

# POSSUM CONTROL - BAIT STATIONS USING 1080 CARROT/APPLE BAITS (CONTROLLED SUBSTANCES LICENCE REQUIRED)

## EQUIPMENT

### Bait stations

- Key requirements: allows possums easy access, limits access by non-targets, protects bait from the elements, limits bait spillage, doesn't get blockages, holds up to 1.5 kg of bait, easy to fill (and transport when establishing the network), durable and designed for easy attachment. An example of one that fits the criteria is the large Philproof bait station.

### Bait

#### Carrot

- Carrots should be high quality Royal Chantenay variety that has been clean pulled and topped within 4 days prior to the operation. Carrots must be washed and free of foreign objects. Poor quality carrots with stones and foreign objects present can damage the cutter blades and drum, affecting the bait quality and increasing the amount of chaff produced. Fresh carrots are more palatable to possums.
- 1080 carrot bait and pre-feed carrot should be screened so that bait has a mean weight of 6 g or larger. This will ensure that single baits will contain a lethal amount of 1080 for a large possum [1].
- Chaff (pieces < 0.5 g) must be less than 1.5% by weight to reduce the risk of poisoning small native birds [2].
- Use 1080 at 0.8 mg/kg or, preferably, 1.5 mg/kg [3]. Lower 1080 concentrations will reduce possum kills and cause bait-shyness [1], while higher concentrations are not legal and may not be adequately masked resulting in 20-42% of possums eating sublethal amounts of bait [3] with a high likelihood of becoming bait-shy [4].
- Toxic carrot must be dyed to meet NZ standards colour range 221 - 267, using a dye that allows good coverage of the cut bait.
- Lure (i.e. cinnamon, orange) concentrations on baits should be 0.3% wt/wt (also referred to as double lure). The primary purpose is to mask the odour of 1080, that possums otherwise detect [5]. Lower concentrations of lure dissipate within 2 days and can result in reduced possum kills and bait shyness. Higher lure concentrations reduce the palatability of baits [3].
- Only freshly manufactured bait should be used. This ensures high bait palatability, which has a direct influence on success. Possums can easily be made poison-shy if they eat sublethal amounts of bait [4,6].
- If not used immediately, carrots baits may become soft or ferment [7].

#### Apple

- Apples should be of a high quality and fresh to avoid sublethal 1080 poisoning and induction of bait shyness in possums.
- Use 1080 at 1.5 mg/kg. Lower 1080 concentrations will reduce possum kills and cause shyness [1], while higher concentrations may not be adequately masked resulting in 20-42% of possums eating sublethal amounts of bait [3] with a high likelihood of becoming bait-shy [4].
- Toxic apple must be dyed to meet NZ standards colour range 221 - 267, using a dye that allows good coverage of the cut bait.

- Lure (i.e. cinnamon, orange) concentrations on baits should be 0.3% wt/wt (also referred to as double lure). The primary purpose is to mask the odour of 1080, that possums otherwise detect [5]. Lower concentrations of lure dissipate in storage and can result in reduced possum kills and bait shyness. Higher lure concentrations reduce the palatability of baits [3].
- Only freshly manufactured bait should be used. This ensures high bait palatability, which has a direct influence on success. If not used immediately, apple baits may become soft or ferment.

## **Bait preparation**

### Carrot cutting

- Use proper carrot cutting machinery by doing it concurrently with a nearby aerial operation. The key elements are: the machine is well maintained, the grill and cutting blades are sharp, a 28mm grill is used and the size of the holes in the screening drum is approximately 19mm diameter.
- Reliance carrot cutters are known to consistently produce good bait [8]. The type and condition of the carrot cutter used will affect the quality of bait and amount of chaff produced, as will the quality of the carrot and skill of the machine operator.

### Apple cutting

- Cutting apples can only be done by hand because they are not suitable for processing with a carrot cutter.

## **TECHNIQUE**

### **Bait station placement**

- In forest habitats, place bait stations no greater than 150 m (i.e. 1/2.25 ha) apart [9]. The average home range of male possums is 1.9ha and, for females it is 1.3 ha [10]. Bait stations spaced at distances greater than 150 m will reduce the chance of some possums finding bait [11].
- If the terrain is suitable, establish bait stations on grids using GPS to locate each bait station and record its location as a waypoint. In rough terrain, locate bait stations on ridges and spurs with additional lines across the contour where possible to ensure that all possums should be within 150 m of a bait station. Spacing and locations should be established as precisely as possible using GPS.
- Possum movement on to pasture can be greatly reduced by spacing bait stations at 50-100 m intervals along the forest/pasture margins. This spacing is required to expose all possums to the bait [12] and reduce reinvasion. Most possums living in the forest within 200 m of the margin will be controlled 200 m in 1-2 weeks [12]. Many possums will travel to pasture from over 200 m inside the forest [13] necessitating ongoing use of bait stations along the margin if no control is being done further back in the forest (e.g. an aerial 1080 operation).
- Bait stations should be attached to the dry side of trees with the opening 25 -30 cm above the ground to optimise use by possums and avoid rain and water splashing off the ground affecting bait quality.
- Where weka are present bait stations must be at least 1 m above the ground.

