SPRAY APPLICATION TECHNIQUES FOR LUCERNE FLEA CONTROL IN PASTURES

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SUMMARY

Insecticides for lucerne flea *(Sminthurus viridis)* control were applied in a range of spray volumes, using boom and nozzle and 'boomjet' application equipment. Lucerne flea was controlled at all volumes of spray mix used (27-300 litres/ha) An effective spray width for 'boomjet' applications was established. Inclusion of diazinon, dimethoate, chlorpyrifos or fenitrothion in a 25% w/v urea/water solution did not result in loss of insecticidal efficacy.

INTRODUCTION

Prior to 1983, maldison was the only insecticide registered for control of lucerne flea in pastures. When applied at recommended rates between 75-200 g ai/ha it gave control for 2-3 weeks (Townsend *et al* 1979; Wrenn *et al* 1983). Consequently, farmers tolerated damage and generally restricted use of maldison treatments to silage and hay crops in spring.

Following the extension of lucerne flea control to 4-9 weeks by use of diazinon, dimethoate, fenitrothion and chlorpyrifos (Wrenn *et al* 1983), use of insecticide to control lucerne flea from autumn to late spring has increased significantly. All four insecticides are now registered for lucerne flea control.

It was apparent from the literature, however, that critical evaluation of the most appropriate methods for spray application of insecticides for control of lucerne flea had not been attempted. Only Watts (1961) has discussed the use of broadcast spray nozzles in this Society's proceedings.

Application of insecticides against lucerne flea coincides with the application of phenoxy herbicides (Matthews 1975) and nitrogen treatments (O'Connor and Steele 1982). Lowe (1962) suggested that insecticides and phenoxy herbicides are compatible.

Three objectives were established for the trials reported in this paper. Firstly, the volume of diluent required to effectively apply insecticide to pasture for lucerne flea control with a boom and nozzle sprayer; secondly, evaluation of the efficiency of a 'boomjet' sprayer and thirdly, the efficacy of insecticide/urea solutions were investigated.

METHODS

Spray volume trials

A constant rate of insecticide was applied in a range of water volumes in two trials (Table 1). Treatments were applied by a hand-held 2.4 m boom fitted with Spraying Systems flat fan tips (No. 730154) operated at 210 kPa. Insecticide solutions were applied at 100, 200 and 300 litres/ha. A plot size of 5 x 10 m was used for all treatments. The insecticides and rate are given in Table 1.

A third trial (Table 2) investigated the effectiveness of spray volumes ranging from 27-181 litres/ha, applied by a hand-held boom fitted with Spraying Systems hollow cone tips, operated at 210 kPa. For purposes of comparison, standard treatments of 181 and 300 litres/ha were applied through a flat fan tip nozzles (No. 730154) operated at 210 kPa. Chlorpyrifos (Lorsban 40 ec) applied at 100 g ai/ha was used in all treatments to 5 x 5 m plots.

Broadcast nozzle trials

Insecticide was applied by 'boomjet' nozzles (Spraying Systems No. 5880-3/4-2T0C10) in trials 1, 2 and 4 (Table 1 and Fig. 1). The nozzle was mounted 1.0 m from the rear of a 'Landrover', 0.9 m above ground and operated at 280 kPa.

TABLE 1: Trials 1, 2 and 4 - comparison of flat fan nozzle and 'boomjet' insecticide applications in various spray volumes for control of lucerne flea.

Nozzle type	Spray volume litres/ha	Percent lucerne flea survival after spraying					
		Trial 1*		Trial 2**		Trial 4***	
		Weeks after spraying					
		2	4	2	4	2	4
Flat fan	100,200,300	3	91	11	41	2	15
'Boomjet' overlapped	200	11	107	18	40	-	-
'Boomjet' non-overlapped	100	17	84	14	48	24	36
LSR P< 0.05		2.1	1.4	1.9	1.6	2.1	1.7

* Trial 1: All treatments applied diazinon at 250 g ai/ha
** Trial 2: All treatments applied fenitrothion at 150 g ai/ha
*/** Trials 1 & 2: Counts for each flat fan application rate pooled as they were not significantly different.
*** Trial 4: Flat fan nozzle treatments applied in 300 litres/ha only. As the level of control achieved by diazinon (250 g ai/ha) and fenitrothion (150 g ai/ha) was not significantly different, results were pooled.

