BAITS FOR CONTROL OF GREASY CUTWORM LARVAE II: FIELD TRIALS

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SUMMARY

In small plot field trials, two new baits (bran + 5% ai carbaryl and kibbled wheat + 5% ai carbaryl) applied at rates of 10 and 20 kg per treated hectare are shown to be superior to three commercially prepared baits for killing greasy cutworm larvae (*Agrotis ipsilon*). These new baits are further shown to be as effective as synthetic pyrethroid sprays. The material cost of the baits is comparable with the synthetic pyrethroids, though ease of application suggests that the latter will remain the most effective control measure for greasy cutworm.

INTRODUCTION

This paper follows on from the work of Martin (1980, 1983) in developing baits for the control of greasy cutworm. Laboratory trials, have shown that both bran and kibbled wheat are highly palatable to greasy cutworm larvae (Martin 1980), and that carbaryl and chlorpyrifos are suitable potential toxicants (Martin 1983). The present paper describes a series of small plot field trials to evaluate the most effective bait from these materials, and to compare it with three commercially available cutworm baits and three synthetic pyrethroid sprays.

METHODS

Field experiments

These were based on the methods of Sechriest and York (1967) and Apple (1967). The experimental unit was a 1.1 x 1.5 m field plot of 10 maize seedlings in two rows, 75 cm apart. At the start of each experiment, the plants were 2-3 weeks old and had 3-5 leaves (stages 3-4 in Hanway's (1963) terminology). The area was enclosed by an 18 cm high galvanised iron barrier rammed firmly into the soil and all extraneous vegetable matter removed. Ten 4th-5th instar greasy cutworm larvae were placed within the area, each 10-15 cm from a plant, towards the centre of the plot. They were covered by the paper cup which had been used to transport them. The larvae quickly buried themselves in the soil beneath cups and the cups were removed within 15-30 minutes. The larvae which remained unburied were replaced by healthy ones which were buried manually. The bait or spray treatment was applied directly onto the plants following the removal of the cups.

Three commercially marketed baits and two experimental baits were used in the trial (see appendix). Baits were applied manually by shaking the pre-weighed bait from a cup onto the plot as a row application. Personal variations in bait spreading were removed as block effects in the analysis.

Synthetic pyrethroid sprays were applied as both band and complete cover applications using a small hand sprayer with a pressure gauge. The quantity of liquid needed to cover the area at the chosen water rate of 1000 litres/ha was 165 ml. Trials with the sprayer showed that this small quantity could be delivered accurately by starting with the sprayer at a set pressure and spraying for a pre-determined time interval.

Five sets of randomised block experiments were conducted, their aims being as follows:

Expt. 1, comparison of the two potentially best chemicals from laboratory screening trials (carbaryl and chlorpyrifos) (Martin 1983) at a variety of concentrations with bran as carrier.

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Expt. 2, comparison of bran and kibbled wheat baits using several concentrations of carbaryl, and two commercially available cutworm baits.

Expt. 3, comparison of bran and kibbled wheat baits using optimal concentrations of carbaryl with three commercially available cutworm baits, all baits being applied at two application rates.

Expts. 4 and 5, comparison of the best baits chosen from previous trials with synthetic pyrethroid sprays, applied as either row or complete cover applications.

Details of treatments and application rates are given in Tables 1 and 2, and specifications of all baits and chemicals used are given in the appendix.

All trials were assessed 1, 2 and 7 days after initiation, and plants were scored as either cut or uncut. Preliminary analysis showed a consistent pattern of cutting with time, 65% and 82% of total cutting (after 7 days) occurring after 1 and 2 days respectively. The results and analysis apply to cutting after 7 days only.

The results have been analysed by assuming a binomial distribution of data (i.e. cut or uncut) and calculating scaled deviances (following probit transformation) from linear models incorporating block and treatment effects. Significant treatment effects are further analysed using the least significant difference (LSD) statistic.

