

Rodent control in agriculture – an HGCA guide

Second edition



Agriculture & Horticulture
DEVELOPMENT BOARD

Introduction

Two rodent species are considered serious pests in the UK: the house mouse and the Norway rat.

Control is needed to:

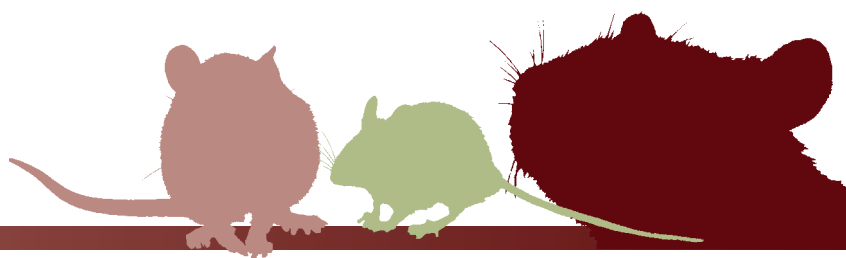
- Prevent storage loss and contamination
- Prevent disease transmission
- Avoid damage to growing crops
- Prevent structural damage
- Comply with legislation
- Meet assurance standards

The use of rodenticides and traps is just a part of the answer to rat and mouse problems. A planned Integrated Pest Management strategy is essential if effective rodent control is to be achieved. All attempts to control rodents and maintain rodent-free environments must combine efforts designed to kill the rodents with measures designed to try and make sure that they are not there in the first place.

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Integrated rodent management

Anti-rodent measures must be maintained throughout any production cycle.

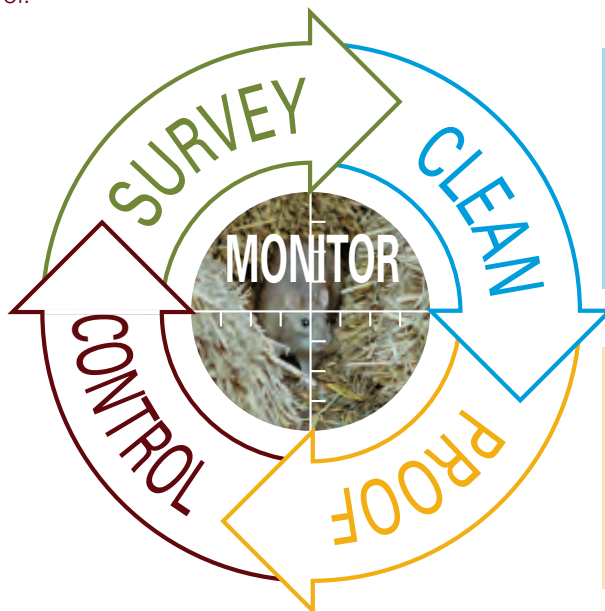
Prevention is always preferable to control.

Survey

Monitor for rodent activity all year round, checking for signs of rats and mice at least weekly.

Control

Most rodent control involves rodenticides. This should be combined with other techniques, such as traps, that may help prevent resistance developing.



Clean

Combine control operations with effective hygiene management to make the environment inhospitable to rodents.

Proof

Apply proofing measures to prevent rodents gaining access to environments where their presence is undesirable.

In case of doubt concerning rodent control, contact your local authority or a professional pest control contractor.



In crop stores, cleaning and control before harvest are vital.

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
SURVEY	ONGOING SURVEYING											
CLEAN			INTENSE CLEANING									
PROOF			INTENSE PROOFING									
CONTROL	ONGOING		INTENSE CONTROL						ONGOING CONTROL			

Livestock farmers should maximise control opportunities when buildings and yards are empty.

	STOCK IN BUILDINGS	EMPTY LIVESTOCK BUILDINGS
SURVEY	ONGOING SURVEYING	
CLEAN	ONGOING HYGIENE	
PROOF	ONGOING PROOFING	INTENSE PROOFING
CONTROL	ONGOING CONTROL	INTENSE CONTROL

Rodents

Rodents in the UK

Of some 2,500 rodent species worldwide, just 14 are present in the UK. Only three species are commensal (associate closely with humans) and only two are considered serious pests: the house mouse and Norway rat.

Other small rodents may enter buildings as casual intruders. Local infestations in fields and hedgerows may damage growing crops, particularly peas and sugar beet. Control is rarely required.

Serious pests

Norway rat *Rattus norvegicus*

Probably arrived in the 1720s and has replaced the black rat as a major commensal pest. It is present throughout the UK.



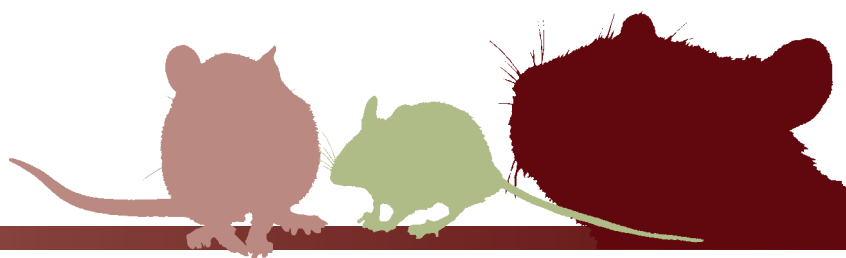
House mouse *Mus domesticus*

A common endemic commensal UK pest.



