CONTROL OF PORINA CATERPILLAR

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Summary

The increased amount of pasture cover resulting from the control of porina caterpillar (*Wiseana* spp.) is used as the main criterion for assessing treatment effectiveness. Initial caterpillar mortality counts and the number of live caterpillars remaining are also given. Diazinon gave a much higher initial caterpillar mortality than trichlorfon, but spray formulations of both chemicals gave statistically significant increases in pasture cover. Applications of granular formulations were made up to late April, and most resulted in pasture responses not significantly different from sprays. Limited tests showed that the experimental spray materials, methidathion, fenitrothion, and phosalone, as well as Bayer S4400 as granules, were all very promising. A microbial insecticide, *Bacillus thuringiensis*, did not reduce larval numbers, but caused some increase in pasture cover. Low-fertility pastures, on which some of the trials were sited, with about three caterpillars per square foot, greatly benefited from treatment.

INTRODUCTION

THE CONTROL of porina caterpillar (*Wiseana* spp.) has become the subject of much research work in recent years. This has been largely brought about by restrictions in the use of DDT. Like grass-grub (*Costelytra zealandica*), porina is a serious threat to pasture productivity unless controlled and, if control measures are to be of benefit, there must be a consequent increase in the amount of pasture. Although pasture yields were not determined, this paper attempts to indicate by the point analysis method the increase in pasture cover that can be obtained from the use of a number of organophosphate chemicals. Of the seven trials referred to, six were conducted when the writer was in the employment of the Department of Agriculture.

EXPERIMENTAL

The results from seven trials are given, of which only four were point analysed to determine vegetation cover and species composition. All treatments were replicated and randomized in blocks, and the relevant trial details are shown in Table 1. All rates mentioned are expressed in terms of active ingredient per acre. The dominant sward species present at the time of treatment were chewings fescue (*Festuca rubra* var. *fallax*) and browntop (*Agrostis tenuis*) for Trials 1 to 4; cocksfoot (*Dactylis glomerata*) and ryegrass (*Lolium perenne*) for Trial 5; and ryegrass and white clover

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(*Trifolium repens*) for Trials 6 and 7. The diazinon granules were not of similar formulation for all trials. The following tabulation sets out the differences.

<i>Trials</i>	<i>Type of diazinon granule</i>
1-3	attapulgit base. Obsolete formulation (1962)
5	calcite base. Current commercial stock
6	walnut shell base

TABLE 1: DETAILS OF TRIALS
(Trials 1-6 conducted in 1965, Trial 7 in 1966)

	<i>Trial</i>						
	1	2	3	4	5	6	7
Date sprayed	Mar. 11	Mar. 30	Apr. 1	May 5	Mar. 29	Apr. 21	Mar. 23
Vegetation cover	85%	90%	90%	80%	90%	85%	90%
Caterpillar size (in.)	1-1¼	1¼-1½	1-1½	1½	1¼	1¼-1½	1¼-1½
Initial No./sq. ft	3-4	2-4	2-3	8	2-5	2-4	10
Replications	6	6	6	3	6	6	6
Volume carrier (gal)	30	55	28	55	45	40	30
Weather	fine	fine	o'cast	fine	cloudy	fine	fine
Temp. (max./min.)	62/51°	57/43°	61/57°	58/46°	59/49°	65/53°	70/65°
Rain (1 day)	nil	nil	nil	nil	0.27 in.	nil	nil

RESULTS AND DISCUSSION

INITIAL CATERPILLAR MORTALITY

Table 2 shows the relative initial caterpillar mortality given by treatments compared to diazinon wettable powder at 1 lb as 100. The counts refer to those obtained early in the morning following treatment application, and are not given from trials where birds were noted as feeding prior to counting.

TABLE 2: RELATIVE INITIAL CATERPILLAR MORTALITY
(1 DAY)
(Diazinon W.P. 1 lb = 100)

<i>Treatment (lb)</i>	<i>Trial</i>			
	1	2	3	6
Diazinon W.P.1	100*	100	100	100
Diazinon G.1	1	2	0	29
Diazinon G.2				52
Trichlorphon S.P.1	30	85		28
Trichlorphon G.1	6	18	10	20
Trichlorphon G.2				32
Methidathion W.P.1			46	107
Methidathion G.1			0	
Phosalone E.C.1	29	23		
Fensulfothion G.1		16		24
S.4400 G.1		3		28
Untreated	0	0	0	0
*Actual count/100 sq. ft	68.2	45.2	10.2	15.3

There were no dead caterpillars recorded in Trial 3 for the ½ lb rate of diazinon, trichlorphon and methidathion (Geigy GS.13005), each as a granule formulation.

The counting of dead or dying caterpillars following treatment application is not a reliable method of showing treatment effectiveness. Granular formulations depend upon a contact action to impart the toxic ingredient to the caterpillar, and thus initial mortality is very much lower than that obtained from spray formulations whereby the caterpillars in active feeding, instead of moving about, ingest sprayed foliage.

