SCREENING SEED PROTECTANTS AGAINST BLACK FIELD CRICKET

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SUMMARY

Ryegrass (*Lolium perenne*) seed coatings were tested in a laboratory and field trial as seed protectants against black field crickets (*Teleogryllus commodus*). The best protectants were the fertiliser granulated 'Supercote' seed with and without incorporated insecticides and repellents, lime coated 'Prillcote' seed incorporating insect repellents and insecticides and bare seed coated with some insecticides.

INTRODUCTION

Black field crickets consume considerable amounts of pasture seed over the summer and autumn. Pasture seed is consumed by crickets in preference to alternative food sources such as fresh plant material. Grass seed (e.g. ryegrass) is preferred to legume seed (e.g. white clover *Trifolium repens*). Adult crickets are active in autumn, which is the recommended time for over-sowing, and can consume high rates of oversown pasture seed within a few days (Blank *et al.* 1980a, 1980b; Blank and Bell 1981).

It is recommended that black field cricket infested areas with poor quality open pasture should be baited to eliminate crickets before oversowing in autumn in order to prevent loss of pasture seed (Blank 1979; Blank *et al.* 1980a). Another approach could be to protect seed from cricket attack by coating the seed with a protectant. The aim of this study was to screen a range of compounds for their ability to protect seed from cricket attack.

MATERIALS AND METHODS

Seed treatments

The 33 seed treatments tested in the laboratory and field trials are given in Tables 1 and 2 respectively. All insecticide coatings used wettable powder formulations or emulsifiable concentrates. 'Supercote' and 'Prillcote' 'Grasslands Ruanui' ryegrass seed were supplied by Coated Seed Ltd. 'Supercote' seed coatings are an experimental product comprising lime reverted superphosphate, nitrogen fertiliser and inert binding agents granulated at approximately 10 times seed weight. 'Prillcote' coatings consist of finely ground limestone at an equal weight to the seed. Treatments in which insecticides were coated onto the bare seed using 'gum' were supplied by Mr G.D.G. du Toit (Ruakura Agricultural Research Centre). The coating method used involved mixing the insecticide with enough water to make 2.5 ml of solution and then adding 1.5 ml of non-toxic liquid gum (Lion brand). This was mixed with 20 g of seed and then 7 g of talc in a fluted kjeldahl flask until evenly coated. Coated seed was then dried (du Toit 1979). The remaining treatments consisted of 'Grasslands Nui' ryegrass seed mixed with various compounds in a glass vial until evenly coated, without the aid of a sticker.

Laboratory trial

Adult black field crickets were captured in a water trap beneath a light source near Dargaville. Crickets were held in plastic cages and provided with food and water until required. One adult male or one adult female (average weight 62 mg) was placed in a

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Beatson jar (500 ml) containing a moistened wettex sponge (20 mm²) and 10 seeds of one treatment. Lids, with holes for ventilation, were placed on the jars where were left at room temperature (maximum 26 ± 2°C, minimum 20 ± 2°C) overnight for 16-18 h. Cricket mortality and seeds remaining were assessed after this time. The 33 seed treatments were tested concurrently in a repeat (replicate) and there was four repeats with male and four repeats with female crickets. Beatson jars were washed between repeats. Trials were conducted during February 1979. Treatment groupings were determined using Scheffe's test (Snedecor and Cochran 1967).

TABLE 1: Seed protectant rankings determined from the number of ryegrass seeds remaining after exposure to an adult black field cricket as well as cricket mortality. Means of eight repeats.

Ranking	Seed coating ^a	Seed treatment	Protection-% seeds not eaten	% mortality
1 =	'Supercote'	bendiocarb 15% ^b	100	50
1 =	'Supercote'	methiocarb 15%	100	38
1 =	'Supercote'	disulfoton 15%	100	0
4	'Prillcote'	repellent A high rate	99	0
5	gum	triazophos 2.4%	96	88
6 =	'Supercote'	omethoate 15%	95	25
6 =	nil	methiocarb 5%	95	100
8	gum	fenamiphos 4%	94	100
9	'Prillcote'	methiocarb 5%	93	50
10 =	'Prillcote'	bendiocarb 5%	91	88
10 =	'Supercote'	untreated	91	0
12	gum	oxamyl 1.9%	86	100
13	'Prillcote'	repellent A low rate	84	0
14 =	'Prillcote'	disulfoton 5%	83	63
14 =	gum	isofenphos 2%	83	88
14 =	gum	dicrotophos 1.6%	83	38
17 =	'Prillcote'	omethoate 5%	80	88
17 =	gum	mevinphos 0.4%	80	50
19	gum	dimethoate 1.2%	76	88
20	gum	omethoate 3.7%	75	88
21	nil	carbaryl 5%	65	25
22	gum	bendiocarb 0.6%	56	50
23	'Prillcote'	untreated	48	0
24	gum	carbofuran 0.5%	46	38
25	gum	thiometon 0.5%	45	38
26 =	gum	demeton-S-methyl 0.5%	44	0
26 =	nil	red lead oxide 6%	44	0
28	nil	captan 2%	34	0
29	nil	thiram 2%	33	0
30	nil	lisamine dye 0.05%	16	0
31	nil	rhodamine B500 dye 0.05%	13	0
32	nil	untreated Nui	10	0
33	nil	curb powder 5%	9	0

— represents a significant division ($P \leq 0.001$)

— represents a significant division ($P \leq 0.01$)

^a see text for description of seed coatings

^b %active ingredient based on actual (not coated) seed weight

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Field trial

Seed theft was measured from seed lines set out on a site at Whareora near Whangarei. The site was on hill country of Marua clay soil type and had long, rank ryegrass-dominant pasture. Each seed line was comprised of 10 seeds of one treatment placed 20 mm apart with the position of each seed marked with a pin. Each replicate was made up of 33 lines of seed placed 50 mm apart on soil which had been cleared of vegetation with a spade. The four replicates were each covered by a plastic covered wire frame to protect the seed from being displaced by wind and rain and being removed by birds but to allow free entry of invertebrates. Seed lines were checked each day over a five day period in April 1980 for missing seeds which were replaced. The black field cricket population in the trial area was assessed using 20 pitfall traps which were opened for three days. The t-test was used to determine differences between treatment group means.

