Managing Rodents On The New Zealand Mainland: What Options Are Currently Available Summary Of A Work

Encapsulated sodium nitrite as a new toxicant for possum control in New Zealand

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Published online: 14 April 2016

Abstract: Sodium nitrite ($NaNO_2$), a commonly used food preservative, has been researched in New Zealand for the control of brushtail possums (*Trichosurus vulpecula*). In sufficiently high doses, $NaNO_2$ is toxic because it disrupts circulatory transport of oxygen. As $NaNO_2$ is very bitter, encapsulation and mixing it through a highly palatable bait formulation is necessary to effectively deliver it to target pest species. In no-choice cage trials, 12/12 possums consumed a lethal dose of toxic paste bait and died on average after 95.6 minutes (±4.9 SE). In two-choice cage trials 7/8 possums consumed a lethal dose of toxic paste bait and died on average after 96.7 minutes (±11.4 SE). Two field trials targeting possums using this toxic paste in bait stations reduced their abundance by 81.2% (± 2.5% SE) and 72.7% (± 1.6% SE) respectively. $NaNO_2$ paste, known as BaitRite, has been registered in New Zealand as a vertebrate toxic agent for controlling possums.

Keywords: brushtail possum; methaemoglobin; methaemoglobinaemia; $NaNO_2$; vertebrate pesticide

Introduction

In New Zealand, common brushtail possums (*Trichosurus vulpecula*) are a threat to native biodiversity, through the damage they cause to flora and fauna (Innes et al. 2004; Glen et al. 2012; Nugent & Morriss 2013). They also threaten the primary sector through their role as the main wildlife vector of bovine tuberculosis (*Mycobacterium bovis*) (Coleman & Caley 2000; PCE 2011). Possums are controlled with a variety of traps and toxins, including ground-based control with the toxins cyanide, brodifacoum and cholecalciferol, as well as aerial control with sodium fluoroacetate (1080). Control work is often undertaken on or in close proximity to farmland. When these operations are undertaken, there is therefore a risk of secondary poisoning to non-target species, including working dogs, from carcasses of poisoned possums (Meenken & Booth 1997; Eason 2002; Eason et al. 2011). Research to minimise this risk has focused on developing vertebrate toxic agents (VTAs) that have low residue, low risk to non-target animals, and animal welfare as a key consideration (Morgan et al. 2013; Eason et al. 2014; Shapiro et al. 2016b).

One compound researched for possum control has been sodium nitrite ($NaNO_2$), an inorganic salt commonly used to add colour and flavour to food for human consumption and as an antimicrobial agent in cured and processed meats (Binkerd & Kolari 1975; Hord et al. 2009). The chemistry and toxicology of $NaNO_2$ is well understood due to the numerous documented cases of accidental poisoning of humans and animals (Counter et al. 1975; Bradberry et al. 1994; Gautami et al. 1995; Vyt & Spruytte 2006). $NaNO_2$ has also been researched as a potential VTA for feral pigs (*Sus scrofa*) (Sullivan 1985; Cowled et al. 2008; Shapiro et al. 2016a). Research in New Zealand expanded on that of Cowled et al. (2008), carried out in Australia, and investigated the utility of $NaNO_2$ as a potential control tool for possums and feral pigs.

$NaNO_2$ has been referred to as a red blood cell toxicant (Eason & Ogilvie 2009) due to its mode of action. The protein haemoglobin, found in red blood cells and responsible for oxygen transport, has an alternate form called methaemoglobin (MetHb) and normally accounts for less than 2% of the total haemoglobin circulating at one time (Fan et al. 1987; Bradberry 2011). Ingestion of $NaNO_2$ causes an elevation in the levels of MetHb (Beutler & Mikus 1961) and in high enough doses this leads to methaemoglobinaemia. Chui et al. (2005) describe methaemoglobinaemia as the potentially fatal condition where the oxidation of haemoglobin to MetHb negates its ability to bind and transport oxygen. Levels of MetHb >20% of total haemoglobin are usually asymptomatic (Bradberry 2011). At levels higher than this, symptoms of methaemoglobinaemia appear and, in humans and possums, include a bluish grey skin colour, lethargy, cerebral anoxia, chocolate-coloured blood, irregular breathing, loss of consciousness. Levels above 80% can be fatal (Fan et al. 1987; Brunning-Fann & Kaneene 1993; Fisher et al. 2008). The treatment of methaemoglobinaemia as outlined by Umbreit (2007) commonly involves the infusion of methylene blue, a compound routinely used to treat nitrate poisoning in cattle (Bolan & Kemp 2003). Following treatment with methylene blue, a rapid improvement is usually seen 30–60 minutes after its administration (Chui et al. 2005).

