

Rabbits: management options for preventing damage

The European rabbit *Oryctolagus cuniculus* has once again established itself as the major vertebrate pest of British agriculture, causing economic losses estimated to be in excess of £100 million annually. The total winter population is estimated to be at 35% to 40% of the pre-myxomatosis level (circa 1952) and is increasing by about 2% annually. This is due primarily to the reduced effect of myxomatosis, resulting from increased levels of genetic resistance. Given the problems associated with rabbits, this increase in numbers is likely to be accompanied by a corresponding rise in the amount of serious crop damage reported. It is essential, therefore, that effective control strategies are available to ensure that crops vulnerable to rabbit damage are adequately protected. This will serve to benefit landowners and occupiers who have a statutory responsibility to manage rabbit infestations on their land and to prevent them causing damage to neighbouring properties.

Damage

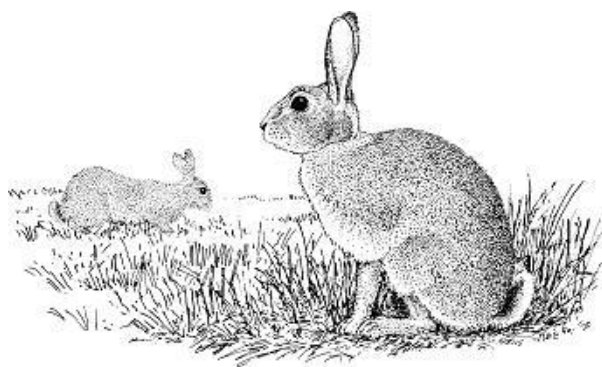
Cereals

It is estimated that farmers are losing about £50 million per annum as a consequence of rabbit damage to cereals. Winter wheat, barley and oats appear to be most vulnerable. Rye and triticale suffer smaller losses and spring barley appears to be the least susceptible to rabbit damage. In terms of annual yield, a loss of 1% per rabbit per hectare (2.5 acres) has been recorded for winter wheat and 0.33% per rabbit per hectare for spring barley.

The effects of grazing on winter cereals are most obvious during the winter, when plant growth is slow, and become less apparent when crops grow more rapidly in the spring.

In fact, by harvest, plants grazed by as many as 20 rabbits per hectare can be the same height as plants that have never been grazed. Yields, however, can be reduced by about 20%.

This clearly illustrates not only the scale of the problem but also the difficulties in accurately assessing the impact of grazing.



Rabbits

Grassland

The effect of rabbit grazing on pasture is less obvious than on cereals. Grazing of newly sown grassland may result in poor establishment or complete failure of the sward. Over-winter grazing of established grassland reduces early grass that is needed in the spring. Yields of crops cut later for silage or hay may also be substantially reduced.

Continuous grazing soon reduces the vigour of species such as Italian ryegrass or meadow fescue.

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Permanent grass on good soils is better able to withstand close defoliation, but grazing by large numbers of rabbits can weaken or kill even persistent leafy ryegrass. Scratching and burrowing can degrade pasture still further by encouraging the establishment of weeds such as nettles, thistles and ragwort. In terms of annual yield, recent studies have indicated the loss to be almost 1% per rabbit per hectare.

Other crops

Rabbit damage has been recorded to a wide range of crops in Britain. Besides cereals and grassland, some of the most important include roots, brassicas and market garden crops, which can all suffer severe damage, both to the growing plants and the marketable end product.

Trees

Rabbits can damage or kill planted nursery stock and young trees of many species. Damage to the bark of large trees can also be serious and semi-mature hedgerows may also be vulnerable. In extreme circumstances, rabbits may prevent natural regeneration in woodlands. Damage ranges from the eating of young seedlings to the destruction of leading shoots, the browsing of branches and removal of bark. The burrowing activities of rabbits can also undermine root systems.

Damage to archaeological sites, monuments and landscapes

Animal burrowing on archaeological sites results in the disturbance and sometimes destruction of artefacts, ecofacts and buried land surfaces. It also leads to the destabilisation of monuments, which in turn can lead to an altering of a monuments profile. Damage by burrowing should be prevented or avoided because our archaeological resource is finite and contains irreplaceable information that is important to the study of the human past.

