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Information Control – Detecting the Presence of Possums in Low Density Populations

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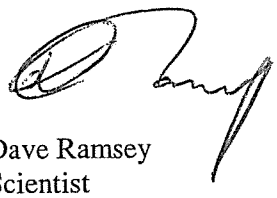

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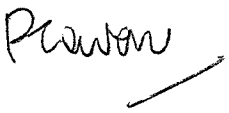

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Summary

Project and Client

A low-cost method of detecting the presence of possums in low density areas, with control then targeting those possums, was trialled by Landcare Research, Lincoln. This trial was carried out for the Animal Health Board (AHB) between December 2000 and July 2001.

Objectives

To determine the cost-effectiveness of a low-cost system for detecting low density possum populations, by:

- testing the acceptance to possums in pen and field trials of a low-cost rat-repellent bait;
- contrasting the cost per hectare of controlling low density possum populations using contractors with no prior knowledge of where possums are with a method that identifies the presence of possums before control effort is applied.

Methods

Rodent repellent trials

Pen trials: Two potential rat repellents, Avex™ (a bird repellent) and a Feral Control rodent repellent (and a no-repellent control) in a mixture (50:50) of flour and castor sugar were tested on 30 wild-caught possums (*Trichosurus vulpecula*) of mixed sex, and three wild-caught ship rats (*Rattus rattus*) individually housed in captivity at the Landcare Research Animal Facility. The trial baits were weighed before and after each night's feeding, corrected for any moisture loss or gain, and bait-take calculated in g / kg body weight for possums and as a percentage of the original bait eaten for rats.

Field trials: Baits of flour and castor sugar containing one of the two repellents or a no-repellent control were tested in the field in beech forest at Big Bush, Nelson Lakes National Park, and in mixed podocarp forest at Hohonu, Westland. The trial at Big Bush was discontinued when rat numbers were found to be too low. At Hohonu, with sufficient numbers of rats and possums, 50 baits of each treatment were made available to possums but not rats by elevating a small plastic dish containing the bait on wires above a rat-proof disk, and 50 baits were made available to rats but not possums by putting a plastic dish containing the bait inside rodent tunnel bait stations. Bait types were randomly allocated at 40-m intervals along 11 transects spaced 200 m apart. At each site, one bait was made available to possums only and one bait to rats only. Baits were checked after 1–4 nights and the amount of bait eaten estimated as a percentage of the total bait offered.

Control operation trials

Four field trials were carried out in conjunction with routine maintenance control operations in Otago. Each trial consisted of a pair of blocks with standard control methods applied to one block ("non-treatment") and the experimental method ("treatment") of detecting possums by interference with non-toxic (prefeed) baits used in the second block. Possum control (Feratox® or traps) was then applied to those areas where bait had been interfered with. Rat repellent was not added to the "prefeed" baits as there was no evidence that it was effective.

Contractors laid baits along lines through possum habitat and checked them after several days. Where animal interference occurred, toxic baits were laid. The effort (man-hours), number of baits or traps, kill rate, residual trap-catch (RTC) results from using the National Trap Catch monitoring (for three of the blocks only), and costs per hectare of using both methods were then compared.

Results

Rodent repellent trials

Pen trials: There were no treatment differences in bait consumption by penned possums for the two repellents and the control on the first night that animals were exposed to the baits, but significantly less Avex™ was eaten on the third night than the Feral Control repellent or control baits. No significant differences were found in the consumption of the repellents by three penned wild-caught rats although they ate less of both repellents than the control.

Field trials: There were no significant differences found in the amount of bait eaten or the frequency of baits touched for either of the two repellents compared to the control for either rats or possums.

Control operation trials

In trials 1 and 2 in which the treatment blocks provided information on where possums were located, the trial method used fewer poison baits or traps per possum killed than the normal method of control. The number of baits or traps laid per hectare was correspondingly less in the "treatment" blocks than in the "non-treatment" blocks. This was due to fewer toxic baits being laid where "prefeed" baits were undisturbed, as animals were not thought to be present. The "treatment" blocks took slightly longer to control than the "non-treatment" blocks although the times were very similar. The number of possums killed per hectare and costs per hectare were also very similar. The RTC after control was below the operational area targets for three of the "treatment" and two of the "non-treatment" blocks monitored and was only slightly above the target for the trial 2 "non-treatment" block.

