



Dr Jonathan Wade

Know your poison!

Selecting the right tool for the job is essential in getting the best results. Not surprisingly this applies to product selection in pest control. An understanding of the differences between the various active substances will help you make the right product choice for effective rodent control. Dr Jonathan Wade, technical director for Hampshire based PelGar International explains.

Active substances used in rodenticides are often marketed in a way that can be confusing, if not actually misleading. By considering a few facts and figures behind the leading rodenticide active substances used in the UK, and across the globe, an informed decision can be made on the best products to be used for a particular job – and each job will be different.

How much do rats & mice eat?

The UK industry focuses on two main active substances – difenacoum and bromadiolone. Both are second-generation anticoagulants. To ensure the ingestion of a lethal dose, both require the target rodents to eat more than a single meal. They are therefore referred to as multi-feed baits. By understanding how much rats and mice eat and what the lethal doses are, we can build a better understanding of which products are best used in different situations.

A rat will typically eat 25-30g of food in a day, taken in about ten small meals, with the maximum consumption per meal of around 3g. Rats may be inclined to ignore food sources which are situated in 'exposed' locations and if the food is 'free' will retrieve it to a place of security and 'stash' it there. Mice on the other hand are exploratory feeders and will consume around 3g of food in a day but in many small meals – with a maximum meal size typically around 0.2g. As such, for a bait to be considered as a single-feed, the lethal dose must be below 3g of bait for rats and 0.2g of bait for mice.

Bromadiolone is regarded by some manufacturers as a 'single-feed'



Formulation choice is key to any rodent control campaign

bait for rats. For this to be true, rats must be capable of ingesting 5-6g of bait at a single meal. As indicated earlier, this quantity is very unlikely to be eaten at a single meal. But, for both difenacoum and bromadiolone baits, if correctly sited and sufficiently palatable, this quantity could be eaten in one day. As with all anticoagulant rodenticides, first-generation or second-generation, single-feed or multiple-feed, once a lethal dose has been eaten death typically occurs three to five days later.

Toxicity information taken from laboratory studies must always be regarded as indicative but does provide very useful comparative information. Conditions vary and the experiments may not have used rodents of the same strain or even sex and the experimental techniques may have been different. All of these parameters affect the results and so the data should be regarded as 'indicative' rather than absolute.

Which actives are most potent?

The data shown in Graph 1 and Table 1 on page 33 has been accepted by the industry as standard for over 25 years. It comes from data published by the World Health Organisation and *The Pesticide Manual* (the industry 'bible') and can provide a good understanding of the potency hierarchy of rodenticides in common usage today. 'Unpublished data' which has not been subject to scrutiny should never be used as a basis of fact.

From this we can see that rats could consume a lethal dose of difenacoum, bromadiolone, coumatetralyl and difethiolone in around two to four meals, confirming their status as multi-feed baits. Depending on the quality and palatability of the bait formulation then all of these baits can provide a good opportunity for the target pest to consume a lethal dose within one day of feeding and commonly rats may ingest several lethal doses over the first two to three days of feeding before ill effects are felt. Brodifacoum and flocoumafen are true single-feed rodenticides against rats. The data also indicates that difenacoum is by far the most effective of the multi-feed baits against house mice and, when its non-target toxicity profile is considered, should be the product of choice for mouse control. The only true single-feed product for mouse control is brodifacoum.

Whilst difenacoum, because of its remarkable specificity to commensal rodents, has one of the best toxicity profiles of the anticoagulant rodenticides, coumatetralyl has also been shown to have reduced toxicity to birds. As such both of these products have merit for rat control programmes in sensitive outdoor situations, such

