RENOVATION TECHNIQUES FOR AUSTRALIAN SOLDIER FLY INFESTED PASTURE: A COMPARISON OF TREATMENTS

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Summary

The trial compared different pasture renovation techniques on Australian soldier fly (*Inopus rubriceps*) infested soil near Hamilton. The removal of existing pasture by minimum cultivation or paraquat before sowing seed with insecticide gave good control of soldier fly. These techniques were less costly and less disruptive to farm management than intensive surface cultivation over an extended period in autumn which gives excellent control of soldier fly.

INTRODUCTION

The status of Australian soldier fly as a pest of pastures and cereal crops has been well documented (Hewitt 1964, 1969; Wilcocks 1974). Pastures harbouring a large infestation of soldier fly tend to lose the ryegrass (*Lolium* spp) component and become weed and clover (*Trifolium* spp) dominant. Previous work has shown that soldier fly damaged pasture can be returned to high production through renovation by prolonged intensive cultivation followed by reseeding in autumn (Wilcocks and Hewitt 1971), or direct drilling seed and insecticide (Dixon 1977; Rowe and Mackay 1975.)

The cultivation techniques require the complete removal of growing plants on which soldier fly feed and Wilcocks and Hewitt (1971) achieved this by surface cultivation over a 7 week period in autumn. Cumberland *et al* (1973) refined the technique by using paraquat before cultivation to allow a more rapid breakdown of the turf and a shorter cultivation period. Soldier fly larval numbers were reduced by 90 to 95% in these trials.

The use of direct drilling in which insecticide could be placed in the soil with grass seed further reduced the time pasture was out of production during renovation. The level of control of soldier fly was increased by the use of paraquat before drilling to remove existing vegetation and force the larvae to move onto the rows of toxic seedlings (Dixon 1977; Dixon and Davison 1975; Rowe and MacKay 1975). Systemic insecticides such as carbofuran, phorate and omethoate can be taken up by ryegrass seedlings to protect the seedlings and kill larvae feeding on them.

The aim of the present trial was to assemble the various techniques for soldier fly control and pasture renovation and test these on one discrete area. The treatments could then be compared on the basis of effect on soldier fly numbers, resulting pasture production and cost.

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METHODS

A summary of the treatments is given in Table 1. The trial was laid down on a Te Kowhai silt loam soil near Hamilton in a randomised block design with six replicates of each treatment. Plot size was 24 x 5.65 m and a 3 m untreated buffer strip was left between each block.

All plots were sown with 20 kg/ha perennial ryegrass (*Lolium perenne* cv. 'Grasslands Nui') on April 14 1975. Each plot received 375 kg/ha reverted superphosphate at sowing. A fertiliser spreader was used to broadcast the superphosphate on treatments 1, 7, 8 and 10.

In the undersown treatments, seed was sown with a triple disc drill, and a coulter or roller drill was used to sow seed in the cultivated treatments (Table 1).

Paraquat was applied before cultivation or direct drilling at 600 g/ha in 200 litres water on treatments 4, 5, 7, 8, 9 and 10.

Carbofuran and omethoate insecticides were used, either as 10% granules (G) or as a seed dressing. The seed dressings were experimentally manufactured by incorporating the insecticides in a wettable powder form with a 1% methyl cellulose solution on the seeds. Carbofuran 75% W P was used at 10% w/w seed to give 1.5 kg carbofuran/ha and omethoate 58% W P at 10% w/w seed gave 1.2 kg omethoate/ha.

Following pasture re-establishment, all plots were sprayed with 0.3 kg/ha MCPB to control weeds. Soldier fly larval populations were assessed in October 1975 by taking 10 soil cores (7.65 cm diameter) from each plot and extracting the larvae by wet sieving and salt flotation (Wilcocks and Oliver 1971). Herbage dry matter production was assessed monthly after mowing a 24 x 0.45 m strip from each plot. Pasture composition was measured by dissection in July 1976.

RESULTS AND DISCUSSION

The densities of soldier fly larvae in the spring following treatments are given in Table 2. Actual means are presented with statistical analyses having been carried out on the log transformed data.

A good level of control was achieved by the extended cultivation (treatment 6; 91%) and also by the incorporation of insecticide with a short tillage period (treatments 7, 8 and 9; 90-92%). Under-sowing generally gave poor control but was enhanced by the use of paraquat before drilling where insecticide was used (treatment 4; 74% control). The omethoate seed dressing proved phytotoxic with a poor rate of seedling emergence (Table 2).

