



POISONING OF FERAL PIGS



This practical guide provides advice that will help you manage pig problems in the Dry Tropics region.

Several techniques are available to control feral pigs. Generally no stand alone technique is sufficient for each situation so a suite of integrated techniques or combination of methods is necessary. When developing a pig control strategy, managers need to consider what problems the pigs are causing and then decide which control option or combination of options is most suitable to **reduce the problem**.

For reasons of economy, efficiency and accessibility, poisoning is considered the most appropriate for achieving large scale population control but may not be suitable for all situations.

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POISONING

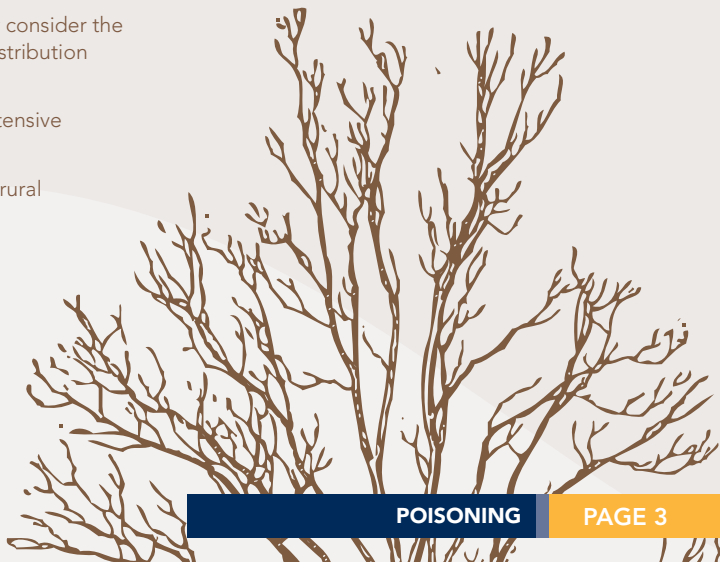
When toxins can be safely used this is the most effective method of removing the bulk of the feral pig (*sus scrofa*) population with the least effort and cost. Poisoning is one of the few methods available which may reduce a pig population quickly over a large area and is especially useful when applied in remote or inaccessible areas. The main problem with poisoning is the perception that poisoning will “kill everything” including all non-target species that may eat a bait. The main poison used for pig control in Queensland is 1080. The Australian Pesticides and Veterinary Medicines Authority 1080 review in 2008 stated; “Although poisoning of individual non-target species may occur, the use of 1080 is not likely to cause widespread or serious impact on non-target fauna at the population level”. Further research has demonstrated that baiting has no effect on scavenging bird populations.

The **ADVANTAGES** of poisoning are:

- Cost effective, reliable and the most effective control technique.
- Fast and effective initial population knockdown method.
- Most effective method in inaccessible areas or in seasonally inaccessible areas due to the tropical wet season.
- Less labour intensive than other techniques.
- Landholders do not generally consider the supply of bait material and distribution costs to be significant.
- Most effective method for extensive grazing areas.
- Widely accepted throughout rural communities.

The **DISADVANTAGES** of poisoning are:

- Risk to some non-target species.
- Legislation requirements.
- Animal welfare implications.
- Some pigs may develop bait shyness.
- Seasonality of food resources may make poisoning ineffective in some seasons.





The effectiveness of poisoning is influenced by the bait material and toxin used, the timing, the placement of the baits and the availability and quality of natural pig food. In times of good seasons, the availability of alternative high quality food may reduce bait uptake. An effective poisoning campaign needs to consider that some proportion of the pig population do not find baits, a proportion do find baits but will not eat it and a proportion that eat baits do not die. This proportion of the population that cannot be poisoned can be regulated by four parameters; bait material used, bait distribution and abundance, and bait availability over time. A research project in southern Australia reported that the proportion of a pig population that ate poisoned bait and died was 73%; the proportion that ate the bait and survived was 4% and the remainder that did not eat baits was 23%.

