CHEMICAL CONTROL OF CLOVER CASE-BEARER MOTH

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Summary

A trial for the chemical control of clover case-bearer moth (*Coleophora* spp.) carried out during the 1964-5 season is described. Two materials were used in the experiment—endosulfan and trichlorphon and applied during flowering. Results were judged by moth counts, larvae control, and seed increase. Both materials are classed as non-toxic to bees and both gave highly significant control. Endosulfan is at present not permitted to be used without a permit under New Zealand conditions.

INTRODUCTION

WITH the introduction of the Agricultural Chemicals Regulations restricting the application of organo-chlorine insecticides to pastures, DDT and toxaphene emulsions and wettable powders previously used to control clover case-bearer moth now require a permit before use by the farmer. The Department of Agriculture informed clover-seed producers that they could use the above materials, provided the resulting trash from the harvested paddock was burnt, and the paddock ploughed after harvesting. This, of course, restricted the use of such insecticides to paddocks, two seasons or older. Normally these older paddocks would be the areas sprayed, as they have a higher population of moths than do one-year-old paddocks. However, this past season showed that a considerable number of new paddocks carried just as high a population of moths and required spraying also.

As there is a considerable interest in insecticides outside the organo-chlorine group to control clover case-bearer moth, it was considered that the most promising insecticide available would be trichlorphon. Endosulfan was included in the trials as investigations indicate that the active ingredient does not accumulate in animal fats. As the moth flights reach two peaks, the first occurring late November-early December, and the second at the end of January, it was decided to apply two sprays each of trichlorphon at 1 lb and endosulfan at 10 oz (all rates in terms of active ingredient per acre). The first spray was to be applied before the first peaks of flight. The second spray would be applied 10 to 14 days later, as it is thought that this spray interval would break the life-cycle of the pest and the clover crops are harvested (except in the case of wet weather) before the second peak occurs.

This seemed simple enough, but the problem still arose as to just when to spray? A considerable amount of work on sampling clover paddocks for moth population and flowering period was done by R. French, Department of Agriculture, Christchurch, who kindly made available the light trap recordings used in Fig. 1. Mr French's findings will, no doubt, be available at a later date.

The method of sampling for moths was either to sweep a 12 in. diameter nylon net across the top of the clover crop (Dumbleton, 1964) or to place the net in the crop just below the flowering heads and drag it for a set distance (say 20 paces). The latter method was used in the trial. As this method could be used on a windy day, it gave more consistent results than sweeping the crop, as the moths seek shelter deep in the flowering crop in a wind (10 m.p.h. and above). An arbitrary figure for a minimum of 10 moths per 20-pace drag was set as the pest level that warranted spraying, this arbitrary figure being the average of 10 drags across a paddock.

METHOD AND MATERIALS

LOCATION

The trial was located at Leeston. The area selected was a "first-year" paddock, having been sown down in the autumn of 1963. The paddock was closed on November 7, 1964, being entered for Mother Seed Certification.

CLIMATIC CONDITIONS

The moth flights reached higher numbers than in previous seasons, probably because of the preceding and prevailing drought conditions.

MATERIAL USED

Two applications were made of endosulfan 10 oz and trichlorphon 16 oz in not less than 25 gal water per acre.

METHOD OF APPLICATION

Two measured areas of the paddock were sprayed with a tractor-mounted 17 ft spray boom with a trailer-drawn pump and tank. A 27 ft control strip was left between the two treatments. Spraying was left entirely to the farmer. Spraying was carried out in the evening as it had been found that this gave a higher percentage kill of moths (which were more active then) than early morning application.

SAMPLING METHODS USED

Moth counts were taken at 24 hours before and 24 hours after both sprayings and then at intervals before and after the second spray (Table 1, Fig. 1).

One hundred clover heads from the three areas were collected at random on January 6, 1965 (7 days after the second spray) and the number of larvae present counted after a 7-day incubation period. The clover heads were placed in a perforated plastic bag and a large proportion of the larvae attached themselves to the side of the bag, thus simplifying counting. The remainder of the larvae were separated from the clover heads by hand rubbing and sieving. A second 100 heads were collected on January 8, 1965, as a check on the first count. On January 26, 1965, a further 100 mature clover heads were collected at random from each of the three blocks. Larvae counts were taken and the seeds from the samples were rubbed out between the palms of the hands into a household strainer which in turn was held over a series of sieves varying in size from 2 mm down to a $\frac{1}{4}$ mm mesh. This enabled separation

of trash and seed to be carried out without much bother. (In the case of the last 100 head sample, the heads were placed in calico bags to avoid "sweating.")

Remaining larvae that had not attached themselves to the sides of the calico bags were easily picked out of the strainer by hand (see Table 2).

A count of percentage damaged seed was next taken from this sample by counting out 10×100 seeds and dividing each 100 into damaged and whole seeds (see Table 3).

Fig. 1: Effect of treatments on moth numbers.