Management

Rabbit populations can withstand high mortality from natural causes, therefore control efforts must add to, and not merely replace, these causes if direct control is to be effective.

Because of the size of the effort required, and the rabbit's inherent capacity for population increase, complete eradication is impractical.

Instead the aim should be to reduce rabbit numbers to levels at which the damage they cause is economically acceptable. Where access can be gained to burrows, gassing - accompanied by careful habitat management to reduce rabbit harbourage, if necessary - is the most effective method of control. In some situations, other techniques may be appropriate.

The most effective time for control is from November to March, although earlier action may be needed on autumn cereals showing signs of heavy grazing. There are four main reasons for this recommendation:

- Mortality from natural causes will have reduced rabbit numbers to their lowest level by the winter. Up to 90% of young rabbits born during the summer will have died by this time without human intervention.
- Action at this time will reduce the adult breeding population before the next breeding season begins. Each doe killed during this period can mean at least 20 fewer young rabbits born next summer.
- Reduction of numbers during this period will reduce damage to vulnerable autumn sown crops.
- Vegetation is dying back, making access to burrows easier.

More effective results will be achieved if adjoining land is treated at the same time in a co-operative exercise. Rabbits do not respect boundaries, and joint action will remove animals that use burrows on one holding and feed on another. Control over a substantial block of land will also reduce the rate of re-infestation.

The quality and amount of harbourage are major factors that can determine the number of rabbits in a particular area. Habitat management should therefore play an integral part of any successful rabbit control programme. Scrub and ground cover may need to be thinned sufficiently to give access to all burrows; this is essential where gassing is planned. Also, where practicable,

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burrow systems should be destroyed following control operations.

Appropriate measures should be taken to minimise damage to other wildlife and habitats. For example, scrub clearance should be avoided during the bird-nesting season.

Legal considerations

Under the Wild Mammals (Protection) Act 1996 it is an offence to intentionally inflict unnecessary suffering, as specified by the Act, on any wild mammal. This legislation may need to be considered where the destruction of occupied warrens and burrow systems is being contemplated.

Under the Animal Welfare Act 2006 a rabbit becomes a Protected Animal once it is caught in a trap or snare, making it an offence to cause unnecessary suffering. Traps and snares should therefore be inspected at least once and preferably twice a day and, wherever possible, be placed where the trapped animal will not be exposed to extremes of weather.

Under Section 12 of the Pests Act 1954, it is an offence to knowingly spread myxomatosis to uninfected rabbits. The Specified Animal Pathogens Order 1998 (S.I. 1998/463) prohibits the introduction into an animal of the live virus causing viral haemorrhagic disease (VHD) of rabbits, except where such introduction is undertaken under the authority of a licence. These prohibitions mean that the deliberate spreading of myxomatosis or VHD cannot be used as a legal method of controlling rabbits.

An Order has been made under Section 1 of the Pests Act 1954 by which England and Wales (except for the City of London, the Isles of Scilly and Skokholm Island) have been designated a Rabbit Clearance Area. In this area, every occupier of land is responsible for the killing or taking of wild rabbits on his land. Where it is not reasonably practical to destroy the rabbits, occupiers must take the necessary steps to prevent them causing damage.

Under section 98 of the Agricultural Act 1947, Defra has the power to serve a Notice under the Agriculture Act 1947, requiring rabbit control to

be carried out; if this is not done, they may arrange for the necessary work to be undertaken at the expense of the occupier, who could also be liable to a fine.

To help manage infestations, the Ground Game Act 1880 gives every occupier of land a limited right to kill and take rabbits and hares concurrently with the right of any other person entitled to do so on the same land. An occupier may use any legal method to kill rabbits and should ensure that they comply with other legislative controls on the methods of killing and taking animals, the most relevant of which are discussed further below.

