BLACK FIELD CRICKET CONTROL WITH CONTINUOUS AND ALTERNATE SWATH BAIT APPLICATION

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SUMMARY

The efficacy of three methods of applying a maldison treated barley bait for black field cricket (*Teleogryllus commodus*) control was investigated at two rates. Blanket aerial application (85% control) and 6 m alternate swath ground application (91%) gave significantly higher kills than a 33 m alternate swath aerial application (63%). There was no significant difference in control achieved with 10 and 20 kg bait/ha. It was concluded that selection of the appropriate baiting rate was the best means of reducing costs. The 10 kg/ha aerial blanket application was the most cost effective treatment at \$9/ha (1983 prices).

INTRODUCTION

The black field cricket can cause serious damage to pasture particularly during dry summers when high densities can occur (Blank *et al* 1984a). Pasture damage can be prevented by applying maldison treated grain baits to kill the small nymphal stages present in January (Blank 1983).

Large areas of pasture may be treated for crickets as, for example, the 76,000 ha baited in Northland during 1983 (Blank 1984). The benefits of applying cricket control measures have proved to be cost effective on dairy farms (Blank *et al* 1982) and are probably also cost effective on the more extensive sheep and beef farms. Even so, it is important to investigate ways of reducing costs of cricket control. Application of bait to alternate swaths could be expected to halve application area and time and so reduce application costs. Crickets in the non-baited swath would be killed when they moved into baited areas. This study compares the efficacy of alternate swath with continuous bait applications, both from ground and aerial spreading equipment and at two bait application rates.

MATERIALS AND METHODS

The trial was carried out on a flat dairy farm on Kaipara clay soil near Ruawai. Cricket density was assessed during 18-24 January 1983 using 10 flushing counts (Blank 1983; Blank and Bell 1983) taken from each of the 33 paddocks. The 73 ha farm was then divided into 21 plots which were allocated between six bait treatments (Table 1) and an untreated control with three replicates; to give similar densities within each replicate (Fig. 1). The 6 m alternate swath plots were 1.5 ha, untreated plots 2.3 ha, and all other plots were approximately 3.8 ha.

Bait was commercially prepared by mixing 12.5 litres of maldison (Malathion 50% EC) diluted 1:1 water per tonne of barley in a seed auger and holding over-night before placement in plastic lined jute bags.

Aerial bait application was made from a Hughes 300 helicopter with a hopper and petrol motor driven spinner slung 4 m underneath. Swath width was determined as 33 m several days before application so that the trial layout could be finalised. Aerial bait application was made on 27 January 1983 in fine sunny conditions with a slight 5-10 km/h south-westerly breeze. It was necessary to apply twice the amount of bait to the alternate swaths to enable direct comparison with the blanket applications at the same rate/ha (Fig. 1). The helicopter was calibrated at 10, 20 and 40 kg/ha blanket application rates. Calibration was achieved by spreading 10 kg lots of bait over a measured distance. The swath distribution pattern was determined by weighing bait collected at 5 m intervals across a 50 x 1 m plastic strip. The time to sow each plot, including loading and turn around time, was measured with a stopwatch.

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Fig. 1: Plan of the 72 ha dairy farm to show the application of aerial blanket and alternative swath treatments, 6 m alternative ground swath treatments and untreated control plots for 3 replicates. Note the alternate swath application rates are twice the effective rate per ha.

The 6 m alternate swath treatments were applied on 28 January using a tractor-mounted Vicon varispreader 400. Application was calibrated for the low bait rate and high rate alternate swaths were travelled twice.

The efficacy of bait applications was assessed during 3-11 March from 20 flushing counts taken at regularly spaced intervals across each plot. The 33 m alternate swath treatments were assessed from seven regularly spaced counts taken at 11 m intervals from the centre of a non-baited swath to the centre of the adjacent non-baited swath.

The level of mortality in baited plots was calculated as the reduction in cricket density 6 weeks after bait application compared with densities before baiting. An analysis of variance of angular transformed % cricket mortality was used to investigate treatment effects. Results are presented as untransformed % mortality after adjustment for the reduction in cricket populations in untreated plots.

RESULTS

Cricket density in plots ranged from 11-54/m² before bait application. The average densities ($\pm$ SD) of the three replicates were 41 ± 10 , 26 ± 4 and 20 ± 7 /m².

The size distribution of cricket populations at baiting was normally distributed about a median head capsule width of 2.7 mm (min. = 1.5; max. = 4.1) and comprised largely of medium-sized nymphs with 10% of the population in the second to last instar. Six weeks after bait application 80% of the cricket population was large nymphs, predominantly the penultimate instar, 19% were adults and 1% were small instars representative of a late egg hatch.

Soil moisture at bait application was moderate (35% Mw) as 60 mm of rain fell 2 weeks before baiting to break an 8 week period when there was little rain. In the 6 weeks following bait application no substantial rain fell (33 mm) and ground conditions rapidly dried to 24% Mw.

The distribution patterns of the bait rates sown by helicopter are shown in Fig. 2. Bait distribution was strongly skewed 5-10 m to the south but increased at the northern

tail of the distribution. The sideways pendulum swing of the suspended hopper, set up by rapid turn around manoeuvres, may account for the skewed application pattern. The average recovery of bait at 40, 20 and 10 kg/ha was 8.2, 4.5 and 2.1 g of bait/5 m² assuming some bait missed the northern end of the plastic sheet. This was 42% of the theoretical recovery. Some loss was attributable to grain skidding off the plastic collecting strip on impact and from movement of plastic in the light wind.

