SELECTIVITY OF FERAFEED® PASTE BAIT TREATED WITH A RODENT REPELLENT – A CAGE TRIAL

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ABSTRACT

FeraFeed® is a non-toxic, pre-feed paste bait used in conjunction with Feratox® cyanide capsules for the control of possums. The selectivity of a formulation of FeraFeed® containing a rodent repellent was tested in a cage trial with Norway rats and possums. Rats were strongly discouraged from eating the material and yet readily consumed non-treated FeraFeed® paste, while possums were not deterred. Incorporation of the repellent should therefore improve the cost-effectiveness of using FeraFeed®/Feratox® in possum control. Additionally, use of FeraFeed®/Feratox® for monitoring possum populations may be improved by the reduced interference by rats.

Keywords: possums, vertebrate pest control, cyanide, rodents, repellents.

INTRODUCTION

Cyanide poison in the form of a paste has been used for almost 50 years for the control or harvesting (for fur) of possums, New Zealand's foremost vertebrate pest (see Montague 2000). As a control method, use of cyanide paste can be somewhat constrained as between 12% and 54% of possums in wild populations have been shown to refuse cyanide paste (Warburton and Drew 1994). Like many other herbivores, possums show a capacity to detect cyanide gas (hydrocyanic acid) as this is released when plants that are 'chemically defended' with cyanogenic glycosides are browsed (Conn 1979). Examples of such plants that are browsed by possums in New Zealand include clover (*Trifolium repens*) and titoki (*Alectryon excelsus*) (O'Connor and Matthews 1995). Additionally, Morgan *et al.* (2000) showed that most possums develop a 'learned shyness' to baits containing cyanide if they ingest a sub-lethal dose, most probably by recognising the distinctive, almond-smelling HCN gas that is emitted when cyanide is exposed to moisture (Eisler 1991).

Feratox® capsules are designed to prevent the emission of HCN gas (Warburton *et al.* 1996), and are often used in the field by mixing several capsules into a large spoonful (i.e. approximately 15–20 g) of a non-toxic, peanut-based bait material known as FeraFeed®. Where rat populations are high, FeraFeed® and Feratox® are sometimes removed by rats, consequently increasing the cost of controlling possums. Physical modifications have been made to the purpose-designed bait station recommended for presenting these baits, appreciably reducing interference by rats. However, other forms of bait presentation, such as the use of small plastic bags, are vulnerable to feeding by rats.

The FeraFeed®/Feratox®/bait station system is potentially suitable as a highly cost-effective method for monitoring possum populations. It is essential though that interference with the bait by rats is prevented if this system is to be developed as a reliable census method.

Feral Control (Auckland) have developed a formulation of FeraFeed® that is intended to deter rats, but not possums, from feeding on the bait, by inclusion of a distasteful compound. A study was conducted to assess the response of both rats and possums to the newly formulated FeraFeed®.

METHODS

Twenty feral rats (*Rattus norvegicus*) and 20 possums (*Trichosurus vulpecula*) were housed at the Landcare Research Animal Facility, Lincoln. Rats and possums were maintained in individual cages on a diet of fresh fruit, vegetables and supplementary dietary pellets. Fresh drinking water was always available. The rats were acclimatised to captivity for at least 2 weeks before the study started, and the possums for 4 weeks.

Rats were randomly assigned to two groups of 10 and the two groups were offered non-toxic FeraFeed® with or without rodent repellent. The two paste-bait treatments were supplied by the manufacturer, Feral Control (Auckland). For 3 days, the rats in each group were presented daily, at normal feeding time (i.e. 4.00 p.m.), with 50 g FeraFeed® paste on a glass dish. At the same time, about half the normal daily ration of fruit and vegetable was presented. About 1 h after rats were offered the bait, the other half of the daily ration was presented. This procedure was followed to simulate as much as possible the expected manner in which paste baits may be encountered in the wild (i.e. with restricted amounts of alternative foods available nearby). The weight of remaining bait was recorded every 24 h. Two samples of 50 g of bait in dishes, not available to rats, were also prepared and these were reweighed to monitor changes in the weight of bait. As these changed by only 0–0.5%, no correction was applied to the data. A similar procedure was followed using 20 settled possums except that each possum was presented with 100 g paste and again no weight-change corrections were necessary.

Mean consumption of treatments by the two groups of animals in each trial over 3 nights was compared by using a repeated measures ANOVA with 'treatment' and 'day' as experimental factors. The raw data were standardised for bodyweight (i.e. weight eaten per 100 g bodyweight for rats and weight eaten per kg for possums) as the mean body weight differed between the treatment groups for both species.

The study was conducted with the approval of the Landcare Research Animal Ethics Committee (approval nos. 98/2/4 and 99/5/1).

FIGURE 1: Mean ($\pm$ SEM) consumption of FeraFeed® paste with and without rat repellent by two groups of wild Norway rats.

