INSECTICIDE TRIALS AGAINST BLACK BEETLE IN PASTURE

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Summary

Pasture plots were treated against black beetle (*Heteronychus arator*) using granular insecticide applications directed against adults prior to egg laying in winter/early spring, and at conventional times against predominantly early larval stages in late spring/early summer. When assessed in February, a reduction in black beetle numbers of 60-90% was obtained for fensulfothion when compared to untreated populations, regardless of time of insecticide application. This was not so for all chemicals tested. When compared with fensulfothion, isazophos gave further promising results for the control of black beetle in pasture, particularly when applied in late November/early December.

INTRODUCTION

Damage to pasture by black beetle (*Heteronychus arator*) largely results from root feeding by third stage larvae in the summer. In current practice chemical control of black beetle in pasture is directed against early larval stages in late spring/early summer (Esson 1973). At this time the farmer has least flexibility in adjusting grazing management to suit withholding periods after insecticide application.

Work by King (unpublished) at Otakanini research area near Helensville indicated that a major proportion of the summer larval population in January was derived from the resident overwintering adult population. The remainder were derived from adults which had immigrated during spring flights. It is therefore possible that application of chemicals against adults in the winter or early spring could reduce the number of eggs laid and the subsequent larval numbers in the following spring/summer. Moist climatic and soil conditions in winter and early spring could possibly favour more reliable insecticide activity.

Todd (1967, 1969) showed in small plot trials that adult beetle numbers in pasture could be effectively reduced using organophosphate insecticides. He did not extend this work to finding an optimum timing strategy for application of chemicals, or to gauge the effects on subsequent larval populations in pastures so treated. Attempts to answer these questions were made in two trials reported here.

Isazophos (CGA 12223) showed promise for control of black beetle larval and adult stages in screening trials (Watson and Webber 1975). This material was further tested in the trials reported here, using fensulfothion as a standard. Other chemicals were also included. Phorate, which was shown to be active against black beetle adults (Watson and Webber 1975) and soldier fly (*Inopus rubriceps*) (Dixon 1974), was tested in one trial for possible use against dual infestations of these pests in pasture.

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METHODS

The trials were conducted using ryegrass (*Lolium spp*)/white clover (*Trifolium repens*) predominant pastures in three widely distributed black beetle infested areas. Plot size, adjusted to utilise available space at each site, varied between 30 and 100 m² and 4 or 5 replicates were used per treatment in a randomised block design. At Otakanini (Helensville, Tangitiki sandy loam) and Huntly (Waikokowai silt loam) insecticides were hand broadcast at times and rates indicated in Table 1. In February 1976 plots were assessed for black beetle numbers using hand sorted 10 cm diameter soil cores. At Omeheu Demonstration Farm (Edgecumbe, Omeheu gravelly sandy loam) insecticides were drilled (delivered rate indicated in Table 1) in strips across two paddocks for demonstration purposes, and 10 × 10 m plots were superimposed on the drilled areas. Pre-treatment sampling indicated that populations were very similar in each field, and the same plot areas were used for assessment of the trial in February.

TABLE 1: EFFECT OF CHEMICALS AGAINST BLACK BEETLE IN PASTURE.

Treatment (% granular)	Rate kg/ha	Applica- tion time*	% Reduction over untreated population††		
			Otakanini	Huntly	Omeheu
fensulfothion (10)	2	1	85 a		
		2	91 a	69 abc	
		3	85 a	69 abc	
	1.7	3			61 ab
isazophos (5)	2	1	73 ab		
		2	70 ab	62 abcd	
		3	91 a	100 a	
	1.7	3			86 a
isazophos (5)	1	2		8 cd	
		3		100 a	
diazinon (2)	2	1	18 c		
		2	24 bc	15 bcd	
		3	79 ab		
terbufos (5)	2	2		—31 d	
		3		85 ab	
parathion (10)	2	3		54 abcd	
ethoprophos (10)	2	3		47 bcd	
phorate (20)	2	3			45 bc
untreated			0 c	0 d	0 c
untreated population/m ² ± SE			53 ± 6	21 ± 6	39 ± 6

* time 1 24 July (Otakanini)

2 24 September (Otakanini) 28 September (Huntly)

3 5 December (Otakanini) 18 December (Huntly)
22 December (Omeheu)

† Assessed February 1976.

†† Statistical analyses on log (n + 1) transformation of larval numbers.

Overall: Time 3 significantly better than time 2 = time 1 (5% level).
No significant interactions.

RESULTS AND DISCUSSION

Results for each trial site are presented in Table 1. The results express the difference in black beetle numbers obtained in treatments, when compared to untreated populations which are indicated at the bottom of

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the table. Those treatments significantly different from untreated include all fensulfothion treatments at all application times, together with isazophos, diazinon and terbufos treatments at time 3, and isazophos treatments (times 1 and 2) at Otakanini.

Isazophos performed favourably compared with fensulfothion on all sites for the December (time 3) application. Phorate when applied against black beetle larvae did not appear to offer a satisfactory alternative control at the rates tested.

The results indicate that in the year under test, fensulfothion and isazophos (at one site), when applied against the adult population, gave control of the subsequent larval population, which was comparable to the late spring/early summer applications. Weather conditions, in which good rainfall followed each application of insecticides, were in 1975 unusually favourable for early summer applications. The degree of success is probably related to

- (i) initial control of adults obtained
- (ii) soil life of the chemical
- (iii) extent of black beetle immigration after insecticide activity has ceased.

In screenhouse pot trials, which may not relate to field situations, the fecundity potential of some females was in excess of 100 eggs (Watson, unpublished data). Light trap and population monitoring from the Huntly site (Watson, unpublished data) indicates that black beetle flights were insignificant in the 1975 spring flight season compared to those of the previous autumn. However, field observations indicate that non-aerial surface activity of beetles in spring (September - November) could be considerable. This movement could have reduced the effect of shorter-lived chemicals in small field plots compared with a full paddock situation in which surface immigration would not be important. This aspect needs further testing. The possibility exists that some of the chemicals failed to reduce adult numbers and that successful reduction of larval numbers at the February assessment depended upon the residual effect of the chemical against larval stages. However, Todd (1969) obtained high mortalities of adults in April, August, September, and October treatments using diazinon (5% granular) applied to small pasture plots into which adults were seeded and confined for several days.

Of more importance to the success of a winter or early spring insecticide timing strategy is the importance of immigration by flight. Occurrence of significant flights may depend on fulfilment of population threshold or climatic conditions which may not have been met during the 1975 spring season. However, if it can be shown that spring flight is consistently of little significance, the possibility exists for chemical application against adults from May, when autumn flight activity declines, until September, adding greatly to flexibility in the use of insecticides against black beetle. Until these questions are answered, post-adult applications in November/December appear to offer the most reliable control, with the possibility of earlier use if insecticide activity is retained until this period.

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