Bait preparation

The chemicals were mixed at the desired test concentration with the test bait material and vegetable oil at a ratio of 80 g bait to 4 ml oil. The oil and chemical were mixed alone and the bait added afterwards. The quantity of oil was doubled in the early trials where higher concentrations of chemicals were used.

Laboratory production of greasy cutworm

The larvae were reared by a method based on Allan (1973). The colony was begun in June 1981 and was continually supplemented by wild adults from light traps. Larvae to be used in a field experiment (4th-5th instars) were removed from the colony on the day before the experiment and placed individually into 50 ml waxed paper cups (Lily and Co.) containing 3 ml of general purpose synthetic diet (Singh 1977). This artificial diet is a suitable temporary food for greasy cutworm.

RESULTS AND DISCUSSION

The results of all experiments are presented in Tables 1 and 2.

Expt. 1. The results show that higher concentrations of insecticide in the bait caused a reduction in cutting. They also indicate that the two chemicals used are comparable within the concentrations applied. Carbaryl has an advantage over chlorpyrifos in being cheaper and less toxic to vertebrates, and was chosen for use in the experimental baits in subsequent experiments.

Expt. 2. The main result is that bran was equally as effective as kibbled wheat, and is therefore preferred as a bait since it is considerably cheaper and more readily available than kibbled wheat. Of note is the poor performance of the two commercial baits used in the trial.

Both experiments 1 and 2 suggest that the effectiveness of the bait is relatively insensitive to changes in carbaryl concentration between 4% and 8% ai. On this basis, a concentration of 5% ai carbaryl was arbitrarily chosen as being a suitable concentration in future trials, and is consistent with the carbaryl concentrations in American apple pomace bait (Sechriest and Sherrod 1977).

Expt. 3. The results show that the experimental baits were superior to the commercial baits and that most baits performed better at an application rate of 20 kg/treated ha.

Expt. 4. The results show that the bran + 5% ai carbaryl bait applied at either rate of application was as good as the synthetic pyrethroid sprays, and the experiment is notable for the extremely high level of control achieved.

Expt. 5. This is a repeat of expt. 4, with the chemical sprays applied as a blanket coverage, rather than a row coverage, and deltamethrin being applied (accidentally) at twice the recommended rate. The results are similar to those of expt. 4, though deltamethrin now provided superior control compared with the other treatments. This suggests that control may well be improved by increasing the concentration or application rate of all of the materials used.

TABLE 1: Results of experiments 1 to 3, expressed as a % reduction in plants cut after one week in each treatment compared with the control.

Expt. 1.		Expt. 2.		Expt. 3	
Treatment ¹	%Damage reduction	Treatment ²	%Damage reduction	Treatment ³ (kg/ha)	%Damage reduction
8% carbaryl	64a	6% + bran	53a	bran (20)	67a
2.4% chlorpyrifos	56ab	8% + kibble wheat	34ab	kibble wheat (20)	60ab
4.0% carbaryl	44ab	6% + kibble wheat	33ab	kibble wheat (10)	45abc
2.0% carbaryl	39b	8% + bran	30ab	apple pomace (20)	40bcd
0.6% chlorpyrifos	35b	4% + bran	29ab	bran (10)	38bcd
0.3% chlorpyrifos	35b	apple pomace	24b	apple pomace (10)	29cde
1.2% chlorpyrifos	33b	4% + kibble wheat	21b	Snylok (10)	17def
0.5% carbaryl	29b	Snylok	16b	Ekalux (20)	10ef
0.15% chlorpyrifos	28b			Ekalux (10)	7ef
1.0% carbaryl	23b			Snylok (20)	2f
Treatment replication	6		6		6
Experiment replication	2		2		1
% plants cut in control plots	62.5%		63.3%		70.0%

¹ All bran formulations (10 kg/ha)

² % figures refer to % ai carbaryl added to bran and kibble wheat baits (10 kg/ha)

³ All bran and kibble wheat baits contain 5% ai carbaryl

The differences in the amount of cutting between experiments 4 and 5 is striking. Expt. 4 was conducted on wet soil throughout, and expt. 5 on dry soil for the first 3 days (determined from Pukekohe Research Station Met. site data). Failure of cutworm baits applied to dry soil has been noted previously and attributed to larvae remaining below ground (Packard 1930, Sechriest and Sherrod 1977) and to bait dryness and unpalatability (Gholson and Showers 1979, see also Martin 1980).