Many of the **unintentional effects** of poisoning of non-target species can be largely overcome by minimising the contact of non-target species with baits while maximising the contact of baits with feral pigs. These include techniques of bait placement, timing of baiting and using bait stations:

- Burying baits, wiring baits to trees, placing under vegetation or camouflaging baits by rubbing in dirt will minimise bait take by non-target species, especially birds.
- Dying baits green or black will reduce bait take by birds.
- Distributing baits in the late afternoon will minimise bait take by birds.
- Pre-feeding un-poisoned bait material at permanent sites prior to placing toxic baits will deter other species from feeding at these sites. Pigs tend to defend feeding sites and some species are scared off by feeding pigs.
- Mechanical exclusion devices have been developed which excludes other species from accessing the toxic bait.

BAIT MATERIAL

Through the wise selection and presentation of bait material, landholders can “target” feral pigs when using poisons. The most essential aspect of poisoning is to increase the detection and palatability of the baits. More easily found and more target specific baits means more baits will be available to pigs.

- The local diet preference of pigs must also be considered. Pigs concentrate on a locally available food source and may ignore “novel” food such as bait material. Bait used successfully in one location may be ineffective in others due to the local food availability.
- Free feeding must be conducted for a sufficient time to allow the pigs to realise that the bait material is food. The timing varies but from experience usually 10 to 14 days is sufficient for pigs to begin feeding on the novel bait material.
- In intensive agricultural areas such as sugar cane plantations, tropical fruit orchards and crops where fruit based foods are readily available and scavenging of carcasses is rare, meat baits are less effective whereas fruits such as mangoes or rock melons are highly acceptable. Generally, whatever the pigs are targeting can be used as bait material. In the tropics, the high acceptance of mangoes by feral pigs makes this the ideal bait material for this region.
- In drier grazing areas, fresh meat baits are preferred due to meat being easily obtained and highly acceptable to feral pigs as they readily seek a high protein source. Grain or fruit baits are less effective if the pigs are scavenging cattle carcasses. Meat is usually hung overnight to drain all fluids, prior to being cut into 500g pieces (regulated bait size) and injected with a toxin the next day.
- According to regulations, all “grain, cereal or meal” poisoned as bait must be coloured to distinguish it from the un-poisoned material. If 1080 is used, the operator will dye the baits green which have been found to make baits less attractive to birds
- A wide range of bait **attractants** have been tested throughout Queensland. Most attractants will increase palatability and detection of bait, but care should be exercised as the attractants may also attract non-target species as well. Adding attractants can help to bring the pig to the bait and not take the bait to the pigs, leading to a decrease in the quantity of bait material required. Attractants are predominantly used in grain or fruit based bait material. Adding meat meal or molasses is the most popular means of increasing attractiveness. Additives such as vanilla, raspberry or banana essence will increase attractiveness of baits but may become cost prohibitive in large baiting campaigns. Creosote (a wood preservative) or old sump oil has been found to increase detection of baits while deterring most non-targets from consuming the bait. Only a very small amount of creosote or oil needs to be added to the bait material; alternatively place the oil or Creosote next to the bait material.



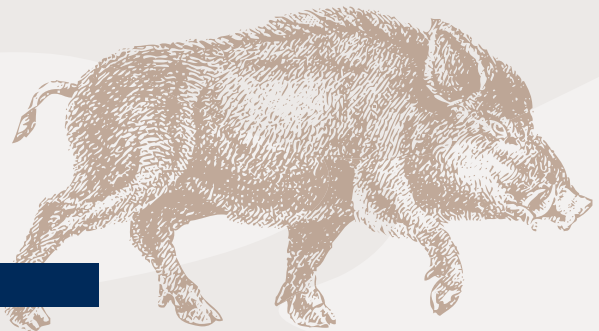


- A commercially available vanilla flavoured food additive “Carasweet” has shown to be effective in enticing pigs to eat novel bait material.
- Commercially produced **PIGOUT®** bait for the control of feral pigs is now available, which is factory-prepared and shelf-stable. The bait is made with a sturdy, fish-flavoured cereal matrix, specially flavoured and dyed to maximise uptake by pigs and minimise uptake by birds and other non-target species. The bait is strengthened by an edible bio-degradable cellulose skin designed to reduce non-target uptake, ensure ease of handling and increase the resilience of the bait when deployed from the air.

