CONTROL OF LUCERNE FLEA WITH INSECTICIDE GRANULES

N.R. WRENN, R.A. MCGHIE and R.P. POTTINGER

Ruakura Soil & Plant Research Station, Private Bag, Hamilton

SUMMARY

Control of lucerne flea (*Sminthurus viridis*) in pasture with granular formulations of diazinon, chlorpyrifos, fenitrothion and isazophos was demonstrated in six field trials. The level of control was equal to or better than that obtained with emulsifiable concentrate formulations. A Vicon Vari-spreader was effectively used to apply granular formulations in two trials.

INTRODUCTION

Both nymphs and adults of lucerne flea damage pasture plants (Dumbleton 1939). Control of lucerne flea has been achieved by spraying insecticides to kill the nymphs and adults (Townsend *et al* 1979; Wrenn *et al* 1983). Effective control has often been for as little as 1-3 weeks. Wrenn *et al* (1983) indicated that longer periods of control ranging from 4-9 weeks could be obtained by the use of more persistent foliar insecticides.

Lucerne flea nymphs hatch from eggs laid on the soil surface and both nymphs and adults are commonly found on the soil. Insecticides formulated as granules tend to have longer biological effectiveness due to their greater ability to withstand weathering in the field (Close 1967; Anon., 1982). Granular formulations of insecticide have further advantages of reduced foliar contamination with insecticide and sufficient weight to carry through the sward to the ground, where many pests such as lucerne flea are active.

For these reasons, trials reported in this paper were established to determine whether or not granular formulations of insecticides could improve the length of lucerne flea control. Granular and emulsifiable concentrate formulations of diazinon (Dyzol 20G, Dyzol 5G, Gesapon 20G, Dyzol 80 ec and Gesapon 80 ec), fenitrothion (Verthion 10 pellets and Caterkil 60 ec), chlorpyrifos (Lorsban 15G and Lorsban 40 ec) and isazophos (Miral 10G and Miral 500 ec) were selected for evaluation.

METHODS

Four, small plot, field trials were laid down in the Waikato and South Auckland areas between July and November 1983. Details of treatments are given in Tables 1, 2 and 3. Granular formulations were broadcast onto the pasture using a hand-held shaker. The spray formulations were applied to 5 x 5 m plots with a hand-held 2.4 m boom fitted with Spraying Systems Co. flat fan nozzles (No. 730154) operated at 210 kPa and delivering 300 litres/ha. Each treatment was replicated four times in randomised blocks.

A 'Vicon Vari-spreader' was used to apply the insecticide granules for control of lucerne flea in pasture in two trials. The effectiveness of insecticide granules was compared in both trials to spray treatments applied in the same manner as described in the small plot trials. Treatment details are given in Table 4.

The spreader was fitted to a Massey Ferguson 165 tractor and operated by power take off at 540 rpm and a vehicle speed of 7 km/h. The angle of spout oscillation was adjusted to the maximum setting of 56°. The spout length was 565 mm and the 'white' end piece was fitted. The spout was kept 750 mm above the pasture during use.

The fine application kit, which is an accessory, and the graduated nylon adjuster were used to obtain the required granule output. This was 73 and 146 g/min. for the low and high rates respectively in the diazinon trial and 175 and 350 g/min. in the fenitrothion trial. In still air conditions, granules were thrown up to 4 m either side of the spreader. Therefore, in accordance with the instruction manual, a bout width of 5 m was used and 15 m wide and 10 m long plots chosen.

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Table 1: Trials 1 and 2 - Control of lucerne flea in pasture using diazinon and fenitrothion granules.

Insecticide	Rate g ai/ha	Formulation	No. ($\log_e x + 1$) lucerne flea/6m sweep at intervals after application			
			Trial 1		Trial 2	
			Weeks after application			
			2	9	2	9
untreated	-	-	0.7	6.0	3.9	4.5
diazinon	250	80 ec	0.2	5.5	0.2	2.8
diazinon	250	20 G	0.4	4.9	1.9	3.0
diazinon	1000	20 G	0.0	3.6	0.4	1.5
diazinon	250	5 G	0.2	5.3	0.5	3.0
diazinon	1000	5 G	0.5	4.6	0.5	2.4
fenitrothion	300	60 ec	0.5	5.9	0.0	2.6
fenitrothion	300	10 G	0.5	5.0	2.5	3.2
fenitrothion	1200	10 G	0.1	4.1	0.7	2.9
SED			0.4	0.3	0.5	0.5

Table 2: Trial 3 - Control of lucerne flea in pasture using diazinon and isazophos granules.

Insecticide	Rate g ai/ha	Formulation	No. ($\log_e x + 1$) lucerne flea/6m sweep at intervals after spraying			
			Weeks after spraying			
			1	2	3	4
untreated	-	-	6.2	4.87	6.0	5.9
diazinon	250	80 ec	1.8	3.71	5.3	5.4
diazinon	250	20 G	4.4	3.30	4.7	4.8
diazinon	500	20 G	3.2	2.56	4.0	4.5
isazophos	100	10 G	5.2	4.35	5.6	5.5
isazophos	400	10 G	3.7	2.64	3.4	4.3
SED			0.5	0.3	0.4	0.4

In the granule treated plots a complete overlap was attained in the central 5 m of the plot by passes of the tractor 5 m from each edge. The remaining area received a single pass. The spray treated and untreated plots were 5 x 10 m. All treatments were replicated four times in randomised blocks. Prior to application of treatments three windspeed measurements were made with an anemometer at each trial site.

