

NEW TOXIN RESEARCH

Collaboration between Lincoln University, the private sector, Otago and Auckland Universities, the Department of Conservation, Regional Councils, Pest Control Professionals and Community groups coupled with AHB and FRST support is accelerating the development of new toxin research and new product registrations.

New Zealand has few native mammals, but many introduced mammals, which cause problems as predators and grazers on native flora and fauna.

Our wildlife evolved in the absence of mammalian predators and birds have been particularly affected by the introduction of non-native predators, with over 40% of the pre-human land bird species now extinct, and the proportion of birds classed as threatened one of the highest in the world. Toxins are used to mitigate conservation problems caused by the impact of rodents and other introduced species, such as possums in New Zealand and foxes in Australia, on indigenous plants and animals in unique ecosystems and island habitats. They have been used successfully to conserve endangered species and eradicate rodents and other introduced mammals to protect populations of endangered indigenous birds and other animals on islands around the world.

Despite the need for effective tools for conservation and protection of agriculture from pest impacts, over the last 50 years the number of vertebrate pesticides registered worldwide has plummeted and there has been negligible international investment in improved rodenticides since the 1970s. New Zealand has therefore become heavily reliant on anticoagulants and 1080 (sodium fluoroacetate) for broadscale pest control. However, 1080 use is often unpopular, and second-generation anticoagulants bioaccumulate and have resulted in wildlife contamination. They are very persistent and have been detected in a range of non-target species including game and native birds. In the face of increasing incidence of brodifacoum contamination of wildlife and secondary poisoning in New Zealand and overseas, there is increasing demand for alternatives to this toxin for field control of rodents, predators and possums.

Animal poisons fall into two classes: non-anticoagulant and anticoagulant agents. Non-anticoagulants include sodium fluoroacetate (1080), first used in the 1950s. Despite over 50 years of research, practical experience, and refinements in quality assurance, application rates and safety procedures, 1080 use is still embroiled in controversy and polarized debate. It is against this background of vehement disagreement that a team of scientists and industry associates has been assembled under Lincoln University leadership to “move pest control to a whole new paradigm”.

Warfarin, the first anticoagulant rodenticide was developed in 1948, following the identification in the 1930s, of coumarins as the causative agent in hameorrhagic disease in cattle. Further first-generation anticoagulant rodenticides were developed in the 1950s and 60s: Pindone has proved most effective for rabbit control; Diphacinone is more toxic than pindone and is registered for field control of rodents. First generation anticoagulants do not bioaccumulate but second-generation anticoagulants

do.

Developed in the 1970s brodifacoum is the most well known second-generation anticoagulant and has been used successfully in many rodent eradication programmes on offshore islands to protect and provide havens for populations of endangered indigenous native birds. Brodifacoum (Pestoff®) is also used for possum control but there are cautions regarding repeated field use as it is persistent and residues can transfer through the food chain.

Research on biocontrol of vertebrate pests remains an important and major focus. However there is a gap between conventional poisons and the hopes for the future that needs to be filled. In response to issues with the use of 1080 and brodifacoum, a momentum has been developed to enable the introduction of alternative toxins, baits and delivery systems within 1-6 years for the control of possums, predators, rodents and rabbits.

Feratox® cyanide pellets were registered in 1997 to increase the effectiveness of cyanide for possum control. Cyanide does not cause secondary poisoning of dogs and it is favoured by some who oppose the use of 1080. Cholecalciferol (vitamin D₃) was also developed in the 1990s and is now registered in Feracol® paste bait for possums and rodents, Pestoff DECAL Possum Bait® and No Possum gel®. There is low risk of secondary poisoning of dogs, and birds are much less susceptible to cholecalciferol than to 1080, but current baits are deemed expensive.

New tools, which build on some of the advantages of “low residue” poisons like cyanide require approval from both the Environmental Risk Management Authority (ERMA) and the New Zealand Food Safety Authority (NZFSA); consultation with Maori is a prerequisite, and welfare considerations are a key component of the registration assessment process as well as the need for demonstrating effective control of pests with minimum non-target impacts. Past experience amongst commercial partners gained in the introduction of cholecalciferol, diphacinone and the development of Feratox® underpins the new initiatives.

