

**1080 Apple Baiting for Possum Control:
Risk Assessment and Best Practice**

ANIMAL HEALTH BOARD RESEARCH CONTRACT R-80529

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Contents

1.	Summary.....	2
2.	Introduction.....	4
3.	Background.....	4
4.	Objectives	5
5.	Methods	5
	5.1 Objective 1: Risks to native birds	5
	5.2 Objective 2: Risks to honey bees.....	6
	5.3 Objective 3: Comparison of cost-effectiveness	6
	5.4 Objective 4: Best-practice use and SOP	7
6.	Results.....	7
	6.1 Objective 1: Risks to native birds	7
	6.2 Objective 2: Risks to honey bees.....	9
	6.3 Objective 3: Comparison of cost-effectiveness	9
	6.4 Objective 4: Best-practice use and SOP	10
7.	Discussion and Conclusions	10
8.	Recommendations.....	11
9.	Acknowledgements.....	11
10.	References.....	11

1. Summary

1.1 Project and client

Pest Control Research was contracted by the Animal Health Board to investigate possum control using 1080 apple bait. The research was undertaken between January 2001 and September 2001.

1.2 Objectives

- Assess the risk that apple bait poses to native birds.
- Assess the risk that apple bait poses to honey bees.
- Undertake a comparison of the cost-effectiveness using apple bait in bait stations with aerial application of 1080 cereal and carrot bait.
- Define the best-practice use of 1080 apple bait and write a standard operating procedure (SOP).

1.3 Methods

- Trials were conducted using captive native birds to compare the consumption of apple bait with carrot bait and the consumption of apple bait containing preservatives with apple bait not containing preservatives.
- Honey bees were trained to feed on a sucrose solution. The sucrose solution was then replaced with apple bait. Comparisons were made of the numbers of bees feeding on the sucrose solution with the number feeding on apple bait.
- A comparison of the cost-effectiveness of apple bait used in bait stations with aerial application of cereal and carrot was made using costs gathered from available literature.
- Information for the best-practice use of apple bait was examined and a standard operating procedure (SOP) to use apple bait was drafted using results from this study and information from available literature. Because the label specifications for 1080 solution may require change the addition of apple preservatives has not been listed in the SOP at this stage.

1.4 Results

- Captive kaka, kea, kakariki and silvereye preferred to feed on apple bait than carrot bait with apple making up 74, 77, 96 and 100% of the time spent feeding on bait respectively.
- Captive kaka, kea and weka showed no preference for apple bait with and without preservatives over a 2 week period.
- A total of 738 bees were observed feeding on the sucrose solution and 12 bees observed feeding on the apple bait.
- Costs of the application of apple baits from bait stations was \$19.50 and \$16.90 per hectare for pre-fed and non-pre-fed options respectively. This is in comparison with \$16.20 for aerial application of cereal or carrot bait.

1.5 Conclusions

- The risk to native birds when using apple bait is likely to be higher than using carrot bait.
- There is a minimal risk to honey bees when using apple bait.
- The risk to native birds could be reduced by using apple bait in bait stations.
- Apple bait is not suitable for aerial application.
- The addition of preservatives to apple bait is unlikely to further increase the risk to native birds.
- Application of apple baits in bait stations is likely to be as cost-effective, in areas where access is good, as aerial application of cereal and carrot baits.

1.6 Recommendations

- Apple bait should be used only in bait stations to reduce the risk of exposure to native birds.
- The AHB should consult the Ministry of Agriculture and Forestry (ACVM) to confirm that the addition of preservatives to the 1080 stock solution will require a change in label specifications.
- If a change in label specifications is required (as indicated) further studies should be conducted to compare:
 1. The difference in palatability to possums of apple bait spray-coated with green dye and orange mask with apple sprayed with green dye, orange mask and preservatives.
 2. The difference in the rate of decay of 1080 on unpreserved and preserved apple bait.

2. Introduction

Pest Control Research was contracted by the Animal Health Board to investigate possum control using 1080 apple bait. The research was undertaken between January 2001 and October 2001.

3. Background

The possum control industry is continually seeking more cost-effective ways to control possums on farmland. Apple baits have been used since the 1980's especially in areas where apple can be obtained cheaply, such as the Bay of Plenty. In 1996 the Wellington Regional Council (WRC) began trials where they alternated baits types to overcome bait shyness (Morgan et al. 1996, O'Conner and Matthews 1999). Apple was an addition to their existing bait options of cereal, carrot, and paste. Efficacy trials undertaken by WRC using sliced apple coated with 1080 indicated that it can be highly palatable and is capable of producing high possum kills (Meenken 1998). However, WRC found that the apple rapidly turned brown in warm weather and investigated ways to help overcome this problem using preservatives.

