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PEST ROOKS

MONITORING AND CONTROL

PRODUCED BY National Pest Control Agencies

ABOUT NPCA

This document was published by NPCA (National Pest Control Agencies) which, until part way through 2018, provided a co-ordinating forum for agencies and stakeholders to address vertebrate animal pest control in New Zealand. In 2018 its role was largely taken over by the Ministry for Primary Industries.

PUBLICATIONS

Most of NPCA's publications on animal pest control were partially updated in April 2018 and transferred to the library section of the Ministry for Primary Industries' 'BioNet' online portal. The updates reflect the transfer and also acknowledge the change in the regulatory regime during 2017 and 2018, while not fully incorporating these changes in the interim, pending further reviews of the publications. Written by experienced practitioners, the main titles cover:

- best practice guidelines on controlling and monitoring vertebrate pests; and
- information about relevant regulations.

The transferred publications can be found at www.bionet.nz/library

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MONITORING AND CONTROL

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AMENDMENTS IN THIS EDITION

This April 2018 edition has been updated as part of an interim generic review of most NPCA publications. The purpose is twofold.

» Firstly, to reflect the substantial change in the regulatory regime relating to Health and Safety and use of VTAs (Vertebrate Toxic Agents) in the workplace, which now both sit under the Health and Safety at Work Act 2015, and associated regulations.

» Secondly, to change links to other NPCA publications and contact details now that NPCA's publications have been transferred to the BioNet portal, run by the Ministry for Primary Industries.

The full nature of the regulatory changes have NOT been fully captured here, and users are directed to the source legislation and website information provided by the various administering agencies.

This interim review is intended to be followed up more fully in due course.

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PART 1. INTRODUCTION

1.1 Purpose

These guidelines were commissioned by the regional councils' Biosecurity Managers Group to provide standardised guidelines on the practical and regulatory aspects of rook control and monitoring. Standardising best practice is expected to contribute to the efficient implementation of regional pest management strategies on rooks.

The primary audience for these guidelines are the field staff and contractors responsible for designing, undertaking and reporting on rook control and monitoring programs.

The guidelines allow flexibility for ongoing innovation and the tailoring of operational design to the behaviour of colonies of rooks.

1.2 Scope

Regional councils have primary responsibility for rook control in New Zealand. At the strategic level, policies and goals are set in each regional pest management strategy. These goals are then pursued via annual plans, which dictate when and where control and monitoring will be carried out. This guidelines document is not intended to provide guidance at these strategic levels.

Based on each council's annual plan, staff and/or contractors will be allocated specific responsibilities for the control and monitoring of rooks, which will involve operational preparation, fieldwork and reporting. It is these elements that constitute the scope of this guidelines document.

The degree of detail in these guidelines depends on the degree to which the particular topic is specific to managing rook populations. Generic requirements, such as a safe handling procedure for off-road motorcycles, are not included. However, the procedure for preparing rook bait is specific to rook control so the related procedures and safety considerations are included.

1.3 Layout

The guidelines are divided into three parts:

1. **Biology and Impact of rooks as a pest species**. The biology and habits of rooks are described, which provide the basis for the nature and timing of the control and monitoring options outlined. Impacts on primary production are also discussed.

2. **Control of rooks**. Best practice guidelines are presented on operational preparation, field deployment and reporting.

3. **Monitoring of rooks**. Best practice guidelines are presented on design, deployment and reporting.

1.4 Acknowledgements

Thanks to the expert working group involved in the preparation of these guidelines. We respectfully acknowledge the late Peter Nelson, whose previous contributions to the industry provided much of the basis for this document.

PART 2. BIOLOGY AND IMPACTS OF ROOKS

2.1 Biology

Introduction

The rook (*Corvus frugilegus*) is black, with a violet blue glossy sheen. It is approximately 50cm long and weighs 350–500 grams. Adult birds are typically crow-like in appearance, and can be distinguished from younger rooks by conspicuous greyish-white bare skin at the base of the beak. In juveniles this area is feathered in the first year, diminishing during the second year until just a few feathers remain at the base of the beak.

History and habitat preferences

Native to Europe and Great Britain, rooks were brought to New Zealand by early settlers and liberated by acclimatisation societies from 1862 to 1874. Rooks are now well-established in many parts of lowland New Zealand and continue to spread to new areas. They have been present the longest, and reach highest densities, in areas climatically suited to the growing of cereals and other extensive field crops and where there are also suitable nesting trees. Suitable trees are mostly eucalyptus and pines but elms, oaks, walnuts, poplars, Norfolk Island pines and wattles are also used. All tend to be trees that provide unrestricted views over the surrounding countryside and are often sited near streams or watercourses where birds regularly drink.

Food and feeding

Rooks show a strong field preference[1] for cereal crops at all stages; for crops of emerging maize, pumpkins and potatoes; for recently cultivated land; and for walnut trees. They generally avoid fields of pasture and many forage crops (again based on the proportion of that land type present), although foraging on pasture provides much of their food.

Rook foods and feeding have been studied in detail in Hawke's Bay and much of this information is relevant where the species occurs elsewhere in New Zealand. In Hawke's Bay, gizzard contents taken throughout the year from rooks foraging on a wide mix of pastoral and cropping land contained a diverse range of foods but were dominated by fly larvae and adult beetles in the summer months and by earthworms during all but the driest or coldest months. In addition, walnuts and acorns were eaten in autumn and winter; cereals and peas in late summer, autumn and winter; carrion from the carcasses of stock; and grass and clover throughout the year. Food fed to nestlings was confined largely to invertebrates.

Rooks change their diet and feeding sites when preferred invertebrates move deeper into the soil and become less available, particularly during dry summers and cold winters. At such times, they often take cereals from stubbles and from grain trails laid for stock.

Daily and seasonal activities

Rooks are highly gregarious birds. They establish permanent breeding rookeries and night-time winter roosts (sleeping sites), which they maintain for many years unless disturbed. From mid-February to late August rooks tend to use such roosts, which may comprise birds from many breeding rookeries and contain several thousand individuals. Rooks fly from the winter

[1] i.e. visit fields more frequently than could be expected from the area of that field type present

roost to their own breeding rookery at dawn, feed communally in the surrounding area and then return at dusk to the winter roost via the breeding rookery.

During August, winter roosts break up and rooks reoccupy breeding rookeries. There, they build new nests or remodel old ones. Adults become strongly attached to the breeding rookery from early September, when eggs are laid, until mid-December when juveniles can fly. During this time, rooks generally forage within 1-2 km of rookeries, with females spending most of their time on the nest and males ferrying food to the hen and nestlings. At other times of the year, birds may forage up to 20 km away from night-time roosts, with their feeding ranges strongly influenced by the occurrence of highly preferred foods.

Photograph 1.A rookery in the Waikato.

Breeding

Hens usually commence breeding at two years of age and tend to retain the same mate in successive years. Nests are built of sticks, earth, leaves, grass, roots, wool and hair. Leaves or needles from the nesting trees are often also used and this needle clipping may serve to provide a clear view of approaching danger. Two to six bluish-green to greyish-green speckled eggs are laid, with an average clutch of four to five. Rooks normally lay only one clutch each year, although they may replace lost clutches or early broods. Chicks hatch from late September to early November and can fly approximately 26-28 days later. Fledglings are fed by both parents for up to two to three months after leaving the nest, as their beaks are initially very soft. The average rate of fledging in New Zealand is approximately 1.5 young per nest, although two to three per nest is common.

Breeding success appears to be independent of rookery size or location but may increase in rookeries under pest management control. However, rookeries with very few birds (as a result of pest control) occasionally fail to produce young, apparently due to the lack of community ’activity’.

Photograph 2. A typical rook nest.