TABLE 1: The reduction in cricket density 6 weeks after bait was applied using three application methods at two rates. Cricket density averaged 30/m² over the 72 ha trial area before bait application

Main effects	% Kill
Application Method	
blanket	85
6 m alternate swath	91
33 m alternate swath	63
Rate kg/ha	
10	77
20	83
standard error of differences	5

Fig. 2: The distribution pattern of cricket bait applied by helicopter. The track of the helicopter is indicated by 0 on the horizontal axis.

Fig. 3: The effect of 33 m alternate swath application of bait on cricket density 6 weeks after application. Rates refer to application rates which were twice the effective per ha rate. Cricket density averaged 30/m² before bait application.

All bait treatments gave significant ($P < 0.001$) reductions in cricket populations compared with untreated plots. Untreated plots showed a 30% reduction in cricket density compared to pre-treatment assessments. Blanket aerial and 6 m alternate swath ground application gave significantly ($P < 0.05$) higher kills than did the 33 m alternate

swath application (Table 1). There was no significant difference between rates. There was an interaction between bait application method and rate ($P < 0.1$). The major contributor to the poor kill achieved using the 33 m alternate swath application was the 10 kg/ha rate which gave 50% kill in contrast to the 76% kill achieved at the 20 kg/ha rate.

Cricket density in the 33 m alternate swath treatments was inversely related to the bait distribution pattern. Crickets were markedly reduced in the non-baited 33 m strips where they ranged from 3 to 14/m² (Fig. 3).

Pasture damage within blanket baited plots was generally kept at low levels with only small patches of dead pasture localised around some severely cracked areas. An exception was a 20 kg/ha blanket plot which suffered moderate damage and had 10 crickets/m² in March. Control in this plot was 69% which was low compared with the 93% control achieved in the other two replicates. The breakdown in control was probably contributed by crickets moving in from an adjacent 'Manawa' ryegrass paddock which died off to leave bare ground over the summer.

Pasture damage in the alternate 33 m swath treatments was obvious in the non-baited swaths. Damage over the whole plots was generally low to moderate and persisted through into June as small patches of bare ground localised around cracks which had long since closed up. The level of damage in the 33 m swath treatment was unacceptable to the dairy farmer.

The alternate swath treatment reduced flying time by 41-47% compared with the continuous application (Table 2).

TA: The costs of four different aerial applications of cricket bait expressed as a proportion of the control level achieved (Table 1) for each \$ spent.

Cost factors	Rate kg/ha:	Blanket		Alternative 33 m swath	
		20	10	20	10
application time min/ha		0.44	0.38	0.26	0.20
cost @ \$7.67/min \$/ha		3.37	2.91	1.99	1.53
bait cost @ \$6.10/10 kg \$/ha		12.20	6.10	12.20	6.10
total cost \$/ha		15.57	9.11	14.19	7.63
% cost effectiveness		100	190	110	160

DISCUSSION

Cricket populations in earlier trial work have been found to be highly mobile necessitating the use of large plots of 1-2 ha and buffer areas in order to obtain meaningful information on damage assessment or control (Blank *et al* 1984b). This trial further confirms the mobility of the larger nymphal and adult stages. The close inverse relationship achieved between bait distribution and resultant cricket density is consistent with the random movement of individuals in all directions. Individuals which move into baited areas are killed so depleting populations within the non-baited swaths. In this trial more than 50% of the crickets in the centre of the non-baited strip were killed from bait laid 16.5 m away. Cricket populations in untreated plots were considerably reduced following bait application suggesting that 2.3 ha plots are too small to prevent loss to adjacent baited areas. Cricket populations monitored on three farms in the same area showed no such decline and hence it is unlikely that natural agents were responsible.

High cricket reductions of 85-91% were achieved with the best treatments illustrating the excellent control that can be achieved, particularly, if bait is applied soon after rain. This trial further demonstrates that nymphal stages can be readily killed with January applications and so supports earlier work which recommends this time of application to prevent damage (Blank *et al* 1984b). Pasture damage is, however, a function of cricket density and time. It was apparent in the 33 m alternate swath treatments that, although overall cricket density was eventually reduced, limited damage occurred in the non-baited swaths.

It is difficult to compare the costs of farmer ground application with contract aerial application. If a farmer's wages and tractor spreading equipment are assumed to cost nothing then bait can probably be spread for \$1-2/ha running costs. This is marginally cheaper than aerial application costs of \$2-4/ha. In most circumstances a farmer would be best to apply bait using aerial operators and, if required, touch up any pockets of crickets remaining using ground spreading equipment.

The cost of applying bait using aerial contractors varies according to the fixed charge rate and a variable application rate. The rate of application is dependant on a number of factors, such as; swath width, flying speed, pay load, length of runs versus turn around time, loading time, and ferrying time. A cost of \$2-4/ha was common in the Whangarei region in the 1983 season.

Total baiting costs were calculated assuming an aerial application cost of \$460/hr and a bait cost of \$610/tonne (Table 2). The 10 kg/ha treatments were considerably cheaper than the 20 kg/ha treatments. The method of application did not have a marked effect on total costs because of the relatively low flying cost compared to bait costs. This was reflected in the 10 kg/ha blanket treatment being 90% more cost effective than the most expensive 20 kg/ha blanket treatment. Although base costs will change with time, provided the ratio of bait to flying costs remain at approximately 2:1, then the correct selection of baiting rates as recommended by Blank (1983) is the best means a farmer has of reducing baiting costs and achieving satisfactory levels of control.

This study showed that the 10 kg/ha aerial blanket application gave 95% control of cricket populations at average densities of 30/m² with minimal damage occurring and was also the most cost effective treatment at \$9/ha.

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