**EVALUATION OF A TECHNIQUE FOR THE EARLY
DETECTION OF PASTURE DAMAGE BY GRASS GRUB,
COSTELYTRA ZEALANDICA AND PORINA, *WISEANA* SPP.**

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SUMMARY

At 46 sites throughout New Zealand, isazophos granules were applied to pasture on plots 2.0 x 30 m in mid January to evaluate the technique for early detection of pasture damage from insect pests. Porina populations in the plots were reduced by 88% within 65 days at the 28 sites where they occurred, but reduction of feeding grass grub populations was more variable, averaging 65% over 44 sites. Pasture responses became visible in nine treated plots after an average of 43 days, allowing time to assess likely pasture loss and implement control options early to maximise their benefit. Where pasture responses were not visible, even when high insect pest populations were present, this resulted from either poor control with the insecticide, presence of grass grub tolerant species, or other pasture growth factors which reduced actual damage.

Keywords: grass grub, porina, pasture damage, early warning

INTRODUCTION

Farmers do not usually apply control measures for grass grub (*Costelytra zealandica*) and porina, (*Wiseana* spp.) until they see signs of pasture damage, by which time it is often too late to achieve the full benefits of control. Such delays in the recognition or treatment of damage result in substantial loss of forage, uneconomic returns from insecticide treatment, and long-term damage to swards. Furthermore, symptoms of damage from pasture pests may be confused with autumn drought stress, making early recognition more difficult, and possibly resulting in unnecessary insecticide application. Farmers appear reluctant to sample for insect pests by digging before damage becomes visible in order to assess if control is worthwhile, or prepare for an anticipated forage loss using pest densities as a guide (Kain *et al.* 1979).

An insecticide plot applied to pasture in mid-January, when grass grub and porina larvae are very small, detected the presence of grass grub up to 6 weeks before recognition of its presence would otherwise have occurred (Stewart *et al.* 1988). This technique is easy to apply and provides the farmer with an ongoing, easily readable monitoring of pest effects.

This method has been packaged as 'Early warning kits' (Barratt *et al.* 1992) which are now commercially available. The kits contain applicators of isazophos, pegs and string to mark area for insecticide application, instructions, and a book (Barratt *et al.* 1990) containing information about phenology, identification, damage recognition, and control options for both grass grub and porina.

This paper reports on an evaluation of this early warning technique throughout New Zealand. The density of insect pests, insecticidal efficacy and time taken before a visual pasture response occurred were measured to determine how effective the technique was in predicting the need for pest control.

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TABLE 1: Effect of insecticide applied to early warning plots on 15-23 January on insect density (larvae/m²) after 8-12 weeks, and time for plots to appear greener than surrounding pasture.