Insect assessments

Lucerne flea populations were assessed at intervals in all trials by sweeping foliage with a 300 mm diameter net. The sweep length was 6 m on all plots except for the central section of the 'Vicon Vari-spreader' treated areas where the sweep length was 5 m. In addition, four sweeps, parallel to the direction travelled by the tractor were taken at 1.33 m intervals from each of the areas receiving a single pass. The sweep net catches were killed in 70% alcohol and counts made with a binocular microscope in the laboratory. A $\log_e x + 1$ transformation was applied to all insect counts before analysis of variance tests. All catches were adjusted to No./6 m sweep.

Table 3: Trial 4 - Control of lucerne flea in pasture with emulsifiable concentrate and granular formulations of chlorpyrifos granules.

Insecticide	Rate g ai/ha	Formulation	No. ($\log_e x + 1$) lucerne flea/6m sweep at intervals after spraying		
			Weeks 2	after 4	spraying 9
untreated	-	-	2.2	3.3	3.5
chlorpyrifos	100	ec	0.6	2.2	3.6
chlorpyrifos	100	15 G	0.4	2.4	3.3
chlorpyrifos	200	15 G	0.6	1.3	1.9
SED			0.4	0.3	0.2

Table 4: Trials 5 and 6 - Vicon Vari-spreader application of granular insecticides to control lucerne flea in pasture.

Application method	Rate of insecticide	No. ($\log_e x + 1$) lucerne flea/6m sweep at intervals after insecticide application				
		Trial 5			Trial 6	
		Weeks 5	10	15	Weeks after spraying 5	10
Untreated	-	4.3	5.2	5.1	5.2	4.6
Spray	low	2.8	4.8	5.5	2.6	4.0
Granule	low	1.6	3.3	3.9	3.1	4.0
Granule	high	1.2	3.0	3.6	3.2	3.9
SED		0.7	0.5	0.2	0.5	0.4

Trial 5: Diazinon sprayed at 250 g ai/ha (low), granules at 250 g ai/ha (low) and 500 g ai/ha (high).

Trial 6: Fenitrothion sprayed at 300 g ai/ha (low), granules at 300 g ai/ha (low) and 600 g ai/ha (high).

RESULTS

All six trials showed that granular formulations were at least as effective as emulsifiable concentrates for control of lucerne flea. As for foliar sprays (Wrenn *et al* 1983) increased application rates generally extended the period of control (Trials 1, 2 and 4). Some granular formulation treatments gave a significantly longer period of control than the equivalent amount of the same chemical applied as a spray (Trials 1 and 5). Granular formulations of insecticide were slower to effect control than spray formulations (Trials 3 and 4). The 5% and 20% formulations of diazinon gave similar levels of control.

Diazinon and fenitrothion granules were effectively applied by a 'Vicon Vari-spreader' (Trials 5 and 6). The period of control achieved by the diazinon granule formulation was longer than the spray formulation, 15 weeks compared to 6 weeks respectively.

TABLE 5: Trials 5 and 6 - Control of lucerne flea with insecticide granules* at various distances following a single pass of a 'Vicon Vari-spreader'.

Side	Distance from spreader (m)	No. of lucerne flea/6 m sweep			
		Trial 5		Trial 6	
		Weeks after application			
		2	5	2	5
Upwind	0.0	6	4	34	20
Downwind	0.0	9	4	19	20
Upwind	1.3	5	3	23	24
Downwind	1.3	4	1	55	24
Upwind	2.7	11	25	73	42
Downwind	2.7	5	1	52	31
Upwind	4.0	61	66	72	74
Downwind	4.0	11	7	41	53
Untreated	-	151	80	107	185
Wind speed m/second		1.7		4.0	

*Trial 5: diazinon applied at 500 g ai/ha

Trial 6: fenitrothion applied at 600 g ai/ha

DISCUSSION AND CONCLUSIONS

The results demonstrate that commercially available insecticide granule formulations of diazinon and fenitrothion were at least as effective as emulsifiable concentrate formulations for control of lucerne flea. Granular formulations of isazophos applied at 400 g ai/ha and chlorpyrifos at 100 and 200 g ai/ha were also effective.

The increased effectiveness of granules probably relates to a longer period of control due to the method of formulation.

The trials with the 'Vicon Vari-spreader' showed that small quantities of granular products, 1.25-2.50 kg/ha of Gesapon 20G and 3-6 kg/ha of Shell Verthion 10G, could effectively be applied with this equipment. The bout width of 5 m used gave a high level of control. Counts of lucerne fleas surviving in the non-overlapped areas indicated that a wider bout width of up to 8 m (4 m x 2) would remain effective at the higher treatment rates used (Table 5). While wind affects the distribution of granules from the spreader, overlapping from the next pass of the machine cancels out the irregular distribution.

Close (1967) has outlined the advantages of granular formulations over sprays. The following advantages are obtained if granular formulations of insecticides are used to control lucerne flea:

1. Time saved in mixing insecticide with water and in refilling the application equipment;
2. Increased operator safety due to ease of handling and application;
3. Shorter stock withholding periods for some granular formulations, e.g., fenitrothion granules have a 7 day withholding period compared to 14 days for emulsifiable concentrate formulation;
4. A longer period of control can be attained with some granular insecticides compared to spray treatments.

On the debit side, granular formulations cost approximately 20% more than emulsifiable concentrate formulations. The advantages, however, should be sufficient to influence lucerne flea insecticide users.

Additional trial work evaluating the use of granular formulations during the early autumn period has been initiated.

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