Population dynamics

The natural mortality of rooks in New Zealand is unknown. Data from Scotland suggest annual losses of up to 70% of birds in their first year of life and 7.5–11% thereafter, with highest losses during summer food shortages. Rook mortality patterns in New Zealand are likely to be similar.

Estimates of population growth rates are largely anecdotal. However, data from uncontrolled populations in Scotland and in Hawke's Bay suggest increases of 20%/annum may be common. Such information has little relevance to current New Zealand populations, as groups of disturbed rooks are highly mobile and may move between several rookeries, and new rookeries increase rapidly in size.

2.2 Impacts

Rooks damage a wide range of crops, such as newly sown cereals; ripening peas, broad beans, pumpkins and potatoes; and also walnuts, acorns and fruit. The greatest damage to crops, particularly maize, is at emergence when rooks pull the young plant from the ground to get the sprouting seed.

Rooks also damage pasture when searching for grass grubs, thus exposing the soil to erosion and encouraging weeds. Such damaged fields often need to be re-sown. It is very unlikely that rooks exert any significant control over pasture pests.

Because rooks feed communally and, unless disturbed, tend to return each day to selected fields until food supplies run out, their effects on crops may be catastrophic and their damage to pasture significant (a flock of 200 rooks equates to c. 80 kg of foraging bird biomass!). Consequently, arable farmers universally condemn rooks.

PART 3. CONTROL

3.1 Options for control

Rooks are intelligent birds so control efforts must be infrequent, professionally undertaken and effective.

Shooting makes for wary rooks, which will then tend to abandon existing rookeries causing the population to fragment into more and smaller rookeries further afield. Most regional pest management strategies prohibit shooting, or piecemeal poisoning attempts by occupiers, and this important aspect of rook management needs to be clearly communicated to the rural populace. When free of disturbance, rooks spread slowly and few young birds disperse, apparently because of their strong attachment to their 'birth' rookeries and roosting sites. Occasional shooting of small numbers of immigrant rooks in areas previously clear of them is acceptable. Indiscriminate shooting of rooks, or their nests, is discouraged.

Ground baiting is the preferred method for controlling larger rook populations. The aim is to achieve large reductions in bird numbers and then leave them undisturbed as long as possible. DRC1339 is the recommended toxin. Alphachloralose has been used in the past but is not considered as effective as DRC1339. Bait types to which DRC1339 may be applied are bread and dripping, or macaroni, or walnut pieces. Historically, bread and dripping was the industry standard, however the macaroni alternative was instrumental in achieving rook eradication in the Canterbury region. There is some speculation that the macaroni looks a bit like maggots or other soil invertebrates and there is the further advantage that the small macaroni baits are too small to carry away like bread baits and are, therefore, consumed at the bait line. Pre-feeding is helpful to determine the preferred bait type. Optimum poisoning periods are mostly when natural food sources are scarce and rooks congregate at available localised food sources, such as harvested pea or stubble fields.

Nest poisoning can be effective after ground-based poisoning operations have significantly reduced a rook population. This technique was pioneered in Canterbury for the final stages of a rook eradication campaign. Petrolatum (Vaseline) containing DRC1339 is applied directly into all occupied nests (i.e. nests with chicks in them), ideally just prior to the nestlings fledging. An operator slung below a helicopter applies the toxin with an applicator gun. The toxin's mode of action is thought to be by external absorption. Beware of problems associated with altered gender ratios that can occur when numbers have been greatly reduced over a period of years. The altered ratio appears to disrupt normal breeding behaviour, thus limiting the effectiveness of aerial nest poisoning.

Deterrents may be the only option for crop protection where control is not feasible. The most effective approach is 'crucifying' rook carcasses between two warratahs or on fencelines.

Photograph 3. Crucified rook carcase used to deter rooks from fields.

3.2 Shooting

3.2.1 Pre-operation

Before proceeding ensure:

- the shooter has a firearms licence, extensive experience and is highly skilled;
- permission is obtained from the land occupier;
- local police are advised if shooting is proposed on public or peri-urban land.

3.2.2 Operation

Failed attempts at shooting rooks will make them extremely wary, hampering all subsequent control efforts. Therefore, the shooter(s) must be confident that all the rooks will be killed in the initial operation.

If there is a reasonable chance that the shooting will only be partially effective, use an alternative control technique.

Recover and dispose of the carcasses on completion or keep carcasses in the freezer. They are useful for crop protection work (see section 3.1).

3.2.3 Post operation

Prepare a written record of the operation including:

- operator names;
- location and number of rooks targeted;
- date of operation;
- number of rooks shot and number of survivors.

3.3 Ground baiting

3.3.1 DRC1339

The VTA (Vertebrate Toxic Agent) guidelines[2] (available at the BioNet publications library: https://www.bionet.nz/library/) complement this document, and are recommended reading for all aspects of toxin use. Always follow the label instructions.

Ground baiting is mostly carried out during summer when the ground is hard, earthworms (a favoured food) descend in the soil and become unavailable, and rooks congregate to scarce food sources such as harvested pea or cereal stubble fields. At this time, birds are still feeding around rookeries but are in moult and thus less mobile.

Optimum poisoning periods are:

1. Early summer (mid-November to mid-December) if drought occurs before the young birds are old enough to range far from the rookery.

2. Late summer (January to February). Rooks are going through moult and may have depleted reserves. Drought conditions may see them targeting crop paddocks.

3. Winter (June to August), if the walnut or acorn supply fails and frosts are severe enough to restrict the availability of invertebrates.[3]

4. Spring (mid-October to Mid-November). Though invertebrate food supply is not scarce, bulk bait near the rookery may be preferred by large nestlings.

Rooks are normally targeted with bait containing DRC1339. This chemical was developed in the USA as an oral toxicant to control starlings in livestock feedlots and has also been used there to kill ravens, common crows and feral pigeons. It is available in New Zealand from Animal Control Products Limited, only as the raw concentrate, for formulation in bait bases suitable for each target species. DRC1339 is inexpensive but application costs significantly increase the cost of its use.

DRC1339 is a water soluble organochlorine (3-chloro-p-toluidine hydrochloride). In its technical grade, it is a pale yellow, relatively unstable crystalline solid. DRC 1339 degrades rapidly when exposed to heat, sunlight or ultraviolet radiation. Its half-life in biologically active soil is 24–48 hours and its metabolites (break down products) have low toxicity. Baits incorporating DRC1339 lose their efficacy after about three days in the field and after about one year in storage.

DRC1339 is readily absorbed into the bloodstream and completely metabolised in the liver within 24 hours. It does not accumulate in the body and its metabolites are mostly excreted while the targeted bird is still alive. Clinical signs of poisoning include hypoglycaemia, depletion of liver glycogen, a build-up of uric acid in the plasma and kidneys, and a loss of protein from the kidneys. Birds die from necrosis of the kidneys and circulatory impairment, and this is irreversible in sensitive species. Symptoms of DRC1339 poisoning include

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[2] NPCA publication (Code B2), *Vertebrate Toxic Agents: Minimum requirements for the safe use and handling of vertebrate toxic agents*

[3] Winter operations are generally less successful than those carried out in the warmer months.

listlessness, inactivity and laboured breathing. Death is non-violent and occurs without convulsions or spasms.

DRC1339 is highly toxic to a limited number of bird species including rooks and starlings, less so to feral pigeons, and of low toxicity to finches, sparrows and most avian predators and scavengers (see below). It is also of low toxicity to humans and other mammals. Its slow mode of action means that the first birds to the bait line do not develop symptoms that cause late-coming birds to become alarmed and avoid baits. Because of its rapid breakdown and excretion, it poses a low risk of secondary poisoning to predators or scavengers. However, DRC1339 may act as a chronic toxicant to birds and adversely affect their reproduction if regularly eaten during the breeding season.