Conclusions

The strategy of finding where possums are present and targeting those possums appears to provide some worthwhile benefits in terms of a reduction in toxic baits and traps used, but did not reduce costs in this study. In the "treatment" blocks, clear identification of possum interference was compromised by not having an effective rat repellent and therefore the full potential of using this method was not realised. The reduction in the number of toxic baits and traps laid for the number of possums killed indicates there are substantial gains to be made from the better targeting of residual possums. A more accurate targeting of possums by having a possum-specific detection device would further decrease the number of baits or traps used per possum killed. Nevertheless, even without using a rat repellent or possum-specific device it appears that the amount of poison bait or traps used can be reduced. The higher kills per bait used that were achieved in the "treatment" trials could also have been a result of the pre-feeding effect of the flour and sugar baits. In these blocks possums had 2–4 days to find the "prefeed" baits and this would increase the potential encounters of possums with toxic baits or traps.

Recommendations

- Control contractors maintaining low density possum populations should be encouraged to use a method of detecting the presence of possums before laying out poison baits or traps, as this would decrease the quantity of poison or traps used in an operation, and possibly also the risk of unnecessarily high expenditure.
- Further research is needed to develop a detection system that is not confounded by rats, either by developing a better rat repellent or a method for distinguishing between possum and rat interference such as wax blocks. This should be tested in a variety of habitats to determine its cost-effectiveness.

1. Introduction

Currently there are no standardised procedures for controlling low density residual possum populations. Most contractors use traps or a variety of toxins but do not have any rigorous method for detecting where possums are present. Consequently a large proportion of trapping and poisoning effort is wasted because it is placed where there are no possums. The Animal Health Board (AHB) therefore contracted Landcare Research, Lincoln, to trial a low-cost method of detecting the presence of possums so that effort could then be directed at areas with possums present. The trial was conducted between December 2000 and July 2001.

2. Background

Maintaining possums (*Trichosurus vulpecula*) at low densities, usually below a residual trap catch (RTC) of often <5%, has become the accepted strategy by the AHB to eradicate bovine tuberculosis (Tb). Current maintenance control methods generally rely on contractors setting traps or spreading a variety of toxins more or less uniformly throughout the control area. This results in a proportion of trapping and poisoning effort being wasted because it is placed in areas where possums are absent.

Possum populations controlled to prevent the persistence and spread of Tb are often highly patchy with pockets of high and low densities of possums occurring within a management area (Coleman & Coleman 2000). The cause of this may be operational, but habitat preferences may also play a part. Habitat heterogeneity has been shown by McKenzie & Meenken (2001) to influence the density of possums, with the probability of catching a possum increasing with diversity of habitat. If patches of possums occur coincidentally with foci of Tb infection (Hickling (1995) found that the proportion of habitat infested with Tb possums was highly correlated with mean crowding), then it would be highly desirable to be able to find and control these patches. Consequently, a low-cost method of detecting residual patches of possums followed by a targeted effort to control them should result in Tb being more effectively controlled in an area with a significant reduction in time, effort, and cost of control.

3. Objectives

To determine the cost-effectiveness of a low-cost system for detecting low density possum populations by:

- testing the acceptance to possums in a pen and field trial of a low-cost rat-repellent bait;
- contrasting the cost per hectare of controlling low density possum populations using contractors with no prior knowledge of where possums are with a method that identifies the presence of possums before control effort is applied.

4. Methods

4.1 Rodent repellent trials

Pen trials

Two potential rat repellents, Avex™, a bird repellent (made by Loveland Industries Inc., Colorado, USA and available through Elliott Chemicals), and a rodent repellent developed by Feral Control were tested on 30 wild-caught possums of mixed sex individually housed in captivity at the Landcare Research Animal Facility. Both repellents have previously been shown to deter rats and not possums from eating baits (E.Spurr, pers.comm.; Morgan & Rhodes 2000). The repellents (1% Avex™ and 0.9% Feral Control rodent repellent) were added to a mixture (50:50) of flour and castor sugar (castor sugar was used instead of icing sugar, which is often used as a possum lure, on the recommendation of J. Kerr, Feral Control). Possums were randomly allocated to three groups, each containing five female and five male possums, and given 200 g of either the Avex™, the Feral Control repellent, or a control (flour and castor sugar without repellent), in addition to their normal food, for 3 days. The trial baits were weighed before and after each night's feeding and corrected for any moisture loss or gain by weighing additional baits left in the room over the same time period. Bait-take was then calculated in grams per kilogram body weight for each possum.

After completion of this possum pen trial, Feral Control changed to a new and supposedly more effective rodent repellent (the same substance with a modified formulation). Because anecdotal information suggested the original repellent was not very effective, we decided to change to the new version (with 1% as the recommended rate) for the field trials.

