PASTURE RESPONSE FOLLOWING INSECTICIDE TREATMENT FOR THE CONTROL OF PORINA

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Summary

Results from replicated field trials laid in Canterbury during 1967 for the control of porina (*Wiseana* spp.) are presented. Early season treatment of infested pastures with diazinon, fenitrothion or trichlorphon is shown to be a profitable investment, while late season applications are shown to be of value in minimizing permanent pasture damage. Surface counts of dead and moribund larvae 12 hours after treatment showed little relationship to pasture production.

INTRODUCTION

PORINA (*Wiseana* spp.) has emerged in recent years as a pasture insect problem second only to grass grub (*Costelytra zealandica*) as a threat to New Zealand grassland productivity. Despite a more recent general appreciation that porina caterpillars present a serious problem, few factual data on the effect of porina on pasture production are available. When it became evident that pelleted formulations of DDT (Anon., 1967) were not truly effective, many farmers doubted that treatment with one of the apparently more expensive organophosphorus insecticides was justified. A trial programme was therefore commenced in 1967 to measure the effect of typical farm infestations of porina on pasture production and to determine the effectiveness of commonly used insecticides in reducing this damage. From the data obtained, an attempt has been made to calculate the profitability of treatment.

EXPERIMENTAL

The plot size used was 1/200th acre (15 ft $\times$ 14 ft 6 in.). All treatments (all rates are expressed as lb of active ingredient per acre) were made as spray applications and were randomized and replicated four times. Insecticide treatment of pasture was made with an Oxford precision sprayer applying 32 gal/acre at a pressure of 30 lb/sq. in. Initial toxicity was measured by counting the dead and moribund larvae found on the surface in square yard sample areas taken at random on each plot 12 hours after treatment. The yield was assessed by mowing two 11 ft 6 in. $\times$ 18 in. strips to a pasture height of one inch from each plot. The herbage fresh weight was recorded on the site. The herbage from each replicate was then mixed together and a random sample taken for pasture dissection and dry weight determination. A visual estimate (0 — 10 scale: 0 = no response; 10 = complete response) of pasture growth was made prior to harvesting.

Treatments in both trials were applied under mild, cloudy weather conditions late in the afternoon so that a minimum loss of insecticide activity would occur before the caterpillars emerged.

RESULTS

TRIAL I — HINDS, MID-CANTERBURY (Treated March 6 1967)

At the time of treatment, an infestation of 15 porina caterpillars per square ft, averaging 1 to 1½ in. in length was present. The two-year-old ryegrass/white clover pasture, although in active growth, was estimated to contain 60% bare ground. Although the soil below 1 in. was fairly dry, the topsoil was near field capacity and the porina larvae appeared to have been actively feeding.

The results of this trial shown in Table 1 include surface counts taken next morning of dead and moribund larvae, visual estimates of pasture growth, and the pasture yield at intervals over a subsequent 40-week period.

Table 1 lists treatments in decreasing order of total pasture growth in the 40 weeks subsequent to treatment.

TRIAL II — CLYDEVALE, SOUTH OTAGO (Treated May 22 1967)

In this two-year-old ryegrass/white clover pasture, active growth had almost ceased at the time of treatment. There was an infestation of up to 30 porina caterpillars per square foot varying from ½ to 2 in. in length.

Total pasture yield was not measured during the winter but the area was closed to stock in late spring (November), and yield data were taken on the hay crop, February 2 1968, over 8 months after treatment. The 12-hour mortality counts and yield results are shown in Table 2.

DISCUSSION

THE TRIAL RESULTS

All treatments in Trial I gave highly significant pasture yield increases compared with the untreated controls. No one insecticide or formulation proved superior. Although there was no significant advantage in applying more than 0.5 lb, field experience has indicated that this low rate does not consistently produce reliable results in a farm-scale application where treatment conditions are often less than ideal. In Trial II, however, while the higher rates of all treatments significantly outyielded the untreated controls, only Dowco 179 was significantly better than control at the 0.5 lb rate.

As suggested by Fenemore (1966), the counts of dead and moribund larvae on the surface the day following treatment cannot be reliably related to the effects of treatment expressed in terms of pasture yield. For instance, trichlorphon at 1 lb in Trial I gave a surface count of 40 caterpillars per square yard, while diazinon at 1 lb produced only half this number. However, the pasture yield of both treatments over the 40-week period did not differ statistically, both producing over 6,000 lb dry matter per acre.