©Adrian Meyer

Characteristic	Norway rat	House mouse
Adult weight	Average 250–500 g (Max 700 g)	Average 17–20 g (Max 25 g)
Tail	Thick, shorter than head plus body, usually dark above and pale underneath	Thin, about the same length as head plus body, dark above and below
Eyes	Small	Small
Snout	Blunt	Pointed
Ears	Small and furry	Large, sparsely haired
Colour	Brown-grey above, grey or white below	Brown-grey above with lighter belly
Habitat	Mainly outdoors, except on intensive livestock units	Indoors
Family units	Eight to fifteen: very territorial when food and shelter in short supply	Social groups of four to nine, dominated by single male
Behaviour	Shy and avoids new objects, prefers stable and predictable environments	Highly inquisitive; investigates, rather than avoids, new objects
Feeding	Feeds at two or three familiar points each night Average daily intake 25–30 g Requires free water	Feeds at many, possibly up to 200, feeding points each night but only eats a very small amount at each feed Average daily intake 3–4 g Does not require free water but can utilise moisture in feed
Territory size	Males typically travel 700 m, females 350 m around farms and farm buildings each night Can travel up to 3.5 km	Ranges from one to hundreds of cubic metres, depending on food availability and harbourage
Activity	Very active in familiar areas Able to climb rough walls and pipes but mostly lives on the ground Can jump with ease – vertically to 80 cm, horizontally to 120 cm Capable swimmer	Particularly good climber, may spend most of its life off the floor of a building Able to squeeze through gaps as small as 5 mm and jump vertically to 30 cm and more
Annual excrement	15,000 droppings 5 litres urine	30,000 droppings 0.75 litres urine
Reproduction	Can produce around eight young about every 24 days in very favourable conditions	Can produce around eight young about every 21 days in very favourable conditions



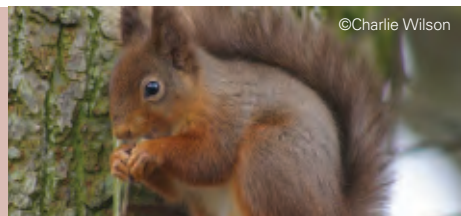
UK Biodiversity Action Plan priority species

These species have been identified as being the most threatened and requiring conservation action under the UK Biodiversity Action Plan (jncc.defra.gov.uk/page-5717).

Harvest mouse
Micromys minutus



Red squirrel
Sciurus vulgaris



Common dormouse
Muscardinus avellanarius



Water vole *Arvicola terrestris*

Can be confused with the Norway rat. Does not cause damage or pose a disease risk. It is increasingly threatened with extinction and is protected under the Wildlife and Countryside Act 1981.



Other rodent species

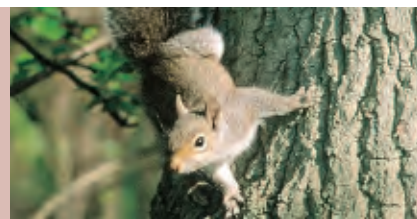
Black rat *Rattus rattus*

Also a pest but now only occurs in a few ports. It is usually smaller than the Norway rat. It has a thinner tail, which is longer than the head plus body, large eyes, pointed snout and large, thin, sparsely-haired ears.



Grey squirrel
Sciurus carolinensis

May attack crops and enter buildings. Different control legislation applies.



Wood mouse
Apodemus sylvaticus



Yellow-necked mouse
Apodemus flavicollis



Bank vole
Myodes glareolus



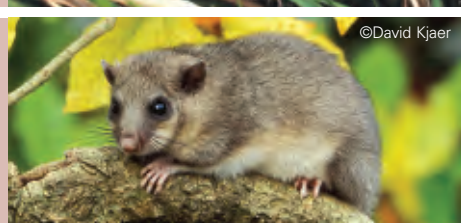
Field vole
Microtus agrestis



Orkney/ Guernsey vole
Microtus arvalis



Edible/fat dormouse
Glis glis



What is a rodent?

Rodents have curved and deeply embedded incisor teeth on both jaws. The specialised characteristics of rodents' jaws include:

- Continuous growth
- Tremendous biting pressure
- A very sharp cutting edge
- A gap in place of canine teeth to hoard and carry food



Need for control

To prevent storage loss and contamination

A serious threat usually occurs when rodent populations build up in food and feedstuff stores.

Rodents not only eat and damage significant amounts of the stored food but their urine and faeces also contaminate stored produce.

Contaminated food or feed may transmit diseases to humans or livestock.

With increasing emphasis on quality assurance, buyers may reject contaminated produce.

To prevent disease transmission

Rodents can spread diseases to humans, livestock and pets through bites, faeces and urine.

Indirect transmission may be through contaminated mud or dust and parasites carried on feet and fur.

Rats may spread foot and mouth disease, which is why control measures are essential on infested farms.

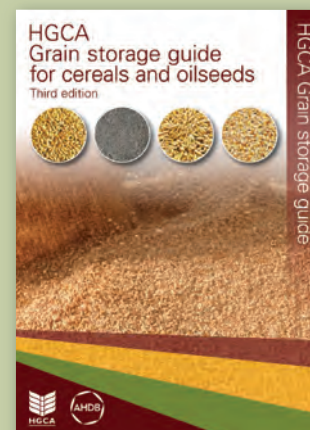
Because of the threats posed to humans from a range of rodent-borne pests and diseases, good hygiene is important:

- Wear protective clothing when working in rodent-infested areas
- Wash hands after work and before any food or drink is consumed

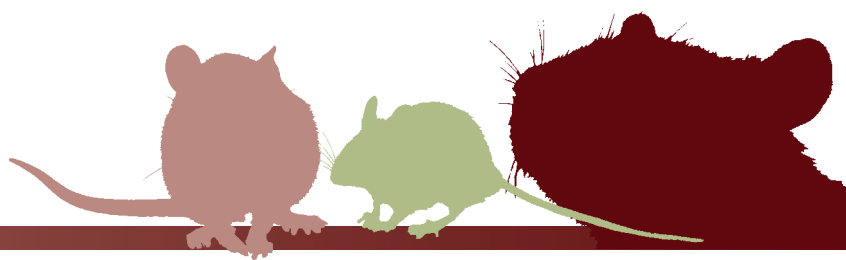
Anyone who has been exposed to rodent-borne threats should inform their doctor when seeking medical advice.

A survey by Oxford University in the early 1990s of farms in England and Wales found most farms contained populations of rats carrying a wide range of pests and diseases that threaten humans and livestock.

