FIELD TECHNIQUE TO ESTABLISH A REPLICATED RANGE OF SITONA WEEVIL DENSITIES

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SUMMARY

A technique is described whereby a replicated range of sitona weevil densities was achieved by the manipulation of incoming weevils with short-lived insecticides. This range subsequently translated into larval populations and emergent adults.

INTRODUCTION

Since the initial discovery of *Sitona discoideus* in coastal Hawkes Bay by Esson (1975), the pest has spread widely and is now found in most parts of New Zealand where lucerne is grown or annual medics (*Medicago* spp) occur (Kain and Trought 1982). When this univoltine, winter active pest reaches high densities, serious damage can occur (Aeschlimann 1979), particularly in young stands (Goldson and French 1983). Such damage is the product of adult defoliation combined with larval feeding on the nitrogen-fixing root nodules and the root hairs.

The lucerne plant is more able to tolerate leaf-damage than root depredation. The effects of the latter are complex with resultant agronomic loss being a product of the interaction of larval density with stand maturity, plant reserves and soil fertility.

In Canterbury there is often debate on the causes of spring yellowing and poor vigour in lucerne stands. Sitona is frequently implicated often by its mere presence (French, pers comm), irrespective of prevailing circumstances. The need for studies on damage assessment and damage thresholds was therefore obvious. However, Barratt (pers comm) has shown that chemical control of subterranean larval stages is impractical and Sue's (1978) work has indicated that laboratory populations of sitona larvae can not be reliably maintained. It was therefore necessary to devise a method for obtaining a replicated range of larval densities in a homogenous lucerne stand so that experimental studies of sitona-plant-soil interactions would become possible.

This contribution describes the manipulative technique used to obtain different sitona densities.

METHOD AND MATERIALS

The technique used in this study relied on the temporary summertime depopulation of lucerne through the emigration of newly-emerged weevils to aestivation sites between January and March (Goldson, unpublished). Return flights occurred between early April and late May but ground densities reached only 10-20% of the population that originally emerged (Goldson and French 1983).

Goldson and French (unpublished) also noted a mean spring density of 550 mature larvae/m² in stands 3 or more years old; life table data of Aeschlimann (1979) and Moulden (1975) indicated that 71% of these would probably survive to produce adults. With these data it was thus possible to estimate the likely post-aestivatory ground density in a 3 year-old lucerne stand at Darfield as follows:

$$\begin{array}{ccccccc}
 550 & \times & 71/100 & \times & 15/100 & = & 59 \text{ adults/m}^2 \\
 \text{mean population} & & \text{survival} & & \text{proportion of} & & \\
 \text{density in 3-} & & \text{of larvae} & & \text{adults returning} & & \\
 \text{year-old stands} & & \text{to adults} & & \text{after aestivation} & &
 \end{array}$$

With this estimate of anticipated density it was possible to devise a plan whereby during the period of post-aestivatory migration back into the lucerne, the accumulated

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ground population could be “zeroed” with insecticide in a replicated fashion at regular intervals. Transient insecticides were used so that the remaining immigrant weevils were unaffected. The anticipated resultant population was estimated as follows:

$$\text{Manipulated population} = \frac{59}{\text{estimated density of post-aestivatory weevil population}} - \frac{\text{GD}}{\text{ground density time of spraying}}$$

Of the materials used the most suitable for an adequate short-term kill was dichlorvos (Vapona Concentrate) at 2 kg ai/ha applied as required during the population build-up period. Chlorpyrifos (Lorsban 40 EC) at 1 kg ai/ha gave longer term control when required.

The experiment consisted of five replicates of six weevil densities laid out in a randomised block design. To avoid edge effects, the plots were large (20 x 24 m) with 24 m buffers. During the weevil immigration period the ground population was monitored at 3 daily intervals and spray treatments were applied between 15/4/82 and 7/6/82 (Table 1).

TABLE 1: Mean populations of the various sitona weevil life-stages arising from the manipulated ‘parent’ densities at Darfield.

Manipulated treatment densities	Spray dates	Parent adults/m ²		Larvae/m ²		Emergent adults/m ²	
1 no spray	control	69.8	a	2075	a	969	a
2	15.4.82	57.1	a	1542	b	798	ab
3	28.4.82	33.3	b	1394	b	596	bc
4	30.4.82	22.1	bc	1084	bc	725	ab
5	5.5.82	11.8	cd	774	cd	379	cd
6 total kill	7.6.82	2.0	d	377	d	241	d
CV %		32.0		27.6		29.1	

RESULTS AND DISCUSSION

In general the method worked satisfactorily partly because, after returning, the weevils were found to be randomly distributed throughout the 8 ha paddock. The ground population actually peaked at 70/m² but the manipulative treatments were still relevant. Table 1 demonstrates how replicated variation of “parent adults” was achieved by autumn spray schedules. This establishment of a range of adult densities translated to larval densities and eventually to emergent adults (Table 1).

The information derived from this experiment is currently providing life-table data, density-related yield losses, effect of root denodulation on soil status and data on many other interactions.

It is felt that this method of population manipulation could be similarly applied during the infestation phases of other pest species.

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