Only three wild-caught ship rats (*Rattus rattus*) were used in a pen trial to test the repellents, as this project was to test repellents on rats in the wild. Each rat was offered 20 g of flour and castor sugar bait containing either 1% Avex™, 1% of the new version of the Feral Control repellent, or a control, in addition to their normal food. The amount of 20 g was chosen as this was about the size of baits used in the field tests. Repellent type was randomly allocated and changed for each following night so that each rat was exposed to each treatment for 1 night. The trial baits were weighed before and after each night's feeding and corrected for any moisture loss or gain by weighing additional baits left in the room over the same time period. The percentage of the original bait eaten by each rat was calculated.
Analysis of the treatment effects was by ANOVA.

Field trials

Three treatments (1% Avex™, 1% new Feral Control repellent, and a no-repellent control) were compared using flour and castor sugar baits in the field in beech forest at Big Bush, Nelson Lakes National Park, and in mixed podocarp forest at Hohonu, Westland. The Big Bush trial was discontinued when rat numbers were found to be too low to show any preference for bait types.

At Hohonu, two baits of 20–30g were placed at each of 50 sites spaced at 40-m intervals along 11 transects. The transects were at least 200 m apart. One of the baits at each site was placed out of reach of rats in an elevated small plastic dish (containing the flour and sugar bait) on wires above a rat-proof disk. The other bait was placed out of reach of possums by

putting it in a plastic dish inside a "PESTOFF" rodent tunnel bait station (Animal Control Products). Bait types were randomly allocated along the transects. Baits were checked after 1–4 nights (only fine nights were used as rainfall affected the baits) and the amount of bait eaten estimated as a percentage of the total bait offered. Control dishes of bait protected from rat and possum interference were put out on each line to see if insects or moisture affected the baits.

Analysis used logistic regression, which assumes that possums and rats choose independently from all the sites with a probability that depends only on the treatment and the line. Two lines were omitted from the possum analyses as they had no baits taken by possums. All lines had some bait taken by rats so none were omitted for the rat data.

4.2 Control operation trials

Four field trials were carried out during May and June 2001 in Otago in conjunction with three routine maintenance control operations carried out by TrappersNZ, contractors to Southern Pest Management, the vector managers. For each trial, a pair of similar blocks was chosen within larger operational areas. The control method to be used in each block of a pair was then randomly allocated as either "treatment" or "non-treatment" with the experimental method of detecting possums by bait interference used in the "treatment" block and normal control methods (i.e. the method used in the larger control operational area) applied to the "non-treatment" block. Possum control in the "treatment" and "non-treatment" blocks was mainly by laying Feratox® baits (Feratox® cyanide capsules in peanut butter balls placed in small paper bags, which are stapled to the base of trees), with bait lines checked for possum kills after several days. In the "treatment" blocks, non-toxic (prefeed) baits were laid for several days prior to the toxic baits being laid. This was to detect where possums were by looking at bait interference and then targeting those possums by laying toxic baits at those sites (Appendix 10.1). If "prefeed" baits were untouched, then no toxic baits were laid at those sites. Rat repellent was not added to the "prefeed" baits as there was no evidence that it worked sufficiently well in the field to be able to eliminate rat interference.

Contractors laid baits in all trial blocks at intervals of about 10–15 m along lines about 100 m apart. Bait lines were put through possum habitat areas in the most efficient way, following bush edges and around tree clumps, with lines put through the middle of bush patches when they were greater than 200 m across (Fig. 1). Neither "prefeed" nor toxic baits were laid in the middle of open pasture. One "non-treatment" block also had one line of leg-hold and Timms kill traps set at intervals of 15–20 m. Three pairs of blocks were monitored using the National Trap Catch Protocol (National Possum Control Agencies 2000) to obtain a residual trap-catch index (RTC) of possum abundance, after control (calculated as the number of possums caught per 100 trap nights with 95% confidence intervals). The effort (days worked), number of baits or traps, % kill, RTC results, and costs per hectare of using both methods were then compared. Costs per hectare included hours worked, vehicle, non-toxic and toxic bait costs. The capital cost of traps was not included.

Trial sites

Taieri/Hindon (Trial 1): The pair of blocks ("treatment" and "non-treatment") was situated on opposite sides of a gully. The "treatment" block consisted of two areas of pine trees and the "non-treatment" block was a larger block of manuka and gorse scrub, some pine trees, and farmland (with one field of cropping). The "treatment" block was prefed by one person laying baits of flour, sugar, and a small "blob" of Animal Control Products (ACP)

feeder paste in the middle. Lines were checked after 2–3 days and poison baits (Feratox®) laid where possums had eaten baits. Rat and possum bait-takes, however, were difficult to distinguish so some poison baits were probably placed where there was rat rather than possum interference. The "non-treatment" block, had poison baits (Feratox®) laid along lines by three people. Toxic baits in both blocks were checked for numbers of possums killed after 6–7 days. Heavy snowfalls hampered this trial, however, with many toxic baits unable to be found when the lines were checked for possum kill.