Farm-District	Year	*Days for visual response	Porina		Grass grub	
			untreated	insecticide	untreated	insecticide
			No./m ²		No./m ²	
Southland						
1 Five Rivers	92	30	27	0	49	62
2 Five Rivers	92	-	13	0	80	142
3 Five Rivers	92	-	31	0	31	13
4 Waimea	92	-	4	0	307	240
5 Waimea	92	-	18	0	151	116
6 Te Anau	92	-	13	0	231	36
7 Te Anau	93	-	22	18	89	31
8 Mossburn	92	-	36	0	369	22
9 Tapanui	92	-	13	0	36	18
Otago						
10 Maheno	92	40	53	0	267	0
11 Maheno	92	-	13	0	27	0
12 Maheno	93	-	9	0	31	0
13 Maheno	93	-	13	4	0	0
14 Maheno	93	-	0	4	67	44
15 Oamaru	92	-	13	4	129	13
16 Hakataramea	92	-	13	0	84	22
17 Maungawera	92	-	0	0	307	76
18 Maungawera	92	50	0	0	947	196
19 Tapui	92	53	49	0	93	0
20 Tapui	92	61	58	0	9	0
21 Tapui	92	-	0	0	133	4
22 Millers Flat	92	45	9	0	40	0
23 Millers Flat	92	-	4	0	18	9
Bay of Plenty						
24 Te Puke	93	-	0	0	55	30
25 Te Puke	93	-	0	0	5	15
26 Te Puke	93	35	0	0	75	25
27 Te Puke	93	-	0	0	55	40
28 Te Puke	93	-	0	0	35	45
29 Te Puke	93	35	0	0	100	60
30 Te Puke	93	-	0	0	40	20
31 Te Puke	93	-	0	0	20	30
32 Te Puke	93	-	0	0	65	60
33 Te Puke	93	35	0	0	35	10
Volcanic Plateau						
34 Kuratau	93	-	10	25	488	173
35 Kuratau	93	-	5	5	291	94
36 Kuratau	93	-	5	0	400	79
37 Kuratau	93	-	5	0	622	99
38 Kuratau	93	-	0	0	651	271
39 Kuratau	93	-	0	0	355	192
40 Kuratau	93	-	0	5	350	212
Hawke's Bay						
41 Takapau	93	-	0	0	178	10
42 Takapau	93	-	30	0	0	0
43 Takapau	93	-	0	0	548	271
44 Takapau	93	-	10	0	271	69
45 Takapau	93	-	0	0	54	15
46 Takapau	93	-	5	0	35	20

*Date of last inspection: North Island - 25 March; South Island - 15 May; - denotes that no response occurred.

METHODS

Isazophos granules ('Miral 5G') were applied at 2.0 kg/ha to plots 2.0 x 30 m in pastures in five regions in New Zealand (Table 1) on 15-23 January 1992 or 1993. These plots were inspected by research staff every 3 weeks until 25 March at North Island sites and 15 May for South Island sites. The plots were visually compared with adjacent untreated pasture for signs of pasture responses. In mid-March to mid-April, insect pest densities were estimated at the South Island sites by extracting larvae from 10 spade soil samples 15 x 15 x 15 cm deep and in the North Island from 25 soil cores 10 cm diameter x 15 cm deep from within the insecticide treated plots and adjacent untreated pasture.

Analysis of variance was performed on larval density data, with means between sites and districts compared at the 5% level. Sites where there were either no porina or grass grub were excluded from the analysis.

RESULTS

Isazophos reduced porina density by 88%, from 17 to 2 larvae/m² ($LSD_{(0.05)} = 6$) within 30-60 days at the 28 sites where porina were present (Table 1). Grass grub were present on 44 sites and the density of feeding larvae (first, second and immature third instars) were reduced by 65%, from 182 to 64 /m² ($LSD_{(0.05)} = 36$). Reduction in porina densities from isazophos did not differ between sites ($P > 0.05$) but reductions of grass grub densities were variable. Poor control of grass grub at Five Rivers in northern Southland may have resulted from lack of rain, since only 20 mm rain fell in the 6 weeks after insecticide application, preventing the active ingredient from being washed into the soil and contacting the larvae.

Visible pasture responses occurred between 30 and 60 days after insecticide application at 9 of the 46 sites treated. Grass grub tolerant pasture species (tall fescue and cocksfoot) were dominant at sites 2, 10 - 13, 15, 19, and 20, but only at site 10 was there a sufficiently high pest pressure (267/m²) for a pasture response to be evident. Generally, reductions in porina and grass grub densities occurred in all districts (Table 2).

TABLE 2: Effect of insecticide applications in January on insect density 8-12 weeks after treatment and number of sites within districts where a visual response was recorded.

