NSW GOVERNMENT
Department of Primary Industries
primefact

Vertebrate pests in macadamia: rats

March 2020, Primefact 1768, First edition
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Background

Rodents are a significant concern for the Australian macadamia industry, accounting for up to 30% of crop losses (Figure 1) in high-pressure years and additional losses from orchard floor nut removal (White et al. 1997; Elmouttie and Wilson 2005). During the past 20 years, significant research has been conducted within Australian orchards to identify the species responsible and to determine how the populations interact with the broader orchard system to achieve high population numbers.

Figure 1. A macadamia branch damaged by rats.

Rodents in orchards

Early studies identified a single rodent species, the common black rat (*Rattus rattus;* Figure 2), as being responsible for >95% of damage across the macadamia growing region (White et al. 1997; Horskins et al. 1998; White et al. 1998). Further studies show that rodents use resources based on availability, feeding within the trees while macadamia is present (Figure 1) and feeding and harbouring in non-crop habitats at other times (White et al. 1997; Horskins et al. 1998; White et al. 1998; Elmouttie and Wilson 2005). Rodents also use on-ground resources by moving the nuts to non-crop habitats and burrows during May–September, i.e. the nut fall cycle when macadamia become plentiful on the ground (Elmouttie and Wilson 2005). This behaviour ensures the rodents maintain a stable food supply throughout the year and are feeding and residing in dense protected environments, thus reducing the risk of predation from birds (Elmouttie et al. 2009). Rodents never solely consume nor depend on macadamia resources, they supplement their diet with alternative non-crop resources throughout the year.

Figure 2. The common black rat (*Rattus rattus*). Photo: The Queensland Museum.

In recent years, rodent population dynamics within orchard systems have changed. Rodents are now nesting in trees, rather than foraging in non-crop habitats abutting the orchard edges. Changes in structure and resource availability are

suspected as the causes, which have primarily been driven by introducing new cultivars that maintain nuts longer within the trees (Eldridge et al. 2012; Whitehouse et al. 2012) and modifying cultural practices to influence non-crop resources within the orchard.

Managing rodents

Managing rodents in macadamia orchards has relied on mortality based approaches (e.g. baiting, burrow fumigation and trapping). Although these tools are effective at killing the rodents, used alone they do little to suppress populations and ultimately do not reduce crop losses.

To effectively manage rodents you must consider the complex crop–pest interactions throughout the orchard and act to reduce the populations before significant crop losses occur. This comprehensive approach needs to incorporate monitoring, habitat modification, resource (crop and non-crop) management and mortality tools. When combined, the result should be cost-effective rodent management.

Managing rodents within orchard systems must be a season-long strategy that aims to reduce alternative food resources and nesting sites. Growers are also encouraged to monitor for signs of rodent activity so they can quickly respond to outbreaks and manage the populations before extensive damage occurs. The recommendations below might not be viable for all orchard systems or every year, however, they are presented as a guide for growers as strategies to implement for maximum success and minimal crop loss.

Figure 3. A rat caught foraging within the tree canopy early in the season.

Season-long strategy

It is imperative that adjacent non-crop habitats are effectively managed and maintained. Riparian zones, headlands, property boundaries and windrows must be kept void of weedy non-crop vegetation (e.g. grasses, lantana and wild tobacco) which provide essential food and nesting resources for the rodents. These areas can be maintained by slashing or revegetated to a forest type known not to support rodents.

The orchard system itself, e.g. inter-rows, must also be effectively maintained to reduce cover and alternative food resources and to encourage natural predators (e.g. owls). This can be achieved by slashing or applying a suitable herbicide (e.g. glufosinate-ammonium).

Cultural practices such as insect refuge strips (i.e. mohawks, Figure 4) can be established to encourage beneficial insects and are compatible with rodent management strategies, although they should be maintained and limited to the areas required. If rodent activity is observed, baiting or trapping programs should be undertaken within these refuges. Once pollination is over, refuges can be slashed and only re-established once required (prior to flowering).

Skirting trees to open up the orchard system to natural predators and reducing canopy access for foraging rodents is also recommended.