North Taieri Hills (Trial 2): The "treatment" and "non-treatment" blocks were adjacent on a hillside consisting of manuka and gorse scrub with native forest in the gullies, some pine trees, and patches of farmland (Fig. 1). "Prefeed" of Ferafeed® baits (non-toxic bait in paper bags stapled to the base of trees) was laid in the "treatment" block on the initiative of the contractors, as they believed it was easier to distinguish between possum and rat interference than when using flour/sugar and ACP feeder paste. After 2 days, Feratox® baits were laid where "prefeed" had been eaten. Control in the "non-treatment" block was with Feratox® baits along with one line of traps (39 leg-hold and 16 Timms kill traps). Poison baits and kill traps were left for 3 days in both blocks before the lines were checked for possum kills. Leg-hold traps were checked daily. Four people shared the control equally in both blocks.

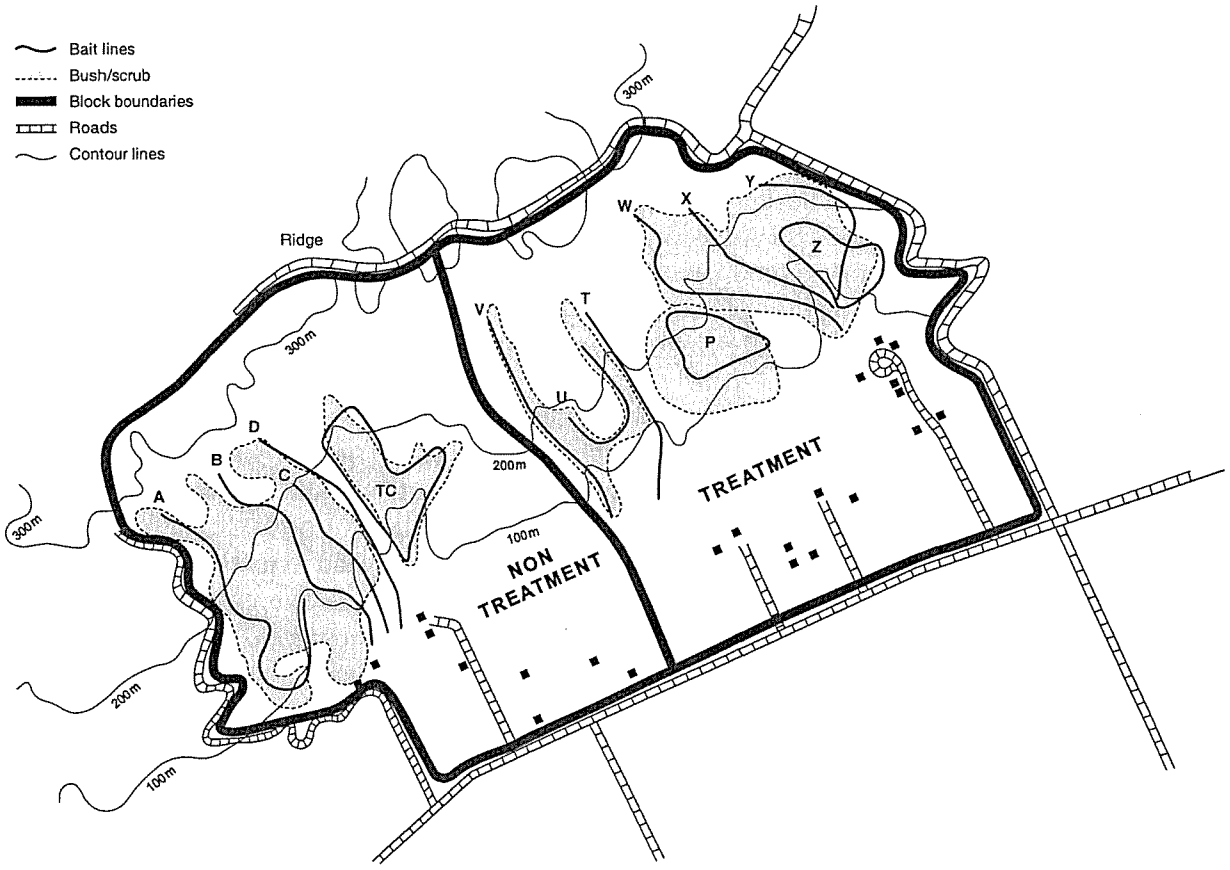

Fig. 1 North Taieri Hills trial block pair showing bait lines and bush coverage.

