A paper from
Proceedings of the 47th NZ Plant Protection Conference (1994)

POSSUM CONTROL IN NATIVE FOREST USING SODIUM MONOFLUOROACETATE (1080) IN BAIT STATIONS

M.D. THOMAS

Manaaki Whenua - Landcare Research, P.O. Box 31-011, Christchurch

SUMMARY

Possum control using baits containing 1080 fed from bait stations (possum feeders) was investigated as a safer and possibly more acceptable method of using 1080 poison in an area where ground access was good. The results indicated that possum populations could be reduced to similar levels to those achieved with aerial application provided the possums were fed non-toxic cereal baits beforehand. If maize or barley were fed beforehand less toxic baits were eaten. Comparisons with aerial application showed that the amount of 1080 used was reduced by over 90% and costs were similar. Costs would increase when terrain became steeper, forest more dense and access more limited.

Keywords: bait stations, 1080, possum control, aerial application, *Trichosurus vulpecula*.

INTRODUCTION

Brushtail possums (*Trichosurus vulpecula*) are a major cause of vegetation damage in New Zealand's forests (Cowan 1991), and there is evidence that they eat native invertebrates and the eggs of endangered birds (Brown *et al.* 1993). Possums are also a major vector of bovine tuberculosis, which they transmit to cattle and deer. There is therefore a need to control possums in many areas. Aerial application of baits containing sodium monofluoroacetate (1080) is the most common method used for large-scale control of possum populations in New Zealand and can successfully remove up to 95% of possums over forested areas as large as 20,000 ha. Aerial application of baits can cover large areas cheaply and quickly, even in remote inaccessible country. There is no evidence that waterways become contaminated using this method (Eason *et al.* 1992), and refinement of the method has significantly reduced risks to native bird populations (Spurr 1991). However, despite the proven environmental safety of the method there is still some public opposition to it. The main concerns are perceived environmental contamination, risks to non-target species, the lack of employment opportunities created and the waste of a natural resource i.e. possum skins.

The delivery of baits containing 1080 from bait stations (i.e., possum feeders that maintain a supply of baits, requiring refilling occasionally) has the potential to address most of these concerns. Bait stations were originally suggested for possum control in exotic forests (Pracy 1964 unpubl. New Zealand Forest Service report) and have more recently been used to control possums on farms (Walker and Hickling 1987 unpubl. Forest Research Institute contract report). This paper examines the suitability of using 1080 poisoned bait fed from bait stations in native forest. It investigates the proportion of possums using the bait stations, the effect of feeding non-toxic baits before poisoning, the suitability of feeding cheaper grains before poisoning, and the ability of the method to reduce possum populations. Some comparisons are also made with aerial application of baits containing 1080.

MATERIALS AND METHODS

All baits used in the trials were 1.5 g " RS5 pellets" (Animal Control Products) which were made predominantly of cereals and sugar. In this paper these baits are referred to as non-toxic when containing no 1080 and toxic when containing 0.15%

1080 wt/wt. The bait stations used in the trials were the "Kilmore Bait Station", which is a plastic container specifically designed to feed possums. It holds 2 kg of baits and is capable of feeding grains as well as cereal baits.

Trials

To determine the proportion of possums eating baits from the bait stations a trial was conducted in April 1992 in a 70 ha area of forest in the Pukenui Scenic Reserve, Northland. A total of 80 bait stations were established 100 m apart on lines 100 m apart (ie. forming a 100-m grid). The bait stations were filled five times over a 10-day period with non-toxic baits coated with Rhodamine-B dye, which marks possums that eat them for at least 7 days (Morgan 1981). Possums were then trapped within the grid and examined for the presence of dye and the proportion of the population eating baits was determined.

The effect of feeding possums non-toxic baits prior to using the toxic bait was evaluated in February 1994 in two study areas in the Waipapa Ecological Area of Pureora State Forest Park. In one area possums were fed non-toxic baits in 99 bait stations four times over a 3-week period (a total of 8 kg/bait station), followed by 600 g of toxic baits/bait station which were left for 1 week. In the other area possums were only fed 600 g of toxic baits which was left in each of 82 bait stations for at least 4 weeks, the same time used for non-toxic feeding plus poisoning in the other area. In both areas the bait stations were spaced in a 150-m grid. The percent kill achieved in the two areas was measured by comparing possum catch from 100 leg-hold traps set for 3 nights before and after poisoning. In the post-poison trapping, trap lines were located in different areas to the pre-poison trapping so that the possums killed before poisoning did not contribute to the kill estimates. The amount of toxic baits eaten was also measured in both areas to determine the effects of feeding non-toxic bait on toxic bait consumption. Both mean trap catch and the mean weight of toxic baits eaten per bait station were compared using t tests.