Rooks have an LD_{50}[4] for DRC1339 of 3mg/kg body weight and baits are designed to contain twice this: 6mg/kg per rook, or 3mg per bait (an adult bird weighs 350–500gm). The time until death is variable and depends on the amount of toxic bait eaten. Most birds will die within four days but can do so in as little as three hours. By comparison, feral pigeons and mallard ducks have an LD_{50} of c. 18 mg/kg, house sparrows c. 300-450 mg/kg, and Norway rats 1500 mg/kg.

DRC 1339 must only be purchased and handled by, and always under the control of, a Certified Handler holding a Controlled Substances.

For more information refer the Worksafe website www.worksafe.govt.nz

The label instructions for the safe handling of the toxin, supplied with the product, must be available and complied with. For the material safety data sheet (MSDS), go to http://pestoff.co.nz/datasheets.

The effect of DRC 1339 on humans is poorly understood. However, users must observe stringent measures to protect against skin contact, eye contact and inhalation. For more detail, see Appendix I in this document and label instructions.

3.3.2 Emergency management

Read the label.

Symptoms of operator poisoning include burning of the throat, skin or eyes; nausea, possible vomiting and stomach pains.

First Aid: Act immediately if poisoning is suspected. DO NOT induce vomiting. If the eyes are affected, rinse with fresh running water for 10 minutes. Wash contaminated areas of skin with warm, soapy water. If swallowed, call a doctor or get the patient to the nearest hospital immediately. For further advice, contact National Poisons Centre 0800 POISONS (Phone 0800 764 766).

Spillage: In the event of a toxin/bait spill, isolate the ‘spill’ area and exclude all bystanders. Take all practicable steps to manage any resulting harmful effects including preventing the powder or baits from entering streams or waterways. Scoop spilled material into secure

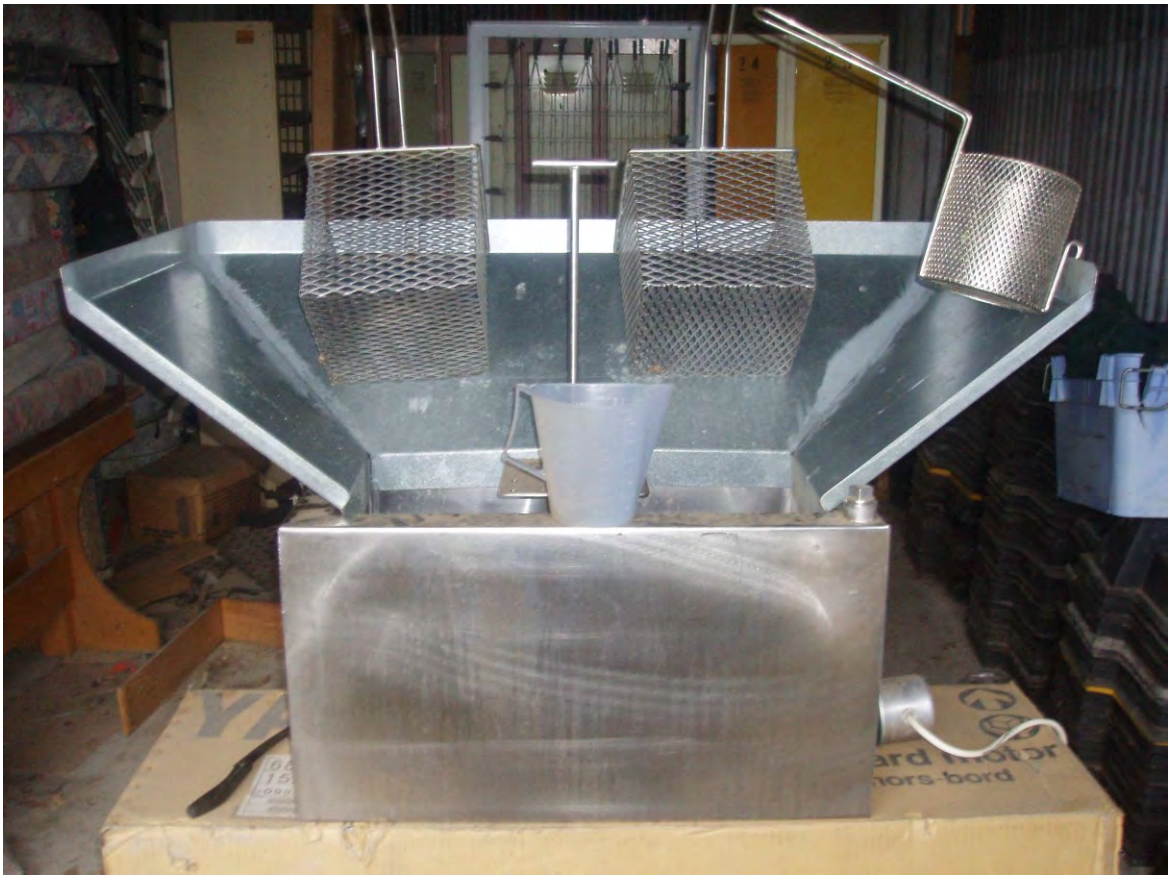
[4] Lethal Dose, 50%. i.e. the amount required to kill 50% of the test population.

containers. Recover any undamaged material for later use by placing it in appropriately labelled containers and dispose of spoiled material by incineration or burial to >60 cm depth. Use a broom to clean up fine material and wash down the spill area with copious water only after all spilled material has been removed.

3.3.3 Bread and dripping bait preparation equipment

You will need:

- a melting tub (20 litre) encased in a water jacket with a thermostatically controlled element to maintain a constant temperature of 70 degrees Celsius;
- a drip tray to capture excess dripping;
- a deep frying basket to hold baits for immersion in dripping;
- a wire basket to sift excess flour from the baits;
- two large galvanised trays, one to coat bait with flour and the other to hold cooling baits;
- plastic buckets with lids;
- a plastic measuring bucket and plastic measuring jug;
- a plastic shovel for transferring bait to storage buckets;
- a wooden mixing stick.



Photograph 4. Bait preparation equipment

3.3.4 Non-toxic bread bait preparation

Two types of pre-feed bait are used, plain bread squares[5], and bread squares soaked in dripping.

Budget approximately three loaves of white toast-slice bread per 100 rooks per day. The bread should be left to air, with the bag open, for 2-3 days to allow for easy handling. A similar total weight of dripping and white flour is also required.

1. Cut the bread into 2 cm squares (16 squares per slice). Bread cutting machines are available.
2. Melt the dripping in the heated tub.
3. Immerse the wire basket containing the cut bread into the dripping until saturated.
4. Remove and drain the baits.
5. Empty the basket onto a tray of flour and roll the baits until well coated to prevent them sticking together. Replace the flour in the tray when it becomes lumpy.
6. Place the baits into the sifting basket to remove excess flour and dripping.
7. Place the baits onto a cooling tray and transfer them to clearly labelled buckets when cooled.
8. Store all pre-feed bait in a dedicated freezer until required.

3.3.5 Toxic bread bait preparation and safety equipment

The same procedure is used for the toxic bait, except that the DRC1339 is mixed with the dripping. **Note:** DRC1339 will NOT dissolve in dripping. It is critical, therefore, that the dripping is stirred almost continuously to ensure even distribution of the toxin in the dripping. Otherwise sub-lethal poisoning may lead to operational failures.

Overalls, gumboots and gloves must be worn when preparing toxic bait. In addition, a full respirator and goggles must be worn when handling the powdered DRC1339 concentrate. Only licensed operators are authorised to handle both DRC1339 toxin concentrate and DRC1339 toxic bait products.

1. DRC1339 is added at the rate of 2.5 g of active ingredient per litre of dripping. The temperature of the dripping must not exceed 70^0C
2. Measure the correct quantity of toxin into the measuring jug.
3. Add a tablespoon of melted dripping and stir into a paste.
4. Add another cup of dripping and mix again.

