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FACTORS INFLUENCING THE PALATABILITY OF BAITS TO GREASY CUTWORM LARVAE

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Summary

Wheat bran was more palatable to greasy cutworm (*Agrotis ipsilon*) larvae than kibbled wheat followed by cornmeal. The palatability of these carriers was influenced by moisture content; for example the palatability of kibbled wheat and bran increased with increasing moisture content. The addition of molasses or vegetable oil to these carriers had no effect on palatability. The rate at which the carrier absorbed water was not reduced by the addition of molasses or vegetable oil. Vegetable oil was a suitable diluent and sticker for the formulation of poisoned baits. Because the denser particles of kibbled wheat spread more evenly in windy conditions, a bait based on kibbled wheat should be preferred to bran as it might give better protection to plants.

INTRODUCTION

The greasy cutworm has become a serious pest of poroporo (*Solanum aviculare*) in Taranaki and of sweet corn (*Zea mays*) in Gisborne since the use of DDT was banned. Control of cutworm was achieved by the application of poisoned baits in the pre-DDT era (Hough and Mason 1951) and more recently with modern insecticides (Sechriest and Sherrod 1977).

The efficacy of baits may depend on the palatability of its ingredients. It was, therefore, necessary to evaluate several materials for palatability, factors affecting palatability and then their effectiveness in the formulation of poison baits.

METHOD

Humidity chambers for feeding and water absorption tests consisted of 0.6 litres Agee® preserving jars; humidity was maintained with saturated salt solutions (30 mm deep) or water (Peterson 1953). A small tray with bran or grain or a plastic pot with tubes of larvae was supported above the liquid in the chamber.

Third or fourth instar cutworm larvae used in tests were reared on dock leaves by a method based on Allan (1973). Two days before feeding tests, 2.5 g of bran or 5 g of kibbled grain on a small tray (plastic lid, 62 mm diam.) was placed in each humidity chamber to allow the moisture of the carrier to reach equilibrium. The moisture content of the carrier in each chamber was determined by drying a weighed sample at 105 °C. The remaining carrier was put in glass tubes (25 mm long, 12 mm diam.) each containing one cutworm larva. The 5 or 10 tubes used for each treatment were covered by nylon netting to retain the larvae. Food was provided *ad libitum*. The tubes were held in the humidity chamber for 24 h. The number of faecal pellets produced by each larva was counted.

Experiments were repeated 2 or 3 times with 15 or 20 larvae per treatment. An analysis of variance and Fishers Protected Least Significant Difference Test were used to interpret the data.

Experiment 1

The palatability of bran, kibbled wheat (400 particles/g) and cornmeal (650 particles/g) was compared at two moisture contents.

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Experiment 2

The palatability of bran, bran + molasses (10 g bran + 2 ml molasses) and bran + vegetable oil (10 g bran + 0.5 ml Sunfields vegetable oil derived from rape seed) was compared at three moisture contents.

Experiment 3

The palatability of bran, bran + oil, kibbled wheat, and kibbled wheat + oil (20 g kibbled wheat + 0.5 ml oil) was compared at three moisture contents.

The rate at which bran and kibbled wheat absorbed water under 3 different humidities was determined. Only one carrier was tested at a time. Approximately 1 g of each carrier was weighed onto each plastic lid (62 mm diam.) and placed in 100%, 85% and 65% relative humidities. The moisture content of the carrier was determined at 0, 1, 2, 4, 8 and 24 h by drying at 105 °C for 24 h. Five carriers were tested: bran, bran + oil, bran + molasses, kibbled wheat and kibbled wheat + oil. Two replicates were used. The moisture content of the carriers after 48 h at each humidity was obtained from the feeding tests.

In order to simplify the presentation of results the moisture content of the carriers will be referred to rather than the relative humidity of the chambers. The moisture contents of each carrier at the different relative humidities are given in Table 1.

