A New Tool in Feral Swine Management: Sodium Nitrite

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Invasive feral swine are one of the most destructive species in the United States. Numerous agencies and organizations led by the National Feral Swine Damage Management Program are working together to reduce their impacts on agriculture, natural resources, and human health and safety. Although efforts have been successful in many areas, new damage management tools are needed. Over the next couple of years, USDA researchers and partners are field testing a new oral toxic bait for feral swine that may increase management options for wildlife and resource managers.

Why is a toxicant necessary?

There is little debate over the damage caused in the United States by invasive feral swine (wild pigs), which are a mixture of domestic pigs that escaped captivity over the years or wild boar that were introduced for recreational hunting. Recent studies estimate the animals cost probably at least $2.5 billion in damage and control costs every year.

Most quantified feral swine damage is associated with agriculture. Feral swine are notorious for rooting up crops, freshly seeded fields, damaging irrigation systems, and spreading zoonotic diseases which can affect humans and livestock. In 2015, researchers at the National Wildlife Research Center (NWRC) of USDA/APHIS/Wildlife Services partnered with the National Agricultural Statistics Service to survey more than 9,500 producers about feral swine damage to crops in 11 states. Results indicated that feral swine damage to six targeted crops in ten states exceeds $190 million each year.

Beyond their impacts to agriculture and humans, feral swine also negatively impact native wildlife. Feral swine compete with native species such as deer, wild turkey, and squirrels for important seasonal foods such as acorns and other tree mast. Feral swine root up squirrel food caches, eat turkey eggs, and kill deer fawns. Feral swine damage...
wildlife habitats by rooting and wallowing in delicate wetlands and riparian areas. These activities cause increased silt in waterways and potentially contaminate water sources with harmful bacteria and diseases.

Feral swine are challenging adversaries for wildlife managers. Although trapping, aerial operations, and other targeted management efforts have effectively reduced their damage in some areas and even eliminated isolated populations, feral swine continue to be a significant threat in many areas where their populations continue to spread. Feral swine eat almost anything, reproduce quickly, lack natural predators, and often learn to avoid humans and traps. Because of this, they continue to challenge those who attempt to control their populations and limit their damage.

**What is sodium nitrite and how does it work?**

A new tool in feral swine management has been extensively studied for many years and is nearing the final stages of research and development. Sodium nitrite, a compound commonly used in curing bacon, has the potential to make a significant impact on feral swine damage management. In high concentrations, sodium nitrite acts as a toxicant by reducing the blood’s ability to transfer oxygen. Feral swine are especially sensitive to this toxin. It causes death similar to carbon monoxide poisoning. After eating a lethal dose of the sodium nitrite bait, feral swine are rendered unconscious and die quickly, within a few hours.

Sodium nitrite is unstable in the environment—quickly breaking down when exposed to air and water. This is a good thing when thinking about limiting environmental impacts, but makes it difficult to create a stable bait that is also appealing to feral swine. To improve its stability and palatability, the sodium nitrite is micro-encapsulated. This means a thin coating is placed around the sodium nitrite before it is made into the feral swine bait. This coating helps protect the compound from breaking down and hides its odor and unappetizing salty flavor. The micro-encapsulated sodium nitrite is mixed with an oil-based bait (peanut-paste and grains) to further improve stability and attract feral swine. The micro-encapsulation breaks down quickly once eaten by feral swine, releasing the sodium nitrite and allowing it to enter the blood stream.

**What are the risks to wildlife and the environment?**

Many factors are considered when developing a toxic bait. Not only must it be effective and humane in eliminating feral swine, but also low risk for those handling it, the environment, and wildlife. Researchers with the NWRC, the research branch of USDA/APHIS/Wildlife Services, have been hard at work researching application methods and developing swine-specific delivery systems and baiting strategies to prevent non-target risks. Specially-designed bait delivery systems which exclude non-target species combined with careful pre-baiting and close monitoring of bait sites are necessary when using sodium nitrite bait. Preliminary research shows these tools and strategies are effective at deterring most non-target species. Due to concerns with excluding bears from the bait, sodium nitrite will likely not be permitted for use in areas with known bear populations, or once perfected by entrepreneurial engineers, bear-proof delivery stations will be employed. Efforts to mitigate the risk to other wildlife such as raccoons, bears, and deer are ongoing. Sodium nitrite risks to scavenging animals are low since feral swine metabolize the majority of the sodium nitrite eaten prior to death. Only a small amount of the compound remains in the carcass. What does remain is predominantly in the digestive tract and breaks down quickly once exposed to sunlight, heat, microorganisms, or air.

**What are the risks to people?**

Sodium nitrite is fast acting. It is unlikely that a hunter would encounter live feral swine exposed to a lethal dose of sodium nitrite because animals die within a few hours of eating the bait. If a
feral swine does not eat enough toxic bait to be lethal, it simply metabolizes the sodium nitrite and is fine. If a hunter does take a feral swine which has just eaten sodium nitrite, the animal’s blood would be thick and chocolate brown in color.

The U.S. Environmental Protection Agency’s (EPA) assessment of human health impacts is ongoing, however, preliminary data show low levels of nitrite in the meat of feral swine that have succumbed to sodium nitrite. Since the digestive tract of feral swine may contain residues of the compound as well as undigested bait, these organs should be discarded. Skin contact with sodium nitrite is not considered harmful, however, since the bait is peanut based, anyone with an allergy to peanuts should avoid contact with the bait or digestive contents. Pesticide labels generally require the use of gloves to handle toxicants and health experts recommend hunters wear gloves when processing feral swine to protect against diseases the animals may carry.

When will the toxic bait be ready and who can use it?

Sodium nitrite as a feral swine toxicant is still under development. The EPA has granted Wildlife Services an experimental use permit to conduct field trials. The EPA will evaluate potential risks to human health and the environment during the federal registration process. If the field trials go well and all EPA needs can be met, it is projected that the bait could be available for use by trained Wildlife Services and cooperating agency personnel for feral swine by 2023. Federal regulations surrounding the use of sodium nitrite toxicant have not yet been finalized. Once completed, States can build upon the Federal regulations when deciding whether to allow the use of the toxicant in their state.

What is happening in Alabama?

Within a year or two, NWRC researchers are planning to conduct a field trial of sodium nitrite bait on free ranging feral swine in Alabama. The trial will be a comprehensive research effort to assess the product’s efficacy. Initially, 30 adult feral swine will be outfitted with GPS radio tracking collars so researchers can follow the fate of several known animals. Then, several sites will be baited with corn. Once feral swine reliably visit the bait sites, researchers will add feral swine-specific bait stations to the sites. During this phase, which could take a couple of weeks, increasing amounts of placebo bait (the peanut paste, grain mix without sodium nitrite) will be added to the bait stations. The bait station lids will slowly transition from opened to closed as feral swine learn to lift the lids and access the bait. Stations will be closely monitored with trail cameras for feral swine and non-target species use. When large numbers of feral swine are seen opening lids and eating bait from closed bait stations, researchers will remove the placebo bait and replace it with the sodium nitrite bait.

Using trail camera data, data from radio-collared feral swine, and carcass counts, researchers will assess the efficacy of the bait trials. Results will be compared and combined with data from a similar field trial in Texas and submitted to the EPA.