[5] The plain bread baits are a tester. If rooks appear interested in using the bait line, the operator will switch to the bread/dripping bait, otherwise the baiting will be abandoned without wasting the more expensive bread and dripping baits.

5. Add mixture to the balance of the dripping in the measuring bucket and thoroughly mix again. Transfer to the immersion tub.
6. Continue to prepare the toxic bait as per instructions for non-toxic bait (4 above). Ensure the buckets or black plastic bags containing the final toxic bait are clearly labelled.
7. Store the toxic bait in a dedicated freezer until required. Ensure bait is always stored the dark as DRC1339 rapidly degrades in heat or sunlight.

Wash down the bait preparation area and equipment with hot water and detergent.

3.3.6 Macaroni bait preparation

You will need:

- a cooking pot large enough for your requirements;
- a large flat tray or bench on which to distribute the macaroni;
- macaroni and cooking oil;
- a tea strainer or pepper shaker dedicated for DRC1339 use.

Cook the macaroni until firm but not soft. Mix in oil and distribute onto flat surface; allow to cool. Cooking oil is a sticking agent for the DRC1339, so add sufficient to completely coat the macaroni but without allowing excess runoff.

Using the pepper shaker, add 2.5 grams DRC1339 per kg of macaroni (cooked weight). Ensure even distribution of DRC1339. It may help to pass the DRC1339 powder through a fine sieve to ensure any lumps are broken up before use.

Ensure the buckets or black plastic bags containing the final toxic bait are clearly labelled. Use within a few days: it is recommended that bait be prepared on an as-needed basis.

Wash down the bait preparation area and equipment with hot water and detergent.

3.3.7 Walnut pieces bait preparation

Apply DRC1339 to raw walnut pieces using cooking oil as a sticking agent. Refer procedures for macaroni bait preparation.

3.3.8 Pre-operation

Before proceeding with a toxic baiting operation ensure:

- an approved handler a current Controlled Substances Licence for DRC1339 will be in charge of the toxin at all times;
- approval to use the bait is obtained from the Medical Officer of Health (if they require it….ask);
- a lockable storage facility for the toxic bait is available both at the depot and in the field (can be a vehicle or lockable trailer);
- a site is located for burying carcasses and excess toxic bait product. Some carcasses may be kept and frozen for crop protection work;

- poison warning signs are erected at all access points;
- permission of the land occupier is obtained.

When rooks are located feeding in a paddock, estimate how many there are and which rookeries (or roosting sites) they are coming from. Estimation can be difficult, as birds may travel long distances to feed.

Consider whether the site is suitable for rook baiting. Bird control is a sensitive issue and should be undertaken well away from built-up or peri-urban areas. Be confident that most dead birds can be recovered. Avoid areas likely to be visited by non-target species such as waterfowl, magpies or gulls. Select an open area away from cover, tree lines and well away from roosting areas.

Check the weather forecast. Baiting is feasible when the ground is dry but not if it is saturated. Rain may ease ground conditions enough to allow rooks to abandon bait lines in favour of soil invertebrates.

Talk to farmers in the area and ensure that no cultivation, planting, harvesting or irrigation will be undertaken during the operation. These activities can provide a preferred food source and draw rooks away from the bait line. Similarly, drenching of stock will result in tapeworms and other intestinal parasites becoming available on the pasture, again drawing rooks away.

During the baiting operation, ensure all variables that may disturb rooks are avoided. Ensure:

- people and stock can be kept at least 500m from bait line;
- local dogs are kept under control;
- the same vehicles and staff are used to approach the bait line each day;
- there is no shooting.

2.3.9 Operation

Pre-feed rooks with non-toxic baits at a rate of three loaves or 2kg macaroni or 2kg walnuts, per 100 rooks. Place toxin warning signs at all access points and leave in place for two months after the completion of the operation. Distribute the feed bait along a 2-metre-wide swath approximately 100 metres long half an hour before dawn so that all birds may feed when they are most hungry. Use rook decoys to initially attract rooks to the bait line or place the bait line where you can be sure rooks will find it (e.g. beside water troughs they have been using). It may be profitable to use carrion (e.g. maggot-infested sheep carcass) to initially attract rooks to the line and then remove it once they have started eating the bait.

Remain in the area to observe rook behaviour on the bait line using binoculars. For best results the pre-feed should all be eaten within two hours of the first birds' arrival.

On subsequent days, tailor the amount of bait to ensure there is enough to feed all rooks including late arrivals. However, rooks may bury excess bread bait, so any excess should be avoided. Excess macaroni or walnuts is less of a problem and it is, in any case, important to have plenty of bait once poisoning phase begins. When it is clear that most rooks are using the bait line, switch to the bread and dripping pre-feed. Apply the bread and dripping at half the rate of plain bread (e.g. if 10 loaves of plain bread were eaten, use five loaves of bread and dripping).

Prefeed for a total of 3-4 days. However, if more than 95% of the targeted rooks are feeding on the bait line prior to this, then toxin may be applied early. This is particularly important if weather or other factors imminently threaten the success of the operation.

If less than 90% of the targeted rooks are using the bait line, continue prefeeding. If more rooks cannot be encouraged onto the line, abandon the operation.

When success appears likely, clean up all remaining pre-feed and apply the toxic bait at a rate of 1.5 times that of the pre-feed e.g. where 5 loaves of bread and dripping pre-feed were applied daily, apply 7.5 loaves of toxic bread and dripping. For macaroni and walnuts, 3kg/100 rooks should be suitable. Take account of the bait consumption rate during pre-feeding to make sure plenty of toxic bait is applied. Do not mix toxic and non-toxic bait as this will reduce baiting effectiveness.

In accordance with label instruction, ensure that gloves, overalls and rubber boots are worn when handling the toxic bait and that toxic bait is securely stored and transported (8).

Estimate the percentage of local rooks that feed on the toxic bait line. After rooks have vacated the area, collect the leftover toxic bait and store it securely for subsequent disposal. Left-over toxic bait can break down in sunlight and may cause issues with sub-lethal poisoning.

On days two, three and four after poisoning, estimate the number of live rooks still using the baiting area. Collect any dead rooks, by searching thoroughly:

- the baited area;
- nearby rookeries and roosting sites;
- plantation trees and hedgerows along flight lines;
- water sources such as dams, streams, troughs and open potable water sources.

Dispose of the dead rooks, excess bait and other toxic waste from the bait preparation process by incineration or by burial to a depth > 60 cm.

Photograph 5. Bait being distributed on the line.

3.3.9 Post operation

Prepare an operational report detailing:

- location of baited area;
- location of rookeries from which birds were thought to originate;
- number of rooks present before toxic baiting;
- dates of pre-feeding and quantity of bait used each day;
- date of toxic baiting, quantity of bait distributed and quantity recovered;
- weather conditions each day;
- location of warning signs, dates deployed and dates recovered;
- percent of rooks estimated to feed on the toxic bait line;
- number and identity of non-target species feeding on the toxic bait line;
- number of rooks using the baited area four days after the operation;
- number of rook carcasses recovered, or observed dead but not recovered (e.g. in trees);
- percent kill (see Part 4 of this document);
- any other field observations that may have affected the operation;
- names of the approved handlers responsible for the operation.

3.4 Nest poisoning

The VTA guidelines[6] (available www.npca.org.nz) complement this document and are recommended reading for all aspects of toxin use. Read the label

DRC1339 can be mixed into petrolatum gel and used as a contact toxin applied directly into nests with nestlings (chicks). The toxin is mixed into petrolatum at the rate of 5% wt/wt. This is applied into the inside edge of the nest, via a mastic gun, by an operator suspended beneath a helicopter. Rook contact and subsequent grooming behaviour appears to provide adequate exposure to lethally dose both adults and the nestlings. Do not apply the toxin directly onto nestlings.

