SOLDIER FLY — PROGRESS WITH CULTIVATION AND CHEMICAL CONTROL

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Summary

Trials involving grass to grass autumn cultivation have mostly confirmed previous work. Soldier fly (*Inopus rubriceps* Macquart) larvae numbers have been reduced by up to 90% with a minimum of workings over specific time periods. Longer cultivation periods, whether one or four workings, were better than shorter cultivation periods. There appeared to be no advantages from the use of crops during cultivation, to control soldier fly. The effects a number of insecticides in granular form, had on soldier fly infested pasture appeared to be negligible. Ryegrass undersowing was similarly unsuccessful.

AUTUMN GRASS TO GRASS CULTIVATION

At a previous conference the authors (Cumberland *et al* 1973) reviewed research investigating the use of cultivation to reduce soldier fly (*Inopus rubriceps* Macquart) larvae numbers in severely infected pastures. They presented the results of one trial at Waiuku where autumn cultivation significantly reduced larvae numbers and subsequently increased the dry matter production of treated areas. The time when cultivation was done, did not have the same marked effect as the length of period over which the cultivation extended. A long period of cultivation reduced larvae numbers, and dry matter production. Shorter cultivation periods were less effective.

This work has been continued with two trials in South Auckland, which started in the late summer of 1973. Both trials were of a similar design (illustrated diagrammatically in Figure 1) and compared in factorial combination; three cultivation periods (February to March, February to May, April to May); with two cultivation intensities (1 or 4 'workings' between initial 'turf breakdown' and seed bed preparation). Untreated control plots were included. The 'turf breakdown' consisted of a rotary hoeing and each 'working' and the 'seed bed preparation' consisted of a harrowing. A normal pasture seed mixture was sown with a roller drill immediately after seed bed preparation.

The project was designed so that at the peak autumn soldier fly flight, two of the treatments (3 and 4) were being cultivated, two had just been sown in new pasture (1 and 2) and two were in old pasture before initial cultivation (5 and 6). All plots were split, one half receiving parathion (2 kg/ha) which was broadcast before seed sowing.

One trial was situated near Buckland on Patumahoe clay loam and the second at Karaka on Karaka silt loam. Plot sizes were large enough to enable all cultivations to be done with conventional agricultural machinery and each treatment was replicated four times.

Soil collected from each block of each trial before commencement, showed a moderate larvae infestation at Buckland (3,500/m²) and a lower level of infestation at Karaka (500/m²). In August 1973 larvae counts were taken from each half plot and visual pasture vigour assess-

ments were made in November 1973 (Table 1). Larvae separating techniques similar to those outlined by Wilcocks and Oliver (1971) were used.

In both trials cultivation reduced larvae numbers (compared with controls) and increased pasture vigour. The extended cultivation — February to May (Treatments 3 and 4). — spanning the flight period, reduced larvae numbers by 90% in the more heavily infested trial (Buckland) and by 75% at the Karaka site. The same treatments substantially increased pasture vigour. The short period pre-flight cultivation (Treatments 1 and 2) achieved a reduction of 80% and 65% respectively, in larvae numbers in the two trials. The equivalent short period post-flight treatment reduced larvae numbers by less than 50%. However, no difference in pasture vigour in the following spring was recorded between pre-flight and post-flight treatments (Treatments 1 or 2, 5 or 6).

The 'intensity' of cultivation (as assessed by the number of 'workings') was less important than the 'period' over which cultivation is carried out. On the severely infested Buckland trial, four 'workings' reduced larvae numbers to a greater extent than one 'working'. This result, however, was not confirmed by pasture vigour observations — there were no differences in pasture vigour in the following spring as a result of more than one working.

