# Observation and monitoring

It is important that landholders become familiar with indicators of 'normal' mouse activity for their properties.

Mouse numbers can build rapidly, but this may be on a local basis due to ready supplies of grain left in paddocks at harvest and poor hygiene around grain stores.

Individuals need to monitor their own paddocks and farms to establish if mice are likely to become a problem. Large numbers around haystacks and buildings do not necessarily mean there are high numbers in paddocks.

When mouse numbers have been high in autumn, monitoring should continue through winter and spring.

Indicators that mouse numbers have increased include:

- numerous burrows;
- mouse droppings on soil and plants, and the typical mousey smell;
- large numbers of mice seen at night, in paddocks or on roads;
- more birds of prey (such as kestrels or kites) than normal;
- signs of seeds being dug up, plants being gnawed or pod and head damage; and
- frequent day-time sightings.

Simple in-paddock monitoring techniques can be used if conditions indicate the risk of increases in mouse populations or if early signs are evident. Hole counts and census cards provide an indication of mouse activity, while trapping provides the opportunity to assess populations and breeding status.

## Hole counts

Active holes can be identified by sprinkling talcum powder around holes and inspecting the level of disturbance the following morning. Five active holes per 100m$^2$ can be equivalent to 1000 mice/hectare. Checks should be made across a paddock as populations can be patchy.

Hole counts vary by soil type. In cracking soils, holes may be difficult to identify. In sandy soils, mice may dig many holes in search of seed, which can look similar to nesting burrows. In hard-setting soils, there may be few holes but each can contain many mice – up to 40 per hole during plagues.


PHOTO: EMMA LEONARD

Mouse numbers should be monitored regularly. Large numbers near storage do not indicate high numbers in paddocks. Keeping areas clear of weeds, debris and grain spills minimises shelter and feed for mice.

## Census cards

This method is most reliable in late autumn/winter when food is scarce. It is less reliable as crops mature, because the crop provides a more attractive food source than canola-soaked card.

- For each sampling area, this method requires 10 pieces of strong paper or light card (10cm by 10cm), marked with a 1cm grid and soaked in canola oil.
- Place the cards randomly across a paddock and peg them to the ground.
- If more than 10 squares per card are eaten overnight, significant mouse populations are emerging.
- If more than 20 squares per card are consumed in immature crops, an on-going mouse problem is present.

## Trapping

- Set out a single straight line of 20 to 25 snap traps, spaced at 10cm interval, for three consecutive nights.
- Lay traps in a variety of habitats: paddock boundaries, in-paddock/ in-crop.
- Trap success is indicated by the number of mice caught, divided by the number of traps per line, multiplied by the number of nights. For example, 20 mice from 25 traps over three nights = 20/(25x3) = 26%.
- A trapping rate of more than 10 per cent indicates a significant mouse population is emerging.
- A trapping rate of 20 per cent in an early maturing crop indicates a problem.
- For ease of baiting, permanently attach a small piece of leather to the trigger and occasionally add a few drops of linseed (or similar) oil. Alternatively, smear peanut butter on the trigger each time the trap is set.

Trapped mice enable breeding status to be assessed. The earlier populations start to breed, the more likely a plague will occur. Signs to look for include pregnant females, females with prominent mammary glands indicating breeding has commenced, and small, juvenile mice. Adult mice measure approximately 72mm from the tip of the nose to the base of the tail.

Wear gloves when handling mice.

# Control

Keeping your farm clean – minimising the supply of quality feed through good harvesting techniques and cleaning up grain spills around stores and in the paddock – helps reduce the potential for the mouse breeding period to extend into late autumn/winter.

An integrated approach to control needs to be taken to help ensure feed supplies are minimised, especially in seasons conducive to mouse population build-up.

## Operations

- Control weeds and volunteers along fence lines, crop margins and channel banks in autumn and before seed-set to minimise sources of food and shelter.
- Rotations – chickpeas after barley are considered a higher risk than beans if mouse numbers are high.
- Sow as evenly and as early as possible for each crop, to achieve rapid establishment of strong plants. Do not dry sow.
- Slightly increase seeding rates and sow as deeply as possible for each crop if mouse numbers are elevated at seeding.
- Cross harrow or roll after sowing to ensure good seed coverage and the removal of sowing lines.
- When mouse populations are high at seeding, these cultural practices are often insufficient to control damage and baiting at sowing may be necessary.
- Harvest crops before they are over-ripe and pod shatter or grain loss occurs.