This method is suited to the final stages of rookery eradication, where only limited numbers of bait-shy rooks survive, perhaps a maximum of 15 nests per rookery. Eradication may take several years as non-breeding juveniles will not encounter the toxin by the nest poisoning method. Where rooks still exist in large numbers, ground baiting is the preferred method for rook control.

Timing is an important factor in the success or failure of this type of operation. The ideal period falls between late September and early October. To maximise results, nestlings must be present. When the nestlings are close to fledging, both parents are likely to be poisoned as they are under pressure to provide food.

and label instructions for the safety and handling requirements for DRC 1339.

3.4.1 Materials for toxin preparation

You will need:

- a water-jacketed container to melt the petrolatum (the melting tub used for preparing bread bait is suitable);
- petrolatum;
- DRC1339 powder;
- a fine sieve;
- labelled 500 g mastic gun tubes and bungs;
- a mixing stick.

Calculate the requirements for the operation. Each 500g tube will treat four or five nests, so total weight of product (kg) will be the number of nests to be treated multiplied by 0.125. Add 20% to this for contingency. Then calculate the weight of petrolatum, and of DRC1339 required. DRC will be mixed at 5% wt/wt.

For example, if 50 nests require treatment:

1. 50 nests x 0.125 = 6.25kg
2. Add 20% contingency, so 6.25 x 1.2 = 7.5 kg (or 15 x 500 g tubes)
3. 7.5 kg x 95% = 7.125 kg Petrolatum

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[6] NPCA publication (Code B2), *Vertebrate Toxic Agents: Minimum requirements for the safe use and handling of vertebrate toxic agents*

4. 7.5 kg x 5% = 0.375 kg DRC1339 concentrate.

3.4.2 Toxin preparation

1. Melt the petrolatum in the melting tub until it is a clear liquid.

2. Allow it to cool to body temperature (excess heat will affect toxicity). 70^0C is maximum temp for DRC1339.

3. Add finely sieved DRC1339 into the petrolatum and mix well until coloration shows the toxin to be well dispersed and the petrolatum starts to thicken. (DRC1339 will not dissolve in the petrolatum, so ensure that it is not allowed to settle out of suspension prior to the petrolatum setting).

4. Pour the petrolatum mixture into the labelled 500 g tubes (nozzle down).

5. When cooled, fit end bungs and store in a dedicated freezer or in a cool dark place until required.

Wash down bait preparation area and equipment with hot water and detergent.

3.4.3 Helicopter selection

Due to the high risks of using a human sling-load in the confines of a tree canopy, a highly manoeuvrable helicopter will be essential.

The machine will need to be capable of lifting a reasonably heavy load (e.g. 375kg) with three personnel on board. Therefore, a turbine-powered craft is the minimum requirement. The preferred choice is a Hughes 500D. A Bell Jet Ranger or machine of similar size could be considered if the preferred machine is unavailable.

Smaller helicopters such as the Hughes 300 or Robinson R22 are inadequate and are not to be used other than for pre-operational nest checks.

Photograph 6. Approaching the rookery.

3.4.4 Safety and other equipment

Safety equipment for human sling

- Approved sling (Human Load Harness)[7]
- Approved chain (including insulation cover to 1m above operator's head to prevent static electricity discharge when contact is made with tree)
- Approved karabiners (should have two clipped on in opposite directions)
- lanyard rope (approved breaking strain) as secondary safety device.

Personal Safety Equipment

- Overalls - high visibility (white overalls are sufficient)
- Gloves (PVC) - rugged construction
- Leather boots
- Earmuffs for air and ground staff
- First Aid Kit
- Sharp knife in scabbard to be worn by official observer
- Safety Helmet (approved) for person in the sling.

Other equipment

- Two poison applicators (caulking guns)

[7] Pilot to provide proof of annual inspection certificate of 'Human Load Harness' and chain for load capacity. For further information refer www.worksafe,govt.nz

- T fittings for the applicators[8]
- Lockable storage container for toxins (must be suitably labelled)
- Washing water in appropriate container and disinfectant soap for decontamination
- Poison warning signs;
- Portable gas burner, pot and water for warming of petrolatum in tubes ***or***
- Chilly bag and hot water bottle for transporting and keeping pre-heated DRC1339 petrolatum tubes warmed to the correct viscosity.

3.4.5 Pre-operation

An initial rookery inspection should be completed (usually at the time of the aerial nest survey). The inspection will:

- determine aerial access to the rookery and ensure there are no wires or obstacles that may impede or add risks to the operation;
- ascertain that nests located can be accessed by the applicator with minimal risk;
- ascertain that a safe approach and landing can be conducted.

After inspection, select which rookeries are to be controlled by nest poisoning.

Before proceeding ensure:

- an approved handler with a current Controlled Substances Licence for DRC1339 is in charge of the toxin at all times;
- approval of the Medical Officer of Health is obtained (if they require it….ask);
- the helicopter pilot has obtained the necessary approvals for undertaking the operation;
- route plan is in place for pilot to work to e.g. rookery to rookery;
- the majority of eggs have hatched but nestlings have not yet fledged;
- a site is arranged for burying carcasses, excess toxic bait product, empty tubes, rags, handy towels etc.;
- permission of the land occupier is obtained.

3.4.6 Operation

Erect poison warning signs at points of access and at the rookery itself.

The pilot is responsible for managing all aerial aspects of the operation. He/she will make the final decision regarding weather and require you to comply with their safety procedures and protocols.

Communication must be maintained with the pilot on the eve of the planned start date to confirm suitability of weather conditions. Flying should start soon after first light if conditions are adequate as this will maximise the amount of flying time available. There is also likely to be less wind at this time.

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[8] T shaped copper fittings have four holes in the tube. The fitting is available from Pest Management Services Ltd, and will distribute 4 lines of toxin around the inside of the nest. The fitting can also be fabricated by a local engineer.

Once the rookery has been located it is important to carry out the operation in the quickest time possible. Rooks are very wary birds and too much time spent at the rookery may cause them to disperse. This is another reason why only small numbers of nests are targeted.

Aerial operations must be aborted when wind speed exceeds 20 to 25 knots, as risks will increase (the final decision is with the pilot). The purpose of the observer is to assist the pilot with guidance of the helicopter to help spot nests and watch for any sign of problems.

The handler is responsible for managing the toxin and ensuring that safety equipment is worn to prevent skin contact with the toxin. This equipment includes overalls, enclosed footwear and impervious gloves. If the handler does not have a controlled substance licence (e.g. professional helicopter staff), then the handler must be under the direct supervision of a licensed operator (i.e. in helicopter).

It is important to apply the toxin to all nests containing nestlings at the site. This is done using the application equipment, running a ring of petrolatum/DRC1339 around the inside edge of the nest. Do not put the toxin directly onto the chicks, only the inner sides of the nest.

Rookeries may need to be treated more than once if not all the eggs have hatched.

After 2-3 days, check rookeries for carcasses and dispose of them by burial to a depth of > 60 cm, or freeze for later crop protection work.

Remove all warning signs two months after bait application.

Photograph 7. Toxin being applied into the nests.

3.4.7 Post operation

Prepare an operational report detailing:

- the location of rookeries treated;

- the dates of toxic baiting;
- weather conditions for each day;
- location of warning signs, dates deployed and dates recovered;
- number of nests treated per rookery;
- number of active nests not able to be treated per rookery;
- number of rook carcasses recovered or observed dead but not recovered (e.g. in trees);
- percent kill (Part 4 of this document);
- any other field observations that may have affected the operation;
- names of the approved handlers responsible for the operation.

PART 4. MONITORING

4.1 Regional trend monitoring

Rook populations are monitored annually, or at some longer interval, to provide an estimate of the distribution and abundance of rooks and rookeries.

This monitoring attempts to census the entire population, rather than estimate the density by sampling a subset of the region. The resulting numbers have no statistical estimates of confidence attached to them, so confidence in the result is qualitatively assessed from the effort expended by the survey team and their competence.

