CONTROL OF ARMY CATERPILLAR *PSEUDALETIA SEPARATA*

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Summary

Seven trials for evaluating the ability of insecticides to control army caterpillar (*Pseudaletia separata*) in pasture are described and the results given. Methomyl as a spray application has been shown to be very active against this pest at rates as low as 4 oz a.i./acre. This insecticide has given excellent control under adverse weather conditions. Results from trichlorophon, fenitrothion and diazinon are variable and seem dependent upon weather conditions, with the former appearing more effective against this pest. The performance of granular applications and other insecticides applied as sprays are also summarized.

INTRODUCTION

LARGE AREAS of pasture and cereals for greenfeed or grain within the mid and northern areas of the North Island are attacked annually by army caterpillar (*Pseudaletia separata*).

In the 1967-8 season, the total acreage of maize in the Waikato area received an average of two sprayings for control of this pest, and it is not uncommon for farmers to spray crops three times in the course of a season.

From observations in the 1967-8 season, it would appear that outbreaks of army caterpillar occur in crops and large pastures from large flights of moths which appear to have an ovipositing preference for this type of herbage. Light trap recordings taken in the Waikato over a number of years show that the moth is present nine months of the year from February until November, with peak flights appearing any time from February until August.

Within the northern regions of New Zealand, it is probable that army caterpillar may have more than four generations a year.

Until 1958, DDT and lindane 1 lb (all rates in active ingredient per acre) gave excellent control of this pest in pastures and crops. However, in the face of an increasing residue problem, both chemicals for use as sprays were banned.

The aim of work reported here was to assess how efficient alternative groups of chemicals were and if possible which chemicals gave the most efficient control.

EXPERIMENTAL

SITES

Trials reported here were carried out in four localities — Cambridge, Matamata, Whakatane and Auckland. All sites consisted of paspalum (*Paspalum dilatatum*), ryegrass (*Lolium* spp.), white clover (*Trifolium repens*) pastures varying from 2 to 3 in. in height. The exception was

the Auckland site, which was an old hay paddock with a lot of dead litter and little living grass.

Sites were chosen in which caterpillar numbers ranged from two to five to the square foot, but were not rampant and were still nocturnal in habit.

TRIAL LAYOUT

Plots were laid out in a randomized block design. Each treatment had between four and six replicates. In the majority of trials six replicates were used. Plots used were 16½ ft square (1/160th of an acre). No buffer strips were left between plots. Although it is generally agreed when working with army caterpillar that larger plots are better, it was found that, provided trial sites met the above requirements, small plots were adequate.

APPLICATION

Chemicals were applied with 20 gal of water per acre at 25 lb/sq. in. pressure through an Oxford precision sprayer. Prilled formulations were mixed with an inert spreader such as sand or pumice, and sprinkled on to the plots from a perforated lidded jar.

ASSESSMENT

Inspection of plots was made at daybreak the morning following application of treatments in order to ward off birds.

Plots were sampled approximately 24 hr after application. In Trial 1, a second assessment was also made after 72 hr.

Assessment of kill was made by placing four 1 ft square frames randomly on each plot. With the aid of a small kitchen knife, the turf and grass were pared away, and the numbers of dead and alive caterpillars were counted in the field.

Caterpillars were judged as dead if they could not curl up when touched. This is the usual pose that caterpillars adopt. However, caterpillars in a state of hyperactivity could not curl up and these invariably died.

ANALYSES OF DATA

All percentages given in tables are the mean percentage kill per treatment.

Analyses of variance were carried out after the percentages were transformed by arc sine percentage. Data were not weighted.

DISCUSSION

Assessment of treatments 24 hr after application obviously favours quick-killing insecticides. However, this property of quick knockdown is extremely desirable for army caterpillar control, especially when it becomes rampant. In such a condition, this species is capable of causing severe damage to pasture within a very short time. In these circumstances, it is desirable to be able to ascertain within 24 hr whether the insecticide has given control or whether an additional application is warranted. This is particularly so with the more transient insecticides, the efficiency of which is so easily impaired by adverse weather conditions.

TABLE 1: PERCENTAGE KILL TRIAL 1

Location: Cambridge

Date: April 16, 1966

Conditions over 24 hour period following application: Cool nights, moderate day temperatures, no rain.