### **Effective use of 1080**

- Pre-feeding must be undertaken for at least two weeks. Note: May need to be extended during wet weather or if bait stations have been raised to minimise the risk to non-target

ground dwelling birds. Pre-feeding significantly increases possum kills [9]. It takes at least 2 weeks for most possums to find the bait stations [12]. Pre-feeding results in more toxic bait being eaten at a population level [9] and individually [3], it reduces wariness (neophobia) of possums to toxic bait [3], and reduces the likelihood of 1080 shyness occurring in possums that have survived 1080 poisoning [14,15].

- The pre-feeding should consist of 1.5 kg non-toxic bait per fill for high population levels i.e. > 20% RTC and 1 kg per fill for low population levels i.e. < 10% RTC. Bait stations must be checked regularly during prefeeding to ensure they do not become empty, or the bait has degraded and become unpalatable. There should be a constant supply of pre-feed in each bait station so possums learn that they are a source of food.
- Pre-feed must not be mixed with toxic bait. Remove any residual pre-feed before putting in the toxic bait. Mixing pre-feed and toxic baits can result in possums being sub-lethally poisoned and becoming bait shy.
- The quantity of toxic bait needed will depend on numbers of possums and other non-target pests i.e. rats. 500 g of 1080 bait per bait station is sufficient to control low-density possum populations (<10% RTC). Up to 1.5 kg 1080 bait per bait station will be required at higher possum densities or where high numbers of non-target pests are present. Ideally there will be a small amount of toxic bait left in each bait station after 5 nights, indicating no possums that fed there were denied a lethal dose.
- Regularly check bait stations and top up with fresh toxic bait if needed. Note: It is usually not necessary to leave toxic bait out for more than 5 nights. Most 1080 bait will be eaten on the first night [16].
- At the end of the operation all uneaten bait must be collected and removed from operational area. This reduces the chance of possums being exposed to poor quality bait and becoming bait shy through sub-lethal doses.

### **SPECIALISED SKILLS REQUIRED**

- Only contractors who specialise in possum control using 1080 carrot bait and have a known track record should prepare and apply 1080 carrot bait.

### **SUSTAINING POSSUM CONTROL OVER THE LONG TERM**

- Monitoring outcomes is essential to judge effectiveness of the control programme. Control operations are useless unless outcomes are achieved.
- Pre- and post-operational monitoring is essential to determine the effectiveness of the operation. A comparison of pre- and post- data gives the most robust estimate of the kill result. Post- data cannot reliably be compared between operations.
- Build into costing provision for replacement of lost/damaged bait stations and track maintenance.
- Alternating bait types, toxins, lures and techniques are important in ongoing control programmes. Continuous use of a single pesticide use is not recommended. Changing method/technique completely or changing bait types and toxicants can be effective if 1080 bait shyness is present [4,15]
- Careful recording of the amount of bait used and retrieved can allow better estimates of future needs.
- Reinvansion of possums into controlled areas can be reduced by using natural boundaries e.g. waterways and pasture, and treating buffer zones of at least 3km wide [17].

- High rat numbers may affect the success of the operation. Higher application rates may be needed to compensate for baits eaten by rats.
- While repeated use of 1080 carrot/apple bait can be effective, the technique should not be repeated more frequently than once every 3 - 4 years unless the previous operation achieved a very high kill. Surviving possums are highly likely to be bait shy, making frequent repeated use of 1080 ineffective [18].
- Where kill rates are high, there are few surviving resident possums. Population recovery is more likely to be due to immigration (i.e. possums not previously exposed to 1080).

## LIMITATIONS

- Apple and carrot baits dry out rapidly in hot weather and become less effective.
- The method is labour intensive and relatively expensive in the first year because of initial set-up of lines and bait stations.
- Labour costs increase in difficult terrain.
- Incorrect use of 1080 can cause bait shyness that probably lasts for the lifetime of individual possums and can be significant in a possum population for at least 3 years [19].
- Native birds may be at risk if they learn to feed from the bait stations [20]. The risk to native birds is likely to be higher when using apple bait than when using carrot [21].
- This technique is incompatible with other conservation work that use dogs, e.g. goat hunting, threatened species and predator work.
- Toxic carcasses can wash out of the operational area posing risks to dogs.
- Community views on poisoning can vary, so effective consultation is required.