For more information on grain storage, see www.hgca.com/grainstorage



Disease agent	Disease of humans/animals	% infected/infested rats
Ectoparasites		
Fleas		100
Mites		67
Lice		38
Helminths		
<i>Capillaria</i> spp	Capillariasis	23
<i>Hymenolepis diminuta</i>	Rodent tapeworm	22
<i>Toxocara cati</i>	Toxocariasis	15
<i>Hymenolepis nana</i>	Rodent/human tapeworm	11
Rickettsia		
<i>Coxiella burnetti</i>	Q fever	34
Bacteria		
<i>Leptospira</i> spp	Weil's disease	14
<i>Listeria</i> spp	Listeriosis	11
<i>Yersinia enterocolitica</i>	Yersiniosis	11
<i>Pasteurella</i> spp	Pasteurellosis	6
<i>Pseudomonas</i> spp	Several pathologies	4
Protozoa		
<i>Cryptosporidium parvum</i>	Cryptosporidiosis	63
<i>Toxoplasma gondii</i>	Toxoplasmosis	35
Viruses		
Hanta virus	Hantaan fever	4



To avoid damage to growing crops

Norway rats may damage crops grown near livestock units, pheasant release pens or feeding points. In addition, sugar beet, beans and other crops may be damaged by either rats or mice when pest populations are high.



Field crops damaged by rodents



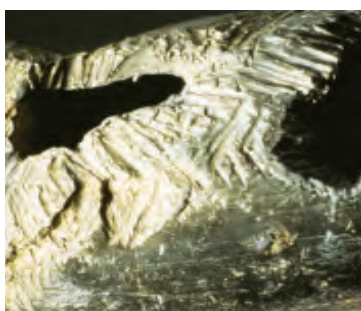
Glasshouse crop attacked by rodents

To prevent structural damage

Rodents damage buildings or equipment by gnawing. Wood, vehicles, electric wires, ventilation and drying systems, computers, water pipes, concrete and even metals can be damaged. Effects can be catastrophic, for example, drying and ventilation failures or fires.



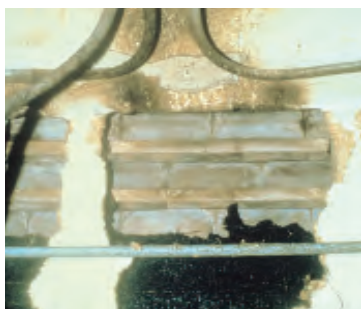
Damaged wiring can lead to fires



Even metal pipes can be gnawed



Building structures can be damaged



Rat smears and damage in livestock unit

To comply with legislation

1. **Prevention of Damage by Pests Act 1949** gives local authorities powers to require land occupiers to keep their land free from rodents.
2. **Food Safety Act 1990** requires that all food sold for humans must be fit for consumption. Any food sold contaminated with rodent urine or faeces will be considered unfit.
3. **Health and Safety at Work Act 1974** requires that all employees are provided with safe working environments. Rodent infestation within a working environment clearly places workers' health at risk.
4. **Food Hygiene (England) Regulations 2006** require food businesses to practise high food safety standards and meet specific requirements on ensuring adequate pest control procedures are in place (due diligence).

To meet assurance standards

Assurance schemes require farmers to demonstrate that they have effective rodent control programmes in place. This will usually involve a good record keeping system that demonstrates that control is being undertaken in line with good practice and legal and label requirements. It should also show that those undertaking the control have been adequately trained and include a plan of baiting points.

See **page 16** for more information on record keeping.

Rodent survey and treatment record

PHOTOCOPIY THIS FORM TO CREATE YOUR OWN RECORDS

Company Name: _____ Date of survey: _____
 Address: _____
 Telephone: _____
 Name of person: _____

How to use:

1. Fill in details	2. Inspect	3. Record
4. Survey	5. Treat	6. Record

Inspection record

Date	Inspected	Treatment	Remarks

Key: 1 = Inspected 2 = Treated 3 = Checked 4 = Rechecked 5 = Not checked 6 = Not checked by rodent control

Inspected by: _____ Treated by: _____
 Checked by: _____ Rechecked by: _____

Cost per animal: _____

Observations and recommendations:
 (Health and safety, animal welfare, etc.)

Integrated rodent manage

Environmental management

Commensal rodent infestations have a basic requirement for the availability of three main characteristics in their environment:

- Food
- Water (house mice less so)
- Harbourage or somewhere to live and nest

If these requirements are not met, the habitat becomes less attractive to rodents and less likely to sustain an infestation.

Survey

Monitor for rodent activity all year round. Look for signs of rats and mice at least weekly.

Keep areas next to doors and walls clear to enable access for inspection and proofing.



Clean

Maintain an environment that does not attract and support rats and mice, both outside and inside buildings. Good cleaning will remove food sources. Take the opportunity when stores are empty or livestock are out of the building to clean intensively.

- Remove cover
- Cut or spray back vegetation
- Tidy up
- Remove all excess food
- Clear spilt grain from doorways
- Clean harvest equipment to avoid providing food and harbourage

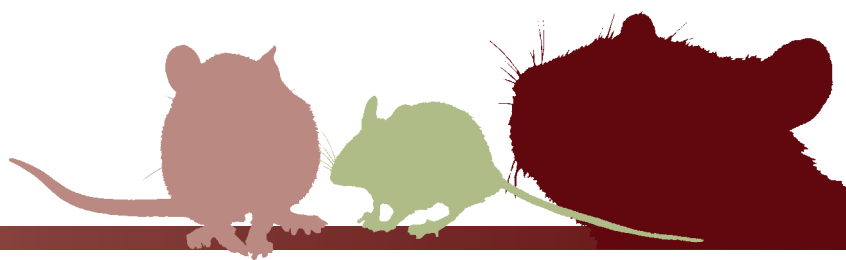
Proof

Apply 'proofing' measures to prevent rodents gaining access to environments where they can find their requirements or where their presence is particularly undesirable.

- Secure glazing prevents rodent entry
- Use sealant to fill gaps that would provide a means of easy entry
- Open areas reduce harbourage
- Covered grain pit enhances rodent proofing
- Contained livestock centralises feeding



Applying hygiene and proofing measures during direct population reduction can be counterproductive. It interferes with rodent behaviour patterns and may encourage the rodents to move to alternative areas. In most cases, hygiene and proofing measures (apart from removing alternative food) should be applied after the infestation has been eliminated.