Commercial baits may be cost prohibitive when used in extensive baiting campaigns. However, these baits are ideally suited for intensive baiting (especially aerial baiting) in small inaccessible areas. These baits use 1080 as the toxin so State regulations on the use of 1080 do still apply.

Further information can be obtained from Animal Control Technologies at: <http://www.animalcontrol.com.au/pig-baits2.htm>

The Invasive Animals CRC with financial support from Meat & Livestock Australia P/L is also developing another manufactured bait; **HOG-GONE®**. This is essentially the “Pigout” bait with a new toxin - sodium nitrite; a rapidly-lethal, more humane and more pig specific toxin. **PIGOUT®** Econobait, a bite sized 1080 bait specifically for use in the **HogHopper™** has also been developed.



GROUND BAITING STRATEGY

The distribution of baits by vehicle is a practical and effective method of controlling pig populations. Land based poisoning is ideally suited for small areas or localised pig populations and is an effective method of rapidly responding to an outbreak of damage or when a pig group is observed to move into a previously unoccupied area. Most landholders have the required vehicles and available bait supplies to conduct ground baiting. Licensed operators for the toxin (if required) are normally available through the local Council.

The **ADVANTAGES** of ground baiting are:

- One of the cheapest and most cost effective methods available.
- Bait can be strategically positioned in high pig visitation areas.
- Useful for controlling pigs in smaller areas or where impact is currently occurring.
- Free feeding can be used to maximise bait uptake.
- The amount of bait material to use can be estimated from the bait uptake at free feeding stations to ensure enough bait material is available for all pigs feeding at the site.
- Additional follow up baiting can be implemented, if required.

The **DISADVANTAGES** of ground baiting are:

- Requires access for vehicles to distribute baits.
- Typically does not ensure an even coverage so baits may not be available to all pigs.
- Adverse weather conditions (flooding etc.) may prevent ground baiting.
- Ground baiting in extensive or remote grazing areas may be too time consuming or labour expensive.
- May become inefficient when pigs' natural food resources are plentiful.
- Risk to non-target species.

THE EFFICIENCY OF GROUND BAITING CAN BE AFFECTED BY A NUMBER OF FACTORS.

Baiting strategies such as pre-feeding using attractive highly palatable bait material, and the correct placement of bait material to maximise the encounter rate of pigs with baits will improve control effectiveness. The most important factor in bait distribution is to ensure that the majority of the pig population finds and eats the bait. This can be influenced by the amount of bait distributed compared to the size of the control area, the movements and distribution of the pig population and their changing feeding habits due to seasonal conditions.

Landholders should target sites of recent pig activity such as pig pads, areas of thick cover, creeks and swamp edges, headlands or road verges. Sheltered areas of thick vegetation are preferred to minimise the effects of the weather on bait longevity and disturbance by non-target species. Targeting drainage lines such as creek and river systems especially near thick scrub harbourage is ideal. Choose sites with adequate vehicle access since large amounts of bait may need to be carried in.

A variety of methods can be used to distribute baits. Usually available tracks and roads are utilised however, in inaccessible areas quad bikes (pictured) with small trailers are ideal.

Larger quantities of baits can be distributed from vehicles travelling along available roads and tracks.

Baits should be thrown into cover such as long grass or under trees to camouflage from scavenging birds. Other bait types such as loose fruits, grain etc are usually distributed in bait stations where piles of bait are distributed along available tracks at distances ranging from 100m to 500m apart. Agricultural areas typically have good road access and small areas so ground baiting is ideal.

Free feeding meat bait is illegal under Government regulation due to the possible transmission of disease concerns. Animal carcasses or refuse such as food scraps containing meat or meat products must not be fed to pigs unless used with an incorporated toxin or the pig is prevented from returning to the wild i.e. in traps.

Free feeding bait stations.