The occupier may, in writing, authorise other persons to assist him, however only he and one other person authorised by him are entitled to kill using a firearm. The Ground Game Act 1880 exempts an occupier, and persons authorised by him, from the need to hold a game licence when killing or taking rabbits on the occupier's land.

Monuments that are being damaged by burrowing animals may be Scheduled. Any proposals to control rabbits on Scheduled Monuments should be discussed with English Heritage before work starts, to determine whether Scheduled Monument Consent is required.

Control methods: gassing

Gassing is the most effective method of reducing rabbit numbers where burrows are accessible. When correctly used, under the right conditions, gassing can reduce the rabbit population by up to 80%. However, effectiveness decreases in porous soils, when soil moisture is low and also when air temperatures fall below 5 °C. For best results, it is essential to drive rabbits to ground before gassing and to find and treat every entrance to the warren system.

On monuments and archaeological sites the soil used for closing up burrow holes should be brought in from off-site as any further digging on site will further damage the monument and add to its disfigurement. On Scheduled Monuments this should have already been agreed with

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English Heritage as part of the Scheduled Monument Consent.

Selective scrub clearance may be necessary to gain access to burrows. Before embarking on a gassing programme, particular attention should be paid to the possible presence of badger setts, as it is illegal to gas badgers. Care should also be taken to avoid gassing fox earths, as no fumigant is approved for use against foxes. Burrows in or around badger setts and fox earths must not therefore be treated. The impact on other wildlife living in burrows, for example adders, may also need to be considered.

Since the withdrawal of Cymag as a vertebrate control agent, the only commercially available fumigants are formulations that generate phosphine gas on contact with moisture. These are available either in tablet or pellet form.

All fumigants must be approved under the Control of Pesticides Regulations 1986 and must be used according to label instructions.

Gassing should only be undertaken by persons trained in the use of aluminium phosphide, and familiar with the precautionary measures to be observed. Fumigants can be lethal to humans and it is essential that users follow the instructions on safety aspects.

Users should be aware of the need to comply with the Control of Substances Hazardous to Health Regulations 2002 (S.I. 2002/2677), in respect both of its general provisions and those which relate specifically to fumigations. Further guidance is provided in the Health and Safety Executive Agriculture Information Sheet No. 22 Gassing of rabbits and vertebrate pests (see Further information).

Use of phosphine

The only available phosphine generating formulations are Phostoxin and Talunex. Both are extremely toxic to rabbits with inhalation resulting in rapid death.

Phostoxin is formulated as a spherical 3 gram tablet and can be introduced into the burrow system either by hand (protected by suitable gloves) or via an applicator. One tablet should

be inserted into each hole. This should then be sealed with a piece of turf, grass side downwards. Care must be taken not to drop soil onto the tablet.

Talunex consists of 0.6 gram pellets that are injected into the burrow system using a Topex applicator, specifically designed for use with this product. The system has the advantage of minimising operator exposure to the formulation. Treatment of infested areas should be the same as with Phostoxin, with the exception that 4 or 5 pellets should be introduced into each hole.

Follow-up action

The effectiveness of all gassing treatments should be monitored by inspecting treated areas for signs of fresh activity 48 hours after the initial treatment. In many situations, a follow-up treatment of re-opened holes will be necessary. Ideally, the procedure should be repeated until no re-opened burrows are found.

Control methods: fencing

Fencing is a particularly useful management tool where the nature of the rabbit harbourage makes other techniques impractical, or when complete exclusion is the aim. In many situations, fencing can be more cost-effective than control methods that have to be undertaken year after year. Traditionally, permanent wire-netting fences have been used to deny rabbits access to vulnerable areas but more recently, temporary electric fences, either netting or multi-strand wire systems, have become popular methods of crop protection.

When correctly erected and maintained, wire-netting and electric fences can reduce rabbit numbers on protected fields by 85% to 90%, and both have a useful life of about ten years. Electric fencing is cheaper to purchase and erect than wire-netting, but its maintenance costs are higher.

