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1080

A selective poison for pests



By Dr D. R. King, Research Officer

Since the 1960s, the control programmes for rabbits and dingoes in Western Australia have relied heavily on the use of sodium monofluoroacetate, more commonly known as compound 1080. Large quantities are used each year as it is a very valuable substance for the control of vertebrate pests.

Once in the animal's body 1080 is converted to fluorocitrate, a poison which is highly toxic to most mammals. Fluorocitrate blocks the Krebs cycle, a fundamental pathway of energy exchange in animals and plants. The animal dies as a result of damage to the heart, or to the brain and central nervous system, or both.

Natural occurrence

Some years after its introduction for pest control, 1080 was found to occur naturally in a number of plant species of the genera *Gastrolobium* and *Oxylobium* in Western Australia. Many of these plants are well-known hazards to domestic stock and include York Road poison, prickly poison, box poison and heart-leaf poison. They are found mainly in the South-West of the State although one species is also found in the pastoral areas of Western Australia and in parts of Queensland and the Northern Territory.

Some of these plants contain very high levels of the poison, with up to 2650 milligrams per kilogram of 1080 being recorded from the leaves of heart-leaf poison. This level is so high that 10 to 15 g of fresh leaves when eaten will kill a 50 kg sheep.

The plants are assumed to have developed these high toxic levels as a means of protecting themselves against browsing animals.

Problems

While 1080 has great value in the control of rabbits and dingoes, there are a number of problems associated with its use.

Compound 1080 is highly soluble in water and is easily leached out of baits by rain, or even by contact with damp soil. As little as 25



■ 1080 is found in some plants, such as this box poison at Tutanning.



millimetres of rain can render 1080-treated oats ineffective (non-toxic). This seriously restricts its use during winter in the South-West.

As 1080 is highly toxic to domestic mammals, stock must be removed from paddocks in which it is used as a rabbit poison. Farm dogs may be killed by feeding on carcasses of poisoned rabbits, and it is also dangerous to people laying baits unless adequate safety precautions are taken. There have been reports of native animals being killed by feeding on poisoned oats.

Severe restrictions have been placed on the use of 1080 in other countries including Britain and the United States of America because of its danger to non-target species. Although there are already some restrictions on its use in Australia, there have been occasional calls for bans or further restrictions. These have generally been based on concern about its alleged persistence in the environment or the possible threat to non-target species.

However, because of its solubility in water, 1080 soon becomes highly diluted when it enters the environment and soil micro-organisms quickly break it down. It does not accumulate or pose a long-term environmental hazard.

The danger presented by a poison is dependent on its toxicity, on the size of the animal and on the dose it takes. This is usually stated as an LD₅₀ figure, which is an estimate of the dose

which would be lethal to 50 per cent of a sample of animals of the species in question. It is expressed as a dose per unit of body weight, usually milligrams of poison per kilogram of animal body weight.

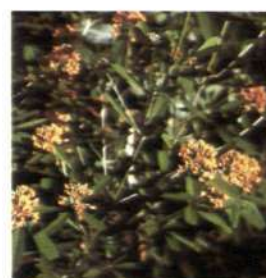
Native animals

The Agriculture Protection Board has carried out research on the toxicity of 1080 to native animals, and on their likelihood of eating different types of bait material. The objective of these research programmes is to minimise the adverse effect of 1080 poisoning through suitable choice of bait material, timing and bait placement.

There have been suggestions for a number of years that some native birds and mammals ate poisonous *Gastrolobium* and *Oxylobium* plants, and that the carcasses of these animals might in turn be poisonous to dogs and pigs. However, investigation of the tolerance of native animals to 1080 did not begin until 1976.

It has since been found that many species of native mammals in the South-West are tolerant of 1080, some to a very high degree. Limited testing of birds and reptiles has shown that some species are also highly tolerant.

Most native mammals from the South-West which have been tested are much more tolerant of 1080 than animals of the same species from



■ The native tammar (above left) is tolerant of 1080. (Photo: A. G. Wells.)

■ The quokka also has a high level of tolerance. (Photo: Ray Smith.)

■ Heart-leaf poison (above) also contains 1080.

south-eastern Australia, where there are no plants which contain 1080.

