A COMPARISON OF THE USE OF ORGANOPHOSPHATE INSECTICIDE OR NITROGEN FERTILISER TO COMPENSATE FOR PASTURE YIELD LOSSES CAUSED BY PORINA CATERPILLAR

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Summary

Yield and botanical composition responses to June applications of nitrogen, fenitrothion and diazinon to a porina caterpillar (*Wiseana* spp.) infested commercial dairy pasture near Dannevirke, were measured. The control porina density of 28/m² was reduced to 10/m² by insecticide treatment. This had a negligible effect on dry matter yield. Applied nitrogen increased yield to an extent which provided an economic return, indicating that of the management alternatives tested, this was the best strategy to sustain production at the site during late Winter-early Spring.

INTRODUCTION

THE usual strategy to off-set pasture yield losses resulting from porina caterpillar (*Wiseana* spp.) infestations in the period between April and October, is the application of organophosphate insecticides. It is recommended that the decision to apply insecticide should be based on spade samples in March or April. McLaren & Crump (1969), provide threshold values of porina density at which it would be economic to apply organophosphate insecticide, taking into account gross margin per ha and cost of applying insecticide. Their estimates were based on a linear relationship between porina densities in autumn, and the percentage reduction in yields of plots not receiving insecticide compared to those treated with insecticide.

Their estimates indicated that at high stocking rates with high gross margin/ha it would be economic to treat at infestations as low as 10 larvae/m².

An alternative approach to off-set pasture losses caused by porina would be to boost pasture production during the April-October period by some other management procedure. The trial described in this paper tests an alternative strategy, measuring the responses obtained by applying either insecticide or nitrogen in winter. The timing of application of both insecticide and nitrogen were outside the times recommended to give optimal responses. However, shortfalls of pasture production for overwintering purposes may not become apparent until the onset of winter, and these management procedures are often applied outside of the optimum time.

METHOD

The trial was carried out on the property of Mr C. Sandbrook, Te Rehunga, near Dannevirke. High levels of butterfat production were being

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obtained from the property through intensive management practices maintaining a high stocking rate. This had involved the introduction of improved pasture species, regular application of fertiliser including nitrogenous fertiliser, and the application of insecticides to control grass grub (*Costelytra zealandica* [Wh.]) and porina caterpillar.

The trial layout was as follows:

- (1) Replications, 3.
- (2) Insecticide treatments as main plots
 - (a) control
 - (b) fenitrothion prills at 1.12 kg/ha
 - (c) diazinon prills at 2.24 kg/ha
- (3) Rate of nitrogen as split-plots. Four rates of 0, 28, 56 and 112 kg N/ha.

The insecticide main plots were 20 m wide by 58 m long. The split-plots within these main plots measured 20 x 3.7 m.

Block grazing of the trial area was completed on 14 June 1969. Insecticide prills were applied by a commercial spreader on 23 June. Nitrogen was applied as calcium ammonium nitrate on 17 June.

On 19 to 20 August three 0.093 m² quadrats were sampled from points located at random within each of the split-plots. Herbage was cut from these quadrats to a stubble height of 0.5 cm to determine yield and botanical composition. Soil within the quadrat area was excavated, sifted, and porina and grass grub larvae counted. After this sampling the paddock was grazed. A further yield sample was obtained on 25 September from rotoscythe cuts measuring 3 x 0.4 m.

RESULTS

Applied nitrogen significantly increased yield for the 20 August sample, and the same trend, though not significant, was shown for the 25 September sample. The average nitrogen response over all levels of application amounted to 9 kg dry matter/kg N applied. By contrast, response to insecticide was small and non-significant, and when averaged over both insecticide treatments for the two yield samples, provided 62 kg additional dry matter/ha (Table 1).

There were no significant treatment effects on botanical composition. The pasture contained a good base of ryegrass, much of which was observed to be of hybrid type (*Lolium multiflorum* x *perenne*) which is adapted to grow in winter and thus able to respond to nitrogen during that time.

Brown top (*Agrostis tenuis*), poa annua (*Poa annua*), poa trivialis (*P. trivialis*), poa pratensis (*P. pratensis*), sweet vernal (*Anthoxanthum odoratum*) and Yorkshire fog (*Holcus lanatus*) formed the bulk of the unsown grasses (Table 2).

Applied insecticide significantly decreased the number of porina larvae. However, the level of infestation was low and insecticide treatment was not fully effective, reducing the population to 36% that of the control (Table 3). For 45 intact larvae weighed after excavation, the mean live weight was 0.755 g, and the range of weight was 0.090 to 1.730 g.