The availability of non-toxic bait material is essential to introducing the bait material to the pigs. Bait stations should ideally be established in pig refuge or feeding areas or areas of fresh diggings, especially on cropping / refuge boundaries. Feeding stations should provide pigs with continuous food or the pigs will become disinterested and move away. Free feeding stations allow landholders to monitor the local pig activity and poison or trap at any convenient time.





Generally pre-feeding over a number of days will increase the likelihood of a successful poisoning as pigs become used to feeding at the site, increasing the chance of the entire group being attracted to the bait material.

Free feeding with un-poisoned bait should continue until pigs are eating the bait material for at least 3 days prior to laying poison baits. Once feeding starts baits should be topped up each night making sure that enough bait material is available for the estimated number of pigs feeding at each site. There should be enough bait material remaining each morning to ensure the pigs return the next night. If the pigs feed for 3 consecutive nights then poisoned bait can be introduced. Poisoned meat and grain baits can be buried at or surrounding the bait stations to deter non-target species. Poisoning should continue for 4 or 5 days or until no more bait material is taken. Sometimes another mob of pigs may be in the area or individual pigs may disperse from the bait station for a few days. The continued availability of poison baits will control these pigs that missed the initial baiting. Bait should also be replaced when exposed to rain that will reduce the bait's toxin concentration.

If **grain** is used, bury the poisoned grain in shallow trenches and place small amounts of un-poisoned grain on top. Pigs will quickly take to digging for the grain. Buried grain baits will retain their attractiveness longer and very few non-targets will dig up the grain. Feral pigs also appear to prefer rooting up the soil to uncover the grain as this behaviour is part of their normal food gathering activity. If stock is present, a wire enclosure can be built to allow the passage of feral pigs but prevent stock from gaining access to the bait material. Try not to disturb or disperse the pigs, avoid shooting or using dogs and keep visits to the free-feeding sites as brief as possible.

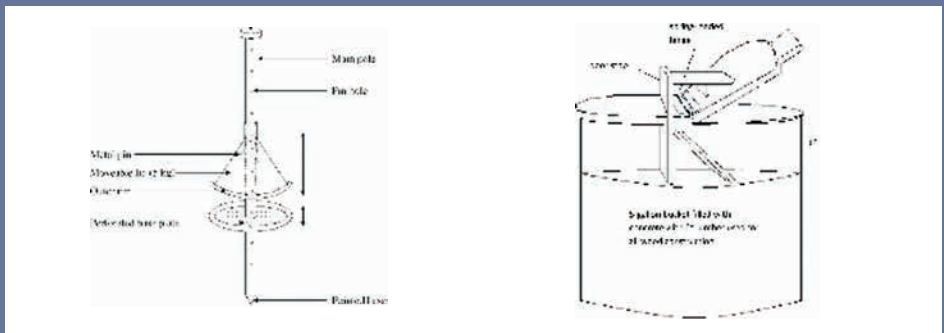
Under Queensland regulation, bait size is regulated. Meat baits must be approximately 500g in weight and injected with 72mg of 1080. For loose grain the bait material is tumble mixed with a solution of 1080 at 72mg / 500gms. Meat may be obtained from domestic cattle sheep goats or horses, offal from abattoirs or kangaroo meat from pet abattoirs. No meat pieces can contain bone material.

Mechanical Bait Stations

In some cases where bait taking by non-target species or where high labour costs associated with free feeding need to be reduced, then establishing permanent bait stations should be considered. Mechanical bait feeder devices have now been developed which can only be operated by pigs to access the bait material. The process requires the pigs to “lift” a device with their powerful nose – other species are not powerful enough or lack a lifting response. This reduces the amount of free feeding material needed and less visits to top up the device as non-target species cannot consume the bait material.

The **HogHopper™** is a new and innovative tool to help combat the impacts of feral pigs in all types of terrain and can be used with any bait type. The unit was developed by the Invasive Animals CRC with financial assistance from the Australia Pest Animal Management Program. It is a feral pig specific bait delivery system that has been tested in many feral pig habitats throughout its development, and is now on sale through Animal Control Technologies Australia Pty Ltd. The unit offers peace-of-mind feral pig baiting, with stock and other wildlife prevented from accessing toxic bait, and also helps to maintain bait freshness and palatability.