Chemical control

Most rodent control involves rodenticides in an integrated programme.

The following pages provide information on:

- The different rodenticides available
- Rodenticide application and safe use
- The Campaign for Responsible Rodenticide Use
- Resistance to rodenticides

Rodenticide formulations

Ready-to-use **loose baits**, based on cereals, are usually the most effective and most widely used. Many formulations include fungicides to prevent moulds and deterioration. Most contain Bitrex™, a human taste deterrent, to increase safety.

Loose baits are also available in **sachet packs** which, while more convenient to use, may be carried into exposed areas, placing non-target species at risk.

Wax blocks and pellets incorporating rodenticide may offer a more weather-resistant presentation. Blocks often have a hole by which they can be secured and spillage can be prevented.



Dead bodies should be removed as soon as possible

Edible gels can be conveniently applied using a caulking gun.

Pasta baits are available, often in sachets, and can be retained by threading the sachets onto wires.

Contact dusts and liquid rodenticides are no longer available in Europe and are being phased out.

Physical control

These techniques may help prevent resistance developing and avoid the risk of contaminating food preparation areas.

Live capture traps

Live capture trapping is usually an expensive approach and is usually only used if rodenticides do not work and the rats or the mice are avoiding killing traps. Traps may also be selected where there is concern about the possible contamination of food or feed by rodenticide spillage.

- Use at high density for mice
- Visit and humanely dispatch rodents every day

Sticky boards

Sticky boards are not very effective and a requirement for frequent checking, for reasons of humaneness, often makes their use impractical.

Ultrasonic repellents

Rodents communicate ultrasonically using frequencies inaudible to humans – above about 20kHz. Ultrasonic devices claiming to drive rodents away are not generally considered effective.

Electromagnetic devices

Devices are available that plug into the ring mains and create an electromagnetic field around the ring main. There is no scientific evidence for the effectiveness of these devices.

Killing traps

Killing traps alone are unlikely to control heavy rodent infestations. They help to reduce survivors of rodenticide treatments, especially if there is resistance, and remove individuals at sites where continued rodenticide use places non-target species at risk. Traps available for rat and mouse control include normal break-back traps and traps approved under the Spring Traps Approval Order 2012.

The use of **break-back traps** for both rats and mice is probably the most widespread and successful trapping technique. Careful placement is required: the trap should be placed at right angles to the direction of rodent travel, the treadle end of the trap being placed across the rodent run, against a vertical surface to minimise avoidance. Baits or attractants can increase catch rates if placed on the trap treadle but traps will work without such attractants.

Approved **spring traps** should be placed along rat runs or where moving rats may be intercepted, for example, along walls or hedgerows, holes in walls, etc. All spring traps must be placed in natural or artificial tunnels to protect non-target species.

- Use only break-back or approved spring traps
- Place along rodent runs at high density
- Secure traps
- Protect against access by non-target species
- Check daily to remove carcasses and reset traps



Approved spring trap set for Norway rats in protective box to prevent non-target access

Check daily to remove carcasses and reset traps

Rodenticides

Rodenticide groups

Chronic (multi-feed)

Almost the only rodenticides currently used in the UK are the anticoagulants, which cause death by haemorrhage. Used correctly, they can achieve 100% kill. Effectiveness depends on regular and continuous feeding over several days – even weeks. Death occurs between two to 14 days after feeding commences.

The slow-acting nature of anticoagulants allows the rodents to keep feeding until a lethal dose has been consumed.

Rodenticide feeding must be maintained until control has been achieved, otherwise recovery may occur. Average treatment time may extend over four or five weeks before a whole population has eaten a lethal dose.

Anticoagulants can be used against Norway rats and house mice.

All anticoagulants registered for UK use have a similar mode of action. 'Second generation' products were introduced in the early 1970s as a result of research to overcome resistance.

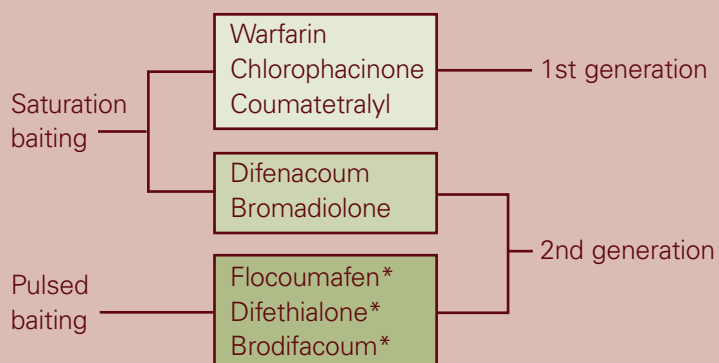
'Saturation' or 'surplus' baits have to be available to rodents throughout the campaign.

- Check and replenish bait points frequently, at least every week and more frequently during the first week of baiting

'Pulsed' baits are more toxic, so less product is needed with less frequent topping up. It is less critical if supplies of these products are not available at bait points for a day or two. While sometimes classed as 'single feed' anticoagulants, the majority of rodents must feed several times before consuming a lethal dose.

- Check and replenish bait points at least every 7-10 days
- Only use these products indoors ('behind closed doors') and 'where the rodents are living and feeding predominantly indoors'

Anticoagulant rodenticides available in the UK:



*Brodifacoum, difethialone and flocoumafen are currently only approved for use 'indoors' – see product labels for the latest restrictions

Acute (single dose)

Acute rodenticides are comparatively fast-acting and produce discomfort. Unless a lethal dose is consumed at the first feed, the rodent will recover and may shy away from further feeds. Only one acute rodenticide is available in the UK. Even with thorough use, mortality will probably average only 70-80%.

Alphachloralose should only be used for house mouse control and is not effective and not approved for use against rats.

Alphachloralose is a narcotic and acts by slowing down the metabolism of the rodent. Death usually results from hypothermia (the mice die of the cold). It is most effective at temperatures below around 14-15°C. It may be directly toxic if larger amounts of bait are eaten. Sub-lethal poisoning will occur in a proportion of the mice and can result in subsequent poison and bait shyness.