Both maize and barley were evaluated as cheaper non-toxic alternatives to the more expensive non-toxic baits (($400-600/tonne c.f. $1600/tonne). In December 1993 a total of 97 bait stations were established in a 150-m grid in the Pikiariki Ecological Area of Pureora State Forest Park and filled with non-toxic baits, maize, or barley. They were then checked and refilled a further 12 times over a period of 1 month before being filled with 600 g of toxic baits which were left for a week. Mean consumption of toxic baits per bait station for the three pre-poisoning bait types were compared using ANOVA to indicate which food type produced the most consumption of toxic bait.

Comparison between bait stations and aerial application

The amount of toxic baits used in the Waipapa trial was compared with the amount used in aerial applications where toxic baits are applied at the rate of 5 kg/ha, so that the actual amounts of 1080 used could be compared. All toxic baits not eaten from the bait stations were recovered and were not classified as used.

Approximate labour, bait, and bait-station costs were estimated and compared with costs collated from 15 aerial applications conducted by the Department of Conservation (Warburton 1993, unpubl. Landcare Research contract report). Labour costs used were $13/h plus $5 for overheads or $144/day.

RESULTS

Trials

Of the 143 possums captured on the 70-ha grid in Pukenui Scenic Reserve, 133 (93%) were marked with Rhodamine-B dye, indicating that most possums located and fed from the bait stations.

Possum numbers were reduced to significantly lower levels in the area that was fed non-toxic bait ($P<0.001$, Table 1), and significantly more toxic baits were eaten ($P<0.001$, Table 1) when non-toxic bait was fed beforehand. Similar results were recorded when bait stations were used on farmland (Hickling *et al.* 1991 unpubl. Forest Research Institute contract report).

TABLE 1: Mean consumption of toxic baits with and without pre-feeding of non-toxic baits and pre and post-poison trap catches from 300 trap nights (95% confidence intervals are shown in parenthesis).

Treatment	Mean toxic bait consumption/bait station (g)	Trap catch		% Reduction in trap catch
		Pre-poison	Post-poison	
Non-toxic baits fed beforehand	265 (± 31)	86	2	98 (± 3)
Toxic baits only	90 (± 20)	118	30	75 (± 9)

Feeding maize or barley before toxic baits resulted in significantly less toxic baits being eaten than was eaten when non-toxic baits were fed beforehand ($P<0.05$ and $P<0.001$ for maize and barley, respectively, Table 2).

TABLE 2: Mean consumption of toxic baits from bait stations after feeding possums with non-toxic baits, maize or barley.

Feed type	Mean toxic bait consumption/ bait station (g)	95% C.I.
Non-toxic baits	241	45
Maize	182	39
Barley	157	26

Comparisons between bait stations and aerial application

Bait stations used substantially less 1080 than aerial application (Table 3). One bait station in the 150-m grid covered an area of 2.2 ha, and as the possums ate a mean of 265 g of toxic baits per station (in Waipapa trial) a total of 120 g of toxic baits per ha was used. These results indicate that a reduction of more than 90% over the amount of 1080 currently used in aerial applications is possible when bait stations are used.

TABLE 3: Comparison of the amount of 1080 used in bait stations and aerial applications using 5 kg of toxic bait/ha.

Method	Toxic baits used/ha (g)	Actual 1080 used/ha (mg)
Bait stations	120	180
Aerial application	5000	7500

Costings using bait stations were based on the premise that one person could locate/fill/remove between 10 and 20 bait stations per day, which would involve walking between 1.5 and 3 km (excluding walking to the start and from the end of the line). The amount of visits to the bait stations were estimated as eight. Therefore 8 days would be required to complete possum control using between 10 and 20 bait stations, or 1 day using between 1.25 bait stations and 2.5 bait stations. The 150-m grid allowed each bait station to control an area of 2.2 ha so between 2.7 ha/person/day and 5.5 ha/person/day could be controlled. Using the labour cost estimate of $144/day costs per ha were between $26 and $53/ha. Additional to this are bait costs ($6/ha), and bait station costs ($2.2/ha assuming they can be used for two control operations), giving final costs of between $34 and $61/ha. Mean costs/ha for 15 aerial application operations ranged between $8 to $54 (Warburton 1993, unpubl. Landcare Research contract report) suggesting that the cost using bait stations in accessible forest fell within the mid to upper range of aerial application costs.

DISCUSSION

The results of this study suggest that effective and safer control of possums can be achieved using bait stations containing 1080 poison. There are several advantages of using bait stations:

- The actual amount of 1080 used can be reduced by over 90% from the amounts currently used in aerial applications.
- Baits can be placed at selected locations so that waterways and public-use areas such as roads can be avoided.
- The bait stations are designed specifically for possums, making it difficult for non-target species to eat toxic bait. Access to baits by domestic livestock and ground birds such as kiwi and weka can be prevented by placing bait stations in trees out of their reach.
- Unused toxic baits can be removed from the forest.
- Baits are protected from the rain, so the success of the control operation is not governed by weather as it is with aerial application.
- Baits eaten from bait stations can be used as an indication of possum numbers, and this can identify where possums are reinvading or establishing.
- The method is suited to Government employment schemes such as Taskforce Green as less specialised skills are needed compared to leg-hold trapping or cyanide poisoning which require trained possum hunters.