The new tools pipeline includes:- i) Products that contain vertebrate pesticides already in use in NZ ii) Products that contain vertebrate pesticides NOT already in use in NZ iii) NZ registrations of a new generation of vertebrate pesticides

Effort to extend existing registrations has focused on cyanide, because, in appropriate doses cyanide kills possums humanely without risk of secondary poisoning. Feratox® is now also under development for control of wallabies. Product license approval from NZFSA for its use on Dama wallabies was obtained in August 2009, following successful field trials with the Department of Conservation in January 2009. Further field work in 2010 will be needed before its registration for Bennett’s wallabies and work continues to produce effective formulations of Feratox® for ferret control.

New “low residue” poisons - zinc phosphide and a combination of coumatetralyl and cholecalciferol are being developed in new multispecies bait formulations to target both possums and rodents. These are being developed as potential alternatives to 1080 and brodifacoum, respectively, and are effective for possum, rodent and rabbit control with low secondary poisoning risks and limited environmental persistence. Zinc

phosphide has been favoured for field use in the USA, as well as in Australia, China and the Asia-Pacific region for field control of rodents and some larger pests. It is quick-acting in possums, rabbits and rodents and would make a suitable back up to 1080. Zinc phosphide dossiers have been submitted to NZFSA and ERMA and reached the “publically notifiable” phase of the process in July 2009. The first zinc phosphide containing product could be available in 2010, subject of course to ERMA approval. Less expensive formulations of cholecalciferol should also be well advanced in 2010. All these developments will hopefully go some way to reducing the pressure on 1080.

In parallel, efforts to complete the registration of completely novel humane poisons e.g. para-aminopropiophenone (PAPP) - a new poison for control of stoats, has accelerated. Recent progress, following field trials in 2008 (stoats) and June 2009 (cats), has been rapid. PAPP dossiers for chemistry and manufacturing, toxicology, efficacy, ecotoxicology and non-target impacts, and welfare were filed with the NZFSA in 2008 and ERMA in 2009. The toxic effects of PAPP are due to rapid formation of methaemoglobin. High methaemoglobin levels reduce the red blood cell's ability to carry oxygen. Hypoxia and central nervous system depression precede death. Mammalian carnivores appear to be much more susceptible than birds, so PAPP potentially has some degree of target specificity. PAPP paste has the potential to become the second vertebrate pesticide product designed with humaneness as a primary consideration and the first new compound to be developed for 30 years. It could become an important tool for stoat control and kiwi protection, is humane, not persistent, has an antidote and does not cause secondary poisoning.

New initiatives in a FRST programme entitled “Pest Control for the 21st Century” which started on the 1st October 2009 include screening of PAPP analogues with a similar mode of action for rodents and possums and identifying other “red blood cell toxicants” and alternative active ingredients which cause a rapid death through central nervous system anoxia or rapid heart failure. Looking to the future, we anticipate more and better control tools combining “low residue” characteristics with humaneness. Our aim is to replace conventional and unpopular poisons with innovative biologically sound alternatives, enabling better management of biosecurity risks, thus reducing or eliminating community conflict over 1080. In fact we will produce the first major advance in mammalian pest control since the 1980s. A new generation of toxins and associated delivery methods will be developed, designed to minimise the impact of invasive animals on the environmental, economic, social and cultural well-being of New Zealand.

We have assembled the best possible team in New Zealand to carry out this research working on five interrelated objectives - the development of new, smarter delivery system materials for the toxicants; the identification of physiological weaknesses in pest animals and the exploitation of these with new, active toxicant ingredients; selection of active ingredients for potency and bioavailability; the exploration of naturally occurring sources of New Zealand toxic compounds and the development of product specifications that satisfy tikanga Maori; and the investigation of promising materials in laboratory, pen and field trials in association with national and international collaborators.

Over the last three decades considerable effort has been put into improving and refining the use of 1080. We are now moving to a time for new product registration advancement. Extensive registration dossiers have been filed for microencapsulated zinc phosphide (MZP) for possums, Feratox® for wallabies, and *para*-aminopropiophenone (PAPP) for stoats with ERMA & NZFSA, and more will follow. PAPP reached the “Publicly Notifiable” stage in the ERMA review process on the 11th December and we hope to have this first cab off the rank in 2010 subject to ERMA.

A suite of more effective and acceptable tools is being developed, to reduce over reliance on 1080 and to provide greater flexibility. There is now an intense focus on delivery of alternatives within 1-6 years through the new consortium, coordinated through Lincoln University.

However, there are no “silver bullet” replacements for 1080 but having a range of tools and alternative more acceptable toxins and traps will certainly take the pressure off 1080 use.

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