- Remove all alternative foods
- Place small bait points at very high density

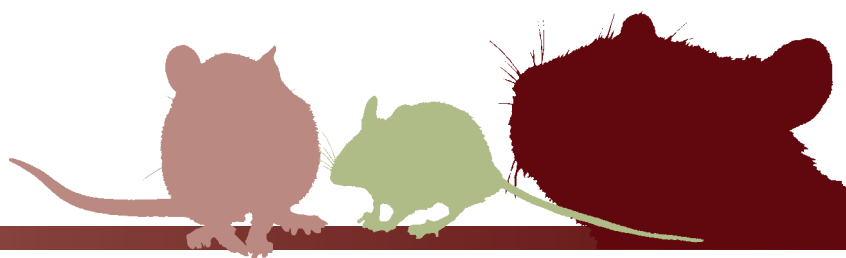
Powdered corn cob (alphacellulose-based) rodenticides

These rely on a non-toxic food source to disrupt the digestive system of rodents. The products are based on ground maize cobs mixed with wheat flour and molasses and are presented as a rodenticide. Unlike conventional baits, these products will need to form a significant part of the diet of rodents to be effective and their level of efficacy remains in doubt.

Phosphine-generating formulations

Formulations based on aluminium phosphide are registered for use against Norway rats (and rabbits and moles). Gases are generated by placing aluminium phosphide tablets in rat burrows, which are then subsequently blocked. The tablets of aluminium phosphide then absorb moisture from the air and soil, liberating toxic phosphine gas which fills the burrow.

- Gassing is not permitted within 10 metres of buildings
- The use of these compounds is particularly hazardous
- Aluminium phosphide may only be used by persons trained in its use and, from November 2015, all users will also have to be qualified and will have had to have passed the relevant examination



Rodenticide application

Every effort must be made to prevent both primary poisoning of non-target species and secondary poisoning of the food chain with rodenticides.

Edible baits should be placed along runs and in areas used by rodents following a thorough survey.

The introduction of permanent toxic baits in areas, as a means of preventing infestation, should not be undertaken unless a risk assessment indicates that the bait point is necessary. Such bait points provide a potential source of toxicant to non-target species, such as the wood mouse, and increase the risk of secondary poisoning and contamination of the food chain. Always follow label recommendations.

House mice enter bait boxes and investigate baits and traps fairly readily. They tend to eat a small amount from many sites.

Effective baiting is best achieved by having a large number of bait boxes and traps, if trapping is being used, ideally at one metre intervals, both on and off the ground throughout the infested areas.

House mice are very good climbers and spend much of their time off the ground: bait this vertical activity as necessary.

Norway rats may avoid baits and bait containers for some time (they are neophobic, ie fear new objects).

Control may best be achieved by placing bait in burrows, where rats feel safest and are most likely to feed. Using natural materials with which the rats are familiar and using bait based on familiar foods encourages feeding.

Safe use of rodenticides

Rodenticides are very toxic, particularly to mammals and birds. Anticoagulant residues are regularly found in predators, eg barn owls, which feed on small mammals. Misuse, even through carelessness or ignorance, may lead to prosecution.

Rodenticides and gases are classed as 'vertebrate control products'. They do not attract a requirement for users to hold a certificate of competence as is required for the use of 'agricultural' pesticides. Users must, however, be trained and competent. A certificate of competence will be required for aluminium phosphide from November 2015.

Ensure rodenticides are used safely and correctly. Always read the label and follow instructions.

- Conduct a COSHH assessment before using rodenticides
- Ensure operators are correctly trained
- Observe relevant legislation
- Use products safely in accordance with label recommendations, including safe storage, protective clothing, visit frequency and maximum bait placement
- Seek medical or veterinary advice in the event of accidental poisoning
- See the Campaign for Responsible Rodenticide Use recommendations (pages 12-13)

Control of Pesticide Regulations 1986 require that users are provided with sufficient instruction and guidance to use rodenticides safely.

Present baits safely

- Do not overfill bait containers
- Do not leave bait boxes open and bait exposed
- Do not allow bait to spill from bait containers
- Do not allow bait to be exposed when burrow baiting
- Bait points should be checked at least weekly so that bait can be replaced

Good baiting practice



Rat bait point protected behind non-target barrier



Rat bait in tamper-resistant bait box. Lock and secure if COSHH assessment indicates risk of interference

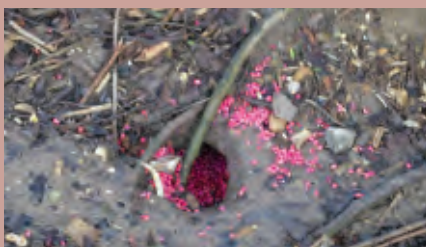


Rodenticide block bait in bait box

Bad baiting practice



Overfilled bait box



Bait spillage around burrow



Spillage from bait box

Responsible rodenticide use

The Campaign for Responsible Rodenticide Use (CRRU) Code

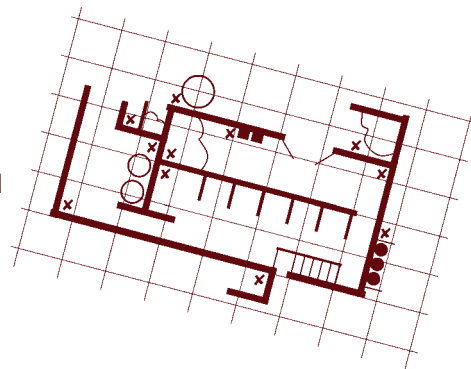
Always have a planned approach

- Before treatment begins, a thorough survey of the infested site is an essential key to success when using any rodenticide.
- Environmental changes that could be made to reduce the attractiveness of the site to rodents should be noted for implementing after the treatment. Usually this will involve rodent proofing and removing rubbish and weeds that provide harbourages and cover. However, the site should not be cleared before treatment since this will disturb the rodent population and make bait acceptance more difficult to achieve.
- Obvious food, such as spilled grain, should be removed as far as possible and any food sources covered.
- Rodenticide baits should only be used for as long as is necessary to achieve satisfactory control.
- In most cases, any anticoagulant bait should have achieved control within 35 days. Should activity continue beyond this time, the likely cause should be determined and documented. If bait continues to be consumed without effect, a more potent anticoagulant should be considered. If bait take is poor, relative to the apparent size of the infestation, consideration should be given to re-siting the bait points and possibly changing to another bait base, as well as making other environment changes.