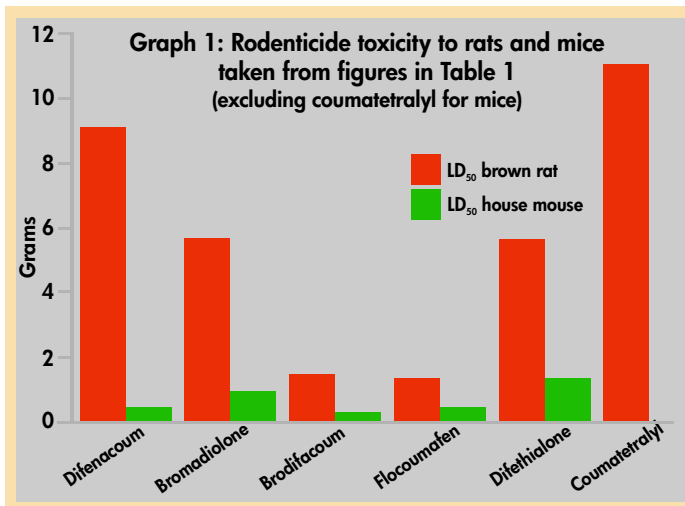


Table 1: Quantity of finished bait required to generate an LD₅₀ in rats and mice

Active	LD ₅₀ brown rat (g)	LD ₅₀ house mouse (g)	Application
Second generation rodenticides			
Difenacoum	9.0	0.4	indoor & outdoor
Bromadiolone	5.6	0.9	indoor & outdoor
Brodifacoum	1.4	0.2	indoor only
Flocoumafen	1.3	0.4	indoor only
Difethialone	5.6	1.3	indoor only
First generation rodenticides			
Coumatetralyl	11.0	66.7	indoor & outdoor

LD₅₀ values are shown in grams (to 1 decimal place) for 250g rats/25g mice. The concentration of active in the baits is the standard commercial rate for that active

as those where birds of prey are in residence. Table 2, below, where figures are available, gives an indication of the toxicity profile of the above rodenticides to non-target animals. These figures should be taken as an indication only. Rodenticides should always be protected from non-target animals and in any case of accidental or secondary poisoning you should always consult a vet or doctor.

Real differences in toxicity shown

The figures show that there is a very real difference in the toxicity profile of the different actives substances to non-target vertebrates. By comparing target species toxicity with non-target species toxicity, a measure of risk can be determined. For instance brodifacoum is around six times more effective against rats when compared to difenacoum, though poses a threat at least 50 times higher to dogs as an indicative non-target species. This information should be considered carefully when selecting the active material in the bait to be used.

There are some pockets of known resistance to the second-generation anticoagulants difenacoum and bromadiolone in the UK, whilst resistance to first generation actives such as warfarin, chlorphacinone, diphacinone and coumatetralyl is widespread.

There is no known resistance to brodifacoum or flocoumafen, outside of a laboratory, in the UK, although it is strongly recommended that these highly potent single-dose baits should only be used where necessary and in limited quantities. Understanding and employing a pulse baiting strategy will also help to limit non-target exposure. Significant constraints apply to the use of brodifacoum, flocoumafen and difethialone in the UK. As a result products containing these active ingredients are restricted to use by professionals and for use indoors only.

Understanding and choosing the right active substance for the job in hand is vitally important due to the significant variation in activity they have against rats and mice and the toxicity to non-target animals. The choice of active substance should form part of the general risk assessment, considering where the key activity is on a site and looking at the potential exposure to both humans and non-target animals. Formulation choice is also key in any rodent control campaign as the rodents must first find the bait and consume a lethal dose. No rodenticide, or formulation, is completely universal and selecting the correct product for a job will save both time and money and minimise environmental risk.



Table 2: Non-target toxicity – LD₅₀ grams of bait per kilo of animal

Active	Rabbit	Pig	Dog	Cat	Chicken
Difenacoum	40	1600-2000	1000	2000	1000
Bromadiolone	20	60	200	500	
Brodifacoum	5.8	10-40	5-20	500	90
Flocoumafen	14	1200	1.5-5	200	2000
Difethialone	15	40-60	100	320	
Coumatetralyl	>500				

Data taken from WHO and The Pesticide Manual

Rats typically consume two to three grams at each meal