RESULTS

Norway rats showed a consistent response to the two types of FeraFeed® paste over 3 days (Fig. 1). Most of the group presented with standard, untreated paste ate between 5 and 31 g each day (Table 1). By contrast, very little of the repellent-treated FeraFeed® paste was eaten by the second group of rats. On the first night most rats ignored the treated paste, and on subsequent nights most rats sampled only very small (i.e. <1 g) amounts. ANOVA confirmed a highly significant effect of the repellent treatment ($P < 0.0001$), and the relative consumption of treatments did not differ between days ($P > 0.05$).

Unlike rats, possums were not deterred from eating paste by the rodent repellent (Fig. 2). Possums ate between 8.1 and 58.7 g treated bait on the first night (Table 2), and on average, more repellent-treated paste was eaten than untreated paste on the first night. Over the 3 nights, mean consumption of the treated and untreated paste by the two separate groups was very similar ($P > 0.05$), and there was no difference in relative consumption of treated and untreated paste between days (i.e. the treatment * day interaction) ($P > 0.05$).

TABLE 1: Consumption of FeraFeed® paste with and without rat repellent by two groups of Norway rats.

Bait presented	Rat number	Body weight (g)	Weight consumed (g)		
			Day 1	Day 2	Day 3
Rat repellent	1	56.5	1.0	0.2	0.2
	2	58.4	0	0.8	0.5
	3	51.9	0	2.2	1.3
	4	98.8	0	0.2	0
	5	87.4	0	0.6	0.9
	6	152.5	0.3	1.5	1.2
	7	256.3	0	0.2	0.2
	8	257.4	3.2	5.0	3.9
	9	243.6	0	1.9	7.0
	10	149.6	0.1	0.4	0
	Mean	141.2	0.5	1.3	1.5
Non-treated	11	149.0	10.1	15.1	8.0
	12	177.6	9.5	11.1	10.5
	13	201.4	2.7	14.5	9.1
	14	218.8	15.3	11.2	17.6
	15	241.8	0.4	0	5.7
	16	188.5	0.3	14.9	20.2
	17	287.5	18.0	25.5	19.5
	18	210.8	5.5	18.4	14.6
	19	356.1	17.7	30.8	17.4
	20	66.5	6.6	10.1	6.3
	Mean	209.8	8.6	15.2	12.9

DISCUSSION

Addition of the repellent compound provides a promising means of reducing rodent-interference with FeraFeed® paste. Rats were strongly discouraged from eating the material and yet readily consumed non-treated FeraFeed® paste, while possums were not deterred. Incorporation of the repellent will therefore substantially reduce loss of both FeraFeed® and Feratox® to rodents, and may consequently improve the cost-effectiveness of this control method against possums. While this study tested the response of Norway rats to the treated bait, it is likely that the other two species of wild rats in New Zealand, black rats (*R. rattus*) and kiore (*R. exulans*), will respond similarly as all three species have broadly similar diets (J. Innes, pers. comm.).

FIGURE 2: Mean ($\pm$ SEM) consumption of FeraFeed® paste with and without rat repellent by two groups of possums.

TABLE 2: Consumption of FeraFeed® paste with and without rat repellent by two groups of possums.

Bait presented	Rat number	Body weight (g)	Weight consumed (g)		
			Day 1	Day 2	Day 3
Rat repellent	1	3.38	57.0	3.3	74.6
	2	3.92	51.9	57.4	38.8
	3	3.35	51.9	1.6	18.2
	4	3.87	52.1	28.2	27.5
	5	3.47	26.2	34.2	33.0
	6	3.73	10.7	16.6	6.5
	7	2.81	36.0	22.8	31.2
	8	4.23	8.1	14.9	0
	9	2.36	58.7	26.2	32.0
	10	3.03	27.5	41.0	19.4
	Mean	3.42	38.0	24.6	28.1
Non-treated	11	4.10	70.0	44.9	46.6
	12	2.95	31.8	38.9	40.8
	13	4.39	41.1	35.0	31.7
	14	4.37	7.5	15.1	28.7
	15	3.41	38.8	38.6	54.2
	16	3.58	22.8	27.4	43.1
	17	5.18	59.6	37.4	38.2
	18	4.42	33.2	34.1	35.9
	19	3.70	0.1	13.1	37.5
	20	4.91	53.1	33.7	33.4
	Mean	4.10	35.8	31.8	39.0

Where it is desirable to target both rats and possums simultaneously (as is usually the case for the protection of native fauna), it may be more cost-effective to use the recently developed Feracol® paste formulation rather than FeraFeed®/Feratox® system. Feracol® has been found to be effective in cage trials against both possums (Morgan and Rhodes 2000) and rats (Morgan and Eason 1999).

Use of Feratox® with FeraFeed® for census of possum populations should become more reliable when the rodent repellent is incorporated, although rat interference was not completely prevented. This reflects the mode of action of the repellent, which functions through the rat's sense of taste rather than smell. However, if the bait is used in a Feratox® feeder that is designed to reduce interference by rodents, a reliable possum census should be possible at considerably lower cost than the present trap-catch-based protocol. Furthermore, restricting the use of FeraFeed®/Feratox® to 1 night when monitoring possum populations, would minimise any confounding effects of rodent interference, as the proportion of rats sampling FeraFeed® with repellent on the first night (40%) was lower than on subsequent nights.

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