Table 2 indicates that diazinon as a wettable powder is more toxic than the other sprayed chemicals, and this would suggest a rate lower than 1 lb would be satisfactory. This higher initial mortality from diazinon would appeal, and has appealed, to many users.

LIVE CATERPILLARS REMAINING

The amount of sampling required to satisfy statistical requirements was not carried out. However, in five trials, a single square foot sample, 12 in. deep, was dug on each plot and counts made of the number of live porina. The results of the sampling are shown in Table 3 as a percentage reduction of the number of live porina from that recorded for untreated control. The actual live count for untreated is the total of 6 replicates, except in Trial 4 where it is from only 3. It was noted in Trial 2 that there were a number of dead caterpillars on the surface and in the soil which had died as a result of the fungal disease *Metarrhizium anisopliae* (G. Helson, pers. comm.). This has probably clouded the effects of the treatments, as well as being the cause for the reduced numbers on the control plots.

TABLE 3: PERCENTAGE REDUCTION OF CATERPILLARS

Treatment (lb)	Counts Made	Trial				
		1 19 wk	2 16 wk	3 20 wk	4 17 wk	5 23 wk
Diazinon W.P. 1		91	60	90	93	
Diazinon G. ½				50		
Diazinon G. 1		36	0	40		63
Trichlorphon S.P. 1		91	80		86	
Trichlorphon G. ½				90		
Trichlorphon G. 1		91	10	80		42
Methidathion W.P. 1				100	79	32
Methidathion G. ½				90		
Methidathion G. 1				70		
Phosalone E.C. 1		95	80			
Fenitrothion W.P. 1					100	
Phenthoate E.C. 1						58
Fensulfothion G. 1			70			90
S.4400 G. 1			60			69
<i>Bacillus thuringiensis</i> 6 pts					0	
Control untreated		0	0	0	0	0
Actual trial total (control)		22	10	12	14	23

As the porina population was not very high in most of the trial sites, and only one sample digging was made per plot, the reductions shown in Table 3 must be taken as a guide only. However, it appears that diazinon and trichlorphon as powder formulations have given satisfactory reduction of caterpillars. The experimental materials methidathion, phosalone, and fenitrothion appear simi-

TABLE 4: POINT ANALYSES OF GROUND COVER EXPRESSED AS A PERCENTAGE OF UNTREATED

Trial	Period since treatment	GRASS COVER				BARE GROUND			
		1	2	3	4	1	2	3	4
		19 wk	16 wk	16 wk	11 wk	19 wk	16 wk	16 wk	11 wk
<i>Treatment (lb)</i>									
Diazinon W.P. 1		131 aA	132 aA	140 abA	179 abA	20 cC	33 cB	34 cBC	23 bAB
Diazinon G.* 1/2				125 bcAB	.....	.....	.....	69 bAB	.....
Diazinon G.* 1		112 bcBC	123 aAB	129 bAB	.....	70 bAB	63 bB	44 bcBC	23 bAB
Trichlorophon S.P. 1		130 abAB	123 aAB	.....	174 abA	25 cC	48 bcB	.....	.....
Trichlorophon G. 1/2				123 bcAB	.....	44 bcBC	60 bcB	56 bcBC	.....
Trichlorophon G. 1		119 abAB	123 aAB	129 bAB	.....	.....	.....	47 bcBC	20 bB
Methidathion W.P. 1				160 aA	183 aA	.....	.....	28 cC	.....
Methidathion G. 1/2				124 bcAB	.....	.....	.....	44 bcBC	.....
Methidathion G. 1				147 abA	.....	.....	.....	37 cBC	.....
Phosalone E.C. 1		123 abAB	124 aAB	.....	179 abA	29 cC	48 bcB	.....	24 bAB
Fenitrothion W.P. 1							49 bcB	.....	.....
Fensulfothion G. 1			118 abAB	.....	.....	.....	36 bcB	.....	.....
S.400 G. 1			137 aA	.....	.....	.....	.....	.....	.....
<i>Bacillus thuringiensis</i>									
6 pts					135 bcAB	.....	.....	.....	73 abAB
Control untreated		100 cC	100 bB	100 cB	100 cB	100 aA	100 aA	100 aA	100 aA
CV		8.9%	13.0%	15.8%	15.4%	46.4%	39.8%	44.8%	63.2%
Actual % cover		67.0	57.7	45.7	48.0	28.0	30.0	32.3	44.0
(untreated)									

* Obsolete attapulgite granule.

larly effective. The obsolete attapulgit-based diazinon granule was not nearly as good as the current one, formulated on calcite, which was used in Trial 5. Although not extensively tested against current granular materials commercially available, the new materials fensulfothion (Bayer S.767) and S.4400 appear to have given fairly good reductions.

INCREASE IN PASTURE COVER

The value of a treatment is if it profitably returns a significant increase in the amount of desirable vegetation available as animal fodder. Although the actual amount of pasture saved would have been a better criterion of treatment effectiveness, a measure of the increase in pasture cover as a result of treatment was made by the point analysis method. The amount of vegetation cover present at the time of treatment is given in Table 1, and was assessed visually.