## REFERENCES

1. Henderson RJ, Frampton CM, Morgan DR, Hickling GJ (1999) The efficacy of baits containing 1080 for control of brushtail possums. *Journal of Wildlife Management* 63: 1138-1151. doi.
2. Batcheler C (1982) Quantifying 'bait quality' from number of random encounters required to kill a pest. *New Zealand Journal of Ecology* 5: 129-139. doi: <http://newzealandecology.org/nzje/1555.pdf>.
3. Henderson RJ, Frampton CM (1999) Avoiding Bait Shyness in Possums by Improved Bait Standards. Landcare Research, Lincoln: LC9899/60. 54 p. doi.
4. Morgan D, Morriss G, Hickling G (1996) Induced 1080 Bait-Shyness in Captive Brushtail Possums and Implications for Management. *Wildlife Research* 23: 207-211. doi: 10.1071/WR9960207
5. Morgan DR (1990) Behavioural response of brushtail possums *Trichosurus vulpecula* to baits used in pest control. *Wildlife Research* 17: 601-613. doi, <http://dx.doi.org/10.1071/WR9900601>
6. Ogilvie SC, Thomas MD, Morriss GA, Morgan DR, Eason CT (2000) Investigation of sodium monofluoroacetate (1080) bait shyness in wild brushtail possum (*Trichosurus vulpecula*) populations. *International Journal of Pest Management* 46: 77-80. doi.
7. Eason C, Wickstrom M (2001) Vertebrate Pesticide Toxicology Manual (Poisons). Department of Conservation, PO Box 10-420, Wellington, New Zealand: 23. 122 p. doi.
8. Batcheler D (1996) Assessment of carrot bait produced by Gibson, Reliance, and Urquhart carrot cutters. Landcare Research, Lincoln: LC9596/52. 10 p. doi.
9. Thomas MD (1994) Possum control in native forests using sodium monofluoroacetate (1080) in bait stations. *Proceedings of 47th New Zealand Plant Protection Conference*: 107-111. doi.
10. Cowan PE, Clout M (2000) Possum on the move: activity patterns, home ranges, and dispersal. In: Montague TL, editor. *The Brushtail Possum: Biology, impact and management of an introduced marsupial*. Lincoln: Manaaki Whenua Press. doi.
11. Thomas MD, Fitzgerald H (1995) Bait-station spacing for possum control in forest. Department of Conservation, Wellington. *Science for Conservation*: 5. 10 p. doi.
12. Hickling GJ, Thomas MD, Grueber LS, Walker R (1990) Possum movements and behaviour in response to self-feeding bait stations. Forest Research Institute, Christchurch. Forest Research Institute contract report: FWE 90/9 unpublished. doi.

13. Green WQ, Coleman JD (1986) Movement of possums (*Trichosurus vulpecula*) between forest and pasture in Westland, New Zealand - implications for bovine tuberculosis transmission. *New Zealand Journal of Ecology* 9: 57-69. doi, <Go to ISI>://WOS:A1986G231300006.
14. Moss ZN, O'Connor CE, Hickling GJ (1998) Implications of prefeeding for the development of bait aversions in brushtail possums (*Trichosurus vulpecula*). *Wildlife Research* 25: 133-138. doi: 10.1071/WR97018
15. Ross JG, Hickling GJ, Morgan DR, Eason CT (2000) The role of non-toxic prefeed and postfeed in the development and maintenance of 1080 bait shyness in captive brushtail possums. *Wildlife Research* 27: 69-74. doi: 10.1071/WR98029
16. Thomas MD (1992) Evaluation of 1080 bait feeders for possum control in small reserves. Department of Conservation. 20 p. doi.
17. Cowan PE (2000) Factors affecting possum reinfestation--implications for management. Department of Conservation, Wellington: 144. 23 p. doi.
18. Henderson RJ, O'Connor CE, Morgan DR (1999) Current practices in sequential use of possum baits. Department of Conservation, Wellington. Department of Conservation Technical Series: 22. 122 p. doi.
19. O'Connor CE, Matthews LR (1999) 1080-induced bait aversions in wild possums: influence of bait characteristics and prevalence. *Wildlife Research* 26: 375-381. doi.
20. Spurr EB. Review of the impacts on non-target species of sodium monofluoroacetate (1080) in baits used for brushtail possum control in New Zealand. In: Seawright AA, Eason CT, editors. *Royal Society of New Zealand Miscellaneous Series*; 1994. pp. 124-133. doi.
21. Thomas MD, Maddigan F, Sessions LA (2001) 1080 Apple Baiting for Possum Control: Risk assessment and Best Practice. Animal Health Board, Wellington: R 80529. 13 p. doi.