3) confirmed the high level of control obtained with both fenitrothion formulations in 1980 but there was no effect due to time of application ($P > 0.1$). These results support previous observations which showed that although isolated frosts occasionally depressed feeding, caterpillars seemed to acclimatise quickly to successive frosts (Esson 1970). In addition, frosts in the Waikato may not be as severe and enduring as in some other parts of the country.

The water-resistant baits gave good control in both trials. In 1980, 5 or 10% fenitrothion baits applied at 10 or 20 kg/ha gave control of the same order as spray treatments and baits prepared with EC or micro-fenitrothion had comparable activity.

TABLE 3: Summary of fenitrothion spray and bait treatments and effects on mature porina caterpillars for applications made at three different dates during June/July 1981.

Formulation	Application date	Insecticide rate (kg ai/ha)	Bait rate (kg/ha)	Porina activity**	Control* (%)
60 EC	22 June	1.2	—	1.0	95
	26 June	1.2	—	1.4	94
	1 July	1.2	—	1.1	91
28 Micro	22 June	1.2	—	1.0	97
	26 June	1.2	—	1.0	94
	1 July	1.2	—	1.5	93
6% Bait (EC)	22 June	0.3	5	2.0	53
	22 June	0.6	10	1.8	76
	26 June	0.3	5	2.5	66
	26 June	0.6	10	1.9	64
	1 July	0.3	5	2.5	58
	1 July	0.6	10	1.9	71
untreated	—	0	—	2.9	0

* As for Table 1. The average population in untreated plots was 47/m².

** Assessed 3-4 weeks after application by two observers scoring as described in Table 2.

The 1981 trials confirmed that a 10 kg/ha rate of 6% fenitrothion lucerne bait (1 particle/12.5 cm²) results in effective control. A further reduction in the bait density to 5 kg/ha (1 particle/25 cm²) gave, overall, significantly ($P < 0.01$) less control. Haack *et al* (1982) and Carpenter (1982) used approximately 0.5% fenitrothion kibble wheat bait at 30-50 kg/ha to give a bait density of approximately 1 grain/6.25 cm² and obtained 42-83% control with fenitrothion EC applied at 129 and 225 g ai/ha respectively. The lowest fenitrothion rate used in the present trials was 300 g ai/ha but this was used as a 6% bait at 1 particle/25 cm². As a combined result of all these observations, it is likely that the presently described lucerne meal bait containing 1-2% fenitrothion and applied at 10 kg/ha should give effective porina control. At present these baits would be more expensive than kibble wheat due solely to the high cost of the wool wax alcohols (\$10-15/kg). Alternative cheap waxy solids are available which could make a 10 kg/ha rate of these baits cost-competitive with kibble wheat at 30-50 kg/ha. For example, a simple saponification of wool grease gives a hard semi-brittle solid at an estimated price of \$1-2/kg.

Despite the high porina mortality on treated plots in 1980 and 1981, little improvement in herbage cover on plots was noted during the course of the trial. At one month after the fenitrothion application in the 1981 larger scale trial, visual assessment showed that porina activity was reduced on every treated area (mean score 1.4) compared with similar untreated areas alongside (mean score 2.5). However, in only one set of plots did point analysis measure a change in ground cover. After two months, point analysis could differentiate between treated and untreated areas at two of the four locations. It was possible that the treatments were applied too late in the season for a herbage response. These observations emphasise the fact that insecticide applications should be made as soon as porina damage is evident. None of the treatment effects were sustained at 12 months after application.

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CHEMICAL APPENDIX

The insecticides used were cypermethrin (Shell FD467, 40EC and 0.4G with 20% oil), diazinon (Dyzol 80EC, Dyzol 20G), microencapsulated diazinon (Knoxout, 20 micro, Pennwalt Corp.), dieldrin (Dieldrex 50WP), difluron (Dimilin 25WP, Batch No.P 7206/K, Philips-Duphar B.V.), fenitrothion (Gramothion 60EC and Sumithion 28 micro), parathion-methyl (Penncap-M, 20.9 micro), permethrin (ICI Tasman 1976 batch, 50EC and 20 micro).