Subsequent to treatments being applied, each plot of Trials 1 to 4 inclusive were point analysed for ground cover of vegetation and bare ground, taking 50 points per plot (10 placings of a frame having 5 needles, 4 in. apart). Recordings were of cover only, and were taken for grasses, bare ground, clovers and weeds, with only the first two being statistically analysed. There were generally no more than 4% of clovers present, and, although weed density varied according to trial site, there was little difference between treated and untreated. The weeds were mainly catsear (*Hypochaeris radicata*) and Scotch thistle (*Cirsium lanceolatum*). The vegetation was $\frac{1}{2}$ to 1 in. high.

The point analyses were carried out towards the end of July, 1965, and as caterpillars by this time were either feeding less frequently, or beginning to pupate, untreated areas would start to recover. Thus the differences between treated and untreated may have been greater at an earlier date. By taking only one assessment, it does not record the intermediate changes, such as the probably quicker recovery of pasture from sprays rather than granules. Table 4 shows the recordings expressed as a percentage of untreated control for both the amount of grass cover, and the area of bare ground for each treatment.

The increase in grass cover is a more reliable estimation of treatment effectiveness than a decrease in bare ground, as the latter could be brought about by an infestation of flatweeds. All chemical treatments caused a significant decrease in the area of bare ground relative to untreated areas, with all chemical spray treatments giving significant increases in pasture cover. In Trial 3, the only one to test $\frac{1}{2}$ and 1 lb rates of granular formulations, only the 1 lb rate gave significant increases in grass cover at the 5% level of significance. It is surprising to note that the obsolete attapulgit formulation of the diazinon granule gave almost identical increases in pasture cover to that of trichlorphon granules at either the $\frac{1}{2}$ or 1 lb rate in all three trials, in spite of being less effective in reducing larval numbers.

Overall, where comparisons can be made, the granule formulations did not give as much increase in grass cover as the sprays. In the only trial shown in the table where S.4400 was used, it gave a highly significant pasture increase, but fensulfothion, although greatly decreasing the area of bare ground, did not result in the pasture cover being significantly different from untreated owing to a fairly high percentage of flatweeds present. The larger increases of grass cover as a result of treatment in Trial 4, as compared with that obtained in Trials 1 to 3, could be attributed

to the higher initial population of porina of 8 per sq. ft compared with about 2 to 4 for the other trials. Even so, with such a relatively low infestation in the first three trials, highly significant increases in pasture cover were obtained.

RESULTS OF 1966 TRIAL

Trial 7 was conducted to determine the effectiveness of an emulsifiable formulation of diazinon relative to the wettable powder one. No sampling or point analyses have been carried out as yet but initial mortality counts the day following spraying, as well as the general pasture responses at 6 weeks, are indicated in Table 5. These show that, in the light of previous trial work, the emulsifiable concentrate of diazinon is more effective than the wettable powder.

TABLE 5: INTERIM RESULTS OF TRIAL 7

<i>Treatment (lb)</i>	<i>Initial Mortality (1 day) Relative No. Dead</i>	<i>Pasture Response (6 wk) (1-10)</i>
Diazinon W.P. 0.6	71	5.3
Diazinon W.P. 0.75	100*	7.0
Diazinon E.C. 0.6	75	8.0
Diazinon E.C. 0.75	99	7.3
Trichlorphon S.P. 0.75	23	8.0
Methidathion W.P. 0.75	31	7.3
Control untreated	0	4.3
*Actual count/100 sq. ft	17.6	

CONCLUSIONS

- (1) The wettable powder formulation of diazinon at 1 lb consistently gave statistically highly significant increases in grass cover from that of untreated.
- (2) On the basis of visual pasture recovery in one trial, emulsifiable formulation of diazinon is more effective than the wettable powder.
- (3) Trichlorphon as a soluble powder at 1 lb gave statistically significant grass cover increases, and was not significantly inferior to diazinon.
- (4) Although diazinon gave a much higher initial caterpillar mortality than trichlorphon, increases in grass cover were similar.
- (5) Limited tests at 1 lb with spray formulations of the experimental materials methidathion, fenitrothion, and phosalone gave highly significant increases in grass cover.
- (6) Compared with untreated, granular formulations of trichlorphon and methidathion at 1 lb gave significant increases in pasture cover which were not significantly different from sprays. The increase from the ½ lb rate was not significantly different from untreated.

- (7) The current diazinon granule based on calcite appears superior to the obsolete attapulgitic granule for reducing the caterpillar population.
- (8) The two granular Bayer compounds, fensulfothion and S.4400, were promising, but only the latter gave a significant increase in grass cover.
- (9) A flowable formulation of a microbial insecticide, *Bacillus thuringiensis*, did not reduce larval numbers, but partially inhibited feeding in causing an increase in pasture cover.
- (10) The treating of low-fertility pastures infested with a low population of 2 to 4 porina per square foot resulted in highly significant increases in grass cover, and decreases in bare ground.

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