The advantages of early treatment were clearly demonstrated in Trial I, and fully support the general recommendation to treat at the first signs of porina infestation. However, there has been some doubt concerning the value of treating porina late in the season when active autumn growth has ceased.

Contrary to the results obtained by Kelsey and Read (1966), Trial II demonstrates that treatment during these winter months can reduce permanent damage to a pasture.

TABLE 1: RESULTS OF INSECTICIDE ACTIVITY AND PASTURE RESPONSE
TRIAL 1 — HINDS, MID-CANTERBURY

Treatment (lb)	Surface Counts (larvae/sq.yd)	Pasture Yield (lb D.M./acre) (Weeks)	Total Pasture Yield Composition (lb D.M./acre)			Visual Pasture Response (weeks)						
			0-25	25-32	32-40	Ryegrass	Clover	Other†	Total	14	32	40
trichlorphon (LC)*	0.75	39 abA	2319 ABC	1561 AB	3251 A	5586	1406	139	7131 aA	8.4	8.2	8.3
fenitrothion (EC)	0.75	26 bcdABC	2897 A	1558 AB	2580 AB	5305	1597	133	7035 abA	9.1	8.2	7.8
trichlorphon (SP)	0.75	33 abAB	2455 ABC	1953 A	2438 AB	5036	1688	122	6846 abcA	8.4	7.8	8.0
trichlorphon (SP)	1.0	40 aA	2761 AB	1688 AB	2355 AB	4967	1728	109	6804 abcA	8.1	7.9	8.3
fenitrothion (EC)	0.5	20 cdBCD	2051 CD	1760 AB	2748 AB	4615	1675	269	6559 abcAB	6.0	6.6	8.8
diazinon (EC)	1.0	20 cdBCD	2306 ABC	1467 AB	2487 AB	4410	1754	96	6260 abcAB	6.5	6.4	7.8
trichlorphon (LC)	1.0	32 abcABC	2403 ABC	1511 AB	2084 B	4439	1531	28	5998 abcdAB	8.2	7.7	7.5
diazinon (EC)	0.5	16 deCD	2153 BC	1399 B	2287 AB	3925	1770	144	5839 bcdAB	5.1	6.4	8.0
trichlorphon (LC)	0.5	34 abAB	1795	1437 AB	2435 AB	4548	1033	86	5667 cdAB	5.9	6.8	8.0
fenitrothion (EC)	0.25	7 efDE	946 D	1382 B	2823 AB	3915	1012	224	5151 dB	3.4	4.0	7.5
Untreated	—	0.1 fE	0 E	190 C	1900 B	1104	610	376	2090 eC	0.6	1.6	2.8
CV	20.0%	15.4%	16.2%	18.2%				12.3%				

* LC = water-soluble liquid concentrate, EC = emulsifiable concentrate, SP = water-soluble powder.

† Other: principally weeds such as storksbill (*Erodium cicutarium*), yarrow (*Achillea millefolium*), shepherds purse (*Capsella bursa-pastoris*), suckling clover (*Trifolium dubium*), and dry litter.

TABLE 2: RESULTS OF INSECTICIDE ACTIVITY AND
PASTURE RESPONSE
TRIAL II — CLYDEVALE, SOUTH OTAGO

<i>Treatment (lb)</i>		<i>Surface Counts</i> (<i>Larvae per 1/200th acre</i>)	<i>Pasture Yield</i> <i>lb D.M./acre</i>
diazinon	0.75	31	2504 aA
fenitrothion	0.75	36	2446 aA
Dowco 179	1.0	13	2429 aA
Dowco 179	0.75	8	2382 aA
Dowco 179	0.5	13	2382 aA
trichlorphon	0.75	23	2208 abAB
fenitrothion	0.5	22	2042 abcABC
Dowco 179	0.25	7	2011 abcABC
diazinon	0.5	16	1981 abcABC
trichlorphon	0.5	14	1833 abcdABC
trichlorphon	0.25	6	1580 bcdABC
Untreated	—	0.2	1393 cdBC
fenitrothion	0.25	6	1251 dC
CV			20.8%

At the time of the first cut taken from Trial I, an attempt was made to determine the number of caterpillars surviving the various treatments. Unfortunately, the caterpillars had migrated from the denuded control plots to the adjacent verdant treated areas. The counts showed caterpillars in the treated plots, especially near the margins, but none remaining in the untreated controls. Visual assessments of pasture response made during the course of Trial I corresponded closely to the pasture yield results (Table 1).