The AHB recognised the value of apple as an additional bait option for possum control but had concerns about risks to non-target animals especially native birds and honey bees. This study was undertaken to assess the risks to native birds and honey bees and to promote best-practice use of apple bait.

The risk of accidental poisoning of non-target species typically involves hazard identification and exposure assessment. The risk of accidental poisoning can be simply expressed by:

$$\text{Risk} = \text{Hazard} \times \text{Exposure}.$$

The hazard that 1080 presents to native birds is well documented and studies have shown that 1080 can kill birds (Spurr 1994). Possum control agencies have very little control over this apart from using alternative toxicants. However, there are no alternative toxicants that are as cost-effective as 1080 (Eason et al. 1994). Control agencies do have control over the risk of exposure of 1080 baits to birds and there are a number of options they can use to reduce this including:

1. Bait formulation - baits can be made of foods that are less attractive to birds and can contain bird deterrents and dyes.
2. Bait size - some birds are more susceptible to small particles of bait.

3. Method of application - exposure is increased using aerial application compared to bait station application and sowing machinery can reduce bait size and expose surfaces of bait that do not have dye or bird deterrents.
4. Controlling the life of the bait - some bait types remain more toxic than others over time.

4. Objectives

1. Assess the risk that apple bait poses to native birds.
2. Assess the risk that apple bait poses to honey bees.
3. Undertake a comparison of the cost-effectiveness using apple bait in bait stations with aerial application of 1080 cereal and carrot bait.
4. Define the best-practice use of 1080 apple bait and write a standard operating procedure (SOP).

5. Methods

5.1 Objective 1: Risks to native birds

Two categories of risk to native birds were identified that required assessment:

1. The risk to native birds feeding on apple bait.
2. The increased risk to native birds from increased exposure to apple bait that contains preservatives.

Risk to native birds feeding on apple bait

This was assessed by comparing the time that captive native birds spent feeding on apple bait with the time the birds spent eating an industry-accepted possum bait i.e. cut carrot. Fresh apple and carrot was cut into pieces weighing approximately 10-25g. The cut apple was spray coated with Bayer V200 green dye and an orange mask following the specifications written in the Department of Conservation (DOC), Technical Series no. 23 (2001). The cut carrot was coated with Bayer V200 green dye and a cinnamon mask again following the DOC (2001) specifications.

Both bait types were presented over a 3 day period in early March 2001 to native birds at Orana Park (Christchurch). The birds were weka (*Gallirallus australis*) (n= 2, ♂ & ♀), kaka (*Nestor meridionalis*) (n = 1, ♂), kea (*Nestor notables*) (n = 4 3♂ & 1♀), kakariki (*Cyanoramphus sp.*) (n = 11, 5♂ & 6♀), kereru (*Hemiphaga novaeseelandiae*) (n=8, mixed sex) and silvereye (*Zosterops lateralis*) (n = large, silvereye were free to fly into and out of the cages).

The normal diet fed to these birds (Ian Adams, Orana Park, pers comm.) includes:

Weka	=	meat mix including egg and bran plus day old chicks and mice.
Kaka	=	fruit and vegetable mix including some carrot.
Kea	=	apple and carrot fed daily.
Kakariki	=	fruit and vegetable mix including some carrot.
Woodpigeon	=	fruit only.
Silvereye	=	as for kea.

Approximately 10 apple baits and 10 carrot baits were placed in piles 50cm apart on the ground to give the birds a choice between bait types i.e. a bait preference trial (Hickling 1997). Birds were observed for at least 6 hours per day and the time (to the nearest minute) that individual birds spent feeding on the two bait types was recorded. Preference for bait types was determined by comparing the total time each species spent feeding on the two bait types.

Risk from an increase in exposure from the addition of preservatives

A trial was conducted to compare the palatability of apple treated with and without preservatives. Cut apple was spray coated with green dye and orange mask (DOC 2001). This was compared with cut apple sprayed with the same solution with the addition of the preservatives.

Once coated the bait types were stored in a cool dark location where they were exposed to daily temperature variations common at that time of year (July). Both bait types were presented to weka, kaka and kea (using the bait preference procedure described above) for three 6 hour periods spaced at 7 day intervals. Comparisons of bait preference were made by comparing the time the birds spent eating the two treatment types over the three bait presentation periods.