FIGURE 1: DIAGRAMATIC PLAN OF CULTIVATION TRIALS

Pasture Pests

TABLE 1: THE EFFECT OF AUTUMN CULTIVATION

Treatment	Trial 1 (Buckland)		Trial 2 (Karakia)	
	Larvae Numbers August 73 (thousands/m ²)	Pasture Vigour November 73 (0-10 scale)	Larvae Numbers August 73 (thousands/m ²)	Pasture Vigour October 73 (0-10 scale)
1. February-March 1 cultivation	1.2 cC	6.0 bcABC	0.6 bcBC	6.0 bBC
2. February-March 4 cultivations	1.0 cCD	5.2 cBCD	0.7 bcBC	6.0 bBC
3. February-May 1 cultivation	0.7 dD	7.7 abAB	0.6 bcBC	8.0 aA
4. February-May 4 cultivations	0.6 dD	8.2 aA	0.3 cC	7.8 aAB
5. April-May 1 cultivation	4.0 aAB	4.7 cdCD	1.1 abAB	6.0 bBC
6. April-May 4 cultivations	2.7 bB	5.5 cdCD	1.3 abAB	5.8 bC
7. Untreated Control CV %	5.4 aA 24	3.0 dD 21	1.8 aA 58	2.3 cD 14
<i>Main Effects</i>				
1 Working	1.9 aA	6.2 a	0.8 a	6.7 a
4 Workings	1.4 bA	6.3 a	0.8 a	6.5 a
February-March	1.1 bB	5.6 bB	0.7 bAB	6.0 bB
February-May	0.6 cC	8.0 aA	0.5 bB	7.9 aA
April-May	3.3 aA	5.1 bB	1.2 aA	5.9 bB
no parathion	1.8 aA		1.1 a	
parathion	1.5 bA		0.8 a	

There were no significant interactions.

CROPS AND CULTIVATION

During 1972 and 1973 projects were initiated to determine the place fodder crops might have in a soldier fly control programme. Summer and winter crops (associated with spring and autumn cultivation respectively) were investigated.

Four summer crops (shown with dry matter production results in Table 2, Trial 3) were established in November after a short period of cultivation. One further treatment, with one of the crops (turnips), investigated a longer cultivation period. This trial, at Aitiriston, was situated on Ardmore peaty loam. The initial soldier fly infestation was 3,000 larvae/m². All cultivation was done by a rotary hoe after pastures had been desiccated with paraquat.

The yield of the uncultivated but soldier fly damaged pasture was not significantly exceeded by any crop. There was a distinct disadvantage in terms of crop dry matter, from later sown turnips. After the crops had been harvested (March) and the ground had received initial autumn seed bed preparation treatment, including those plots untreated through the summer, larvae counts revealed virtually no larvae present on any treatment.

In February 1973 three winter crops were established in areas cultivated from pastures at a Buckland site (Table 2). These crops were harvested in July and September and larvae counts were made in August.

At both times of harvest turnips were the most productive. At the July harvest chou-moellier had produced less dry matter than untreated pasture but in September all crops out-yielded pasture. Larvae numbers were low but they were reduced by between 65% and 85% under cropping (relative to untreated plots).

TABLE 2: THE USE OF CROPS

<i>Trial 3 — Alfriston (Summer)</i>		<i>Dry Matter Production (kg/ha)</i>	
<i>Treatment</i>		<i>(October-March)</i>	
Uncultivated Control		6850 abAB	
Continuous Cultivation		—	
Maize		8340 aA	
Sudan		6950 bAB	
Chou-moellier		6090 bAB	
Turnips		5630 bcAB	
Turnips (December sown — extended cultivation)		3900 cB	
CV %		21	

<i>Trial 4 — Buckland (Winter)</i>		<i>Dry Matter Production (kg/ha)</i>	
<i>Treatment</i>	<i>Larvae Numbers August 73 (thousands/m²)</i>	<i>July 73</i>	<i>September 73</i>
Tama	0.6 bB	2130 bB	3910 cB
Turnips	0.3 cC	4000 aA	7840 aA
Chou-moellier	0.3 cC	1130 cC	5040 bB
Pasture	1.7 aA	2160 bB	1670 dC
CV %	74	20	20

CHEMICAL CONTROL

There have been a number of papers reporting trials with chemicals on pasture for soldier fly control. Dixon and Grimmer (1973), Cumberland and Honore (1973) and Fellowes (1973) have offered a fairly complete review of previous work and up to date reports of recent work. Of large numbers of chemicals tested, a few, notably systemics, showed some promise against soldier fly larvae.

With dual objectives of checking the effectiveness of chemicals, on pasture and the place for undersowing seed into damaged pastures (with and without chemical treatment) in the autumn, two trials were laid down in the South Auckland area, one at Buckland (Trial 5) and one at Karaka (Trial 6), in 1973. There were two times of chemical application — March and May — and two times of undersowing a mixture of ryegrasses (*Lolium* spp) into the pasture treated with chemicals. The chemicals used in the experiments, are shown, together with pasture vigour and dry matter results, in Table 3. With one exception, chemicals were broadcast onto pastures, as granules at 2.2 kg/ha. (Thionazin as an EC was applied at 2.2 kg/ha in 1,000 litres/ha.)