Two classes of information are collected. The number and location of rookeries, and the number of active nests per rookery (). The nest count is multiplied by 4.5 to estimate the number of rooks using the rookery (nominally 2 adults and the previous year's surviving juveniles).

The number and location of rookeries is the most critical aspect of regional monitoring and this is where the bulk of the effort is expended. If some rookeries have not been located, then any estimates of the total rook population will be quite false.

Therefore, a good knowledge of the location of active rookeries and only a rough estimate of active nests per rookery is good information. Intensive effort devoted to estimating nest numbers is pointless if only partial information on rookery distribution is available.

4.1.1 Locating rookeries

Rookeries tend to persist for many years and most rookery locations will be known.

Locating new rookeries is an ongoing effort and this is the core of the monitoring program. Sources of information that will help locate new rookeries include:

- your own observations;
- land occupier reports;
- reports from other field staff and contractors;
- helicopter pilots;
- reports from the public following media releases.

4.1.2 Estimating number of rooks

Rook population size is usually determined from nest counts, traditionally undertaken during late September to early October. This may be a little early as studies in Canterbury suggest nest occupation rates reach highest levels in late October.

All known active and inactive rookeries are checked. Two observers count nests from the ground using binoculars, arriving at a consensus for each occupied tree. The accuracy of nest counts may vary greatly, however, depending on the density of the canopy in the rookery, the closeness of adjacent nest bowls, and the presence of unused nesting platforms. Such problems lead to underestimates of the numbers of nests and thus the numbers of breeding birds. The numbers of active nests (and thus of counts of breeding birds) can be verified by climbing to and counting a sample of nesting trees where this is possible, and extrapolating the findings to the entire rookery.

Nest counts take no account of non-breeding 1-year-old and, occasionally, 2-year-old rooks, which in rookeries under control in Hawke's Bay averaged about 25% of the population. The total population around each rookery is currently determined from the number of active nests multiplied by 4.5, although the basis of this multiplier is unclear and the estimate a rough approximation at best.

Active nests can be identified by their solid bowl-shaped structure and presence of green leaves. Unused nests have a thin, sparse and flat structure.

As an alternative to ground based surveys, helicopter surveys are now commonly undertaken. It is perceived that the correct identification of active nests from the air provides a better estimate of the rookery populations.

Photograph 8. Rook nests as seen from the ground.

4.1.3 Compiling rookery data

For each rookery, compile the following information on a standardised form:

- the unique number allocated to the rookery;
- rookery name;
- NZMG co-ordinates (from GPS) of rookery;
- property and owner name;
- year the rookery was established;
- status (Active, Inactive, Destroyed);
- tree species;
- date of nest count;

- number of active nests;
- estimate of total rooks (i.e. this will be nest total x 4.5);
- number of free-flying rooks (may provide a good population count where rook numbers are low);
- other comments;
- observer names.

4.1.4 Compiling regional data

Update the regional database with individual rookery information. Prepare a report to include:

- the historical trend of numbers of regional active and inactive rookeries;
- the historical trend of estimates of the total rook population;
- a map (preferably GIS generated) showing the location of active rookeries, colour-coded to depict the rook population present at active rookeries;
- some commentary regarding the perceived reliability of the reported information.

4.2 Operational monitoring

Reporting of a control operation will include an estimate of the percent kill.

This can be derived at the time of the operation and confirmed during subsequent nest counts.

4.2.1 Estimating percent kill from ground baiting

During the operation, the following estimates should have been recorded:

- number of birds observed prior to toxic baiting (N_{pre});
- number of birds observed feeding on the toxic bait (N_{toxic});
- number of carcasses recovered or observed but unable to be recovered (N_{dead});
- number of survivors observed four days after the operation ($N_{survive}$).

These numbers provide three estimates of % kill.

1. $\%Kill_{toxic} = N_{toxic} / N_{pre} * 100$
2. $\%Kill_{dead} = N_{dead} / N_{pre} * 100$
3. $\%Kill_{survive} = 100 – (N_{survive} / N_{pre} * 100)$

At the very least, the number of carcasses counted provides a minimum estimate of the kill. However, as all carcasses usually cannot be located, this is likely to be an under-estimate. The maximum possible kill can also be known. If only 90% of rooks fed on the toxic bait line, than at least 10% must have survived. Similarly, the number of survivors observed after 4 days indirectly provides a maximum estimate of the kill.

The %kill can therefore be reported as a range where the lower estimate is the $\%Kill_{dead}$, and the upper estimate is the lesser of either the $\%Kill_{toxic}$ or $\%Kill_{survive}$.

For example, let's say the following counts derived from a baiting operation:

$N_{pre} = 200$

$N_{toxic} = 190$

N_{dead} = 150

$N_{survive}$ = 20

Then:

$\%Kill_{toxic}$ = 190 / 200 x 100 = 95%

$\%Kill_{dead}$ = 150 / 200 x 100 = 75%

$\%Kill_{survive}$ = 100 – (20 / 200 x 100) = 90%

Hence we conclude that the highest possible kill ($\%Kill_{toxic}$) was 95%, and we are confident it was at least 75% (based on the number of dead birds recovered). So we report the percent kill being within the range of 75-95%.

4.2.2 Estimating the percent kill from nest baiting

The effectiveness of nest baiting operations is estimated from the following observations and assumes that treating a nest will kill both parents and the nestlings. This assumption relies on both adults brooding nestlings and, as adult males spend little time in the nest, they are less likely than adult females to be killed.

- number of active nests at rookery (N_{nest});
- estimated number of adults is 4.5 x number of active nests (N_{pre});
- number of active nests with unfledged nestlings treated(N_{toxic});
- number of adult carcasses recovered (N_{dead});
- number of survivors observed after 4 days ($N_{survive}$).

Some active nests within treated rookeries may not be treated due to timing problems (nestlings unhatched or already fledged) or being physically inaccessible. This limits the effectiveness of the operation.

The numbers provide three possible estimates of % kill.

$\%Kill_{toxic} = N_{toxic} / N_{nest} * 100$

$\%Kill_{dead} = N_{dead} / N_{pre} * 100$

$\%Kill_{survive} = 100 – (N_{survive} / N_{pre} * 100)$

At the very least, the number of carcasses counted provides a minimum estimate of the kill. However, as all carcasses will not be located, this is likely to be an underestimate. We also know what the maximum possible kill can be. If only 70% of nests were treated, then at least 30% of adults and chicks must survive. Similarly, the number of survivors observed after 4 days provides a maximum estimate of the kill.

The %kill can therefore be reported as a range where the lower estimate is $\%Kill_{dead}$ and the upper estimate is the lesser of either $\%Kill_{toxic}$ or $\%Kill_{survive.}$

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APPENDIX I. DRC 1339 FOR BIRD CONTROL

CONTROLLED PESTICIDES
DRC 1339 For Bird Control

General
This material, known chemically as 3-chloro-p-toluidine hydrochloride, was developed by the Denver Wildlife Research Centre in the United States in response to the need for an effective, safe, slow-acting material to control bird pests such as starlings and blackbirds around livestock pens and poultry yards. (The European blackbird that occurs in New Zealand has different habits and belongs to a different family from the blackbird species in the United States.)

The material is being evaluated in the U.S. as a 0.1% bait formulation, under the name Starlicide. It can be sold only to Government agencies and qualified pest-control officers.

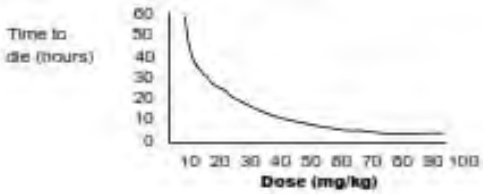
In New Zealand DRC 1339 has been used successfully in experiments to control rooks on farmlands in Hawkes Bay (Bull.P.C. 1975).