TABLE 2: Trial 3 - lucerne flea control with chlorpyrifos applied at 100 g ai/ha using a range of spray volumes.

Nozzle type	Spray mix litres/ha	No. ($\log_e x + 1$) lucerne flea/sweep Weeks after spraying	
		1	3
Untreated	-	3.2	2.2
Flat fan 730154	300	0.0	0.2
Flat fan 730154	181	0.0	0.5
Hollow cone Tx8	181	0.9	0.0
Hollow cone Tx4	92	0.3	0.0
Hollow cone Tx3	72	0.3	0.0
Hollow cone Tx2	50	0.3	0.0
Hollow cone Tx1	27	0.0	0.5
Standard error of the difference		0.4	0.3

The application rates chosen were based on the manufacturer's recommendations for a swath width of 12.4 m. In order to reduce the trial area required, one off centre tip No. 0C10 and Veejet nozzle No. H 1/4U-0508HE were plugged. As a consequence, the 'boomjet' sprayed to one side only. A plot size of 10 x 10 m was used, with the central 6.2 m (12.4 ÷ 2) section only receiving total coverage. Overlap treatments were achieved by a second pass in the opposite direction, 6.2 m from the first.

Trials 1 to 4 all had four replicates laid out in randomised blocks with buffers up to 5 m wide between blocks for vehicle access.

Efficacy of urea/insecticide solutions

Diazinon (Gesapon 80 ec), dimethoate (Rogor E), chlorpyrifos (Lorsban 40 ec) and fenitrothion (Caterkil 60) were added to a 25% w/v urea/water solution, 1 h before application to pasture. The mixes were applied by a hand-held boom delivering 200 litres/ha at 210 kPa to 5 x 10 m pasture plots. Each treatment was replicated four times in a randomised block layout.

TABLE 3: Trial 5 - The efficacy of insecticide/urea tank mixes for the control of lucerne flea in pasture; bioassay and field trial results.

Insecticide	Rate g ai/ha	Field assessment No. ($\log_e x + 1$) lucerne flea/ sweep Weeks after spraying		Bioassay test No. lucerne flea alive/pot Days after spraying	
		0.5	4	1	3
untreated		4.8	3.5	7.8	9.8
diazinon	250	1.2	2.9	0.0	9.0
diazinon	250 + urea	1.2	2.2	0.0	9.0
dimethoate	200	0.4	2.9	1.8	8.4
dimethoate	200 + urea	0.9	2.9	2.8	9.2
chlorpyrifos	100	0.5	1.4	0.0	1.4
chlorpyrifos	100 + urea	0.6	1.8	0.2	2.8
fenitrothion	300	0.6	2.7	0.2	1.4
fenitrothion	300 + urea	0.2	2.6	0.0	2.4
SED		0.6	0.3		