A device that also relies on the lifting principle has been developed in England. The BOS system (Boar Operating System) can be easily made and is relatively inexpensive. This device is more suitable in built up areas or areas of high conservation significance as the device cannot contain much bait material and requires bait top up each day. Only a few pigs can feed from the device at the same time. However where a problem pig(s) occurs in areas where other control techniques are not suitable, this BOS device can target the problem pig(s) and eliminate the risk to non-target species.



A diagram of the mechanism involved in the BOS.

The movable lid slides up the main pole when lifted by the pig snout. A star picket can be used for the main pole. The sliding lid is initially wired up to get pigs to feed. After feeding for a few days the lid can then be placed over the bait material. Pigs will soon learn to lift the lid with their noses to feed. Non-target animals do not have the capacity to lift the lid and access the bait.

Another simple mechanism relies on the same lifting principle. A bucket is half filled with concrete and buried in the ground. The wooden flap door allows only pigs to access the bait in the bucket after initial free-feeding to train the pigs to operate the device.

AERIAL BAITING

Aerial baiting is the most effective and cost efficient method over extensive areas or in inaccessible areas. Bait uptake rates of 81% have been achieved although aerial baiting is generally considered to be not as effective as strategic ground baiting. Areas of high pig activity or suspected pig refuge areas can be identified and targeted during aerial baiting.



ADVANTAGES of aerial baiting are:

- Most effective technique to control large pig populations over extensive areas.
- More cost effective, especially in large properties or remote areas.
- Useful in large control operations where the amount of bait material required may be very large. The economy of scale principle ensures that the cost per bait is reduced as the quantity of required bait increases.
- Cost effectiveness is further increased in coordinated landholder group situations where members of the group share the costs and effectiveness is increased due to the large area that can be baited.
- Can be used in adverse weather conditions or in seasonally inaccessible areas.

DISADVANTAGES of aerial baiting are:

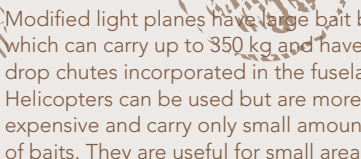
- Initial high cost of aircraft hire.
- Risk to some non-target species.
- Strategic placement of baits is difficult from aircraft.
- Pre or free feeding is not undertaken.
- Not suitable for small or near urban areas.





A number of strategies can be used to increase the effectiveness of aerial baiting:

- Aerially baiting pig refuge areas such as draining lines, swamps or thick vegetation areas is the most effective strategy.
- Cost effectiveness can be improved when adjacent landholders conduct coordinated baiting programs. Baiting large areas and spreading costs over a number of landholders is a very cost effective control strategy.
- Aerially dropping baits in refuge areas during periods of flooding may be very effective in agricultural areas. Pigs forced to move to high “islands” during floods will accept baits readily and the high population concentration will reduce costs and improve effectiveness. For drier areas, targeting watering points or wet areas during periods of drought is also effective.
- Any situation where pigs are forced to concentrate into a smaller area is a trigger for conducting aerial baiting. Local knowledge and observations are important to determine when and where these situations occur.



Modified light planes have large bait bins which can carry up to 350 kg and have drop chutes incorporated in the fuselage. Helicopters can be used but are more expensive and carry only small amounts of baits. They are useful for small area applications where accurate placement is required.

Research has found that approximately 80% of bait material will be found within the first 2 nights. However research has also found that in some cases up to 57% of these baits may be interfered with by non-target species. A project that monitored baits with remote cameras and using radio transmitters inserted in baits has demonstrated that the majority of meat baits were approached by scavenging birds. However most bait was only moved less than 20 m and only partially eaten. Baits were still available to pigs and birds did not consume enough to receive a lethal dose.

Bait uptake can be affected by pigs’ foraging range, which is influenced by availability of cover, prevailing temperature and water

and food availability. For example, high temperatures and lack of cover will restrict pig movements between foraging areas thus reducing the number of baits that potentially can be encountered. Strategic baiting where the baits are placed in pig refuge areas is much more effective than broad scale blanket baiting.