The improved performance of the experimental baits compared with commercial baits is likely to result from small particle size and increased palatability. Gholson and Showers (1979) have shown that bran is more palatable to greasy cutworm than apple pomace. The palatability of Snylok or Ekalux was not tested as they are unavailable without their toxicants.

Material cost and application

Material costs/ha (at February 1983 prices) for the bran + 5% ai carbaryl bait at 15 kg/treated ha is \$11.37 while that for kibbled wheat + 5% ai carbaryl at 15 kg/treated ha is \$17.12. This compares with a mean cost of \$13.40/ha for the synthetic pyrethroid sprays.

Preliminary trials with a commonly used moving arm type fertiliser spreader (Vicon) gave a band width of only 4 m for the bran bait, while a rotary seed spreader operated from a helicopter achieved a 7 m band width. Where large areas require treatment, it is likely that either a helicopter or aeroplane could be used to distribute the bait reasonably economically, though under New Zealand conditions, where treated areas are relatively small, the ground application of bran baits is likely to be more expensive than synthetic pyrethroid sprays.

These new experimental baits need to be tested in full sized field trials, though at present, they do not offer a significant advantage over conventional spraying. Baits may become a more viable method of control if future exotic parasite introductions manage to boost levels of parasitism beyond their present level of 5-10% (Allan and Hill, unpublished data).

TABLE 2: Results of experiments 4 and 5 expressed as % reduction in plants cut after 1 week in each treatment compared with the control.

Expt. 4.		Expt. 5	
Treatment ¹ Rate/ha	% Damage reduction	Treatment ² Rate/ha	% Damage reduction
bran 20 kg	94a	deltamethrin 12.5 g ai	87a
permethrin 50 g ai	94ab	bran 20 kg	67b
bran 10 kg	87ab	fenvalerate 50 g ai	64b
deltamethrin 6.25 g ai	85ab	bran 10 kg	61b
fenvalerate 50 g ai	72b	permethrin 50 g ai	56b
Treatment replication	8		8
Experiment replication	1		1
% plants cut in control plots	58.8		83.8

¹ All bran baits contain 5% ai carbaryl. Sprays applied as a row application

² All bran baits contain 5% ai carbaryl. Sprays applied as a complete cover

CONCLUSIONS

Bran + 5% ai carbaryl and kibbled wheat + 5% ai carbaryl are both superior cutworm baits to Snylok and Ekalux, and are marginally superior to commercially prepared apple pomace + 5% ai carbaryl at rates of 10 kg and 20 kg/treated ha. Bran is preferred to kibbled wheat as a carrier because it is cheaper and more readily available. Bran + 5% ai carbaryl at 10 kg and 20 kg/treated ha provides comparable control to spray application of synthetic pyrethroid.

ACKNOWLEDGEMENTS

Deborah O'Donnell for statistical analysis, the staff of the Pukekohe Research Station for assistance with the field trials, Donna Lahood for technical assistance and Nick Martin and Peter Workman for invaluable advice.

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APPENDIX

Specifications of chemicals and baits mentioned in the paper.

Chemicals:

carbaryl (Septan 80% WP); chlorpyrifos (Lorsban 25% WP); deltamethrin (Decis 2.5% EC); fenvalerate (Sumicidin 10% EC); permethrin (Ambush 50% EC).

Baits:

Name	Carrier	Particles /g	Active ingredient	Concentration (% ai)	Origin
Exptl 1	Bran	1100	(carbaryl) ((chlorphyrifos)	various	N.Z.
Exptl 2	Kibbled wheat	650	carbaryl	various	N.Z.
	Apple pomace	27	carbaryl	5	U.S.A.
Snylok	"edible materials"	500	sodium fluosilicate	10	Israel
Ekalux	"vegetable meals"	500	quinalphos	0.25	Switzerland