5.2 Objective 2: Risks to honey bees

A bait acceptance trial (Hickling 1997) was conducted to assess the risk to honey bees using apple bait spray-coated with green dye and orange mask (DOC 2001). The trial was undertaken at Halswell (Christchurch) in May 2001. Two Petri dishes containing a sucrose solution were placed 1m from 2 active beehives and bees were trained to feed on the solution (Morgan 1999). The number of bees feeding was counted at 5 minute intervals for 1 hour. Then, the sucrose was replaced with apple bait and the number of bees feeding was again counted at 5 minute intervals for 1 hour. This was repeated over a period of 3 days. The risk to honey bees was assessed by comparing the mean number of bees per hour that fed on the sucrose and apple bait over the 3 days.

5.3 Objective 3: Comparison of cost-effectiveness

Cost-effectiveness of possum baiting using apple in bait stations and aerial application using cereal or carrot bait was compared by estimating costs of a theoretical possum control operation in a 144 ha forested area. Costs per hectare using apple bait in bait stations were calculated using information from Thomas et al. (1995), and costs per

hectare for aerial application were calculated using information from Henderson et al. (1999).

5.4 Objective 4: Best-practice use and SOP

Factors to promote the safe and cost-effective use of apple bait for possum control were identified using information from the following sources.

1. Bait registration requirements (Ministry of Agriculture and Forestry 1999).
2. Non-target risks (this study).
3. Best-practice baiting using bait stations (Thomas 1998).
4. Pest Management Services label for 1080 stock solution.
5. Use of 1080 for possum control (DOC 2001).

This information was used to draft a SOP for agencies and contractors undertaking possum control when using apple bait. The information will be presented at the NPCA Technology Seminar for Possum Control at Wellington, 11th and 12th December 2001.

6. Results

6.1 Objective 1: Risks to native birds

Risk to native birds feeding on apple bait

Kaka, kea, parakeet, and weka were observed feeding on the apple and carrot bait while silvereye fed on the apple bait only and tui and kereru did not feed on either bait. With the exception of weka all birds preferred to feed on the apple bait rather than the carrot bait. The proportion of feeding time that kaka spent feeding on the apple was 74%, kea 77%, kakariki 96% and silvereye 100% (Figure 1).

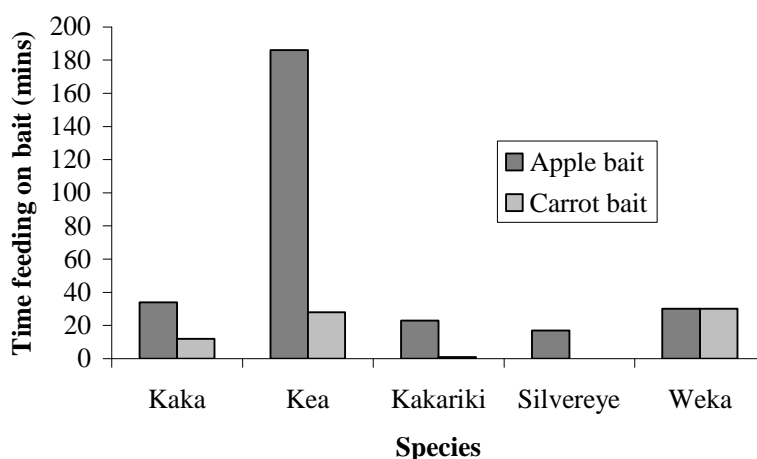


Figure 1. Comparative times birds spent feeding on apple bait spray coated with green dye and orange mask and carrot spray coated with green dye and cinnamon mask.

Risk from an increase in exposure

Only small differences were recorded in the times that birds fed on the apple bait with, and without the preservatives (Figures 2, 3 and 4). The data gave no indication that there was a preference for the preserved apple in the third sampling period. Very little difference was observed between the freshness of the preserved apple and the non-preserved apple until after 2 weeks when the unpreserved apple became noticeably softer. (n.b. the trial was undertaken during cold weather when frosts occurred which may have reduced the rate of decay. Rates of decay could be faster in warmer weather).