Wire-netting

Netting fences should be constructed of 18 gauge, 31 mm (1 1/4 in) hexagonal mesh. They should be a minimum of 750 mm (2 ft 6 in) high with a further 150 mm (6 in) lapped on the surface of the ground towards the rabbit

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harbourage. Turfs of grass should be placed on the lapped netting at 1 m (about 1 yard) intervals to hold it firmly in place (vegetation should later grow through the mesh to complete this job). The netting should be attached to two 2.65 mm (1/8 in) high tensile spring steel straining wires (one at the bottom of the fence and one at the top) with galvanised fence rings. The straining wires should be supported by wooden stakes 1.8 m (5 ft 11 in) x 80 mm (3 in). The stakes can be placed up to 15 m (48 ft 9 in) apart although ground undulations may dictate closer spacing. End posts 2 m (6 ft 6 in) x 100 mm (4 in) braced by struts 2 m (6 ft 6 in) x 80 mm (3 in) should be placed at the ends of the fence and at bends.

Local site conditions or other considerations may demand a variation to these specifications. For example, particular attention should be paid to the presence of potential weak spots such as uneven ground, dry stone-walls and watercourses. In areas such as young farm woodlands, where it is especially important to prevent invasion by rabbits, the fence specification can be improved by projecting the top 150 mm (6 in) of the fence outwards at 45° towards the harbourage. It is recommended that any proposed changes to the specification are first discussed with one of Natural England's Wildlife Management Advisers (see *Further information*).

Ideally, wire-netting fences should be erected to surround fully the area to be protected. If this is not practical, a strip fence, which extends at least 150 m beyond either end of the problem area, may be used.

The number of gates in a fence should be kept to a minimum because they make maintenance more difficult. They should be hung on supports independent of fence straining posts, as the latter will inevitably move and so affect the hang of the gates. A wooden sill must be dug into the ground to prevent burrowing underneath, and gates should shut against a post. Badger gates should be installed in the netting if the fence crosses any badger tracks or paths.

An advisory leaflet, describing the design and installation of badger gates in rabbit-proof

fencing (TIN026) is available (see under *Further information*).

Regular monthly inspections and maintenance of fences are essential to block burrows dug under the fences and to repair damage caused by farm machinery, fallen tree branches and vegetation. This safeguards the long-term effectiveness of the fence.

Electric fences

There are two types of electric fence in common use: netting and strained-wire. Both have been shown to be as effective as wire-netting fences.

Electric-netting fences are available in a number of commercial designs. Basically, they all consist of a heavy-duty polythene twine mesh in which the horizontal strands are interwoven with electrically conductive stainless steel wire. To prevent shorting, the steel wires are omitted from the bottom strand. They are between 0.5 to 0.75 m (1 ft 8 in to 2 ft 5 in) high and are supplied in 25 m (82 ft) or 50 m (164 ft) rolls in which the fence posts are already fitted. This type of fence is very quick and easy to erect and take down.

The electric strained-wire system consists of seven parallel electrified conducting wires (7-strand, 16 gauge medium tensile mild steel) at heights of 5, 10, 15, 20, 25, 30, and 40 cm (2, 4, 6, 8, 10, 12 and 16 in) above the ground. The lowest wire is earthed and the remaining six are live (a small length of wire should be wound around each of the top six wires to electrically connect them). Adjustable plastic insulators supported on metal stakes hold the wires. The stakes can be placed up to 7 m apart (about 8 yards), although ground undulations may dictate closer spacing. Where the fence line bends, anchor posts replace the normal metal stakes. The whole system is tensioned at a reel post placed at the end of the fence.

Both electric fence types must be powered by an energiser capable of producing an output of at least 1 joule when measured into a 500 ohm resistance. Most mains-operated energisers, and the more powerful battery-powered units, have this capability. Batteries should be

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changed regularly (a fully charged 70 Ah battery will need to be changed every 2 to 3 weeks). A wide range of energisers is available and users are advised to discuss specific requirements with their supplier. To effectively deter rabbits, it is important to maintain a minimum of 2.5 kV throughout the fence line. A good earthing system is essential to achieve this.