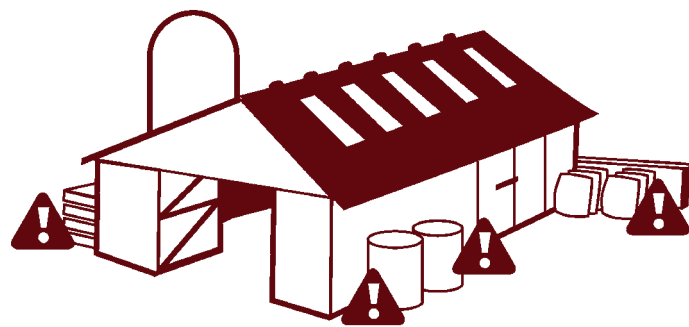
Always record quantity of bait used and where it is placed

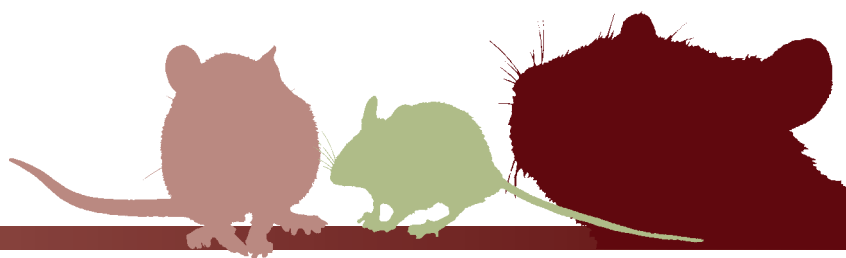
- A simple site plan or location list identifying areas of particular concern pertinent to the site should be drawn up and retained on file.
- A record of all bait points and the amount of bait laid should be maintained during the treatment. Activity should be noted at each bait point, including any missing or disturbed baits, as the treatment progresses.
- By carefully recording the sites of all bait points, responsible users of rodenticides are able to return to these sites at the end of the treatment and remove uneaten bait so that it does not become available to wildlife.



Always use enough baiting points

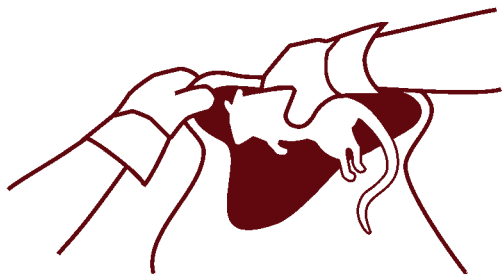
- Users should follow the label instructions regarding the size and frequency of bait points and the advice given regarding the frequency and number of visits to the site.
- By using enough bait points, the rodent control treatment will be conducted most efficiently and in the shortest possible time. This will restrict the duration of exposure of non-target animals to a minimum.





Always collect and dispose of rodent bodies

- The bodies of dead rodents may carry residues of rodenticides and, if eaten by predators or scavengers, may be a source of wildlife exposure to rodenticides.
- It is essential to carry out regular searches for rodent bodies, both during and after the treatment period. Bodies may be found for several days after rats have eaten the bait and rats may die up to 100 metres or more away from the baited site.
- Any rodent bodies should be removed from the site and disposed of safely using the methods recommended on the label.



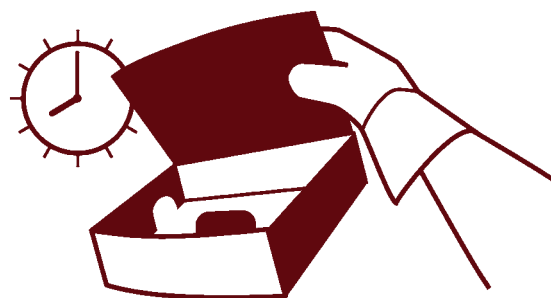
Never leave bait exposed to non-target animals and birds

- Care should be taken to ensure that bait is sufficiently protected to avoid accidentally poisoning other mammals and birds. Natural materials should be used where possible.
- Bait stations should be appropriate to the prevailing circumstances. They should provide access to the bait by rodents, while reducing the risks of non-target access and interference by unauthorised persons. They should protect the bait from contamination by dust or rain. Their design, construction and placement should be such that interference is minimised.



Never fail to inspect bait regularly

- Where the risk assessment or treatment records show that multiple visits are required, then those should be made as frequently as is considered necessary. Daily inspection may be required in some circumstances.
- At each visit, baits should be replenished according to the product label and a thorough search made to ensure that bodies and any spilled bait are removed and disposed of safely. Records of such visits should be maintained.



Never leave bait down at the end of the treatment

- Bait left out at the end of a treatment is a potential source of contamination of wildlife.
- On completion of the treatment, records should be updated to signify that the infestation is controlled and that, as far as reasonably practical, all steps have been taken to ensure that the site is now free of rodenticide bait.



For further information visit: www.thinkwildlife.org.uk

Rodenticide resistance

Identifying situations of rodenticide resistance

Explore all causes of poor control before assuming resistance is an issue. Incorrect or inadequate bait use or placement as well as bait palatability will most often explain the apparent ineffectiveness of rodenticides. Inadequate coverage of the infested area and immigration from adjoining areas may also cause a problem.

Where there is rodenticide resistance, bait consumption continues and may even increase over time. Using good practice, control of Norway rats and house mice should typically be achieved in five weeks. If bait consumption continues much longer than this, resistance to the anticoagulant used may be present.

Anticoagulant resistance in Norway rats

Resistance in Norway rats to first generation anticoagulants was first identified in the late 1950s.

Resistance is genetically based and transfers from one generation to the next. Nine different anticoagulant resistance mutations are found in the UK.