DRC 1339 was discovered during the screening of over 400 chemicals at the Denver Wildlife Research Centre for a material that was highly toxic to a limited number of bird species, of low toxicity to humans and other animals, palatable to the bird pests (in that case, starlings), and with a slow, non-violent mode of action to prevent other birds from being alarmed and avoiding the baits. DRC 1339 met all these requirements.

Properties
In its technical grade, the chemical is a pale-yellow, crystalline solid, very soluble in water and other highly polar solvents. The formulation available for commercial use is a fine white powder.

Commercially, in the U.S. the bait material (mash, poultry feed, corn, raisins, rolled barley) is treated with a solution of DRC 1339 sufficient to impregnate one bait particle with enough chemical to kill a blackbird or starling. This treated bait is then mixed in the filed with untreated bait in a ratio suitable for the particular job.

How does it work?
One particle of the treated bait is sufficient to kill a feeding starling (or blackbird), but the more baits it eats, the sooner death occurs. The effect of an increasing dose rate can be shown graphically:



Thus, the time of death and the consequent dispersal of dying birds can be controlled by varying the ratio of treated to untreated bait. A high concentration of treated bait, and the increased possibility of one bird eating three, four, or five poisoned baits, reduces the dispersal area of the poisoned birds (De Cino *et al.*, 1966).

Depending on the number of baits consumed, starlings die 3 to 50 hours after feeding.

Symptoms of poisoning in birds
DRC 1339 is absorbed into the bloodstream and impairs the liver and kidney functions.

Death apparently results from uremic poisoning. The damaged kidneys are unable to excrete the body's waste products and these build up in the bloodstream to a lethal level.

The first symptoms of poisoning are an increase in water consumption, followed by a sharp drop in the intake.

About 4 hours before death, the birds cease to eat or drink and become listless and inactive. They perch with feathers ruffled, as in cold weather, and appear to doze. As death nears, breathing increases slightly in rate and becomes more difficult. The birds finally become comatose and die. There are no convulsions or spasms; consequently there are no distress calls or 'spooking' to deter other birds from feeding. Poisoned birds are characterised by fluffed-out feathers and by tucking their feet inside the lower breast feathers.

Toxicity
One of the advantages that DRC 1339 has over the other birds poisons in use today is that it is highly toxic to a few bird species and yet is relatively safe to humans and domestic animals (except poultry). This specificity of DRC 1339 is best shown in tabular form. See Table 1.

This shows that starlings, American blackbirds, and crows are highly susceptible to DRC 1339, but that most other bird species are more resistant to the poison.

Poultry, however, are susceptible to DRC 1339, and care must be taken to prevent them from feeding on poisoned bait. Under normal conditions, DRC 1339 is not dangerous to sheep, dogs, cows or other mammals.

Secondary poisoning, through hawks eating poisoned birds, does not appear to be a problem. In feeding tests hawks were fed up to 200 poisoned starlings with no adverse effects.

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Studies of the breakdown of DRC 1339 in starlings have shown that less than 10% remains in the bird after 40 hours; the remainder has either been excreted unchanged or converted into something else.

Table 1

Toxicity of DRC 1339

Species	LD50* (mg/kg)	No. of poisoned baits
Starling	3.8	1
Blackbird (American)	3	1
Rook (New Zealand)	3	1
Crow	2	1
Chicken	6	2
Turkey	6	2
Pheasant	10	3
Bluejay	10	3
Magpie (American)	6-18	2-6
Dove	6-10	2-3
Duck	10-30	3-10
Teal	10-100	3-30
Marsh hawk	100	30
Sparrowhawk	320	100
Sparrow	320-450	100-150
Sheep	400	130
Mouse	1000-2000	300-700
Rat	1200-1800	400-600

* LD50 represents the dose of DRC 1339 required to kill half the animals in a treated sample and is expressed as milligrams of DRC 1339 per kilogram of body weight.

How to use DRC 1339

Most birds, and especially starlings, will reject treated bait if it is different from their normal food, even if the difference is in colour only.

In each situation the type of food that is normally consumed must be determined, in order to prepare a bait that is identical to the normal diet; or else the birds must be conditioned to the new food by prebaiting.

Bait Preparation and Use (United States)

The selected bait material (be it cracked corn, barley, or poultry pellets) is mixed with a 7.5% solution of DRC 1339, using 130 ml of solution per kilogram of bait. This usually results in each bait particle containing a lethal dose.

The treated baits are placed in feeding stations (troughs or dishes) or scattered thinly and evenly in the pens or the adjacent areas. About 2kg of treated bait per 1000 birds is the normal rate of application; it should not exceed 5kg of treated bail per hectare.

For a more uniform distribution and to enable more birds to consume a lethal pellet, the treated bait is diluted with about 5 to 10 parts of untreated bait.

Poultry should be kept away from the bait, as DRC 139 is toxic to them. More effective control may be achieved if several 'prebaitings' are carried out to attract and accustom the birds to feeding in the area.

The bait should be applied before the birds arrive for their first morning meal. One baiting should last up to 3 days.

Because of the slow action of DRC 1339, large numbers of dead birds will not be apparent in the baited area. It takes most birds within 1 to 3 days to die after consuming the treated bait. Most die at their roosts and along flight lines to the feeding areas.

Bait Preparation and Use (New Zealand)

For poisoning rooks in New Zealand, DRC 1339 is now usually incorporated in dripping (to disguise the taste) and applied to bread, each square of which contains 3 mg of DRC 1339 (two lethal doses for a 500g rook).

Sixty-six squares of bread can be impregnated with 100ml of prepared dripping. Thus, with 97% active DRC 1339, 204 mg must be mixed with each 100 ml of dripping to provide baits of the desired concentration. (Some, but not all, supplies of DRC 1339 include 25% of inert 'flowing agent', and this must be allowed for in calculating the dose rates.)

When only a few baits are required, the DRC 1339 is still mixed with dripping, but in small vats or pots. Apart from this, there is no difference from the procedure for mixing large amounts of bait. (The use of butter and the injection of baits have been discontinued.)

Mr D.V. Flynn (Hawkes Bay Pest Destruction Board) and Mr R.E.R. Porter (Ecology Division, DSIR) have devised a way of impregnating large quantities of bread with DRC 1339. The equipment consists of two tubs for holding the melted dripping, which is kept warm by a water jacket heated by a thermostatically controlled electric element. In each tub, a wire basket is used to hold the bread.

Once the bread has absorbed the maximum amount of dripping (with its contained DRC 1339), and the excess dripping has been drained off, the baits are dropped into a tray of white flour. The flour-coated baits are then sieved free of any surplus flour and placed in a second tray to cool. Baits that are stored in too large a quantity tend to stick together-they are therefore kept in 13 litre plastic, seal-top buckets.

Some rooks seem to eat only one or two baits, so that in New Zealand the poisoned baits are not normally diluted with untreated ones.

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Research by Dr T.P.G. Purchas of the Ecology Division, DSIR, has shown that most baits are accepted when invertebrates and walnuts are scarce, and the rooks are eating less-preferred foods, such as crop seeds or food put out for livestock. At these times rooks fly in well-defined paths from their rookery or roost to one or two paddocks. When at least 95 percent of a population are congregating each morning, good takes of bait are likely. Several days of prebaiting will take the rooks to accept bait and will provide an opportunity for observing what other species may be at risk.

The bait line must be under constant observation when the toxic feed has been laid. Usually, the feeding activity will lessen after the first hour, but on a number of occasions the baits have all been eaten within the first 2 hours. Any uneaten baits must all be collected before nightfall.

Rooks poisoned with DRC 1339 usually die at their rookeries or winter roosts that are nearest to the bait line, or else under trees or beside water between the bait line and the rookery or roost. In midsummer, however, the dead rooks are sometimes scattered over a wide area (they have been found up to 20 km from the bait line); this scattering may occur at other season, too, if the rooks which have fed on poisoned bait are disturbed at the rookery before the poison has acted.