TABLE 1: Mean percentage moisture content of carriers after 48 h at 4 relative humidities

carrier	relative humidity			
	33%	65%	85%	100%
bran	11	14	20	37
bran + oil	-	14	20	40
bran + molasses	-	15	24	49
kibbled wheat	14	16	20	29
kibbled wheat + oil	-	15	19	27
cornmeal	12	-	-	25

RESULTS

Factors affecting palatability

Experiment 1

At the highest moisture contents bran was more palatable than kibbled wheat followed by cornmeal (Table 2). At the lowest moisture content bran was significantly ($P < 0.05$) more palatable than the other two carriers.

TABLE 2: Palatability of foods to cutworm expressed as mean number of faecal pellets produced in 24 hours

Experiment 1		Experiment 2		Experiment 3	
Food		Humidity		Food	
bran	24.7 a	100%	16.7 a	bran	21.5 a
kibbled wheat	20.6 b	85%	13.5 b	bran + oil	15.3 b
cornmeal	14.9 c	65%	10.7 c	kibbled wheat	13.9 b
				kibbled wheat + oil	18.2 ab

Expt 1; bran, kibbled wheat and cornmeal at high moisture contents.

Expt 2; bran at moisture contents reached in 3 relative humidities.

Expt 3; bran, kibbled wheat, with or without vegetable oil, means from 3 moisture contents.

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Experiment 2

No significant differences were found between the palatability of bran, bran with oil or bran with molasses. However, there was a significant difference between the palatability of bran at different moisture contents (Table 2); more bran was consumed at the higher moisture contents.

Experiment 3

As in experiment 2 more bran and kibbled wheat were consumed at higher than lower moisture contents. The addition of oil appears to have depressed the consumption of bran (cf Expt 2) but not kibbled wheat (Table 2).

In each experiment a proportion of the larvae which were in a moulting state did not feed. The experimental design took this factor into account. In experiment 3 the moulting larvae were unevenly distributed through the treatments and this may account for the discrepancy between the results of experiment 2 and 3.

Rate of water absorption

Fig. 1 shows that bran absorbs water rapidly at high humidity and the addition of a small quantity of vegetable oil does not affect the rate of absorption. Bran with molasses absorbs water at the same rate as bran alone for the first 8 h. After this the absorption rate increased to give moisture contents of 44% and 49% at 24 and 48 h respectively.

The moisture content of kibbled wheat was higher than bran when both were dry but was lower than bran after 48 h at 100% relative humidity (Table 1). Unlike bran at 100% relative humidity, the moisture content of kibbled wheat reached equilibrium within 24 h. The addition of oil had no apparent effect on the rate of water absorption.

Fig 1 Rate of water absorption by bran and bran + oil under three humidities. Log 10 time scale

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DISCUSSION

Wheat bran was more palatable than kibbled wheat followed by cornmeal. The superiority of bran may be due to its shape or the crushed nature of the grain. The palatability of kibbled wheat may be improved by using finer particles (600/g) which may absorb water faster than the larger particles (400/g) tested. It appeared that the yellow part of the cornmeal was not eaten and this may be why its palatability was low.

This report confirms Sechriest and Sherrod (1977) that as the moisture content of a carrier increased it was more readily consumed by cutworm larvae.

Cutworm larvae feed at night when the humidity at the soil surface is at or near 100%. If a dry bait is spread in the afternoon or a bait has dried out from the previous night it will absorb moisture rapidly in the evening as the surface rises and increases its palatability to cutworm.

Bran has one major disadvantage as a carrier. The light particles were observed to be spread unevenly in windy conditions giving variable protection to the crop. The denser particles of kibbled wheat do not have this disadvantage.

CONCLUSIONS

Fine kibbled wheat is a suitable base for an insecticide bait to control cutworm. Vegetable oil is a satisfactory diluent and sticker for the insecticide. The only disadvantage is that under very dry soil conditions, water must be added to the bait before use.

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