Owaka (Trials 3 & 4): Two pairs of blocks were chosen in the lower part of the Catlins Valley, with the trial-3 blocks on the eastern side and the trial-4 blocks on the western side of the Catlins River. All the blocks consisted of patches of forest on farmland but the trial 4 "non-treatment" block had more bush cover than the rest. Baiting of the trial 3 and trial 4 "treatment" blocks and the trial 3 "non-treatment" block was carried out by one person but three people laid baits in the trial 4 "non-treatment" block due to the extra bush cover. The "treatment" blocks had "prefeed" baits (flour/sugar and ACP feeder paste) placed at about every 10 m along lines and checked after 3–4 days. However, over 98% of these "prefeed" baits were eaten by rats, so it was not possible to work out where possums might have been present. Consequently, trials 3 and 4 did not have treatment blocks that were able to provide information on the location of possums. Feratox® baits were, therefore, then laid at spacings of about 15 m along the "prefeed" lines with several baits placed at sites of obvious possum sign and baits were checked after 3 days for possum kills. In the two "non-treatment" blocks Feratox® baits were laid at 20 m spacings along lines and checked after 7 days for possum kills.

5. Results

5.1 Rodent repellent trials

Pen trials

There was no statistically significant difference in bait consumption (g/kg body weight) by penned possums for the two repellents and the control on the first night (Table 1). Less of all the treatments were eaten on the second night with some evidence that less Avex™ was eaten than other treatments. By the third night, however, there was significantly less Avex™ eaten than the Feral Control repellent or the control ($P < 0.001$). There was no evidence for any sex differences in the amount of bait eaten.

Table 1. Average amount of bait eaten (g/kg body weight) by three groups of possums (each containing five females and five males) over 3 nights.

Repellent	Night 1	Night 2	Night 3
Avex™	14.3	8.9	3.4
Feral control	17.3	13.7	15.6
Control	18.5	14.8	13.3
Repellent effect	N.S.	N.S.	Avex™ low $P < 0.001$

The pen test of bait consumption by rats only used three animals and so did not provide a powerful enough analysis to determine any treatment differences between the two repellents and a control (Table 2). The percentage of the total bait eaten was used instead of g/kg body weight as we were interested in whether all the bait would disappear due to being eaten by rats in the field trials. All three rats ate some of both repellents, indicating only moderate repellency. However, the rats ate more control than either the Avex™ or Feral Control

repellents but the difference was not significant. This suggested that it was worthwhile to test both these repellents in the field with wild ship rats. It was always intended that the main repellent trial for rats would be run in the field.

Table 2. Bait-take over 1 night by three wild-caught ship rats in pens. The amount of bait eaten is estimated as a percentage of the total bait (20 g) offered.

Repellent	Rat 1 male, 372g	Rat 2 female, 305g	Rat 3 female, 145g	Average
Avex™	100	15	27	47
Feral Control	63	25	47	45
Control	99	57	75	77
Repellent effect	-	-	-	N.S.

Field trials

There were no significant differences found in the amount eaten or the frequency of baits touched for either of the two repellents compared to the control for either rats or possums (Table 3). The amount of bait eaten by rats and possums varied from 5 to 100% for individual baits of all treatments.

Table 3. Amount of bait containing repellents eaten by rats and possums at Hohonu, averaged over 11 bait lines. Baits lines were checked after 1–4 days and the amount of bait eaten estimated as a percentage of the original bait. The "% interference" is the percentage of baits that were touched (averaged) and "amount eaten" is the percentage of the baits eaten per sites available (averaged).

Repellent	Rats		Possums	
	% interference	Amount eaten (%)	% interference	Amount eaten (%)
Avex™	20	12	41	38
Feral Control	34	8	30	27
Control	31	12	34	29
Repellent effect	N.S.	N.S.	N.S.	N.S.

5.2 Control operation trials

In trials 1 and 2 in which the treatment blocks provided information on where possums were located, the trial method (i.e. "treatment" where "prefeed" was used to identify where possums are) used less poison baits or traps per possum killed than the normal method of control ("non-treatment") although this was not statistically significant (Table 4). The number of baits or traps laid per hectare was correspondingly less in the "treatment" blocks than in the "non-treatment" blocks. This was due to fewer toxic baits being laid where "prefeed" baits were undisturbed, as animals were not thought to be present. The "treatment" blocks took slightly longer to control than the "non-treatment" blocks, although not significantly so. The number of possums killed per hectare and costs per hectare were also very similar.