## Hygiene

- Minimising spilled grain in paddocks is key to limiting mouse populations and damage in next year's crop.
- Set harvesters to minimise grain loss and monitor how much grain is left in the paddock (Table 1).
- Heavy grazing can help clean up high harvest grain losses, but sufficient ground cover should be left to minimise erosion potential.
- Clean up any concentrated spills of grain around field bins, augers, silo bags and other grains storage.

PHOTO: EMMA LEONARD

**TABLE 1** How much mouse food is your harvester leaving? An acceptable level of harvester grain loss is 10 to 30kg/tonne harvested. A mouse can eat 3.5g/day, so 30kg/ha loss at harvest (that is for a yield of 1t/ha) is equivalent to 8570 mouse grazing days per hectare. A 10cm by 10cm quadrant = 0.01m$^2$.

| Grain type | 100 grain weight | Grain count in 0.01m$^2$ for a loss of 30kg/ha |
|---|---|---|
| Wheat, oats | 3 to 4 | 10 to 7.5 |
| Kabuli chickpeas, faba beans | 25 to 36 | 1.2 to 0.8 |
| Desi chickpeas, field peas, lupins | 17 to 25 | 1.7 to 1.2 |
| Lentils | 3 to 6 | 10 to 5 |
| Barley | 4 to 5 | 7.5 to 6 |
| Canola | 0.3 to 0.4 | 100 to 75 |

- Remove or reduce cover, including plant material, rubbish and general clutter around buildings, silos and fodder storage as these all provide protection for mice.

## In crop baiting

Baiting is not a total solution for crop protection, but assists in minimising potential damage. Baiting only kills those mice that eat the bait. In trials, 90 per cent of the mouse population in the baited area were killed.

Two rodenticides are currently registered for field use: bromadiolone and zinc phosphide. The GRDC is continuing research on mouse bait technology.

Zinc phosphide is registered for in-crop use only. Growers should consult the label for use instructions. Strict baiting criteria have been established to minimise risks associated with the release of toxic phosphine gas. The gas is not readily released into the atmosphere and the concentrations are insufficient to be harmful to grazing animals or humans. However, bee hives should be moved away from areas that will be baited.

Aerial or ground application can be used to spread zinc phosphide bait. A rate

of 1kg/ha provides 20,000 lethal doses per hectare. It can be spread in stubble, pasture and crop, or a vegetative fallow, but not on bare ground.

Ideally, mouse bait should be used in dry conditions to achieve maximum ingestion of the active ingredients.

Baiting at the time of sowing, or immediately after, is most effective for protecting recently sown crops. Baiting is also effective for controlling mouse damage during vegetative growth, flowering and seed set.

After baiting, mouse activity should continue to be monitored and rebaiting should not occur for 14 days. Baiting must not occur within two weeks of harvest, due to the withholding period. Bait must not be laid within 50m of the crop perimeter or native vegetation.

Many granivorous native birds feed in crops and are at risk if bait is laid on bare ground or if patches of bait are spilled during baiting operations. However, native mice are seldom found in crops and those that most commonly occur in crops feed on insects so they are at little risk of non-target mortality. Only chemicals that are registered to control mice can be legally used for this purpose. Other chemicals are not registered because they are either not effective or they have the potential to cause serious loss of wildlife.

### BAITING OUTSIDE OF CROPS

Bromadiolone is an anticoagulant poison. It is a grain-based bait and is registered for use only as a crop perimeter bait. It can be used on fence lines but not within the crop. Growers should consult the label for use instructions.

Secondary poisoning of (primarily) birds that feed on mice is a significant risk where bromadiolone bait is used. Zinc phosphide poses little secondary poisoning hazard. Checking for non-target animal mortalities is a condition for the use of either type of rodenticide.

No rodenticides are registered for use in native vegetation, other non-cropping areas such as roadsides or in Crown land. A wide range of baits are registered for use around farm storages, but zinc phosphide cannot be used around buildings, in towns or residential areas.

## Frequently asked questions

*How long will mice continue to cause damage?*

Mice can cause damage to seed, emerging, growing and ripening crops. Mice will continue to feed on a crop while it is a food source. Damage is most severe for about two to three weeks after crop emergence and again around seed-set. However, mice will sometimes cause significant damage to tillering cereals; for example, they are particularly fond of durum wheat.

*Can zinc phosphide and bromadiolone be used in the same paddock?*

Bromadiolone can only be used around the perimeter of a paddock and zinc phosphide can only be used broadacre. However, if mouse numbers are high it is a recognised strategy to use both baits in the same paddock.

