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SHORT COMMUNICATION

Early field experience with microencapsulated zinc phosphide paste for possum ground control in New Zealand

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Abstract: In New Zealand we need to develop new control tools for the overabundant brushtail possum, which is an agricultural and environmental pest. In this study we evaluated the performance of a new microencapsulated zinc phosphide (MZP) paste (1.5% w/w nominal conc.) in a captive study and at six North Island field sites. In the captive study 14 out of 16 possums fed MZP paste bait died (87.5% kill ± 8.3% SE) with death occurring on average 165.4 minutes (± 5.5 SE) after first eating the bait. At all field sites relative possum abundance was estimated using a residual trap catch index, and contractors were able to choose their preferred ground-control technique. Pre-feeding non-toxic paste (using 200–320 g/ha) was carried out over 2 weeks with at least one top-up after 7 days. Toxic bait was then deployed using the same baiting regime, and the average decline in possum abundance at the field sites was 82.2% (± 3.2% SE). This trial demonstrates that experienced contractors can get good kills using MZP and a refinement of best practice techniques could further improve control efficacy.

Keywords: Bovine Tb; mammalian pest control; *Trichosurus vulpecula*; vertebrate toxic agent; wildlife management

Introduction

The introduced brushtail possum (*Trichosurus vulpecula*) is a major environmental and agricultural pest in New Zealand (NZ) (Cowan 1998). Browsing by possums contributes to defoliation and mortality of trees (Sweetapple et al. 2002; Nugent et al. 2012), and possums also prey upon (Brown et al. 1993) and compete with (Leathwick et al. 1983) native fauna. Finally, they are identified as the most important wildlife host of bovine tuberculosis (bTB) (Parkes & Murphy 2003).

Currently, the most widely used pesticide for broad-scale aerial control in NZ is sodium fluoroacetate (1080) (Eason et al. 2008) and it is the only non-anticoagulant poison registered for the aerial control of terrestrial vertebrate pests on the NZ mainland (Eason et al. 2010, 2011). However, public opposition to the use of 1080 can be high (Fitzgerald et al. 2000) and there is demand to develop suitable alternatives with minimal non-target species risk. Consequently, ongoing research and development is investigating alternatives.

One such alternative is zinc phosphide (Zn_3P_2). This compound has been used for several decades overseas for the control of rodents (Hood 1972; Twigg et al. 2002) and other animal pest species due to its relatively low risk of secondary poisoning (Casteel & Bailey 1986; Fellows et al. 1988; Colvin et al. 1991; Brown et al. 2002) and lack of environmental persistence (Brown et al. 2007; Eason et al. 2013). Microencapsulated Zn_3P_2 paste bait (MZP) containing 1.5% w/w of the active compound was previously shown to be effective in the field for possum control (Ross & Henderson 2006) and this bait was registered by Connovation Ltd for possum control in NZ in 2011.

Although registration requirements have been met, there is limited field experience of MZP, particularly when compared with established possum control tools, and what few pen trials had previously been carried out were done over 10 years ago (Ross & Henderson 2006). In the time since these initial trials, Connovation Ltd have taken over the manufacture of MZP paste baits and it was deemed necessary by TBfree New Zealand, the agency responsible for the bTB eradication effort, to first confirm the killing efficacy in a pen trial before any field work was undertaken. Accordingly, this paper reports the results of this pen trial and six field trials using the new paste bait formulation.

Materials and methods

Cage trial

Sixteen possums were captured from the wild (in winter 2012) and acclimatised following the guidelines detailed in Duckworth and Meikle (1995). During acclimatisation possums were on two occasions pre-fed 20 g of non-toxic paste. Once acclimatised, all possums were put on half rations for 24 hours (to simulate winter feeding conditions) and then presented with c. 20 g of the MZP paste. Based on a published LD50 of 9.6 mg kg^{-1}, this amount of bait with a nominal toxin concentration of c. 1.5% w/w (see assay details below) is well above the 5 g required as a lethal dose for most possums (Morgan et al. 2001; Eason et al. 2013). All toxic baits were placed in cages in the early evening, and all possums were monitored each hour and continuously videoed to ascertain the time to onset of poisoning symptoms and death.

Field trials

A total of six field trial sites (chosen in discussion with TBfree New Zealand) were monitored for possum abundance (in autumn 2013) before the trials started (Fig. 1). Sites one to four were in Northland, sites five and six located just north of Wairoa in northern Hawke's Bay. The relative possum abundance was measured pre- and post-poisoning using residual trap catch index (RTCI) (NPCA 2011), which indicates the number of possums trapped per 100 trap nights after adjustments are made for traps being 'sprung' or catching non-target species. Possum control using MZP was carried out by accredited pest control contractors.

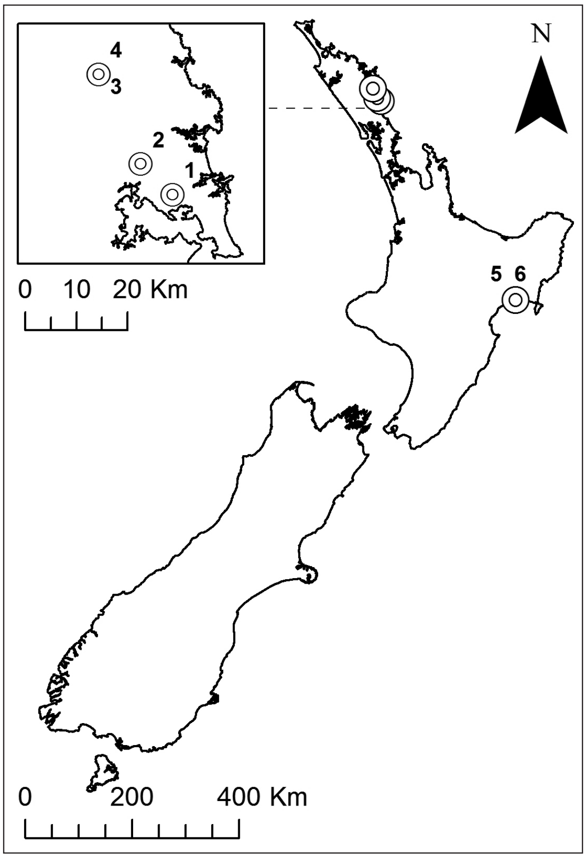

Figure 1. Location of study sites in the North Island, New Zealand.