Understanding of the geographical distribution of resistance is incomplete but increasing. In some parts of the country, it is found extensively on farms, especially livestock holdings.

Anticoagulant resistance in house mice

In house mice, resistance to first generation anticoagulants has been widespread for many years and none are approved against this species.

House mice possess a degree of natural resistance to anticoagulant rodenticides, so they are generally less effective than against rats.

The genetics of resistance is less well understood in the house mouse but there is evidence of house mouse resistance to the second generation anticoagulant bromadiolone. Its extent is not known.

Resistance management

Continued application of active ingredients to which there is resistance may result in the spread of resistance.

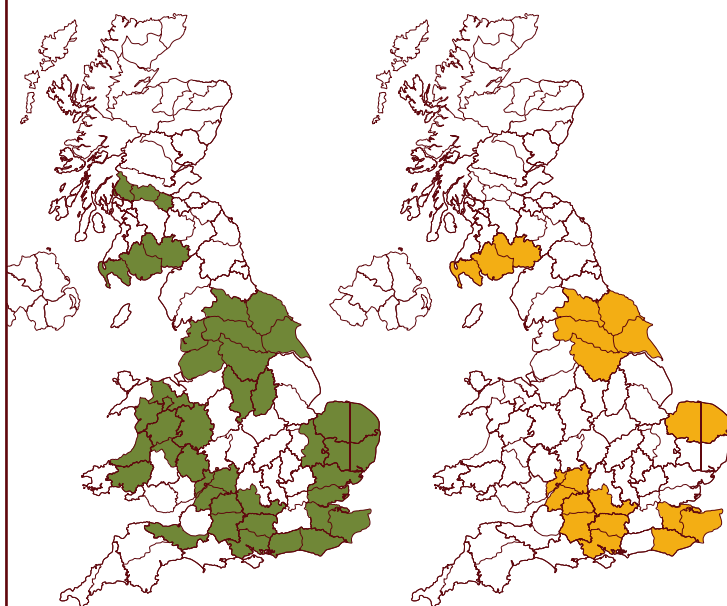
Reliance on anticoagulants for control means that improved resistance management strategies are important. These include:

- Use of alternative control methods
- Knowledge of the distribution of resistance mutations
- Use of only fully effective anticoagulants

Norway rat resistance to anticoagulants

Where, over 40 years of monitoring, resistance has been recorded at some time to:

- first generation rodenticides
- second generation rodenticides difenacoum or bromadiolone

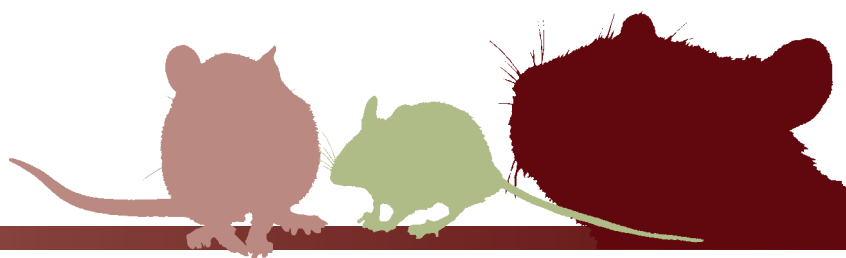


Shading does not imply that all rodents in these areas have resistance, nor does lack of shading imply that there is no resistance, as testing may not have been carried out.


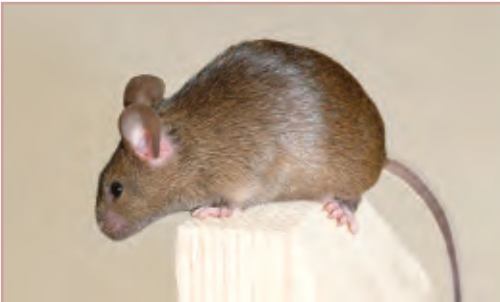

There is no evidence of resistance to brodifacoum, difethialone or flocoumafen.

Continuing evidence emerges that the extent of resistance to first and second generation anticoagulants may be more extensive than illustrated.

For the latest information on rodenticide resistance, see www.bpca.org.uk/rrag



Resistance strategies

		
Where resistance is suspected to:	Norway rats	House mice
First generation anticoagulants	Use a second generation anticoagulant Consider the use of physical controls	Never use first generation anticoagulants 
Difenacoum	Consider using bromadiolone Alternatively, brodifacoum, difethialone or flocoumafen may be used 'indoors' (behind closed doors and where rodents are feeding and living predominantly indoors) Consider the use of physical controls	Use bromadiolone, brodifacoum, difethialone or flocoumafen Consider the use of physical controls
Bromadiolone	Consider using difenacoum Alternatively, brodifacoum, difethialone or flocoumafen may be used 'indoors' Consider the use of physical controls	Use difenacoum, brodifacoum, flocoumafen or difethialone Consider the use of physical controls
Difenacoum and bromadiolone	Use brodifacoum, difethialone or flocoumafen 'indoors' Consider the use of physical controls	Use brodifacoum, flocoumafen or difethialone Consider the use of physical controls

For situations where resistance to all the anticoagulants that may legally be used out of doors is present and therefore no effective control of Norway rats can be achieved using anticoagulants:

– Use extensive and intensive trapping

And/or:

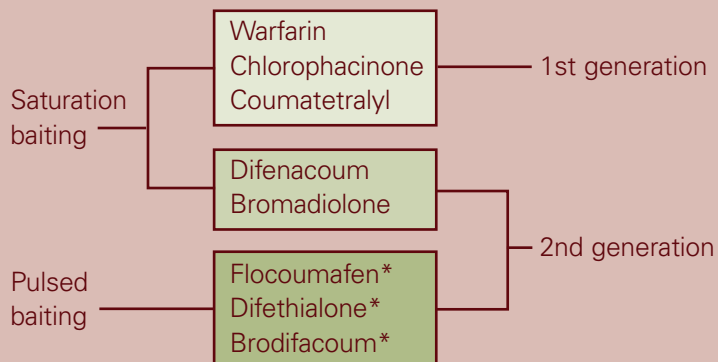
– Use aluminium phosphide phosphine as a part of the resistance control strategy where gassing can safely be carried out

And/or:

– Use other physical control techniques

This situation already exists in many parts of central southern England (W Berks, Hampshire, Wiltshire, S Oxfordshire) and possibly beyond.