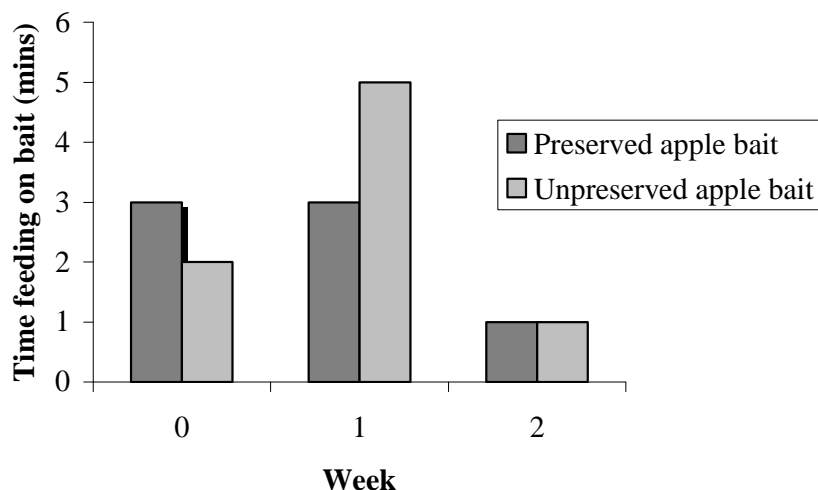


Figure 2. Comparative times that kaka spent feeding on preserved apple bait and unpreserved apple bait during three 6 hour sampling periods.

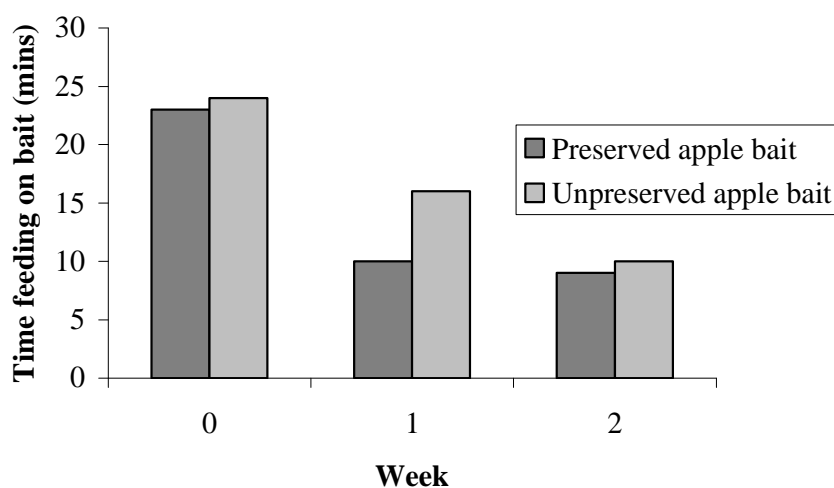


Figure 3. Comparative times that kea spent feeding on preserved apple bait and unpreserved apple bait during three 6 hour sampling periods.

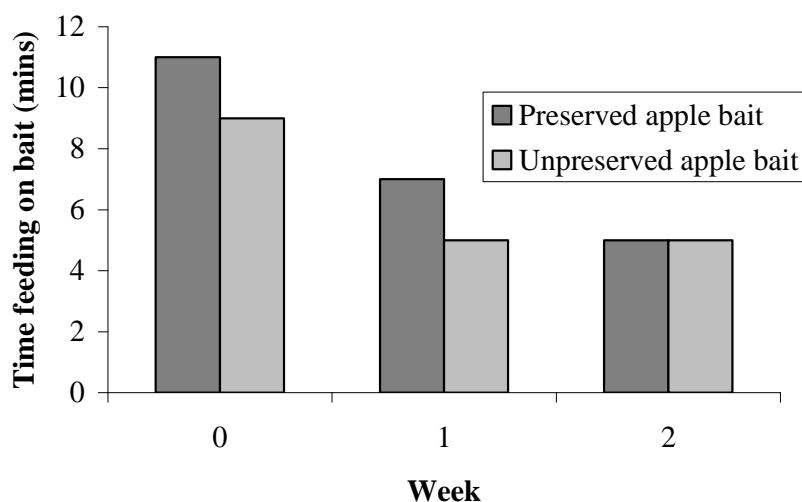


Figure 4. Comparative times that weka spent feeding on preserved apple bait and unpreserved apple bait during three 6 hour sampling periods.

6.2 Objective 2: Risks to honey bees

A total of 738 bees were observed feeding on the sucrose solution while 12 were observed feeding on the preserved apple bait over the three 2 hour/day sampling periods. The mean number of bees observed on the dishes for each 1 hour sampling period was 246 for the sucrose solution and 4 for the preserved apple bait.

6.3 Objective 3: Comparison of cost-effectiveness

Calculated costs for the application of apple baits in bait stations and aerial application of cereal and carrot baits were similar (Table 1).