For instance, brush-tailed possums from south-eastern Australia have an LD.50 of 0.68 mg/kg, but possums from Western Australia have survived doses as high as 125 mg/kg. Native bush rats from south-eastern Australia have an LD.50 of 1.1 mg/kg, whereas similar rats from near Manjimup, Western Australia where *Gastrolobium* occurs, have an LD.50 of up to 35 mg/kg (see table).

Feeding on poisonous seeds or leaves of these plants would result in the deaths of the least tolerant animals, and the most tolerant ones would survive. Their offspring would in turn inherit this higher tolerance, and thus the LD.50 of the population gradually increases over many generations. Differences in tolerance are known to occur between isolated populations of other species of south-western mammals, such as tammars and quokkas, which have been in contact with poisonous plants for different lengths of time in their evolutionary history.

Once a population has developed tolerance of 1080, it can persist for a very long time during which many generations of their descendants have not fed on poisonous plants.

Several species of mammals with very high levels of tolerance of 1080 are found on islands which have been separated from the mainland for 7000 to 12,000 years and where no poisonous plants grow. These mammals include the banded hare wallaby, the boodie and the Shark Bay mouse on Bernier and Dorre Islands, west of Carnarvon, tammars on Garden Island and the western grey kangaroo from Kangaroo Island, South Australia.

No differences in tolerance could be found between kangaroos from Kangaroo Island, where no plants containing 1080 occur, and those from the South-West of Western Australia where toxic species of *Gastrolobium* and *Oxylobium* are abundant and are eaten by kangaroos. The LD.50s of both populations are estimated to be within the range 35 to 40 mg/kg.

Introduced pests

Rabbits have not evolved a higher level of tolerance of 1080 since they spread into the South-West of Western Australia. The LD.50s of rabbits from areas where poison plants grow and frequent baiting with 1080 takes place were no different from those of rabbits from an area where neither of these occur. Nor were they different from those determined for rabbits in the South-West some years ago, or from eastern Australia. All LD.50 values for rabbits were in the range 0.5 to 0.7 mg/kg.

Fox numbers in the South-West are believed to be controlled to some extent by secondary poisoning through feeding on carcasses of poisoned rabbits. This indicates their continuing low level of tolerance. Dingoes are also highly susceptible to 1080, with an LD.50 of 0.1 mg/kg.

Baiting programmes

Many native species of mammals in the South-West are at relatively little risk from baiting programmes using 1080 to control introduced pest animals. Birds and reptiles are generally much more tolerant of 1080 than are mammals. Some of these also appear to have evolved even higher levels of tolerance, which further minimises the hazard to them from control programmes.

The high levels of tolerance of 1080 found in native animals in the South-West is a fortunate base to which other methods can be added to minimise the hazard to non-target species. The size and quantity of the bait, the type of bait material and amount of 1080 in each bait can be selected to lessen the danger to native species, as can the timing of the control programme and the placement of baits.

Carnivores, for example, are unlikely to eat poisoned oats or apples, nor are herbivores such as kangaroos likely to pick up meat baits designed for dingoes. Similarly large baits, each containing enough poison to kill one fox, may be too big for any small native carnivore to eat at one meal and of too low a concentration to cause death.

Selective bait placement is an effective strategy. Baits hidden under stones and debris are unlikely to be eaten by birds of prey, while buried apple baits are dug up and eaten mainly by pigs and possibly foxes.

By considering all these methods and choosing that which is most likely to safeguard non-target species, responsible pest control can be achieved. In this way, 1080 will continue to be available for the control of pest species in Western Australia to the benefit of farmers and pastoralists. It can even be a powerful tool for wildlife biologists wishing to reduce the pressure of competition and predation by introduced animals on native species.

1080 LD.50 values of some Australian fauna (mg/kg)

	South-west	South-east
Bush rat	23-35	1.1
Common brushtail possum.....	>100	0.7
Tammar wallaby	5-10	0.3
Western grey kangaroo.....	35-40	—
Eastern grey kangaroo	—	0.3
Brush-tailed bettong.....	>100	—
Tasmanian bettong	—	about 1
Bobtail skink	508	206