Anticoagulant rodenticides available in the UK:



*Brodifacoum, difethialone and flocoumafen are currently only approved for use 'indoors' – see product labels for the latest restrictions

Record keeping

Why is record keeping important?

- Maintaining good records helps to demonstrate that a fully integrated rodent management strategy is in place and due diligence is being applied
- Comprehensive records not only help identify what has happened but also monitor the progress of control and satisfy legislation
- Farm assurance and registration schemes of buyers and customers and their auditors impose record-keeping requirements
- Failure to keep adequate records could mean loss of markets, registration or certification

What information should be recorded?

Staff training and safe working practices are required by law

- Record staff training detail

All purchase and usage must be recorded to meet legislation and to ensure others can take over control programmes with minimum risk

- Record amount purchased and date delivered
- Record name of operator
- Record amount and date of use
- Record number of points baited
- Map location of bait points

Record of progress of campaign

- Record date of bait points inspection
- Record amount of bait consumed
- Record carcasses found and method of disposal

Bait inspections are an ideal time to observe areas requiring proofing or improved hygiene

- Note issues requiring attention
- Record date when issues addressed

At the end of a campaign rodenticide should be disposed of safely in line with current regulations

- Record amount of rodenticide requiring disposal
- Record method and location of disposal

How should records be kept?

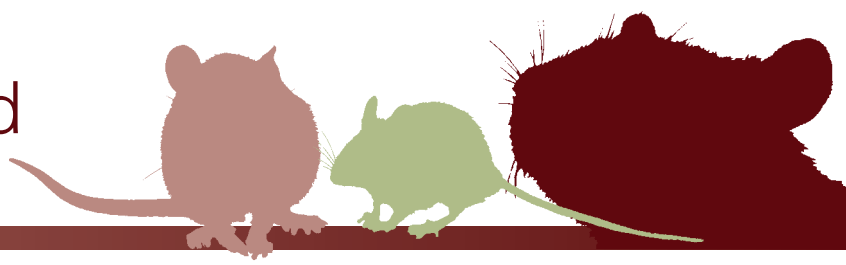
- All records should be maintained at a central point for ease of access
- The form opposite may be photocopied to provide a detailed record that will demonstrate due diligence

Rodenticide use and records must meet the needs of legislation and assurance schemes

- Ensure you understand legal obligations
- Check requirements of assurance schemes and customers
- Undertake COSHH and risk assessments and keep Safety Data Sheets used for the assessments
- Follow label recommendations



Rodent survey and treatment record



PHOTOCOPY THIS FORM TO CREATE YOUR OWN RECORDS

Business name <input style="width: 95%;" type="text"/> Site address <input style="width: 95%;" type="text"/> <input style="width: 95%;" type="text"/> <input style="width: 95%;" type="text"/> <input style="width: 95%;" type="text"/>	Operator's name <input style="width: 95%;" type="text"/> Rodenticide/ formulation <input style="width: 95%;" type="text"/>
---	---

How to use

	1/01/13	8/01
Bait point	CT	1 carcass
1. GRAIN STORE DOOR	250g	disposal method
		PT 100

Inspection record	Inspection date					
Bait point	1	2	3	4	5	6
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

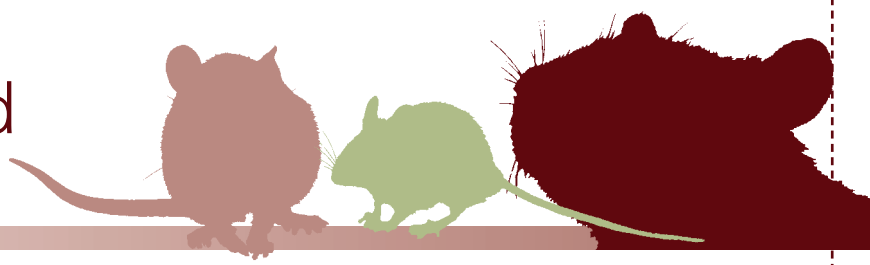
Key: NT = No take PT = Partial take CT = Complete take
 L = Lost D = Disturbed by non-target animal/bird

Date treatment finished / /

Date bait removed / /

Observations and recommendations

(Sketch area surveyed overleaf. Note signs of activity and proofing/hygiene issues.)



Bait location plan

Sketch area surveyed and note signs of activity and proofing/hygiene issues.

A large area for sketching and notes, featuring horizontal dotted lines for writing and a vertical dashed line on the right side.

Further information

HGCA information

HGCA publications are freely available to download from www.hgca.com/publications

Grain storage

- G52 Grain storage guide for cereals and oilseeds, 3rd edition (2011)
- P01 Insects and mites in stored grain and grain stores
- P03 Inspecting grain for defects and impurities

Other information

Guidance on storing pesticides for farmers and other professional users, Agricultural Information Sheet No 16, HSE (1997) – free

Safe use of pesticides for non-agricultural purposes, Control of substances hazardous to health regulations – 1994, HSE (1995) ISBN 0 7176 0542 6

Safe use of rodenticides on farms and holdings, Agricultural Information Sheet No 31, HSE (1999) – free

Guidelines for the safe use of anticoagulant rodenticides, British Pest Control Association (2001) – free

The British Pest Management Manual (2012), Published by the British Pest Control Association

Killgerm pest control manual, The Killgerm Group Ltd (2012)

Websites

British Pest Control Association: www.bpca.org.uk

Campaign for Responsible Rodenticide Use:
www.thinkwildlife.org.uk

Chartered Institute of Environmental Health:
www.cieh.org.uk

Rodenticide Resistance Action Group: www.bpca.org.uk/rrag

Health & Safety Executive: www.hse.gov.uk

Natural England: www.naturalengland.gov.uk

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Rodenticide resistance maps (page 14) compiled using data provided by the Rodenticide Resistance Action Group in collaboration with the Centre for Ecology and Hydrology.

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