Non-toxic pre-feed was put out to encourage subsequent uptake of toxic bait and the contractors were allowed to use their preferred ground-control technique. Consequently, a variety of different bait station designs were used among sites and these are detailed in Table 1. In Northland, each Striker station contained 18 g of pre-feed and each Bio Bag contained 20 g. Both sites in northern Hawke's Bay were set up with Sentry bait stations. Mini Philproof and Sentry bait stations were each loaded with approximately 200 g of pre-feed on the first pre-feed and then topped up where needed on the second pre-feed. Where mini Philproof and Sentry bait stations were used, these were placed at approximately one bait station per hectare. Where Strikers and Bio Bags were used, these were placed out with approximately 16 Bio Bags or Strikers per hectare. Accordingly, 200–320g ha^{-1} of pre-feed was initially put out and then topped up once after 7 days and left for another 7 days. Following pre-feeding, all non-toxic bait was removed and replaced with toxic bait following the same baiting regime. At site three there was high rodent interference so the non-toxic pre-feed was topped up twice, at 3 and 7 days.

Contractor feedback

The ease of use of MZP was discussed with the contractors in an effort to ascertain best practice techniques. Contractors were also asked to comment on the label instructions and detail any other information that they thought should be included for future training courses.

Subsamples of the MZP were assayed by Landcare Research Ltd and found to contain an average of 1.41% ± 0.14% (95% CI) w/w zinc phosphide active (Brown et al. 2007).

Results

Fourteen of the 16 possums fed the MZP paste bait died (87.5% kill ± 8.3% SE). Twelve of these 14 possums ate all the MZP paste provided and most animals became quiet and subdued c. 50–90 minutes after consumption, with death occurring on average 165.4 minutes (± 5.5 SE) after first eating the bait. Two of the 16 possums ate none of the MZP paste and at the conclusion of the trial were euthanased in line with our animal ethics permit.

The relative possum abundance at all sites was markedly

Table 1. Estimated percentage reduction in possum trapping rates following control with microencapsulated zinc phosphide at six North Island field sites.

Region (Site)	Size (ha)	No. of lines	Bait Station Type[1]	Contractor[2]	Pre-trt RTCI (%)	Post-trt RTCI (%)	Reduction (%)	SE (%)
Northland (1)	38	3	Mini-Philproof & Striker	Calm	9.00	1.11	87.66	1.38
Northland (2)	48	4	Bio bags	Calm	31.08	3.39	91.82	0.82
Northland (3)	300	10	Mini-Philproof	Calm	11.85	2.01	83.03	1.67
Northland (4)	65	5	Striker	Calm	30.89	4.77	84.42	1.08
Hawkes Bay (5)	50	4	Sentry	Absolute	16.81	5.00	70.00	1.16
Hawkes Bay (6)	225	10	Sentry	Absolute	20.13	4.75	76.39	1.61

[1]Four different bait stations were used in the trials. Striker bait stations & Bio bags supplied by Connovation Ltd (Auckland), Sentry bait stations supplied by Pest Control Research Ltd (Christchurch) and Mini-Philproof bait stations supplied by Philproof Pest Control (Hamilton).

[2]Calm = Calm Contracting, Absolute = Absolute Pest Control

reduced (Table 1), with an overall average estimated kill of 82.2% (± 3.2% SE). The highest percentage reduction in possum abundance was achieved at site two, where Bio bags were used.

The contractors indicated that Striker bait stations and Bio bags were easier to set up in steeper terrain and easier to use when disposing of bait compared with the other bait stations that had to be physically cleaned. Feedback related to safety was that the current label instructions were clear and concise, and that the containers should always be opened in well-ventilated areas.

Discussion

The pen trial indicated that the new MZP paste formulation was palatable, readily consumed, and efficacious with an 87.5% kill (± 8.3% SE). The average time to death was within that expected for zinc phosphide as reported overseas (Parton et al. 2006) and also consistent with earlier trials using captive possums in NZ (Ross & Henderson 2006). The high level of kill achieved in the pen trial was confirmed in the field with an overall mean kill of 82.2% (± 3.2% SE) and all RTCI post-monitor levels ≤ 5%.

The results from the Northland trials are consistent with those found in initial trials using an earlier MZP paste formulation made by a different company, where the RTCI values were consistently reduced by 80–90% (Ross & Henderson 2006). The percentage reduction was lowest in the Hawke's Bay region where Sentry bait stations were used; however, less bait was put out compared with some of the Northland sites. It is possible that either the bait station design or the amount of bait put out resulted in lower kills at these sites, but the study design does not enable us to formally test this.

In conclusion, the contractors reported that the current label instructions are clear, but stressed the need to open containers in a well-ventilated area. This is already stated on the product label, and will be further emphasised at the point of sale by Connovation Ltd. In terms of best practice, we are currently unable to recommend any individual ground control technique. What we can conclude from this trial is that contractors are able to get good kills using their preferred ground-control technique. Determining best practice was not a goal of this study and this would require a more robust experimental design with replication of each baiting technique.

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