Pasture composition after one year showed that cultivated treatments, excluding omethoate, (treatments 6-9) had significantly higher percentages of ryegrass and lower levels of *Poa* spp. than untreated pasture, and generally more ryegrass and less poa than undersown treatments 2-5 (Table 2).

There were no significant differences due to treatments in dry matter production 6 months after sowing. This was probably related to the unexplained decline in soldier fly densities in all plots over the year following treatments (80% fewer larvae in untreated control plots by March 1976).

The costs of materials and contract rates for application of treatments are given in Table 3. The costs were calculated at March 1979 prices. Seed dressing costs were estimated as insecticidal seed dressing costs were not available.

Undersowing in existing pasture (treatments 2 and 3), although low in cost was largely ineffective at controlling soldier fly larvae (Table 2; Dixon and Davison 1975). The use of insecticides and paraquat gave satisfactory control of soldier fly and was more economical than the

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Table 1. Summary of pasture renovation treatments.

Treatment No.	Pretreatment	Method seed applied	Method super applied	Method insecticide applied
1	untreated	—	broadcast	—
2	hard grazed	undersown	with seed	—
3	hard grazed	undersown	with seed	carbofuran G with seed
4	paraquat	undersown	with seed	carbofuran G with seed
5	paraquat	undersown	with seed	carbofuran G with seed
6	rotary hoe - 6 weeks	cross drilled coulter-drill	drilled	—
7	cultivation paraquat rotary hoe	roller-drill	broadcast	carbofuran seed dressing
8	paraquat rotary hoe	roller-drill	broadcast	carbofuran with super
9	paraquat rotary hoe	coulter-drill	drilled	carbofuran G drilled
10	paraquat rotary hoe	roller-drilled	broadcast	omethoate seed dressing

Table 2. Soldier fly numbers and pasture composition following treatments

Soldier fly density October 1975			Pasture composition - July 1976		
Treatment	No/m ²	% control	% ryegrass	% Poa spp.	% white clover
1	7802	0 aA	51.8 cBC	16.7 aA	21.7 abc
2	6720	14 abAB	51.5 cBC	15.8 aAB	20.8 abc
3	4997	36 bcBC	55.0 bcABC	13.8 abABC	21.5 abc
4	2028	74 dE	52.3 cBC	12.3 abcABC	23.3 ab
5	3707	53 cdCD	51.3 cBC	13.7 abABC	23.2 ab
6	688	91 eF	66.8 aA	9.2 bcdBCD	14.7 d
7	814	90 eF	66.8 aA	9.2 bcdBCD	14.7 d
8	752	90 eF	64.7 aA	6.8 deCD	17.5 bcd
9	621	92 eF	61.0 abAB	8.3 cdeCD	21.3 abc
10	2419	69 dD	47.2 cC	16.3 aAB	25.3 a

Table 3. Cost of pasture renovation treatments (at March 1979)

Treatment No.	Cost/ha	A. Contract costs	
1	\$14	Rotary hoeing	\$28/hr
2	\$62	Drilling a) triple disc	\$24/ha
3	\$125	b) coulter	\$12/ha
4	\$137	c) roller	\$10/ha
5	\$150	Rolling	\$10/ha
6	\$192	'Roto-tilling'	\$12/ha
7	\$143	B. Material costs	
8	\$158	grass seed	\$1.20/kg
9	\$160	fertiliser	\$37/tonne
10	\$140	insecticide a) carbofuran	\$60/ha
		b) omethoate	\$41/ha
		insecticide application	\$3.50/ha
		paraquat	\$7.57/litre

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extended cultivation technique. The incorporation of insecticide with seed following minimum cultivation gave optimum control of soldier fly as well as being economical. The use of insecticidal seed dressing at low rates may reduce costs further when combined with direct drilling or minimum cultivation techniques.

CONCLUSIONS

Undersowing seed into soldier fly-infested pasture was ineffective at controlling larvae, although the populations of soldier fly subsequent to treatments in this trial were not great enough to significantly affect dry matter production. The use of paraquat or minimum surface cultivation to destroy the larval food source and subsequently incorporating insecticide at resowing protected developing seedlings adequately and killed significant numbers of soldier fly larvae. These techniques compare favourably with intensive surface cultivation over an extended period of time in reducing larval numbers and considerably reduces the period during which pasture is out of production before resowing.

The effectiveness of carbofuran seed dressing suggests that low rates of insecticide could be used in this method profitably.

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