Figure 4. An insect refuge strip (i.e. mohawk).

Harvest

Harvest should be conducted regularly to minimise the number of nuts on the ground. This is particularly important from May to September when rodents will remove nuts from the orchard floor. At the end of each harvest season, any remaining nuts on the ground should be mulched as soon as practical to ensure the nuts are not left for the rodents.

New plantings

When establishing new plantings, consider the possible effects of rodents. Certain tree varieties exhibit traits which make them more susceptible to rodent damage, such as thinner shells and having sticktights (Eldridge et al. 2012). Although using these varieties is not being discouraged, consider where these higher risk varieties will be planted and how rodents can be managed within those orchard blocks.

Block design

Block design should also be contemplated, as the inability to harvest and manage blocks resulting from poor weather is often a precursor to high rodent damage.

Baiting and burrow management

Baiting should be undertaken strategically, targeting known areas of rodent activity within orchards. Rather than spreading limited baiting resources around the entire orchard system, growers are encouraged to focus on key blocks which have suffered rodent activity previously.

Early in the season, when rodents are known to be feeding in the trees (January–May), baiting programs should focus on the tree, then as the nuts become more abundant on the ground (May through to final harvest), baiting programs should target that area.

Using bait stations is imperative; they are a legal requirement of registered bait products and are essential to increase bait take and maintain bait freshness. Baits should be secured within bait stations ensuring they are kept off the base using the securing rods provided. In stations where securing rods are not provided, a wire tie should be used.

Where burrows are observed (Figure 5), rodents should be eradicated before the burrows are disturbed or ripped. Burrow fumigation (e.g. carbon dioxide) and baiting can be effective. When baiting, use baits that will not fill the burrow entrances as the block baits will be expelled from the burrows and thus made available to non-target species. Using appropriately registered dust or grain baits is considered the most suitable approach.

Figure 5. A rodent burrow in headlands adjacent to orchard blocks.

Other methods

There are potentially other methods for rodent control and while perhaps not considered conventional, one grower in Queensland is using snakes to help (Figure 6).

Figure 6. Every little bit counts; snakes might contribute to rat control programs in a limited way. Photo: Paul Trollis.

Case study

Phil Bevan – Dalwood, NSW

We have always had a rat control program but two years ago, a favourable season for rats caught us by surprise and caused significant crop loss. You could say that year opened

our eyes to the potential damage from rats and the effort required to bring down a large population; we have been more vigilant with our program since.

A key part of our management program is regularly monitoring our orchard for rat activity using an electronic mapping system on our phones. This allows us to add points where we find nests so we can come back later and deal with them.

We aim to keep the grass down in the orchard and along headlands. This removes habitat for rats to hide in and makes spotting activity easier. It also gives predatory owls a better chance to catch prey.

We also have about 50 rat bait stations (Figure 7) on our 30-hectare orchard that we locate in potential problem areas. We move them to areas of high activity based on monitoring results to focus more on potential hotspots than spreading stations over the orchard. We use only an approved rodenticide for the orchard, which is currently racumin. We mix the racumin and macadamia kernel, mindful to use stations that are inaccessible to pets and other animals, and only use baits that do not translocate. The baiting program is mainly useful in the period when nuts are not developed, mostly in the spring and early summer.

Figure 7. A rat bait station that is inaccessible to non-target species such as birds and uses baits that do not translocate.

Based on our monitoring, we return to eradicate ground nests (burrows) with a small engine device (Cheetah) that produces carbon monoxide and blows it into the rat hole (Figure 8). This system humanely euthanases the rats. We use newspaper and a bit of dirt to plug up the other holes in the same nest and run the machine for a bit over five minutes. We monitor the sites for a few days afterwards and rarely find subsequent rat activity. For the odd cases where we do, we re-treat the burrow.

We also harvest frequently to keep the food source low for rats.

We have become vigilant against rats, as we know changes in weather conditions can bring on a significant increase in rats. This combination of activities has managed to keep rat activity to a minimum in our orchard – and has kept crop loss to rats down.

Figure 8. A device used to fumigate a rat nest.

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Further information

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Reference number: **PUB19/106**.