AN ECONOMIC APPROACH

Obviously porina caterpillar has a significant effect on pasture production and eventually on the profitability of the farming operation. The financial interpretation of these effects will vary from one situation to another. Assuming a typical mid-Canterbury farm, relying on autumn-saved grass and hay for winter feed, an attempt has been made in Fig. 1 to relate the pasture availability to flock requirements for both treated and untreated pasture based on the data obtained in Trial I.

For the period from March to December, an arbitrary carrying capacity of 4.5 ewes per acre of pasture has been adopted. It is assumed that an August lambing produces 110% surviving lambs which are weaned in mid-December. A daily dry matter requirement of 3 lb per ewe has been assumed increasing to 4 lb per day during late pregnancy (R. W. Brougham, pers. comm.). Provision has also been made for a gradually increasing feed intake requirement by the lambs which reaches a level of 2.8 lb dry matter per day at weaning. It is not suggested that these intake levels are exact but it is believed that they are sufficiently realistic to demonstrate the effect of porina on feed availability.

THE RELATIONSHIP BETWEEN SUPPLY AND DEMAND

Figure 1 shows that production from pasture treated with 0.75 lb trichlorphon keeps pace with demand until the end of June. Although production is shown as a straight line, in actual fact this is unlikely and there would be periods of both under and over supply. In practice, compensation would probably be made for this variation by closing areas during the flush growing period for consumption later.

Fig. 1: Diagrammatic representation of pasture availability and demand.

On the treated pasture, supplementary feeding becomes necessary from the beginning of July, reaching a peak during late August and declining as spring growth begins in September. Assuming hay is used to overcome this deficit of 168 lb of dry matter, approximately 200 lb of hay will be required (Coop, 1949).

On the untreated pasture, a gross feed deficiency occurs. In the trial, the effect of the caterpillars was to denude existing vegetation and to destroy new growth as it was produced. In addition, as shown in Table 1, pasture quality deteriorated and it was noteworthy that, when the pasture growth recommenced in the spring, the total production of the untreated pasture during the October-December flush was only about 60% of that produced by the treated pasture.

Although Fig. 1 shows a wide gap which commences in March between supply and demand for the untreated pasture, it is possible that the ewe flock could be supported on the limited feed available until the end of June.

At this time, however, all pasture reserves would probably be exhausted and supplements would be required to provide the bulk of the increasing feed demand. Under the stocking regime adopted in this example, pasture growth does not satisfy demand again until early November, during which time a total deficit of 1,744 lb dry matter has occurred which will require 2,073 lb of hay to overcome.

Faced with a feed shortage of this magnitude the farmer would be forced to adopt one of several alternatives as lambing approached. In this case it has been assumed that he would be reluctant to take the extreme step of selling a percentage of his in-lamb ewes and would resort to the use of additional hay to maintain his flock. This would be potentially salable surplus from his own reserves or would need to be bought in. Either way it would be an additional direct cost of production. Should this be the case, a comparison can be made of the profitability of treatment compared with non-treatment (Table 3).

TABLE 3: PROFITABILITY OF TREATMENT

REVENUE PER ACRE						
4.5 ewes producing 10.5 lb wool each @ 20 cents/lb	....	....	....	....	....	\$9.45
4.95 lambs @ \$5.00 each	....	....	....	....	....	24.75
Total revenue	....	....	....	....	....	\$34.20
DIRECT COSTS PER ACRE						
				<i>Untreated</i>	<i>Treated</i>	
0.75 lb trichlorphon (as at May, 1968)	....	....	....	—	1.46	
Application	....	....	....	—	1.00	
Hay @ \$24.00 per ton delivered	....	....	....	22.18*	2.14†	
				\$22.18	\$4.60	
Gross profit per acre	....	....	....	\$12.02	\$29.60	
Difference in profit per acre	....	....	....		+ \$17.58	

* 2073 lb of hay

† 200 lb of hay

CONCLUSIONS

Yield data showed no significant differences in pasture yield and composition between comparative rates of diazinon, fenitrothion and trichlorphon despite differences in initial surface kills of larvae. It is therefore concluded that the numbers of caterpillars on the pasture surface 12 hours following treatment is not a reliable indication of the prime objective of treatment: increased pasture production. The current recommendation to treat at the first signs of infestation appears likely to result in maximum pasture productivity, although it is evident that, where heavy populations are present, even late season applications are justified to minimize long lasting pasture damage.

A hypothetical economic example shows that treatment of porina with an organophosphorus insecticide can be a highly profitable investment. It would appear that these residue-safe materials are a cost efficient alternative to DDT for porina control and, because of short or nil withholding requirements, have the added advantage of allowing full flexibility of grazing management.

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