Ideally, as for wire-netting fences, electric fences should be erected to surround fully the area to be protected. If this is not practical a strip fence, which extends at least 150 m beyond either end of the problem area, may be used. Prior to erection, a 450 mm to 600 mm (1 ft 6 in to 2 ft) wide strip should be mown along the fence line or the vegetation killed off using an approved herbicide. This ensures that the conducting wires are kept clear of vegetation that would otherwise short-circuit the system thereby draining power and reducing effectiveness. Initially, fences should be inspected every few days but this can later be extended to 2 to 3 week intervals.

A more detailed advisory leaflet on the use of fencing (TIN023) is available (see *Further information*).

Lethal control methods

Shooting

Shooting is a popular method of rabbit control and is most effective when conducted at night, using a spotlight.

The Ground Game Act 1880 gives an occupier the right to shoot rabbits on his land during the day and to authorise in writing one other person to do so. The person must be a member of the occupier's household or staff or be employed for reward. Under the Pests Act 1954, an occupier may apply to Natural England for authority to use a reasonable number of extra guns, if the owner of the shooting rights will neither permit the occupier to bring on extra guns, nor undertake to destroy the rabbits himself, and it is necessary to use more guns than the occupier has the right to authorise.

Under the Ground Game Act 1880 as amended by the Wildlife and Countryside Act 1981, the following are allowed to shoot at night:

- An owner-occupier with shooting rights.
- A landlord who has reserved his shooting rights.
- A shooting tenant not in occupation who has derived his shooting rights from the owner.
- An occupier or one other person authorised by him provided he has written authority from another person with shooting rights.

The Firearms Act 1968 requires any person possessing, purchasing or acquiring a shotgun to obtain a shotgun certificate from the police. A firearms certificate is required for rifle use.

Single shooting operations are not particularly effective and reduce rabbit numbers by only about 30%. The technique should only be used therefore as an adjunct to more effective control methods or to remove problem individuals that cannot be disposed of by other means. Shooting also tends to target adult males and therefore has a relatively limited effect on the breeding potential of the population the following spring unless considerable time and effort are expended.

Baited cage trapping

This technique involves the live capture of wild rabbits in galvanised wire-mesh cages baited with carrot. The technique can be used throughout the year, but is most effective at catching adult rabbits during the winter. Additional benefits are that the technique does not require access to burrows and non-target species can be released unharmed.

The traps should be set in short open vegetation and checked twice a day, early morning and late afternoon. Captured rabbits must be dispatched humanely. Cage trapping has been shown to reduce numbers by about 65% and is most appropriate for protecting high value crops where manpower is available for frequent checking of traps. A detailed advisory leaflet on the use of cage trapping is available from Natural England (see under *Further information*).

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Drop box trapping

Drop boxes are designed to be used in conjunction with wire-mesh netting. A tunnel is either inserted into the fence line at right angles or placed parallel to the netting on the harbourage side of the barrier. Rabbits are caught when they enter the tunnel and fall through a hinged flap into a box that has been buried in the ground. The lid returns to place by means of a counter balance weight fixed to it.

Drop box traps should be visited at least once a day, when set, preferably early in the mornings. Captured rabbits must be despatched humanely. Traps should not be installed where they may be at risk from flooding. Permanently sited traps can be an effective method of capturing rabbits where fences are newly erected and where rabbits are passing through holes in established fences.

Spring trapping

Under the Pests Act 1954 only approved spring traps, designed to catch and kill rabbits humanely, may be used. Those currently approved by the Spring Traps Approval Order 1995 are the Imbra Trap Mark I and Mark II, Jubu Trap, Fenn Rabbit Trap Mark I, Fenn Vermin Trap Mark VI (Dual Purpose), Springer No. 6 (Multi Purpose), Victor Conibear 120-2, BMI Magnum 116, and clones of any of these listed spring traps.

Spring traps generally consist of a pair of clamps that are triggered to catch rabbits that step onto a plate mechanism. The traps should be set firmly in position with the treadle plate flush with the floor. The plate should be concealed by covering lightly with soil. To minimise the risk to non-target species, stock and pets should be excluded from the trapping area and the traps must be set only within the overhang of natural or artificial tunnels.