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TABLE 1: YIELD (kg DM/ha) ON TWO DATES AS AFFECTED BY NITROGEN APPLICATIONS AND ORGANO-PHOSPHATE INSECTICIDE

Insecticide kg/ha	N level kg N/ha	N level x insecticide means		Insecticide means		N level means	
		20 Aug.	25 Sept.	20 Aug.	25 Sept.	20 Aug.	25 Sept.
control	0	739	1398	896	1450	711	1297
	28	931	1372			887	1490
	56	837	1384			913	1523
	112	1075	1649			1118	1612
fenitrothion 1.12	0	629	1360	897	1612		
	28	896	1826				
	56	1012	1636				
	112	1049	1624				
diazinon 2.24	0	765	1133	928	1379		
	28	833	1271				
	56	1112	1549				
	112	1229	1561				
Standard errors		±112	±199	±44	±121	±58	±103

TABLE 2: BOTANICAL COMPOSITION PER CENT ON 20 AUGUST. Means for nitrogen application and organophosphate insecticide treatments
TREATMENT EFFECT

Compound	Insecticide			Nitrogen kg/ha			
	Control	Fenitro- thion	Diazinon	0 N	28 N	56 N	112 N
ryegrass	43.7 ±1.8	42.9	43.6	37.3 ±3.0	47.7	46.4	42.3
white clover (<i>Trifolium repens</i>)	18.0 ±1.7	12.0	13.7	17.3 ±1.5	14.3	12.2	14.5
cocksfoot (<i>Dactylis glomerata</i>)	9.7	8.5	11.8	10.5	7.3	11.1	11.1
timothee (<i>Phleum pratense</i>)	3.6	3.9	3.0	4.0	3.8	4.1	2.1
other grasses	15.6	19.7	17.6	19.2	15.1	16.9	19.3
other species	2.2	2.0	1.3	2.8	1.8	1.4	1.3
dead matter	7.2 ±1.3	10.8	8.9	9.0 ±0.8	9.6	7.9	9.4

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TABLE 3: TREATMENT MEANS FOR PORINA AND GRASS GRUB LARVAE NUMBERS PER m². MEANS AND STANDARD ERRORS OF TRANSFORMED DATA (SQUARE ROOT OF SUM OF LARVAE IN THREE 0.093 m² SAMPLES + 0.5) ARE SHOWN IN PARENTHESES

Insect	Control	Insecticide		0	Nitrogen kg/ha			
		fenitrothion	diazinon		28	56	112	
porina	28.0 (2.85±0.10)	9.7 (1.69)	10.8 (1.80)	14.0 (1.90) (±0.13)	12.9 (1.98)	20.5 (2.38)	17.2 (2.19)	
grass grub	0.9	12.3	0.9					

Grass grub larvae occurred in 8.3% of the quadrats excavated, a count of 19 in 1 quadrat being recorded. This low overall density and clumped distribution of grass grub excluded the possibility of detecting treatment effects.

DISCUSSION

The results indicate that for this trial the best management strategy was application of nitrogen fertiliser to boost winter and early spring yield. Further, the gain of dry matter from applied nitrogen exceeded the ratio of 8 units of dry matter for each unit of nitrogen considered by O'Connor and Gregg (1971) to provide an economic return to applied nitrogen fertiliser.

However, as a single example of a direct comparison of nitrogen or organophosphate insecticide response, the result is of indicative value only. The certainty of obtaining satisfactory responses from either treatment is determined to a large extent by climatic conditions after application. This uncertainty factor in control of porina by organophosphates is discussed by Perrott (1970), and the level of control obtained in the present trial falls in to the range of effect that can be expected from commercial applications. The response to nitrogen would have been enhanced by the species composition at the site, and it may not be coincidental that the best response to autumn applied nitrogen reported by O'Connor and Gregg (1971) was obtained from a site in the Dannevirke district. June and July of 1969 were reported as being colder than average resulting in stock feed shortages (New Zealand Meteorological Service 1969). Thus the winter nitrogen response obtained cannot be discarded as atypical because of better than average temperatures for growth during that season. However, August and September 1969 were good months for growth.

If it can be established with certainty that an economic response to applied nitrogen can be obtained during the period when yield losses from porina are the most serious, it is necessary to determine the threshold porina density at which yield losses caused by porina feeding are no longer compensated by yield gained by nitrogen application. Using the estimate of McLaren and Crump (1969) of 4.6% reduction of yield below 'potential' for 10.7 larvae/m² (which exceeds the 2.6% increase obtained with insecticide treatment which removed 18 larvae/m² in this experiment, and the 25% gain of yield using 56 kg N/ha (which approximates the cost of applying fenitrothion prills at 1.12/ha) the threshold density in this trial would have been about 50-60 larvae/m².

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