SOLDIER FLY — ASPECTS OF ITS CONTROL WITH AUTUMN CULTIVATION

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Summary

One trial is reported, in which times and intensities of autumn cultivation of soldier fly (*Inopus rubriceps* [Macq.]) infested pastures were compared with untreated control, and undersowing without cultivation. The trial showed that all treatments involving cultivation reduced numbers of larvae by between 75% and 90% (compared with control). Continuous cultivation (between February and May) was superior to short period cultivations, at different times, during that period. The use of paraquat increased effectiveness of cultivation treatments in reducing larval numbers. Undersowing proved to be ineffective.

INTRODUCTION

WILCOCKS (1971) reviewed measures to control soldier fly (*Inopus rubriceps*) which have been tried in Australia and New Zealand. Heavy winter stocking to trample larvae has been tested and found to be only partially effective.

Shallow cultivation in the autumn was moderately successful and Wilcocks and Hewitt (1971) showed that frequent cultivations reduced the numbers of larvae. Hewitt (1964, 1969) found that insecticides gave some degree of control. Organochlorines were the most effective, but the rates of chemicals needed were extremely costly and affected pasture.

A trial, laid down on badly damaged pasture in February 1971, tested the effectiveness of grass to grass cultivation in the Auckland district (Cumberland *et al* 1972). Late autumn cultivations (April/May) were more successful, both in pasture establishment and reduction in larval numbers, than early Autumn cultivations (February/March).

TRIAL DESIGN AND MANAGEMENT

During a 6 week period in the autumn the insect is present in all 4 of its life cycle stages—larva, pupa, adult and egg. The trial was designed to test control of the insect by soil cultivation, to desiccate and kill the pest, at different stages of the life cycle.

The trial was designed so that treatment 3 should affect mostly larvae, treatments 4 and 6 affect pupae, larvae and eggs, and treatment 5 affect mostly larvae and eggs.

Treatments used are shown in Table 1. Turf, breakdown, subsequent workings as well as a cultivation just prior to sowing were all done with a

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rotary hoe set at 10 cm depth. All treatments were sown with a mixture of ryegrass (*Lolium* spp), *Phalaris* spp, cocksfoot (*Dactylis glomerata*) and clovers (*Trifolium* spp). This seed mixture was sown and raked by hand. (Treatment 2 was undersown using a disc drill with only Tama ryegrass.)

Plots were rolled with a Cambridge roller in August 1972. All plots were split and one half of each plot (chosen randomly) was treated with paraquat (0.12 kg/ha, 40 litres water) just prior to cultivation (or in mid-February treatments 1 and 2). Plot size was 4 m x 9 m and there were 6 replications of all treatments.

Ten 2.5 cm soil samples of 15 cm depth were bulked for larval counts at each sampling. The trial was situated at a dairy farm near Whiriwhiri on Karaka soil type. The pasture had been permanent for some years and prior to soldier fly depredations, first noticed during the droughts of 1969/70 and 1970/71, consisted of high fertility ryegrass and white clover species. The trial was assessed by larval counts prior to each initial cultivation and as shown in Table 1. The larvae were separated mechanically (Wilcocks and Oliver, 1971) or by hand (September count). Visual observations of pasture vigour were made. A year after treatment dry matter production was measured (over a 4 week period) and the sward was point analysed.

RESULTS AND DISCUSSION

Soldier fly larvae population changes are shown in Table 1.

TABLE 1: SOLDIER FLY LARVAL NUMBERS (Thousands/m²)

Treatment (main effect)	February 1972	March 1972	April 1972	May 1972	September 1972
1 Uncultivated control—over- sown mid March	3.9 a	1.5 abA	2.2 aA	3.6 aA	6.2 aA
2 Uncultivated— undersown tama mid March	3.6 a	1.7 aA	—	—	4.6 aA
3 Mid February turf breakdown —1 working— sown mid March	2.8 a	1.2 abA	—	—	1.5 bB
4 Mid March turf breakdown — 1 working—sown mid April	3.1 a	2.3 aA	0.9 bA	—	1.2 bB
5 Mid April turf breakdown — 1 working—sown mid May	3.5 a	—	1.5 abA	2.3 bA	1.1 bBC
6 Mid February turf breakdown — 5 workings — sown mid May	3.8 a	0.7 bA	0.9 bA	0.9 cB	0.7 cC
C.V.	29%	70%	47%	30%	25%

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Untreated control plots showed some fluctuation — notably a predictable decline of larvae numbers during the autumn flight (March 1972), and thereafter a gradual increase. (This latter effect is probably accounted for by the increasing size of larvae resulting in more accurate counts.)

