RENOVATION OF AUSTRALIAN SOLDIER FLY DAMAGED PASTURE IN NORTHLAND

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Summary

Australian soldier fly *(Inopus rubriceps)* has recently established in Northland and has caused extensive damage to Kikuyu grass *(Pennisetum clandestinum)* pastures on a bouldery loam soil. The direct drilling of grass seed and insecticide was tested in two trials. Grass establishment was successful in Trial 2 but grasses did not persist with higher soldier fly infestations in the small plots of the first trial. Larval mortality with direct drilled seed and insecticide (2.2 kg/ha carbofuran, 3.0 kg/ha phorate or 2.5 kg/ha isofenphos) was 44-63%. Broadcast insecticidal sprays on existing pasture were ineffective (33-37% control).

INTRODUCTION

Australian soldier fly is a recently established pest of Northland pastures. The first record of soldier fly in this region was by Wilcocks (1974). Severe pasture damage over approximately 50 ha was evident in 1978 when soil populations of up to 8,000 larvae per m^2 were measured (Robertson and Blank, in prep.). The current known distribution of soldier fly in Northland includes the volcanic soils surrounding Whangarei to Kauri, Ruatongata, Maungatapere and Kiripaka. Another localised infestation is known from a sandy soil of Mangawhai Heads near Wellsford.

The heavier clay soils adjacent to infested friable volcanic soils apparently are unfavourable for rapid population development of soldier fly, and no large infestations or pasture damage by soldier fly have been recorded on these soils. Kikuyu grass appears to be particularly susceptible to damage by soldier fly in Northland and P.J. Gerard (pers comm) has shown that larvae develop rapidly on this grass.

Control procedures for soldier fly have included surface cultivation (Wilcocks and Hewitt 1971; Cumberland *et al* 1973) and direct drilling of systemic insecticides with grass seed into chemically desiccated pasture (Dixon 1977). Broadcast insecticides are ineffective against soldier fly (Dixon *et al* 1974). Davison *et al* (1979) compared costs and controls of direct drilling vs. minimum and intensive cultivation.

Much of the infested pasture in Northland is on a bouldery soil type and intensive surface cultivation is not practical. Oversowing of grass seed gives only short-term benefits of increased pasture production as soldier fly feeds on the establishing grasses. Undersowing with seed and insecticide was considered to be a suitable method of controlling soldier fly and renovating pasture on these soils and this paper reports two experiments investigating this method.

METHOD

Trial 1

Several paddocks on a Kiripaka bouldery silt loam near Whangarei were found to be heavily infested by soldier fly in early 1978. The sward had deteriorated over 2-3 years from Kikuyu to predominantly *Oxalis corniculata* with some clover *(Trifolium* sp). Five treatments to control soldier fly were applied on 27 April 1978, and these are given in Table 1. Treatments 1 to 3 were sown with 15 kg/ha ryegrass seed *(Lolium* *perenne* cv. 'Mangere') in 15 cm rows to a depth of 2-3 cm. Treatment 3 was sprayed with paraquat (o.6 kg/ha) immediately prior to drilling. The chemicals in treatments 4 and 5 were sprayed in 200 litres/ha water.

Plot size was 4 m^2 with six replicates of each treatment in a randomised block design. Buffer strips, 0.1 m wide and defoliated with paraquat were established to discourage larval movement between plots.

The grass seed and insecticide granules were drilled by cutting slots and sowing by hand to simulate direct drilling.

Soldier fly larval densities were estimated on 27 June 1978 by taking seven 7.65 cm diameter cores from each plot. The larvae were extracted by wet sieving and flotation in Mg SO_4 solution. The coring was carried out over the rows of seedlings in treatments 1, 2 and 3.

Trial 2

The second trial was laid down in a paddock adjacent to Trial 1 on 27 March 1979. The four treatments were as follows :—

1. 2.2 kg/ha carbofuran (10G) drilled with 25 kg/ha ryegrass (cv. 'Grasslands Nui') and 3 kg/ha white clover *(Trifolium repens* cv. 'Grasslands Huia').
2. 3.0 kg/ha phorate (20G) drilled (as 1. above).
3. 2.2 kg/ha carbofuran (10G), 20 kg/ha Nui ryegrass, 3 kg/ha Huia white clover, 10 kg/ha *Paspalum dilatatum,* 3 kg/ha cocksfoot *(Dactylis glomerata* cv. 'Grasslands Apanui') and 2 kg/ha *Lotus pedunculatus* (cv. 'Grasslands Maku').
4. No insecticide, seed mix (as 3, above).

All plots were drilled using a triple disc drill (16 row 'Duncan Multiseeder') and plot size was 0.04 ha. Four replicates of each treatment were used except that one control plot was abandoned due to adverse terrain. All plots received 200 kg/ha reverted superphosphate which was used as the insecticide carrier and drilled with the seed in 15 cm rows.