Results from the trial 3 and 4 pairs of blocks, in which the treatment failed because of excessive rat interference, were quite variable with the trial 4 "non-treatment" block being much more expensive to control (32.6 baits per possum) than its "treatment" pair (3.6 baits per possum). This exceptionally high number of baits was attributed to a greater cover of bush in this block with more toxic baits subsequently laid, as well as a worker who laid baits at a higher density than those laid in other blocks.

The residual trap catch (RTC) after control was below the operational area targets (Table 5) for three of the "treatment" and two of the "non-treatment" blocks monitored and was only slightly above the target for trial 2 "non-treatment" block.

Table 4. Number of possums killed and effort put into the control of four pairs of blocks in three control operation areas. The trial method was used in the "treatment" blocks and the method of control used over the main control operation areas was used in the "non-treatment" blocks.

Control Operation	**Taieri/Hindon**		**North Taieri Hills**		**Owaka**			
	Trial 1		**Trial 2**		**Trial 3**		**Trial 4**	
Blocks	**Treat.**	**Non-treat.**	**Treat.**	**Non-treat.**	**Treat.**	**Non-treat.**	**Treat.**	**Non-treat.**
Area (ha)	90	270	260	230	170	200	250	420
No. "prefeed" baits / ha	2.52	0	1.86	0	1.32	0	0.88	0
No. poison baits (& trap nights) / ha	1.6	2.6	1.4	1.9*	1.1	3	0.7	6.7
Effort / ha (man-hours)	0.16	0.11	0.11	0.10	0.14	0.12	0.10	0.17
No. poison baits & trap nights / possum killed	4.4	7.8	3.2	5	4	4.3	3.6	32.6
No. possums killed / ha	0.38	0.33	0.42	0.37	0.26	0.69	0.18	0.20
Costs / ha	$6.19	$5.28	$4.54	$4.22	$5.10	$5.85	$3.42	$10.14
Residual Trap Catch (95% CI)	0	0	0	3.33% (3.32–3.34)	2.53% (0–5.21)	0.85% (0–3.54)	-**	-**

* 55 traps run for 3 nights were used in addition to poison baits in the control of this block.

** Not monitored.

Comparing the trial blocks with the overall control operational areas (Table 5) shows that the numbers of possums killed per hectare in the trial blocks (with the exception of trial 3 "non-treatment" block) was similar to that for the overall area. However, the number of poison baits or traps per possum killed was greater in all three operational areas than in the corresponding trial "treatment" blocks. This was particularly high in the North Taieri Hills area as much of the country was covered in young pine trees and gorse making it difficult country to control. Also, all three operational areas required an extra week's reworking when initial control attempts failed to meet the RTC targets set, partly due to heavy snowfalls affecting the Taieri/Hindon and Owaka operations.

Table 5. Number of possums killed and effort put into the control of the overall control operation areas.

Control Operation	Taieri/Hindon	North Taieri Hills	Owaka
Area (ha)	4,563	3,435	12,010
No. poison baits / ha	1.75	2.04	0.83
No. trap nights / ha	0	8.73	2.08
Total baits & trap nights / ha	1.75	10.77	2.91
Effort (man-hours) / ha	0.25	0.57	0.16
No. poison baits & trap nights / possum killed	6.6	26.9	18.4
Possums killed / ha	0.27	0.40	0.16
Target residual trap catch	2%	3%	3%
Actual residual trap catch (95% CI)	1.11% (0.00 - 1.93)	1.57% (0.56 - 2.58)	1.64% (0.85 - 2.43)

6. Conclusions

The strategy of identifying where possums are present and targeting those possums appears to provide benefits especially in terms of a reduction in toxic baits and traps used. However, as applied in this study it did not reduce costs. For the two blocks where prefeeding provided information on where possums were (i.e., where to place toxic baits), there was no great reduction in cost - in fact, costs/ha were slightly higher, probably because of the extra prefeeding required. However, it did appear to reduce the amount of toxin used.

The Owaka trials did not provide a useful test of the effectiveness of advance information on the whereabouts of possums because rats removed most of the bait. However the trials do highlight large differences that can arise in the absence of information - the three-times higher cost in trial 4 "non-treatment", is we believe, likely to have been avoided with prior mapping of possum presence.

In the "treatment" blocks, identification of possum interference was confounded by not having an effective rat repellent, so the full potential of using this method could not be realised. A more accurate targeting of possums by having a possum-specific detection device would further decrease the number of toxic baits or traps used per possum killed. Nevertheless, even without using a rat repellent or possum-specific device it appears that the amount of toxic baits or traps used can be reduced. The number needed to kill one possum using the standard control method was often 8 or 9 times more than that using the new strategy. This indicates there could be substantial gains to be made from the better targeting of residual possums.

