Research Note

SOME APPLICATIONS OF BASIC RESEARCH TO THE DEVELOPMENT OF GRASS GRUB CONTROL METHODS

J. A. WIGHTMAN

Entomology Division, DSIR, Nelson

Summary

Methods that are being considered for grass grub (*Costelytra zealandica*) control are discussed. These are rolling the pasture just before or as beetles emerge; crop rotation using a pulse crop; and applying an insecticide in a foam carrier to the pasture surface to interfere with mating and to ensure that beetles come in contact with the insecticide.

INTRODUCTION

Kain and Atkinson (1970) have stated that "economics and legislation dictate that we can no longer rely completely on any one method of control for grass grub" (*Costelytra zealandica*). This paper discusses new or modified control techniques that have been suggested by the results of basic research. Three approaches to grass grub control are described in the order of their practicality based on present knowledge. The field trials reviewed were carried out on a vacant house section near Riwaka, Nelson Province.

CULTURAL CONTROL

ROLLING

It is assumed that adult beetles are located just below the soil surface prior to emergence at dusk and are, therefore, susceptible to physical injury such as might be caused by a heavy roller. Two passes with a hand roller reputed to weigh 200 to 250 kg were made over four strips of mown turf measuring 28×1 m. These strips were rolled on six evenings during the flight period, 5 to 15 minutes before emergence was expected. This resulted in a 65.2% reduction in larvae in the next generation (Table 1). It is hoped that further tests will be carried out to investigate

TABLE 1: RESULTS OF CULTURAL CONTROL EXPERIMENTS

Treatment	No. of Larvae		% of Control Population	Mean Dry Weight (mg)
	/m ²	/ft ²		
Peas	152.7	14.2 A	8.9	0.35 A
Cultivation	254.6	24.4 A	15.3	0.33 A
Cultivation + Peas	241.8	23.1 A	14.5	0.32 A
Rolling	598.2	55.6 B	34.8	0.57 B
Control	1718.2	159.7 C	—	0.57 B

the effect of rolling when the beetles are actually at the pasture surface. While not very efficient, this method could be used on sports grounds, golf courses or bowling greens where heavy rolling is part of the routine maintenance of the turf and where the level ground and short grass should increase the efficiency of the technique.

CLEANSING CROPS IN ROTATION

There is evidence that germinating peas and beans are antibiotic to grass grubs (Wightman, 1972). The possibility of using this together with the cultivation necessary for preparing seedbeds for grass grub control was investigated in a small field trial. The treatments were:

- (1) Deep cultivation (rotary hoe to 15 to 18 cm) twice during the pupal period (Kain and Atkinson, 1970) followed by peas ("Victory Freezer") hand-sown at the commercial rate (75 kg/ha).
- (2) Deep cultivation as above without peas.
- (3) Sward killed with paraquat, surface cultivated to 3 cm, and peas sown at commercial rate.
- (4) Control; grass cut with lawn-mower prior to expected emergence period.

Cultivations took place on October 14 and 19. The main flight period lasted for 3 weeks from October 29 when the pea plants were 2 to 5 cm high. Larvae were sampled in mid-January when they were in the first and second instar (Table 1). Results show that there were considerably more larvae in the control than in the treated plots. A comparison of larval dry weights shows no difference between treatments (1), (2) and (3). The dry weights of larvae from control (and rolled) plots were significantly larger than those from plots 1, 2 and 3.

A complicating factor that should be considered in discussing these results is that of ground cover. Kelsey (1957, 1968) has shown that grass grub beetles do not readily lay eggs in soil devoid of cover. Thus it is possible that female beetles emerging from the bare, cultivated plots moved to grass-covered or pea-planted areas to lay eggs.

INSECTICIDAL CONTROL OF ADULT STAGE: FOAM FORMULATION

This method of control and the rolling technique are directed at the adult stage which is considered a good target because (Fenemore and Perrott, 1970):

- (1) The adult is theoretically more vulnerable to attack when at the pasture surface.
- (2) Populations are at their lowest.
- (3) Tests have shown that adult beetles are more susceptible than larvae to the insecticides assayed in the laboratory (Perrott, 1964).

Results of field trials in which insecticides of proven toxicity to grass grub beetles have been used in ULV or high volume sprays on the pasture surface during the flight period have been disappointing (Fenemore and Perrott, 1970). The failure of these tests was put down to the lack of

contact between the adult insect, particularly the female, and the insecticide. This is particularly frustrating as observations in Nelson Province have shown that many beetles of both sexes stay on the surface for several hours feeding on clover and grass foliage (Farrell and Wightman, 1972). However, at the start of the flight period, female beetles do not move far from their emergence hole and attract males by means of a sex attractant (*e.g.*, Osborne and Hoyt, 1969; Henzell *et al.*, 1969).

As a result of these developments, a new formulation was devised involving the incorporation of an insecticide in a foam that is applied to closely grazed pasture to form a continuous layer. Such a formulation could work by:

- (1) Ensuring that the emerging beetles come in contact with the insecticide.
- (2) Preventing the sex attractant reaching flying males.
- (3) Interfering with movement of emerging beetles.
- (4) Fumigant action under the foam if the insecticide has a high vapour pressure.

The test formulation was "Dursban" mixed with the contents of a 9 l (2 gal) inverting fire extinguisher which was refilled for each plot. The treatments were:

- (1) Foam: 6 applications during flight period;
- (2) Foam plus "Dursban": as above, insecticide used at 2.2 kg/ha on first occasion and at 1.1 kg/ha thereafter;
- (3) "Dursban": 2 applications at 2.2 kg/ha at start and middle of flight period;
- (4) Control: No treatment.

The foam settled to a layer up to 1 cm thick and lasted for up to two hours. Application was timed so that the last plot was completed about 10 minutes before the flight started. The results (Table 2) assessed by larval counts in mid-January, show that foam plus insecticide caused a

TABLE 2: RESULTS OF FOAM FORMULATION EXPERIMENT

Treatment					No. of Larvae /m ² /ft ²		% of Control Population
Foam + "Dursban"	....	....	....	....	267.3	25.4 a	21.6
"Dursban"	....	....	....	....	521.9	49.6 a	42.2
Foam	....	....	....	....	725.6	69.0 a	58.8
Control	....	....	....	....	1234.8	117.4 b	—

significant (but not necessarily economic) reduction in the number of eggs laid (= larvae found).

However, before this method can be considered on a commercial basis, a precise and verified account of the timing of egg deposition in respect to the first emergence of beetles must be available so that the number of treatments could be reduced. A careful costing of the whole process must also be made.

DISCUSSION AND CONCLUSIONS

These control methods are by no means fully substantiated techniques and obviously varying degrees of evaluation must be carried out before they could be presented to the farmer as efficient and economic methods of grass grub control. However, they do indicate ways in which basic studies of a pest can bring about new control methods. The application of these techniques to the control of other pasture pests is worthy of consideration.

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