The plots were split-treated with paraquat (0.6 kg/ha) or glyphosate (2.0 kg/ha) the day previous to drilling. At spraying, the sward was short (2-4 cm in height).

Soldier fly densities were estimated as in Trial 1, on 6 June 1979. Pasture dry matter production was assessed on all plots on 8 May 1979 and thereafter on one representative plot of each treatment at approximately monthly intervals for one year. Three metre strips were mown from two enclosure cages rotated around each plot. All plots received 450 kg/ha superphosphate (30% potash) in August 1979.

Statistical analyses were by analysis of variance of log. transformed soldier fly counts.

RESULTS

Trial 1

TABLE 1: The effects of insecticides on soldier fly, 2 months after application : Trial 1.

Treatment	Insecticide	Rate (kg/ha)	% control cf. untreated
	Drilled with ryegrass seed:		
1.	carbofuran 10% granules	2.5	32*
2.	isofenphos 5% granules	2.5	32*
3.	isofenphos 5G, after paraquat	2.5	57**
	On existing pasture:		
4.	carbofuran 75% wettable powder	2.5	37*
5.	isofenphos 50% emulsifiable concentrate	2.5	35*
6.	untreated	0	—

Untreated population = 7680/m^2
Significance of difference from untreated: * P◄0.05 ** P◄0.01

All treatments gave significant reductions in soldier fly numbers compared to the control (Table 1). Treatment 3 gave significantly greater control than the other insecticide treatments (P◄0.01).

The ryegrass established in all drilled plots, but did not persist. After one year, all plots were again weed dominant with little or no ryegrass.

Trial 2

TABLE 2: Soldier fly control by direct drilled insecticide and effect on pasture production : Trial 2

Treatment	Insecticide (seed)	Rate (kg/ha	% control cf. untreated	6 wk DM (kg/ha)	12 mth DM (kg/ha)
1.	carbofuran, (ryegrass)	2.2	46*	273*	7142*
2.	phorate, (ryegrass)	3.0	44*	238*	8178*
3.	carbofuran, (seed mix)	2.2	63**	170*	6147*
4.	no insecticide (seed mix)	0	—	37	3555

Untreated population = 2453/m²

Significance of difference from untreated: * P◄0.05 ** P◄0.01

The results of the field scale trial are given in Table 2. Treatments 1, 2, and 3 gave significantly fewer soldier fly larvae than untreated (P◄0.01) and treatment 3 had significantly fewer larvae than treatments 1 and 2 (P◄0.05). Reasons for this latter result were not clear.

The initial pasture establishment production (6 weeks growth) and the total production over one year are given in Table 2.

There was no significant difference between the use of paraquat and glyphosate on pasture establishment or soldier fly control. Both herbicides satisfactorily removed the existing sward.

DISCUSSION AND CONCLUSIONS

The results of the two trials using 2 to 3 kg/ha of the systemic insecticides drilled with seed into chemically desiccated pasture showed lower levels of control (44-63%) than reported from similar work in the Waikato and Bay of Plenty (60-80%) by Davison *et al* (1979), Dixon (1977) and Rowe and Mackay (1975).

There was no significant difference between the herbicides on soldier fly mortality in the second trial, and therefore paraquat would be more cost efficient than glyphosate under the conditions of the trial. The presence of *Paspalum dilatatum*, Kikuyu or other plants which are difficult to control may necessitate the use of glyphosate, to limit competition with the establishing grasses (cf. Robertson *et al* 1980).

The use of granular insecticide with undersown grass seed in existing pasture gave poor control (Trial 1, treatments 1 and 2) as found by Davison *et al* (1979) and Dixon and Davison (1976). This was probably related to the lack of movement of larvae under existing pasture as opposed to a herbicide-killed sward. The removal of plants forces the larvae to seek alternative host plants for feeding and/or insulative cover. Where the alternative plants are sown with systematic insecticide, a higher level of soldier fly mortality can be expected (Dixon and Davison 1976) and this was seen in Trial 1, treatment 3, and Trial 2, treatments 1, 2 and 3.

Insecticide sprays (Trial 1, treatments 4 and 5) gave poor control of soldier fly populations. The levels of control of soldier fly (44-63%) obtained by the use of carbofuran, phorate and isofenphos direct drilled with seed into desiccated turf were adequate in Trial 2 to allow good pasture establishment and to give a considerable increase in annual yield over the control (Table 2). This was in contrast to Trial 1 where the sown ryegrass did not persist, even in Treatment 3.

Soldier fly population densities were lower in Trial 2 than Trial 1 which may have allowed greater persistence of sown grasses in the former. The population of soldier fly at the site of Trial 2 had dropped from 6500/m^2 (June 1978) to 2000/m^2 (March 1979), at which time the trial was laid down. The lower population, however, was still sufficient to suppress the yield of undersown pasture.

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