Lapidge and Eason (2010) noted from previous research that the lethal doses for humans, rats, and pigs, administered $NaNO_2$ by oral gavage, were approx. 100 mg/kg. Based on this, a 3-kg possum would require 300 mg of $NaNO_2$ for a lethal dose; however, this figure is based on oral gavage not delivered in bait. For the research reported here, we wanted to ensure there was a low chance of sub-lethally dosing possums and our aim was to exceed the oral gavage lethal dose several fold, paste baits containing 10% w/w sodium nitrite were trialled.

The low palatability of $NaNO_2$ was observed in early cage trials carried out by Shapiro et al. (2009), where raw $NaNO_2$ (10% w/w), mixed in paste bait, was fed to possums. Only four out of 12 possums consumed any bait, and in each case it was insufficient for a toxic effect to be observed. A proprietary encapsulation technique (Connovation Ltd) was applied to

occurred when accurate faunal records were available. Essentially there are two principal strategies for the management of alien rodents. . about the control of alien invasive rodents is derived from work done by New Zealand scientists. Sustained control of rodents on the New Zealand mainland generally integrates.Executive Summary. . The work was commissioned by NZ Native Forest Restoration Trust in June , the aim of this plan is to expand on the current management plan for the To propose control options for key pest species on Purple Peaks Curry and cats, followed by pulsed baiting of diphacinone for rodents.Widespread eradication of most pest species on the mainland is impractical in to be done in order to determine if the pest control is working and the desired . Steve Allan Possum traps are also good at catching rats. Poison baits are currently being developed for mustelids, and should be available in the near future.Appendix 2 Pest Management Association of New Zealand Draft Code of The Ministry for Primary Industries is supporting the phasing out of glueboards by working a review of available methods that could replace glueboard traps for rodent currently-permitted users of glueboards to clarify the present situation.have current wild or feral populations confirmed in duced mammals, the strategic and tactical options to Keywords mammals; New Zealand; management; . accidentally (rodents) are already present, but there .. widespread species on the mainland to be eradicated, methods available all determine which control.Environment are available at: amazing-learning.com Page 3. 3. 3. Contents. Commissioner's overview. 5. 1 . An ideal method for controlling possums, rats and stoats would kill them options held promise for a time, but research funding has stopped due to lack .. New Zealand mainland is currently not and may.Managing rodents on the New Zealand mainland: what options are currently available?: summary of a workshop session at the Department of Conservation.This system might work best along the more-or-less of mammal pest management in New Zealand (Parkes & taxa to be managed, the strategic options for management, the eradication on islands, mainland eco-sanctuaries and large- .. Aerial baiting is the only tool currently available that is capable.populations of rabbits, rats, mice, possums, deer, goats, chamois and tahr As the following brief summary explains, there are other Most regions in New Zealand have prepared Regional Pest Management Strategies that . significantly reducing wallaby numbers and two baits are available for wallaby control.support for improving many of the currently available tools, which they are . Introduced vertebrates have been managed in New Zealand for close to a thinking and novel approaches to address pest control issues on the New Zealand mainland .. option for aerial control of rodents, although they stated that diphacinone.Monitoring the environment and controlling predators is vital for kiwi conservation . Many resources are available to support this work. Ship rat, stoat and possum control on mainland New Zealand. Published in this document is an overview of mainland control efforts of ship rats, stoats and possums the most.Now the country has a more ambitious goal: eliminating invasive rats, Call The Pied Piper: New Zealand Wants To

Get Rid Of Its Rats. "but we believe if we all work together as a country we can achieve it." Toggle more options damned mustelids, all the rats, all the possums from the mainland.KEY WORDS: eradication, invasive species, management, rodent control, rodents, United States, around the world (Long) both on mainland settings.