Experimental poisoning of rooks with DRC 1339 in central Hawkes Bay during 1970-73 killed at least 16,760 rooks and caused population reductions of between 73% and 82% (as determined by counts of nests in nearby rookeries in October 1973). Some important rookeries were abandoned altogether and other than rooks, but most of these (459) were black-backed gulls (an abundant and unprotected species that sometimes attacks newborn lambs). In planning DRC 1339 poisoning when gulls are present, remember that some of the gulls may die in water reservoirs or on public beaches and cause widespread public annoyance.

The use of maize has been investigated experimentally, with encouraging results. It may be used to replace the bread and dripping baits when large numbers of black-backed gulls (which do not usually eat maize) are feeding on a bait line.

Important

- DRC 1339 can be used only when serious, prolonged damage, directly attributable to rooks, is occurring and cannot be alleviated by other means.

- The use of DRC 1339 is subject to the approval of and monitoring by the Agricultural Pests Destruction Council.

PRECAUTIONS TO TAKE

User Precautions

Although DRC 1339 has an LD50 of about 1000 mg/kg of body weight in mice, which compares favourably with materials such as carbaryl, pyrethrins, and dicofol, very little is known about the effects of DRC 1339 on the skin or when it is inhaled, or about the long-term effects of continuous exposure to low concentrations of DRC 1339 over an extended period. Consequently, stringent measures for protection against skin contact and inhalation should be undertaken, particularly in handling the concentrate.

The low concentration of DRC 1339 in treated baits reduces the risk of poisoning, but you should wear protective gloves, overalls, boots, and a face mask or respirator when you are handling the treated baits (a face mask is not needed with bread baits already treated with DRC 1339 in dripping). Any contact with your eyes, skin, or clothing must be avoided and your hands should be washing with soap and water afterwards, before you eat, drink, or smoke. Protective clothing should be washed before it is reused.

First Aid Treatment in the Field

If the concentrate or treated baits are swallowed, you should make the patient drink a glass or two of water and induce vomiting by putting your finger down his throat. Repeat until the vomit fluid looks clear. Call a doctor immediately.

Danger to Other Animals

Although DRC 1339 is relatively non-toxic to most mammals and many bird species, poultry and game birds are susceptible to the poison and should be kept out of treated areas.

Environmental Contamination

DRC 1339 is an organochlorine, but does not appear to have the persistence or the tendency to accumulate in the food chain that other organochlorines such as DDT have. However, DRC 1339 is soluble in water and is moderately toxic to fish. Take care to avoid contaminating streams, lakes, ponds, or other water supplies. Some plant species are also affected by DRC 1339.

DRC 1347 - A Contact Avicide

The free base of DRC 1339 is used to control starlings in urban areas where baits cannot be used effectively. This has the code name DRC 1347 and has the chemical name of 3-chloro-p-toluidine.

DRC 1347 has shown promise in controlling starlings in the United States when it is applied as a 20% paste on to perching areas.

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The problem of short persistence (2 to 3 days) remains to be solved, but the addition of U.V. absorbing materials may extend the life of DRC 1347.

The properties of DRC 1347 are similar to those of DRC 1339 as is shown by the following comparison.
DRC 1347 is still in the developmental stage and further work is necessary before its widespread use can be contemplated.

Toxicity to Four Bird Species
(mg/kg of body weight)

Species	Dose Method	1347	1339
Starling	Oral	4.2	3.8
	Dermal, breast	8	14
	Dermal, foot	25	80
Pigeon	Oral	13	18
Sparrow	Oral	320	365
Sparrowhawk	Oral	420	320

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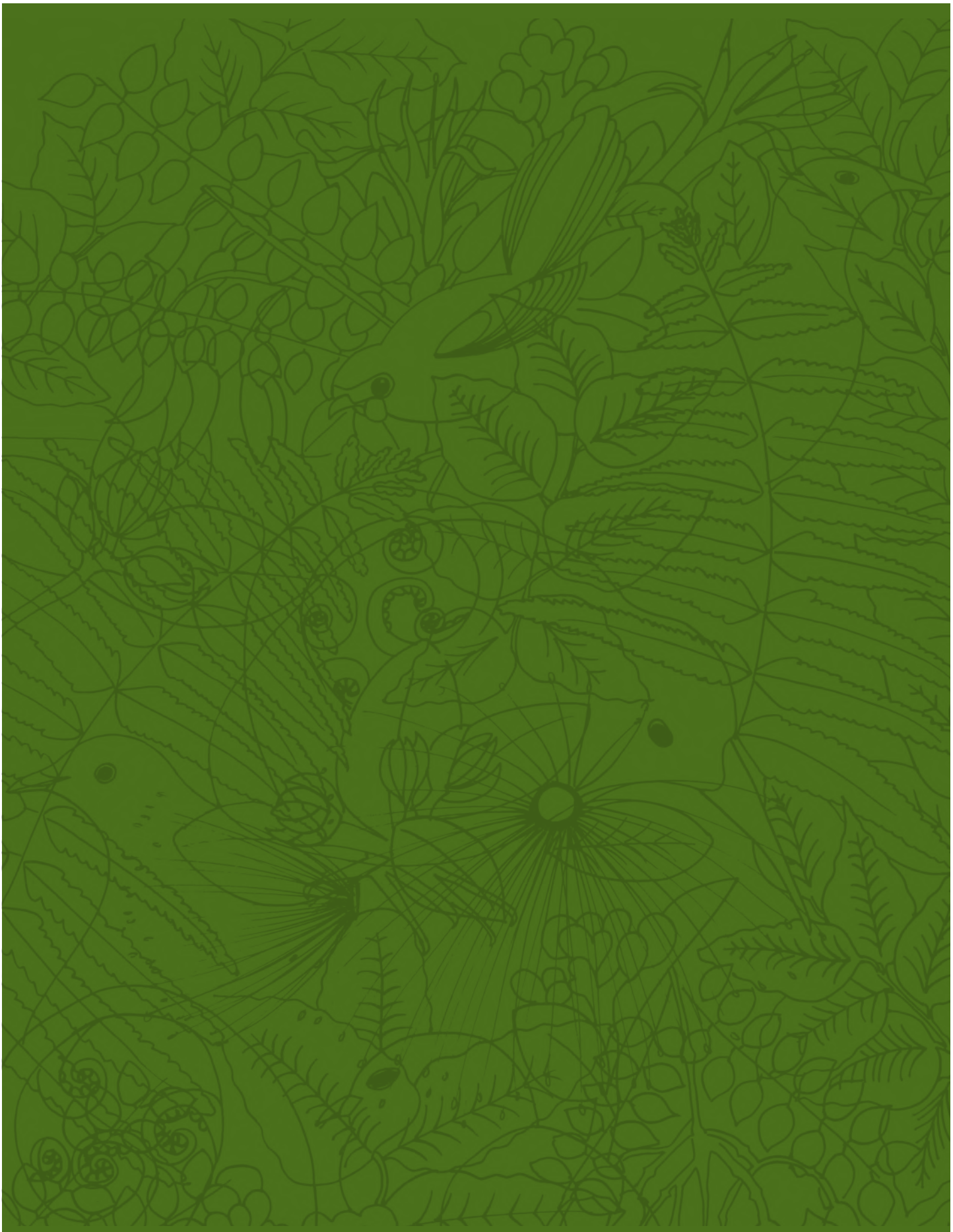
APPENDIX II: ABBREVIATIONS

DRC1339	Starlicide
NPCA	National Pest Control Agencies (publisher of this document, winding up in 2018)
NZMG	New Zealand Map Grid
VTA	Vertebrate Toxic Agent



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National Pest Control Agencies