Perimeter and in-crop areas should be monitored after baiting.

*How many applications of bait are required?*

Monitoring is the only method of establishing if further applications of bait are required. After baiting, mouse activity should continue to be monitored and rebaiting should not occur for 14 days.

Zinc phosphide bait will tolerate some rain, but rain action erodes the poison off the bait. Bromadiolone bait will only tolerate light rain and dew. Rebaiting may be required if rainfall occurs within the first couple of days of baiting.

*Are other animals at risk from mouse bait or baited mice?*

Mouse bait and mice that have succumbed to bait represent a very small but potential risk to dogs and other animals. It is recommended that growers restrain working dogs and pets during the baiting program.

## Useful resources:

- **Contact local mouse bait suppliers for up to date information on products**
- **CRC Invasive Animals CRC** — **www.feral.org.au/pest-species/mouse/**
- **Pestlinks** — **www.grdc.com.au/pestlinks**



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# MOUSE MANAGEMENT
## FACT SHEET

GRDC Grains Research & Development Corporation

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# On-going control of mice

Mouse numbers can build rapidly in the right conditions, leading to crop damage throughout the growing season. Monitoring and early detection of an increasing mouse population is essential if effective control is to be implemented.

### KEY POINTS

- In the right conditions, mouse numbers can increase rapidly.
- Crop damage, loss of feed and fodder, contamination of stored grain and disease spread are all associated with mouse plagues.
- Quality and availability of feed help extend the breeding season.
- Paddock and farm hygiene (including on-farm storage) are key to minimising the supply of quality food to mice.
- Monitoring numbers through the whole year and after baiting helps indicate changes in population size.

PHOTO: GRDC

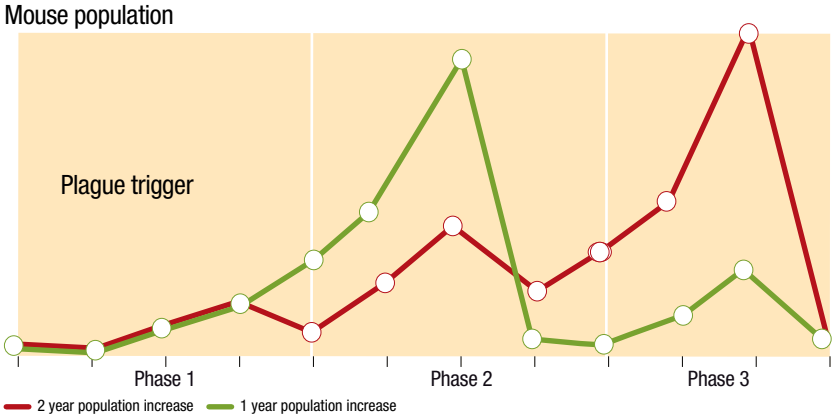
In the right conditions, mouse numbers can increase rapidly. Early detection of changes in mouse populations is essential so that appropriate control can be put in place.

Mice are always present in crops in low numbers, but can increase rapidly under favourable conditions, including:

- prolonged availability of high-quality feed;
- high crop yields and poor harvesting efficiency;
- early autumn rains that produce early seed-set of winter weeds;
- late spring or early summer rains that damage mature crops and produce a flush of summer weeds
- favourable burrowing conditions, such as cracking or light soils; and
- heavy crop residues.

All these factors help extend the breeding season beyond the usual October to May period. Knowledge of changes in breeding performance and the size of the over wintering population are important factors when assessing the likelihood of a plague. However, the rapid increase phase in mouse populations is often not fully recognised until numbers are approaching plague proportions. At this point control and damage minimisation becomes extremely difficult, so early detection and action are essential. It has been estimated that 200 mice are equivalent to one sheep grazing. In addition to causing damage to crops and spoiling stored grain, mice can spread food poisoning bacteria and disease such as meningitis.

**FIGURE 1 Population trends of mouse plagues**




Changes in abundance of house mice leading up to and during a plague.
The heights of peaks may vary between plagues.
Seasonal conditions during Phase 2 may prevent the population peak at Phase 3.
The population peaks occur four to six months after maximum feed availability, which will vary in, irrigated and summer cropping systems.

Previous research by CSIRO generally considers anything over 500 mice per hectare as representing a plague. The entire cycle of a plague is one to two years, with competition between mice causing high populations to crash (Figure 1).

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