TABLE 1: MEAN COUNTS OF ADULT MOTHS PER 20-YARD DRAG*

Date	Endosulfan 10 oz	Trichlor- phon 16 oz	Untreated	Least Differences for Significance	
				5%	1%
Dec. 9, 1964	Not sampled	Not sampled	4.0	—	—
Dec. 16, 1964	Not sampled	Not sampled	17.5	—	—
Dec. 17, 1964	FIRST TREATMENT APPLIED				
Dec. 18, 1964	0.4 C	2.3 B	5.8 A	0.33	0.45
Dec. 23, 1964	7.4 C	13.3 B	24.5 A	0.48	0.64
Dec. 30, 1964	12.2 C	14.9 BC	17.5 AB	0.41	0.56
Dec. 31, 1964	SECOND TREATMENT APPLIED				
Jan. 1, 1965	0.4 B	1.1 B	6.7 A	0.34	0.46
Jan. 4, 1965	6.8 Bc	9.1 Bb	16.6 Ab	0.32	0.43
Jan. 6, 1965	7.8 Bc	10.7 Bb	19.0 Aa	0.38	0.52
Jan. 8, 1965	22.3 B	37.6 A	37.3 A	0.39	0.53
Jan. 12, 1965	35.6 B	45.7 A	45.6 A	0.55	0.75
Jan. 16, 1965	57.4 A	55.2 A	58.8 A	0.51	0.68

* Counts were transformed ($\sqrt{n+0.5}$) before statistical analysis.

TABLE 2: LARVAL COUNTS (FROM 100 CLOVER HEADS/ TREATMENT)

Date Sample Collected	Endosulfan	Trichlor- phon	Untreated
Jan. 6, 1965	4	6	32
Jan. 8, 1965	2	4	22
Jan. 26, 1965*	92 C	179 B	257 A

* Poisson distribution used variance=mean.

TABLE 3: PERCENTAGE SEED DAMAGE FROM 100 HEADS (JAN. 26, 1965)

Mean of 10×100 Seeds	Endosulfan 10 oz	Trichlor- phon 16 oz	Untreated	Least Difference for Significance	
				1%	5%
Mean arithmetic	11.8	24.0	47.1	—	—
Mean transforma- tion (angular)	11.8 C	23.9 B	47.6 A	5.8	4.3

HARVEST

The crop was harvested on February 16, 1965, harvesting being deferred a fortnight owing to wet weather.

Three equal size areas were harvested as close together as possible by a combine harvester, the bags from each area being tagged and weighed, then dressed to prevent heating of the clover seed (see Table 4).

Unfortunately, an assessment of the amount of damaged seed lost out the back of the header, could not be obtained at the time.

TABLE 4: HARVESTED YIELDS FROM 250 YD $\times$ 9 YD
(2,250 SQ. YD)

	<i>Endosulfon</i> 10 oz	<i>Trichlor- phon</i> 16 oz	<i>Untreated</i>
Header dressed weights (lb)	194	179	159
% Seed lost in first dressing	10	12	25
Final machine dressed weights (lb)	127	114	64
% Seed lost from header to machine dressed	34.5	36.5	59.5
% Increase over control	98	78	—
Yield per acre (lb)	270	242	136
Per acre cost per treatment (material only)	22s.	17s. 8d.	—

NOTES:

- (1) The dressing losses were extreme as a Murphy pickup was used during harvesting and a considerable amount of trash was put into the bags.
- (2) There was a slight fertility gradient across the paddock in favour of the trichlorphon block.
- (3) Header adjustments were made at the start of harvesting on the control strip.

DISCUSSION

Endosulfan gave the better control of the adult moth and larvae. The use of endosulfan at present is restricted to the same extent as other organo-chlorine insecticides.

The results achieved with trichlorphon are encouraging and warrant its use against this pest of clover seed production. Compared with endosulfan, the moth population built up more rapidly on the trichlorphon sprayed blocks and it appears that a third spray applied at a time when the moth count reached 55 per 20-pace drag (January 16, 1965) would have been beneficial, particularly as the harvest was delayed for two weeks owing to unsettled weather. Further work should be carried out to determine the correct time to spray and the number of sprays that can be applied, and yet still provide an economic return of seed to the farmer.

It is of interest to note that the equipment used in the trial consisted of a front-mounted spray boom, which probably would give a better contact kill of moths with the insecticide than a rear-mounted boom, as in the latter case moths may be disturbed by the vehicle and fly out of spray zone.

The lower moth counts obtained from the control strip 24 hours after each spray may be attributed to the moths flying from the control to the treated areas and being killed.

CONCLUSION

Both treatments gave adequate control of the adult moth, although endosulfan gave a higher percentage kill of moths and larvae than did trichlorphon.

Endosulfan gave an increase in yield of 113 lb/acre of dressed clover seed over control.

Trichlorphon gave an increase in yield of 105 lb/acre of dressed clover seed over control.

The results show that a good control of clover case-bearer moth can be achieved by spraying with trichlorphon.

Further work needs to be done to determine the number of sprays that will give control of the pest, yet still be economical, and the correct time to spray.

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REFERENCE

Dumbleton, L. J., 1964: *Proc. 17th N.Z. Weed & Pest Control Conf.*: 161-4.