A project in the dry tropics compared the uptake rates of aerially distributed baits between blanket baiting (baits evenly distributed) and strategic baiting (baits placed in concentrated high pig usage areas near water and feed sources). Uptake was strongly influenced by seasonal conditions which play an important part in pigs encountering baits. Pigs generally dispersed during the wet season which increase pigs encountering the aerially blanket distributed baits. During the dry season pigs are less dispersed so baits that had been blanket distributed were not found. In this situation strategic baiting in the pig refuge areas achieved the highest bait uptake rate (81% of pigs had consumed bait).



AVAILABLE TOXINS

1. Compound 1080 (sodium fluoroacetate)

Poisoning with 1080 is the most widely used toxin for the control of feral pigs and used by all vertebrate pest control organisations within Australia. This is the only toxin recommended by the State Government for feral pig control. The major issue with 1080 baiting is the perceived effects on non-target animal species, especially scavenging bird species and some endangered carnivorous animal species. A review by the APVMA, the Federal Government regulatory body, recommended that although poisoning of non-targets does occur, it is limited to individual animals and does not adversely affect overall populations of non-target species. For further information see http://www.dpi.qld.gov.au/documents/Biosecurity_EnvironmentalPests/IPA-1080-Guidelines-Fluoroacetate.pdf

- Compound 1080 is produced naturally in over 30 species of native Australian plants including Goergina gidgee (*Acacia georgina*) and heartleaf poison bush (*Gastralobium grandiflorum*). 1080 does not accumulate in the food chain and readily breaks down in the soil to harmless substances as a result of fungal and bacterial action. Rain leaches the poison and warm air temperatures assist in decomposition of the poison.
- Compound 1080 is itself not toxic. It is absorbed, activated and metabolised in the body cells to be converted into fluorocitrate which blocks a vital biochemical pathway known as the Krebs Citric Acid Cycle which is directly involved with the cellular production of energy. This causes the energy supply in cells to be reduced to a point where they lose function and die.
- Toxic effects do not appear immediately after ingestion, because of the time required for converting the fluoroacetate to fluorocitrate. In pigs, death results from heart or central nervous system disorders. There is considerable variation in susceptibility between species; birds show considerable resistance and cold-blooded animals, such as reptiles and fish, are more resistant still. Dogs are the most susceptible of all animals to 1080.
- Principal advantages of this poison are it is difficult to detect, colourless and odourless, easy to handle and with a latent period (4 to 12 hrs) that allows pigs to disperse from feeding areas prior to death, thereby reducing bait shyness, and increasing effectiveness.
- Generally 1080 is significantly leached from bait material by rain and is then inactivated in the soil by microbial action. The amount of rain required to leach all of the 1080 from baits is determined by the bait substrate and vegetation cover. Generally at least 25mm of rain is required (antidotal evidence only).
- The problem of non-target species death during poisoning is determined by many factors including species sensitivity to the poison, body weight, concentration of 1080 in the bait, bait placement, bait type and palatability, timing of baiting and level of exposure to toxic baits. Landholders can significantly reduce this problem by adopting a baiting strategy outlined above.
- Some pigs may vomit for a number of hours after 1080 ingestion, creating a potential hazard for domestic dogs.



Preparing feral pig baits. A toxin (1080) is injected into 500 g pieces of meat such as kangaroo (obtained from licensed abattoirs), cattle, horse goat or offal (liver, heart etc). No bone material may be present in the meat. In Qld only licensed operators can provide 1080. The efficacy of poisoning has been reported as high as 81% population knockdown in Qld although generally 60 to 70% is considered as normal.

Compound 1080 can be supplied and used only by accredited officers.