District	No. paddocks total visual response		Mean no./m ²			
			Porina		Grass grub	
			untreated	insecticide	untreated	insecticide
Southland	9	1	20	2	147	76
Otago	14	5	21	1	165	29
Bay of Plenty	10	3	0	0	49	34
Volcanic Plateau	7	0	5	7	451	160
Hawke's Bay	6	0	15	0	181	64
$LSD_{(0.05)}$	-	-	12		90	

In the Bay of Plenty, variable and generally poor control of the mainly low population densities of grass grub ($LSD_{(0.05)} = 16$) was associated with low soil moisture levels below 30% w/w between mid January and March, with pasture brown-off conditions prevailing. Despite this, reduction in grass grub numbers combined with a reduction in other pasture insect pests contributed to the visual pasture responses at three sites. White fringed weevil (*Graphognathus leucoloma*) populations were reduced from 41 to 25/m² ($LSD_{(0.05)} = 12$) and those of black beetle (*Heteronychus*

arator) from 19 to 2/m² ($LSD_{(0.05)} = 15$) averaged over the seven sites where they occurred. Tasmanian grass grub (*Aphodius tasmaniae*) was present in low numbers (<35/m²) at three of the sites but probably contributed to a pasture response.

In the Volcanic Plateau, populations of grass grub were reduced by 39-84%, and control of the low numbers of porina was also variable. Despite the high populations of grass grub, no visual responses were observed, probably because by the last inspection in late March, the majority of grubs were still in the second instar, and had not yet completed their feeding cycle. At Hawke's Bay, excellent control of porina was achieved, but reductions in grass grub populations ranged from 43-94%. Rainfall was considered adequate in this instance to wash the insecticide into the soil.

DISCUSSION

Under conditions of adequate rainfall and closely grazed pasture, the early warning technique can provide a convenient means of monitoring pasture pest status. In this study, farmers were alerted at nine sites by mid-March to the presence of pasture insect pests at levels sufficient to cause pasture damage. This early detection enabled assessment of grass grub and porina density by digging (Heffernan *et al.* 1992), and an estimate of the amount of potential pasture loss (Barlow 1985; van Toor, unpubl.) and value (Garnham and Barlow 1993) to be made before actual losses occurred. This projected monetary loss could then be compared with the cost of supplementary nitrogen, insecticides, the biological control agent 'Invade' and heavy rolling to alleviate the expected grass grub damage, and growth regulators and insecticides to alleviate the expected porina damage (Barratt *et al.* 1990). Furthermore, it allows farmers to plan while most options are still open. Clearly the technique is not appropriate where controls need to be applied prophylactically such as mobstocking in January-March for porina control.

For farmers to benefit from the early warning technique, it must demonstrate the presence of pasture pests in situations where damage will result. In this study there were 11 sites which had grass grub densities of over 200/m², and three sites where porina densities were over 30/m², all having levels high enough to potentially give economic damage (Barlow 1985; Garnham and Barlow 1993) and effective insecticide activity, but without early visual pasture responses occurring. This may occur when grass grub tolerant species are present, when grub development is slowed by drought or cool wet summer conditions, or where favourable pasture growth conditions compensate for damage. Under these conditions, the early warning of damage is appropriately not indicated. In 1993 in the Volcanic Plateau and Hawke's Bay damage was of little consequence, despite some quite high pest populations. This may have been a result of favourable pasture growing conditions masking the impact of grass grub and porina larval feeding.

The results indicate that isazophos may have limitations for use in early warning plots for grass grub under dry soil conditions. Increasing the insecticide rate may improve efficacy and give a more reliable indication of actual pasture damage, but increased nematicidal activity may mean that pasture responses reflect nematode damage as well as insect pest burdens. Alternative more reliable insecticides are not currently available. Pastures in the northern North Island are likely to contain insect pests such as black beetle, weevils, soldier fly and Tasmanian grass grub in addition to grass grub and porina, so that altering the timing of insecticide application may be necessary, eg. in November to detect summer damage from black beetle (Watson *et al.* 1981).

Application of insecticide plots in paddocks when the larval stages of pasture pests are very small can provide an easy method of monitoring effects of insect pests in pasture. They can alert farmers to impending feed shortages resulting from pasture insect pests earlier than would become evident in the absence of the plots. The method has proved particularly useful for detecting damaging porina populations.

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