Initial larvae numbers were 3,500/m² at Buckland and 2,000/m² at Karaka. Laboratory facilities did not permit subsequent larvae counts to be taken.

All chemicals produce some dry matter advantage but with the exception of carbofuran (pasture vigour) at Buckland, there were no significant responses to chemicals (Table 3) or ryegrasses (not shown). Dixon *et al* (1974) with the use of extra replication, has achieved significant dry matter responses to chemicals of a similar magnitude (10%) to those reported.

Pasture Pests

TABLE 3: THE EFFECT OF CHEMICALS

Treatment (Main Effect)	Trial 5 — Buckland		Trial 6 — Karaka	
	Dry Matter Production October 73 (kg/ha)	Pasture Vigour October 73 (0-10 scale)	Dry Matter Production September 73 (kg/ha)	Pasture Vigour September 73 (0-10 scale)
parathion	1370 a	7.3 abAB	600 a	5.0 a
fenamiphos	1340 a	7.5 abAB	670 a	4.9 a
carbofuran	1540 a	8.5 aA	720 a	5.9 a
quinalphos	1440 a	6.0 bB	680 a	5.6 a
phorate	1450 a	6.4 bB	590 a	4.4 a
thionazin			680 a	4.8 a
untreated	1330 a	7.3 abAB	540 a	4.3 a
March application	1340 a	7.2 a	650 a	5.2 a
May application	1520 a	7.1 a	660 a	5.0 a
CV %	22	19	24	27

DISCUSSION

Cultivation associated with subsequent pasture re-establishment has been shown previously to reduce soldier fly larvae numbers and so to lessen the adverse effects of soldier fly infestations (Cumberland *et al* 1973, Wilcocks and Hewitt 1971). The current trials confirm that the technique can be usefully employed in farm situations and can reduce larvae numbers by up to 90%. In earlier work it was shown that the actual time when cultivation was done was not as important as the length of the cultivation period. To check this effect and to see if it was due to the number of workings or the length of the cultivation period two trials specifically compared one and four 'workings' over three time periods.

February/March cultivation was better than April/May. This is contrary to previous work which tended to show later cultivation was better. In terms of a reduction of larvae numbers cultivation and resowing pre-flight has been shown to be better than that post-flight. These treatments were not different, when November pasture vigour assessments were considered.

The long period of cultivation (spanning both the pre-flight and post-flight periods) has in both trials been shown to be superior in terms of larvae numbers and in pasture vigour, compared with control.

The effect of number of workings seems to be of less importance. Although on one of the two trials there was a significant difference in reduction in larvae numbers between one and four 'workings'. There was no carry-over effect recorded in November when pasture vigour was assessed. Such a result is somewhat unexpected but could be accounted for by drought conditions which prevailed during the summer of 1972/73.

Larvae deaths (presumably due to desiccation) did occur with a minimum of workings. In normally less dry years, more workings might have proved necessary to achieve the same result.

The chemical parathion was shown to increase pasture vigour for a short period after germination, in both cultivation trials. Its effect appeared to be protection for the seedling, but subsequent counts showed larvae numbers were reduced by the chemicals in both trials. (This result achieved significance in one trial and only just failed to do so in the second.)

The use of crops to provide some fodder during soldier fly cultivation control procedures has been considered by many farmers. Two trials have shown that crops can be successfully established into ground cultivated from soldier fly infested pastures. (Practical experience has indicated that establishment is difficult, due to seedling damage by larvae, and so is not always successful.) The results of two trials show that the dry matter production from summer or winter crops is not exceptionally high and may be less than that from uncultivated soldier fly infested pastures. Due to the associated costs and risks, and the lack of distinct dry matter production advantage, the use of crops with cultivation is less attractive than no crop grass to grass cultivation in the autumn.

The use of chemicals as granules broadcast on pastures, has not produced sizeable effects. Other workers (Dixon *et al* 1974 and MacKay *et al* 1974) have shown that two factors — soil incorporation and distribution — influence the effectiveness of chemicals.

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