1. Baits can only be laid on land described in a written agreement.
2. No baits can be laid on any stock route or reserve for travelling stock without local government approval.
3. No baits can be laid within 5 m of a fenced boundary.
4. No baits can be laid within 50 m of the centre line of a declared road.
5. No baits can be laid within 20 m of permanent or flowing water bodies.
6. Owners may only lay baits within 1 km of any habitation (habitation includes schools, dwellings and public facilities, but does not include the dwelling of the person laying the baits) if they first seek **written agreement** from all habitation occupiers within 1 km of the bait site. At least 80 per cent agreement must be gained before baiting can proceed. The Authorised Person may increase this to 100 per cent written agreement if required as a further risk mitigation measure.
7. Owners may only lay baits within 2 km of any habitation (habitation includes schools, dwellings and public facilities, but does not include the dwelling of the person laying the baits) after they provide **written notification** to all habitation occupiers within 2 km of the bait site.
8. No baits are to be laid within 5 km of a town without approval.



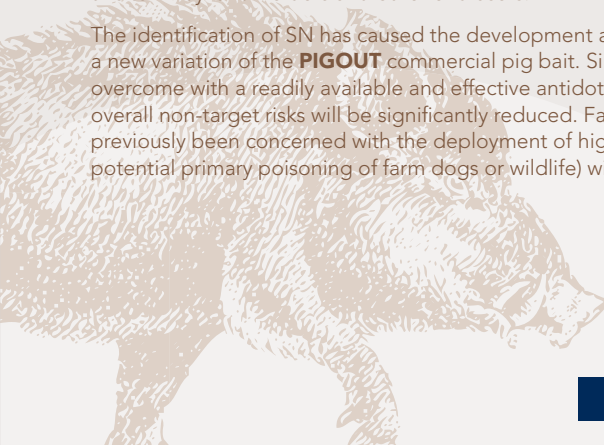
2. Phosphorus

Phosphorus is a yellow, wax-like substance with a pronounced taste and garlic-like odour. Phosphorus is absorbed through the skin but primarily through the gastro-intestinal tract where it causes severe irritations. Symptoms include acute pains; convulsions; liver damage; bloody diarrhoea; skin eruptions; coma; collapse and death. Some pigs in advanced stages exhibit the "smoking stool" syndrome where they "smoke" from mouth, nose and anus. Phosphorus was previously sold as SAP but is now marketed as the commercially available "CSSP" pig poison. CSSP is not soluble in water and does not break down readily in the environment - is toxic to a wide range of bird and animal species, is generally slow acting and inhumane, and can cause secondary poisoning from the vomit or carcass of poisoned animals. In pigs, death may take from 2 hours to 5 days following the ingestion of a lethal dose. Phosphorus is considered inhumane and is undergoing deregistration as a commercially available toxin.

3. Sodium Nitrite

The development of new and improved toxin that is more target-specific and reduces welfare concerns is needed especially in relation to the use of 1080 for feral pig control. An 'Achilles' heel' approach was used to find potential alternative toxic substances that exploited specific metabolic weaknesses of pigs. This led to the identification of sodium nitrite (SN) as a rapid and humane feral pig toxin that pigs are highly susceptible to. This toxin acts by stopping haemoglobin from carrying oxygen which leads to hypoxia (inadequate supply of oxygen to tissues) and cyanotic effects to cause painless unconsciousness and death. Pigs are highly susceptible as they possess lower levels of an enzyme that has the capacity to reverse the effects of hypoxia. Pigs can only convert approximately 1% methaemoglobin per hour; while other species have a much higher percentage of conversion so can recover more rapidly. SN is perceived as more humane than 1080 so is preferred on welfare grounds. Pigs simply go to sleep and die within a few hours. Sodium nitrite is registered as a S6 poison, rather than a restricted S7 like 1080, so there will be improved access to this toxin by land-holders and other end users.

The identification of SN has caused the development and subsequent registration of **HOGGONE®** a new variation of the **PIGOUT** commercial pig bait. Since the effects of SN can potentially be overcome with a readily available and effective antidote (methylene blue) it is considered that overall non-target risks will be significantly reduced. Farmers and agency land managers who have previously been concerned with the deployment of high dose pig baits containing 1080 (and hence potential primary poisoning of farm dogs or wildlife) will be more likely to use **HOGGONE®**.



Acknowledgements

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