Treatment (lb)	Mean Kill (%)	Transformed	After 24 hr		After 72 hr
			Arc sin %	Mean Kill (%)	Arc sin %
Spray WP* DDT 1	81.0	64.1 aA		87.2	69.1 aA
Spray WP trichlorphon 1	73.4	59.0 aA		80.7	64.0 aA
Spray WP diazinon 1	37.3	37.7 bB		55.3	48.1 bA
Spray EC† trichloronate 1	20.0	26.5 bcBC		51.4	45.8 bAB
20% granules DDT 2	9.2	17.6 cdC		4.1	11.7 cC
2.5% granules tri-chlorphon 2	24.2	29.5 bC		65.4	54.0 bA
2.5% granules diazinon 2	20.4	26.9 bcC		15.8	23.5 cBC
2.5% granules trichloronate 2	9.4	17.9 cdC		6.7	15.0 cC
Control	6.4	14.6 dC		10.5	12.9 cC

* Water-soluble powder or wettable powder.

† Emulsifiable concentrate.

TABLE 2: PERCENTAGE KILL, TRIAL 2

Location: Matamata

Date: April 10, 1966

Conditions following application: Cool night temperature and fine

Treatments (lb)	Mean Kill (%)	After 24 hr
		Arc sin % Transformed % Kill
trichlorphon WP 1	74.0	59.3 aA
diazinon EC 1	57.6	49.5 bAB
bromophos EC 1	50.2	45.13 bcAB
chlorfenvinphos EC 1	44.7	41.9 bcB
carbaryl EC 1	31.5	34.1 cB
Control	4.7	12.5 dC

TABLE 3: PERCENTAGE KILL, TRIAL 3

Location: Whakatane

Date: April 27, 1967

Conditions over 24 hr period following application: Cool night temperature and fine

Treatments (lb)	Mean Kill (%)	After 24 hr
		Arc sin % Transformed % Kill
methomyl WP 1	89.2	70.5 aA
trichlorphon WP 1	75.1	59.8 bB
fenitrothion EC 1	77.2	61.6 bB
diazinon EC 1	54.1	47.6 cB
Control	0.6	4.5 dC

TABLE 4: PERCENTAGE KILL, TRIAL 4

Location: Whakatane

Date: April 20, 1967

Conditions over 24 hr period following application: Warm night temperature and fine

Treatments (lb)	Mean Kill (%)	After 24 hr
		Arc sin % Transformed % Kill
trichlorphon EC 1	83.3	65.8 aA
methomyl WP 1/2	74.2	59.3 aA
methomyl WP 1/4	67.1	54.8 aA
diazinon EC 1	60.1	50.3 bA
fenitrothion EC 1	58.9	49.5 bA
Control	2.2	8.2 cC

TABLE 5: PERCENTAGE KILL, TRIAL 5

Location: Whakatane

Date: April 10, 1967

Conditions over 24 hr period following application: Warm night temperature and fine

Treatments (lb)	Mean Kill (%)	After 24 hr
		Arc sin % Transformed % Kill
trichlorphon 1	83.1	65.6 aA
trichlorphon 1/2	62.1	52.0 bB
fenitrothion 1	61.0	51.0 bB
fenitrothion 1/2	59.1	50.2 bB
diazinon 1	58.9	49.6 bB
diazinon 1/2	45.5	42.4 bB
Control	8.6	17.0 cC

TABLE 6: PERCENTAGE KILL, TRIAL 6

Location: Whakatane

Date: April 18, 1967

Conditions over 24 hr period following application: Cool night temperature with fine misty drizzle

Treatments (lb)	Mean Kill (%)	After 24 hr
		Arc sin % Transformed % Kill
trichlorphon WP 1/2	67.1	55.1 aA
trichlorphon WP 1	74.0	59.2 aA
fenitrothion EC 1/2	47.4	43.5 bB
fenitrothion EC 1	74.0	59.2 aA
diazinon EC 1/2	29.8	33.1 cC
diazinon EC 1	67.8	55.3 aA
Control	0.6	4.7 dD

TABLE 7: PERCENTAGE KILL, TRIAL 7

Location: Auckland (Brookby)