The higher kills per bait used that were achieved in the "treatment" trials could also have been a result of the pre-feeding effect of the flour and sugar bait. In these blocks possums had 2–4 days to find the "prefeed" baits and this would increase the potential encounters of possums with toxic baits or traps. Nevertheless, a large number of baits were either untouched or interfered with by rats or unidentified animals in all trial blocks (Appendix 10.2) indicating that significant savings could be made if "prefeed" baits were laid first to find where the possums were, particularly if rat interference could be eliminated.

7. Recommendations

- Control contractors maintaining low density possum populations should be encouraged to use a method of detecting the presence of possums before laying out poison baits or traps, as this would decrease the quantity of poison or traps used in an operation, and possibly also the risk of unnecessarily high expenditure.

- Further research is needed to develop a detection system that is not confounded by rats, either by developing a better rat repellent or a method for distinguishing between possum and rat interference such as wax blocks. This should be tested in a variety of habitats to determine its cost-effectiveness.

8. Acknowledgements

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10. Appendices

10.1 Detecting possums in low density areas

Area: ... Nth Taieri - "treatment" block..... Date: ..... 3 / 7 / 01 – 8 / 7 / 01 Observer: ..BR..

Control method: .....Feratox.....

Line	Bait no.	"Prefeed" interference	Toxic bait laid	Possums killed & interference	Non-targets killed	Notes
Date:	*3/7/01*		*5/7/01*	*8/7/01*		
W	26	Untouched				
	27	Possum*	Toxic	Untouched		
	28	Possum	Toxic	Untouched		
	29	Rat interf.				
	30	Rat interf.				
	31	Untouched				
	32	Untouched				
	33	Possum	Toxic	Possum kill		
	34	Untouched				
	35	Untouched				
	36	Possum	Toxic	Possum kill		
	37	Untouched				
	38	Untouched				
	39	Possum	Toxic	Possum kill		
	40	Untouched				
	41	Untouched				
	42	Possum	Toxic	Untouched		
	43	Untouched				
	44	Possum	Toxic	Untouched		
	45	Possum	Toxic	Untouched		
	46	Possum	Toxic	Possum kill		
	47	Rat interf.				
	48	Untouched				
	49	Untouched				
	50	Possum	Toxic	Untouched		

* Possum and rat interference may sometimes be confused.

10.2 Fate of baits in four "treatment" blocks as a percentage of total baits.

Bait take	Taieri / Hindon Trial 1		North Taieri Hills Trial 2		Owaka Trial 3		Owaka Trial 4	
	"Prefeed"	Toxic	"Prefeed"	Toxic	"Prefeed"	Toxic	"Prefeed"	Toxic
Possum or rat	65		74		99		98	
Untouched	35	11	23	46	1	4	2	11
Possum		23		31		25		28
Rat		19	3	11		71		61
Unknown fate		47*		12*				

* Baits were totally missing (possibly due to rats) with no dead possums found nearby.

11. Addendum

The Animal Health Board (AHB) Technical Advisory Group (TAG) reviewers raised several questions related to this report and this addendum provides our response to these issues.

1. *A reviewer asked why only 3 rats were tested in the pen trials?*
   The AHB TAG did not support or fund tests of the rat repellents on penned rats but wanted field trials to be carried out. The pen trials carried out focussed on whether possums would eat the flour/icing sugar bait with either repellent in it. Because there were three rats available in the pen facility at the time of the possum trial, we took the opportunity to qualitatively assess how the rats might respond to the different bait types. It was never intended to be a rigorous trial on penned rats.

   The reason our field-trial results (i.e., ineffective rat repellency) contrasted with previous pen-trial results (i.e., a significant repellent effect) is unknown, but one possibility is that when using pens, the rats were tested in individual cages where as in the field more than one rat could visit a bait. So even if there is a 75% reduction in bait consumption by individual rats, with 4 visits by separate rats, as could happen in the field, the total bait could be eaten.

2. *Why did the trial continue without an effective repellent and without discussing the issue with AHB's technical manager?*
   The inclusion of an effective rat repellent was necessary if the trial was to produce a "tool" that could be used throughout New Zealand in a range of habitats. However, the lack of an effective repellent does not preclude testing the detection method in an area where rat numbers were low, provided we assume that a suitable repellent would eventually be found or an alternative detection device that was not affected by rats. We specifically selected sites that should have had (based on past experience) low rat numbers (i.e. farmland with manuka scrub without podocarps). Although there will always be some rats present in any area, we understood from discussions with the contractors that the areas selected did not have high rat numbers. We were also restricted to using areas where contractors were already carrying out possum control. In hindsight we should have discussed this approach with AHB's technical manager before proceeding.