RESULTS

Laboratory trial

There was no sex times treatment interaction and so the mean values of % seed remaining and % mortality for the combined male and female repeats are given in Table 1. Three groups of seed protectants can be distinguished. The worst group of seed protectants was made up of untreated seed (control), two dye stuffs and curb powder. All gave no mortality and even though high numbers of seed were consumed. The intermediate seed protectant group was comprised of two fungicides, red lead, the standard 'Prillcote' and gum coated seed with low insecticide rates, plus carbaryl at 5%.

TABLE 2: Mean % daily seed theft for groups of ryegrass seed protectants exposed for five days to a low field population of black field crickets.

Seed group	Seed treatment	mean % daily theft
'Supercote'	untreated	0.0
'Supercote' + insecticides 5% ^b	disulfoltan, isofenphos, methiocarb, bendiocarb, oxamyl	0.9
'Supercote' + repellents 1% and 5%	repellent A, repellent B	
'Prillcote' + insecticides 1% and 5%	disulfoltan, isofenphos, methiocarb, bendiocarb, oxamyl	5.7
'Prillcote' + repellents 1% and 5%	repellent A, repellent B	
gum + insecticides 0.4% — 3.7%	isophenphos 2%, oxamyl 1.9%, discrotophos 1.6%, mevinphos 0.4%, omethoate 3.7%, methiocarb 3.5%	7.8
'Prillcote'	untreated	10.0
ryegrass	untreated Nui, untreated Ruanui	22.5

abbreviations as for Table 1

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Cricket mortality in this group ranged from 0-50%. The best seed protectant group included all the 'Supercote' seed with and without high rates of insecticide (15%); the standard 'Prillcote' with medium rates of insecticide (5%) and both high and low rates of the insect repellent; and a group of gum coated seed plus insecticides. Mortality in this group was variable ranging from nil for the 'Supercote' seed alone and with disulfoton, as well as the 'Prillcote' insect repellent seeds; to 100% for some insecticide treated seeds.

Field trial

Seed theft over all five days was low due to low black field cricket populations (mean of 0.8 crickets/pitfall/3 days). Over the five assessment days six black field crickets and two small field crickets (*Pteronemobius nigrovus*) were found dead on the seed lines. There was no detectable rate effect for either insecticides or repellents. Comparisons of individual treatments were not possible because of low theft. Instead, groups of seed protectants have been compared and three distinct groupings found (Table 2). The untreated ryegrass seed controls formed the worst group. The intermediate group consisted of all the 'Prillcote' treatment as well as the insecticide gum coated seeds. The best group was comprised of all the 'Supercote' seeds.

DISCUSSION

Seed coated with bird repellents and dye stuffs may reduce seed theft by birds while fungicide-coated seed may give increased germination rates (Falloon 1980). These treatments however, did not give the additional benefit of protection from cricket consumption in the laboratory trial. The standard 'Prillcote' ryegrass gave approximately half the level of seed loss compared to the untreated ryegrass seed in both trials. The addition of insecticides and insect repellents considerably enhanced the protection obtained from the standard 'Prillcote' and appear an essential addition if the standard 'Prillcote' is to act as a seed protectant. In another study, standard 'Prillcote' ryegrass gave poor protection (0-11%) when exposed in the field to high cricket populations (Blank and Bell 1981). Of interest was the high protection obtained by the insect repellent treatments on 'Prillcote' which showed a small advantage over the insecticide 'Prillcote' treatments. Insecticide coated seed, in contrast to a repellent, relies on a proportion of seed being consumed in order to obtain protection for the remaining seed.

The two best insecticides incorporated with a gum sticker, triazophos and fenamiphos, as well as dimethoate, are unsuitable as protectants at the rates tested because of phytotoxicity effects on germinating seedlings. Oxamyl, isofenphos, dicotophos, omethoate and mevinphos at the rates used in this study, have not been found to exhibit phytotoxicity symptoms on ryegrass seedlings (du Toit 1979; Mr G.D.G. du Toit pers. comm.). Higher rates than used in this trial of carbofuran and bendiocarb treated ryegrass seed exhibited no phytotoxicity symptoms in insecticidal seed coatings used to control soldier fly larvae although there was some discrepancy as to phytotoxicity due to isofenphos (Dixon and Holland 1977; Wrenn and Dixon 1977).

The experimental 'Supercote' seed alone gave good protection in both trials and there was no benefit gained from the addition of insecticides or repellents.

A number of treatments from the best treatment groups are worthy of further investigation as protectants against black field cricket attack. These include the 'Supercote' and 'Prillcote' seed with repellents or insecticides as well as some of the insecticide treated seed. If a protective coating can be developed which will adequately repel or kill crickets, as well as provide seed in one operation, then this approach may be more cost efficient than having the additional expense of prebaiting before broadcasting seed on to black field cricket infested pasture.

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