Research indicates that feeding non-toxic baits before toxic baits attracts more possums to the bait stations rather than inducing individual possums to eat more toxic baits (M. Thomas unpubl. data). The greater consumption of toxic baits after feeding non-toxic baits compared to that when feeding maize or barley was attributed to the higher palatability of the non-toxic baits attracting more possums to those bait stations. The amount and time non-toxic baits were fed in this study was determined from a previous trial which indicated that it took 2 weeks of feeding before all possums were using the bait stations (Hickling *et al.* 1990 unpubl. Forest Research Institute contract report). It may, however, be possible to reduce this, thereby making the method more cost-effective.

Possum use of bait stations is not only dependent on feeding non-toxic bait but also on bait station spacing and both are interrelated (Thomas 1994 unpubl. Landcare Research contract report). When spacing is increased fewer possums find the bait stations although this can be overcome to some extent by increased feeding of non-toxic baits. Further research is required to determine the best bait station spacing and non-toxic feeding combination that will give the most cost-effective control of possums.

Based on present knowledge a recommended operating procedure to use 1080 in bait stations is as follows. Bait stations should be spaced in a 150-m grid located using a compass and hip-chain. They should then be filled with 2 kg of non-toxic baits, left for 1 week, refilled, left for a further week, and then refilled twice in the third week (a total of 8 kg of non-toxic baits). The bait stations should then be filled with 300-600 g of toxic baits (the amount will depend on possum density) containing 0.15% 1080 wt/wt and left for 1 week . If the possums are not fed non-toxic baits or fed maize or barley before the toxic bait, fewer are likely to be killed. Continued control (to prevent reinvasion or natural increase) can be maintained after using toxic baits by filling the stations with anticoagulant baits (Eason *et al.* 1993) such as Talon Possum Bait (ICI Crop Care).

Partly as a consequence of these trials, the Department of Conservation (Waikato Conservancy) chose this method to control possums over a large area (4000 ha) of the Waipapa Ecological Area starting in November 1993. Using bait stations was seen as a safer and possibly more effective alternative to aerial application, which had not achieved adequate possum kills here in the past. The method was also chosen because it was able to use subsidised labour available from the Government. The area contains populations of rare birds (i.e., North Island kokako, North Island kaka, yellow crowned parakeet, New Zealand falcon), and the method was considered a safer alternative to

use in the presence of these birds. In an additional area toxic baits were aerially applied because thick scrub and heavily milled forest made ground access difficult.

This research was undertaken in relatively flat and open forest where road and foot access were good. In steep areas where vegetation is dense and access poor operational costs would increase making the method more expensive than aerial application. Poor access could, however, be overcome to some extent by using helicopters to deliver bait stations, baits and personnel but costs would increase. However, in areas where more controlled use of 1080 is desirable these increased costs may be justifiable. The use of Government subsidised employment schemes such as Taskforce Green may also help to reduce operational costs to control agencies.

The integration of a variety of possum control methods becomes increasingly essential to meet the ecological, economic, and social goals of possum control operations, and new methods are keenly sought. In accessible areas, and those which have a degree of environmental sensitivity, the use of 1080 in bait stations could prove to be a very valuable addition to possum control technology.

ACKNOWLEDGEMENTS

Funds for this research were provided by the Department of Conservation and the Foundation of Research Science and Technology. Thanks to P. McArthur and N. Saunders (Northland Conservancy), J. Mason, K. Broome, and S. Kelton (Waikato Conservancy) and the Taskforce Green group at Pureora led by K. Chalmers for helping with the trials. D. Morgan, B. Warburton, C. Eason, and J. Orwin commented on the manuscript. C. Frampton provided statistical assistance.

REFERENCES

Brown, K.P., Innes, J.G., and Shorten, R.M., 1993. Evidence that possums prey on and scavenge birds' eggs, birds and mammals. *Notornis 40*: 169-177.

Cowan, P., 1991. The ecological effects of possums on the New Zealand environment. Pp 73-89 *In:* Symposium on tuberculosis. *Vet. Cont. Educ. publ. 132*: 73-89.

Eason, C.T., Wright, G.R., and Fitzgerald, H., 1992. Sodium monofluoroacetate (1080) water residue analysis after large-scale possum control. *N.Z. J. Ecol. 16 (1)*: 47-49.

Eason, C.T., Frampton, C.M., Henderson, R., Thomas, M.D., Morgan, D.R., 1993. Sodium monofluoroacetate and alternative toxins for possum control. *N. Z. J. Zool. 20*: 329-334.

Morgan, D.R., 1981. Development of a tracer technique for monitoring bait acceptance in brush-tailed possum (*Trichosurus vulpecula* Kerr) populations. *N.Z. J. For. Sci. 11*: 271-277.

Spurr, E.B., 1991. Effects of brushtail possum operations on non-target bird populations. *Proc. Int. Ornithol. Congr. 20:*: 2534-2545.