The Protection of Animals Act 1911 requires that all spring traps set for the purpose of catching rabbits (or hares) should be inspected at reasonable intervals and at least once every day between sunrise and sunset.

Snaring

Snares are intended for use to tether animals for subsequent humane despatch. They are made from stranded brass wires that run freely through a small eye made in one end of the wire. The looped end of the wire (100 mm (4 in) diameter), into which the animal places its head, is positioned about 90 mm (3 in), above the ground using a short, notched stick (the 'pricker' or 'teeler'). The free end of the wire is securely tethered by a strong rot-proof cord to a peg, which is driven firmly into the ground. This prevents captured animals from escaping. Snares with a 'stop' or knot about 140 mm (5 in) from the eye can be used. The 'stop' prevents the loop from closing fully, thus ensuring the snare tethers rather than kills the rabbit. Snares should be set on well-used rabbit runs, in short vegetation, close to the harbourage from which rabbits are gaining access to crops. Where rabbits are numerous, the use of well-placed snares can catch animals quickly and efficiently, but results are poor during dry weather and frost.

The Wildlife and Countryside Act 1981 prohibits the use of self-locking snares and requires free-running snares to be inspected daily. All reasonable precautions should be taken to avoid catching non-target animals. Under the Wildlife and Countryside Act 1981 it is illegal to set a snare to catch certain animals, such as badgers and otters. Under the Deer Act 1991 it is an offence to use snares to kill or take deer. It is recommended that they are inspected at dawn and dusk, and that they are not set where livestock are present or if there is a risk to domestic pets.

Ferretting

This involves the introduction of ferrets into the burrow system. The ferrets drive rabbits into nets, which are placed over the burrow entrances or to waiting guns that shoot them as they bolt from tunnel entrances. Ferretting is most successful outside of the breeding season and, having the advantage of capturing more females than males, may serve as a valuable technique for dealing with intransigent populations. However, the method is time consuming and, when used in isolation, is

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unlikely to produce effective control of rabbit infestations.

Damage reduction methods

Tree-guards

Individual tree guards and shelters can be used to protect young trees and shrubs from rabbit browsing and bark stripping where it is impractical or uneconomic to enclose them with fencing. There are many types available including plastic net guards, split plastic tubes, spiral plastic sleeves and welded mesh cylinders. Spiral plastic sleeves are perhaps the least successful because they tend to be displaced by wind or animals. The effectiveness of split plastic sleeves and net guards is greater because they are more robust. To effectively reduce rabbit damage tree guards should be at least 60 cm (2 ft) high.

Repellents

The use of repellents can be expensive, and does not always provide long-term protection from attack by rabbits. Any benefit they can provide is often offset when, as is often the case, repeated applications are necessary. Their use should therefore be restricted to small plantations or to areas that cannot be protected in any other way. Only repellents approved under the Control of Pesticides Regulations 1986 may be used. Users must comply fully with the label instructions.

Further information

In England further advice on dealing with rabbit problems, as well as problems caused by other

mammals and birds can be obtained by contacting Wildlife Management and Licensing at: Natural England, Wildlife Licensing Unit, First Floor, Temple Quay House, 2 The Square, Bristol, BS1 6EB

Tel: 0845 601 4523 (local rate). Email: wildlife@naturalengland.org.uk

A range of leaflets on wildlife topics is available online www.naturalengland.org.uk. In particular see:

- TIN023: *Rabbits: use of fencing to prevent agricultural damage*
- TIN024: *Rabbits: use of cage-trapping to prevent agricultural damage*
- TIN026 : *Badger gates in rabbit-proof fencing*

The Forestry Commission produces a number of publications and these can be obtained from Publication Section, Forest Research Station, Alice Holt Lodge, Wrecclesham, Farnham, Surrey GU10 4LH. Tel: 01420 23337.

The Health and Safety Executive Agriculture Information Sheet No. 22 Gassing of rabbits and vertebrate pests is available via their Infoline (Tel: 08701 545500) or online at www.hse.gov.uk/pubns/ais22.pdf

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