3. *Field study design issues.*

   3.1 Treatment and non-treatment areas were poorly matched, and snowfall hid many toxic baits.
   The treatment and non-treatment areas were selected to be as equivalent as possible, given the variation in habitat on farmland. Three of the 4 areas were paired well, with the fourth area having one block with a greater area of scrub. Even so, the amount of habitat was not an important factor as it was the ratio of baits laid to possums killed that was the key measure. The problem of snow could not have been foreseen (this was exceptional with snow down to sea level in the Catlins).

3.2 There was a prefeed effect in the treatment blocks but not in the non-treatment blocks.

We commented in the discussion that there could have been a prefeeding effect that would increase the kill per bait as opposed to an increased kill because of better targeting of poison or traps. However, the prefeeding effect is actually part of how the sensor works, and by using a palatable "sensor" such as flour and icing sugar, the effective radius of the sensor increases (and therefore the number of possum encounters). Although we do not know how effective a palatable sensor would be relative to an unpalatable one, we can assume that a palatable one would be more cost-effective to use if it has a greater detection radius and detection probability.

The difference in the amount of prefeeding between blocks was due to the terrain and varying amounts of bush between blocks, because prefeed (the trial method) as well as toxic baits were only laid around bush edges and not in the middle of open pasture.

3.3 Why did only 3 of the 4 blocks have residual trap catch (RTC) estimates?

A decision was made to measure the RTCs on only 3 of the trial areas because of funding constraints and because the main measure of success was the number of possums killed per bait or trap used.

Contractors running the trials varied the number of days between checking lines due to unforseen events such as snowfalls and other operational factors. The difference in diligence between some poison operators also contributed an observer effect, which is often a problem in field trials.

3.4 The Taieri non-treatment block had a trap-line but the treatment block did not.

The trapping line in the North Taieri Hills non-treatment block was part of the normal control methods used by the contractors. We had asked that they use their normal control method in the non-treatment block and we would compare it to this trial method of laying prefeed baits in the treatment blocks.

3.5 Why was there a variation in the amount of baits used and in days between prefeeding and placing toxin and traps?

The differences in the amounts of prefeed laid per hectare in the different blocks is a reflection of the differing amounts of bush present in each of these blocks as control is targeted around bush edges and not in the middle of open pasture (see comment 3.2 above).

The variation in the number of days between prefeeding and laying toxic baits was from 2-4 days which is an acceptable time difference for contractors who are maximising their control work over large areas.

3.6 Would an effective rat repellent have reduced the effort/ha or improved the kill per unit effort?

An effective rat repellent may not have reduced the effort/ha or kill per unit effort. That is, any time saved by reducing the amount of toxin to be put out might be balanced by the extra time needed to prefeed. However, it would reduce the amount of toxin used and trapping effort because traps and poison baits would only have been placed where possums were present. This "smart" location of baits and

traps will have the biggest effect on the use of traps because many fewer of them can be carried than poison baits.

In summary:

- The trial was not as effective as it could have been because of an unforeseen failure of two previously identified rat repellents, and because of unexpected high rat numbers in the trial areas.

- The AHB requested that we use contractors as much as possible and "real world" situations to run these trials. This limited the potential trial areas to current possum control operation sites. It also resulted in less control over the implementation of the trial than if it had been all carried out by research staff, because, for the contractors, the trial requirements were subsidiary to their commercial imperatives. In this project we used contractors that were recommended to us by a Vector Manager and who were trustworthy and hard working. We visited the field sites on two occasions and demonstrated the baiting procedure in one of the trial sites. We also provided the contractors with work plans and discussed with them what was required. More frequent monitoring of the operation could have been carried out but this was affected by unpredictable weather with snow preventing the operation continuing during one of our visits. The contractors also had unexpected failures in other operations and chose to redo these operations in preference to moving onto our sites. The contractors were confident they could follow the relatively simple work plan, and therefore for us to force our presence on them would have indicated our distrust of them. This highlights the difficulty of using non-science staff in research trials and the added risks involved in trying to reduce costs for the AHB. Despite all this, we felt the contractors carried out a good job considering the constrictions that their operations, our requests, and the weather placed on them.

- As a result of the repellent failure the outcomes of the trial were inconclusive, however the results indicated that the approach of using a cheap and simple detection method has real merit and has now led to the testing of three "sensors" in a project on mapping possums at low density. It is worth noting that the contractors involved in this project already use such a method where they know possums are at very low density and where they want to minimise the amount of toxin they use. For example, some farms receive no poison or trapping effort when the prefeeding has indicated the absence of possums.

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