Date: April 9, 1968

Conditions over 24 hr period following application: Windy with 0.62 in. of rain

Treatments (lb)	Mean Kill (%)	After 24 hr
		Arc sin % Transformed % Kill
methomyl 1	98.3	82.5 aA
methomyl 1/2	97.7	81.3 aA
methomyl 1/4	77.7	61.8 bAB
trichlorphon 1	50.1	45.0 cB
fenitrothion 1	46.2	42.8 cB
Control	8.3	5.35 dC

Perusal of the seven tables summarizing the results shows the variability of insecticides between trials. This is also a marked feature within treatments of trials and is the reason why, although differences between treatments appear large, they are not significantly different (at the 1% or 5% level).

Reasons for such variability would appear to be:

- (1) *Pasture cover.* Although in most cases this did not exceed 1 to 3 in., the pasture was dense and it is possible that a percentage of caterpillars were not moving on to the pasture during the night but feeding around the base. If the caterpillars had been rampant or short of food, they would have stood a better chance of coming in contact with the toxin.
- (2) *Stage of insect.* Sampling was carried out so that all caterpillars, irrespective of age and size, were noted. From the data recorded, two sizes of caterpillars were not as susceptible as others. These stages were some of the large caterpillars which were nearing pupation. These possibly were not feeding nightly; also extremely small caterpillars, which are probably not living on leaf tissue and are thus resident at the base of the pasture sward.
- (3) *Weather conditions.* The percentage killed appears to be lower for trichlorphon on cooler nights and after drizzle or rain.

In Trial 1, DDT applied at 1 lb was not significantly better than trichlorphon at the same rate, whether judged 24 hr or 72 hr after application. A similar situation was observed by Gould (1967) when comparing trichlorphon with dieldrin spray at similar rates.

Spray applications were observed to be not only faster in action than granular formulations but in general gave better control. Trichlorphon granules applied at 2 lb seventy-two hours after application were not significantly different from the better spray treatments.

Methomyl, when compared with trichlorphon, fenitrothion or diazinon at 1 lb, was significantly better and gave extremely good control. In trials in which it was applied at lower rates — i.e., $\frac{1}{2}$ and $\frac{1}{4}$ lb — control was either superior or not significantly different from trichlorphon, fenitrothion or diazinon at 1 lb.

In Trial 7, 62 points of rain fell after application. As can be seen from Table 7, methomyl gave 98.3%, 97.7% and 77.7% control for 1 lb, $\frac{1}{2}$ lb and $\frac{1}{4}$ lb, respectively. Under the same conditions, trichlorphon and fenitrothion at 1 lb gave 50.1% and 46.2% control.

On comparing trichlorphon, fenitrothion and diazinon, it would appear that the former gave better control. Trichlorphon at 1 lb in Trial 4 was significantly (1% level) better than the other two. This trend was also shown in Trial 6 at the 5% level. In all other trials, trichlorphon has given a higher percentage kill with the exception of Trial 6 in which it gave identical results to fenitrothion, but was higher than diazinon.

When comparing these three insecticides at the $\frac{1}{2}$ lb rate, trichlorphon appears to be significantly better (1% level) than fenitrothion or diazinon in Trial 6 but only numerically better in Trial 5.

Fenitrothion and diazinon did not differ significantly in any of the five trials in which a comparison was made at 1 lb but at $\frac{1}{2}$ lb fenitrothion was significantly better (1% level).

Bromophos, chlorfenvinphos, carbaryl and trichloronate were also tested at 1 lb but gave significantly poorer control than trichlorphon.

CONCLUSION

Under the conditions of the trials, methomyl appears to be a very promising chemical. However, further work to elucidate the conditions under which trichlorphon, fenitrothion and diazinon are most effective is required.

Failures of these chemicals to control army caterpillar successfully in pasture and maize crops in the 1967-8 season have been numerous. From the above work, this would seem to be caused by climatic conditions, pasture, the stage of the life cycle, and the cover presented by crops and pasture at the time of spraying.

Further work to find more reliable chemicals and better methods of application seems warranted.

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REFERENCE

Gould, G., 1967: Internal report, Field Research Division, N.Z. Department of Agriculture.