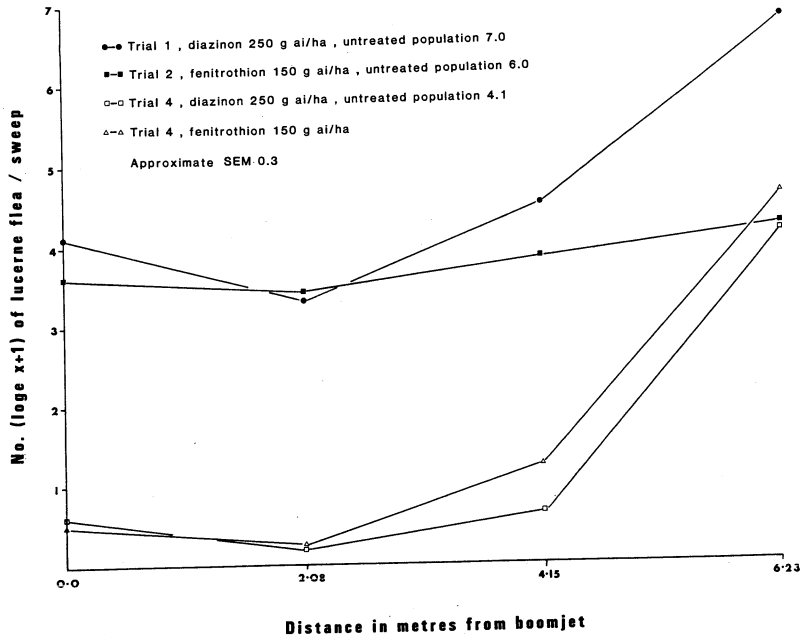

Fig. 1: Trials 1, 2 and 4: Lucerne flea control with insecticide 2 weeks after spraying at various distances from the 'boomjet'; non-overlapped applicatons.

For the bioassay experiment, foliage was clipped 1 and 3 days after application of the spray, from one of the field replicates of each treatment. Ten lucerne fleas were added to each of 5 subsamples in the laboratory. The mean number of lucerne fleas alive per pot after 24 h exposure is given in Table 3.

Assessment of lucerne flea

Lucerne flea populations in all trials were assessed by foliage sweeping with a 300 mm diameter net. In treatments which were sprayed with boom and nozzle equipment, the length swept was 6 m. For the non-overlapped boom jet treatments, a 6.2 m sweep across the width of each plot was made. In addition, to assess the efficacy of insecticide coverage, four sweeps equally spaced from the nozzle path to the outer edge of the 6.2 m swath were taken from each plot.

The insects were killed in 70% alcohol and counted under a binocular microscope. Numbers of lucerne flea caught in all cases have been adjusted to numbers per 6 m sweep.

All insect counts from field trials were transformed ($\log_e x + 1$) before analysis of variance tests.

RESULTS

All spray volumes evaluated, ranging from 27 to 300 litres/ha, were equally effective for each of the three insecticides tested (Table 1 and 2). Flat fan tips and hollow cone tips for application of insecticide were of equal effectiveness (Table 2).

In the non-overlapped 'boomjet' treatments, three of the four applications showed a significant decline in lucerne flea control as distance increased from the nozzle path. Counts taken 6.2 m from the nozzle path were generally similar to the untreated plots (Fig. 1). Overlapped treatments generally gave a similar level of control as the flat fan nozzle applications (Table 1). Windspeed was less than 1 m/second in all trials.

The field trial (Table 3) and the supporting bioassay experiment showed that tank mixtures of urea and insecticide sprayed within 1 h of preparation do not lose insecticidal activity.

DISCUSSION AND CONCLUSIONS

These trials have indicated that changes in spray volume (litres/ha) have no significant effect on lucerne flea control. Considerable time saving can be achieved by reduction in volume of insecticide mixes applied. Spray volumes of 300 litres/ha are commonly used for applications of insecticides against lucerne flea on pasture. In practice, however, the lowest volumes evaluated will probably be impractical due to increased blockage of the smaller orifice nozzles and drift of the small droplets. The use of around 75 to 100 litres/ha should be attainable by most applicators, so long as attention is given to water quality and adequate filtration.

The need to overlap swaths with 'boomjet' nozzle applications has been clearly demonstrated. For the 'boomjet' used in these trials, the effective swath width is approximately 8.3 m (4.15 m x 2), two-thirds that indicated by the manufacturer.

All nozzle types evaluated, flat fan, hollow cone and 'boomjet', gave similar levels of lucerne flea control if correctly overlapped. It is apparent that a wide range of spray application techniques can be used with similar effectiveness for residual, foliar insecticides applied to control lucerne flea in pasture. On-farm application costs of agricultural chemicals can be reduced by combining insecticide applications with urea or phenoxy weedkillers.

ACKNOWLEDGEMENTS

The authors thank Messrs, S.D. Caley, G.E. Lamb, D.J. Judge, R. Burnett and P. Steiner for allowing trials on their farms and also Ms B. Dow for statistical analysis of the results.

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