Costs	150-m grid, prefed	100-m grid not prefed	Aerial application of cereal and carrot bait
Labour	\$1890 (63 km walking)	\$1170 (39 km walking)	–
Bait stations	\$569 (63 @ \$8.50 each)	\$1105 (130 @ \$8.50 each)	–
Prefed apple 1080 apple	\$300 (300 kg @ \$1/kg)	–	–
	\$50 (63 kg)	\$163 (130 kg)	–
Total	\$2809	\$2438	\$2332
Cost/ha	\$19.50	\$16.90	\$16.20

6.4 Objective 4: Best-practice use and SOP

A SOP based on best-practice use of bait stations and apple bait was drafted and presented as a stand alone document suitable for possum control contractors (see the last page of this report). This document will be made available to contractors at the December 2001 NPCA technology transfer seminar. Because the label specifications for 1080 solution may require change the addition of apple preservatives have not been included in the SOP at this stage.

7. Discussion and Conclusions

The risk to native birds is likely to be higher when using apple bait than when using carrot bait but the risk to honey bees is negligible. The result for the native birds is not unexpected as they commonly eat fruits in their diet. Preference for the apple bait may also have been partly due to the use of the orange mask on the apple bait. The cinnamon mask, used on the carrot bait, is recognised as a partial bird repellent (Udy and Pracy 1981) which may have reduced the amount of carrot bait eaten in this trial.

Increased risk to native birds is likely to occur if apple bait is placed directly on the ground and even greater risk if it were applied aerially. Apple bait is not suitable for aerial application because it is softer than carrot bait and more easily fragmented by mechanical sowing buckets (D. Meenken pers comm.). This would lead to an increase in small bait fragments that have been shown to increase bird deaths (Spurr 1994). Fragmentation would expose the undyed white flesh of the apple which could attract birds and the efficacy of surface coated bird repellents would also be reduced (T. Day pers comm.). Therefore, it is recommended that apple baits be used in bait stations only. This is the current method used by WRC (D. Meenken pers comm.).

Results from the comparison of the cost-effectiveness of ground-based possum control using apple bait with aerial application of cereal and carrot bait suggest that where access is suitable for ground-based control apple baits in bait stations would be a cost-effective option.

The licence for 1080 stock solution is held by the Department of Conservation and Pest Management Services. The label defines the use of 1080 solution for use on apple bait. The formulation described on the label is mandatory and the addition of other chemicals e.g. preservatives, is likely to require a change in label specifications (W. Hughes, ACVM, pers. comm.). Approval for such a change would require studies to assess the added risks that the addition of the new chemicals could create. Risks associated with the addition of preservatives to the formulation would require the following studies (W. Hughes, ACVM, pers comm.).

1. A comparison of palatability to native birds using preserved and unpreserved bait through time (undertaken in this study).
2. A comparison of the palatability to possums using preserved and unpreserved bait over time (to demonstrate that the bait is likely to be more effective).

3. A measurement of the reduction in 1080 concentration in preserved and unpreserved bait through time (to demonstrate that the preserved bait will not last for an unacceptable period of time).

8. Recommendations

- Apple bait should be applied in bait stations only to reduce the risk of exposure to native birds.
- The AHB should consult the Ministry of Agriculture and Forestry (ACVM) to confirm that the addition of preservatives to the 1080 stock solution will require a change in label specifications.
- If a change in label specifications is required (as indicated) further studies should be conducted to compare:
 1. The difference in palatability to possums of apple bait spray coated with green dye and orange mask with apple sprayed with green dye, orange mask and preservatives.
 2. The difference in the rate of decay of 1080 on unpreserved and preserved apple bait.

9. Acknowledgements

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Apple Bait for Possum Control

Best-Practice Use

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Apple bait has been shown to be effective for controlling possums and is an additional bait option in areas that require a change in bait base to help overcome bait shyness. Like all baits, apple baits need to be prepared and stored carefully so that possum kills are maximised. Apple bait is highly palatable to some native birds so it should be used only in bait stations. Applying apple bait directly on the ground or aurally using sowing buckets could increase the risk of killing native birds.

Bait stations should be located 50 to 150 m apart and placed 15 cm above ground level. Possums should be pre-fed 1.5 to 2 kg of non-toxic apple bait at weekly intervals for one to three times before toxic bait is used. Non-toxic apple bait should then be replaced with 1 to 2 kg of apple bait that is surface coated with 1080 at the rate of 0.15% wt/wt.

Preparation of toxic apple bait should be undertaken using the instructions and safety precautions as per the label on the 1080 stock solution supplied by Pest Management Services (11 Sunset Terrace, Waikanae). In addition a green dye needs to be added to the solution to give a colour on the apple within the range of 221-267 specified by the New Zealand Standard Specification 7702 (Section 23, Standards Act 1965). Orange oil (Firmenich product 52.596/T, H.E. Perry, Auckland) also needs to be added at the concentration of 0.125% (v/w) to mask the taste of the 1080.