In September, 1972, treatments 3, 4, 5 and 6 had appreciably fewer larvae than control or treatment 2. Treatment 6 showed a 90% reduction of controls. The reduction in larvae numbers favoured later treatments (N.S.). This effect is much less marked than the previous work (Cumberland *et al* 1972). Pasture establishment was good on all treatments. Those plots which had been sown in March and April were better in August than the treatments sown in May (Table 2). On the undersown plots (treatment 2) Tama established well but disappeared after 6 to 12 weeks, apparently before there was any useful production from it. However, 1 year after the trial was started, the relative effectiveness of the treatments had altered.

In January 1973 the plots were trimmed to an even height and 4 weeks later were point analysed and mown. The results show that all treatments which involved cultivation were superior to those not cultivated (Table 2).

TABLE 2: PASTURE SPECIES AND PRODUCTION

Treatments	Pasture vigour August 1972	Point Analysis Feb. 1973		
		Dry Matter February 1973 (kg/ha)	Grass %	Clover %
1 Uncultivated control	9.5 aA	440 cB	27 cC	52 aA
2 Undersown	8.3 bA	500 cB	18 dC	55 aA
3 February/March	8.9 abA	890 abA	60 bAB	10 bcBC
4 March/April	6.7 abA	770 bAB	58 bB	17 bB
5 April/May	1.9 eD	890 abA	73 aA	1 dD
6 February/May	3.2 dC	1100 aA	70 aAB	4 cdCD
C.V.	6.5%	31%		

The treatment cultivated, virtually fortnightly, from February to May, produced more dry matter than the other cultivation treatments (collectively significant at 5% level), and showed 150% more dry matter than control.

Point analysis (February 1973) showed a greatly increased proportion of grasses (mostly ryegrass) in swards established after cultivation.

Although May sown treatments (5 and 6) lacked vigour in August (Table 2), the reduction of numbers of larvae (Table 1) enabled pasture to establish strongly in the spring and summer. Conversely, uncultivated treatments appeared vigorous in August, but had heavy infestations of larvae and were subsequently low producing.

The effect of paraquat applied to split plots is shown in Table 3.

TABLE 3: EFFECT OF PARAQUAT

<i>Treatment</i>		<i>Larvae number September 1972 (thousands/m²)</i>	<i>Dry Matter February 1973 (kg/ha)</i>
Main effect	No paraquat	2.2 aA	720 a
	paraquat	1.5 bB	810 a
1 Uncultivated control	No paraquat	6.7 a	300 a
	paraquat	6.3 a	580 a
2 Undersown	No paraquat	5.3 a	520 a
	paraquat	4.1 a	470 a
3 Cultivation February/March	No paraquat	1.8 aA	810 a
	paraquat	0.8 bB	980 a
4 Cultivation March/April	No paraquat	1.2 a	720 a
	paraquat	1.1 a	820 a
5 Cultivation April/May	No paraquat	1.6 aA	820 a
	paraquat	0.6 bB	950 a
6 Cultivation February/May	No paraquat	0.7 a	1120 a
	paraquat	0.6 a	1090 a
C.V.		27 %	33 %
Significance of Interaction		5 %	N.S.

The overall effect of paraquat has been to reduce larval numbers (markedly in some treatments) and to increase subsequent pasture growth. It is considered that the relationship between paraquat treatment and dry matter production could, in fact, be stronger than that shown in the table. When two atypical reps are excluded from the analyses, dry matter production shows some highly significant responses to paraquat. An application of paraquat appears to be an effective substitute for some of the workings of the continuous cultivation treatment.

There is no evidence to show that paraquat had a direct effect on larvae. It probably caused faster elimination of live vegetation, and a quicker degradation of larval food sources.

CONCLUSIONS

1. Larval numbers fluctuated on untreated plots — showing a predictable drop at the time of the autumn flight.
2. All treatments which were cultivated showed a significant reduction in larval numbers after treatment.
3. Time of cultivation had no significant effect.
4. The continuous cultivation treatment was superior to others in terms of larval reduction and dry matter production.
5. Pasture vigour in August on non-cultivated treatments was better than on those cultivated and resown in the autumn. The situation is reversed 6 months later.
6. Extrapolation of the regression curve of (February 1973) dry matter cuts on (September 1972) larval numbers suggests that dry matter produced, over the period measured, for zero soldier fly larvae, would be 1200 to 1400 kg/ha. This suggests that control plots have shown a reduction of 65% to 70% of the hypothetical potential pasture production over this limited period.

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7. Cultivation and resowing treatments altered pasture composition increasing grass species at the expense of clovers.
8. Paraquat has assisted in the reduction of larval numbers.
9. Undersowing infested pasture with tama ryegrass was relatively ineffective.

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