Determining the Efficacy of a Warfarin-based Feral Hog Toxicant to Mitigate Economic Harm and Damage to Texas Lands

Final Report

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1.0 Executive Summary

The 87th Legislature provided direction to the Texas A&M AgriLife Extension Service through a budget rider to evaluate producer use of a warfarin-based feral swine toxicant (Kaput®), such as to (1) determine the efficacy of the product in multiple regions of the state, and (2) determine the ability of the product to assist landowners in and economic harm and damage caused by feral hogs. From that direction, we developed the following project to carry out the wishes of the Texas Legislature, while also collecting valuable information as to detailed interactions of this product with feral hogs and native wildlife in the locations it is used.

The specific language was:

> **8. Experimental Use Program for Feral Hog Abatement.**
>
> (a) Amounts appropriated above out of the General Revenue Fund in Strategy D.1.1, Wildlife Management, include $250,000 in each fiscal year of the biennium to be used by the Texas A&M AgriLife Extension Service to implement an experimental use program for the purpose of advising the Department of Agriculture under Section 76.007, Agriculture Code, regarding pesticide products containing warfarin that are registered by the United States Environmental Protection Agency for use to control feral hogs. The Texas A&M AgriLife Extension Service shall cooperate with the Department of Agriculture in implementing the experimental use program.
>
> (b) The experimental use program must obtain from pesticide applicators licensed by the Department of Agriculture information necessary to validate the efficacy of any pesticide product containing warfarin registered by the United States Environmental Protection Agency for use to control feral hogs. The program must determine the product's efficacy in multiple regions of this state and its ability to assist landholders in this state in their efforts to mitigate the economic harm and damage caused by feral hogs.
>
> (c) Not later than August 31, 2023, the Texas A&M AgriLife Extension Service shall submit a report to the legislature and the Department of Agriculture regarding the results of the experimental use for each pesticide product evaluated under the program.

This project engaged 23 sites on 11 properties in 10 counties across the State of Texas, capturing the environmental variability in the regions of the state throughout all seasons of the year.

We found that the product had the ability to control feral hogs when applicators adhered to best practices, consistent with, but modified from, manufacturer instructions. In situations where applicators diligently followed our protocol, lethality of 100% was achieved among feral hogs visiting the bait site. In situations where applicators did not follow our protocol, lethality was significantly lower, or, in some cases, there was 0% lethality due to lack of time investment on the part of the applicator. These results were consistent, without respect to season of the year or region. Only in situations where acorns or peanuts were available in great abundance, did feral

hogs decline to use Kaput® bait when protocols were followed. This is not unexpected, and is consistent with any method that requires baiting of feral hogs (e.g. trapping).

As noted, the greatest variation in efficacy of an application of this product was due to diligence of private and commercial applicators to follow protocols laid down by this project, and commit the necessary time and attention to the product. Those that did, had success in making a significant difference in the feral hogs on their property. Those that did not, saw limited to no success from applying this product. This is as any other pesticide: it must be applied according to best-practices to achieve maximum effect.

When trials were carried to completion, we did not detect sub-lethal doses in feral hogs, or feral hogs surviving consumption of the product, leading us to believe that the product is effective in killing feral hogs when applied correctly. In one trial that was ended abruptly, and feral hogs were immediately lethally sampled, some sows were detected with sub-lethal doses—likely because they had not fed the requisite number of days to expire yet.

While there is no doubt the toxicant is capable of effectively killing feral hogs, we had several mechanical issues with feeder apparatus specified by the label. These were generally overcome with modest modifications. Nevertheless, over time the feeders tend to jam open, allowing potential for unintended access to the toxicant, when they become worn. As with any mechanical item, it must be monitored, maintained, and replaced when no longer safe or effective in its designed task.

Succinctly, we found success in the use of this product, and landowners across Texas reported meaningful reductions in feral hog presence and damages on their properties as a result of the use of this product. It helped mitigate economic harm, and was efficacious in managing feral hogs. We did not detect significant issues related to non-target access to the toxicant. We learned a great deal from this effort, and hope the lessons learned will assist regulators, policy makers, and feral hog managers in their decisions related to this product.

This report summarizes the above-described program conducted during Texas FY 2022 and FY 2023 in detail.

2.0 Project Overview

2.1 Toxicant Background

Warfarin-Based Feral Swine Toxicant
Kaput Feral Hog Bait ® toxicant (hereafter Kaput® or "the toxicant") is a 0.005% AI warfarin-based toxicant which was labeled in 2017 by the EPA and subsequently registered for use with the Texas Department of Agriculture for use in Texas. Originally labeled as a general-use toxicant (no special licensing required), the Texas Agriculture Commissioner put a special order in place which required a private applicators license for use. Legislative interest immediately followed as well as a lawsuit against the TDA special order by a Texas-based feral swine processor, with legal briefs supporting the processor by the Texas Hog Hunters Association and the Environmental Defense Fund.

Warfarin is an anticoagulant pesticide commonly used for rodent control in and around buildings. The manufacturer holds several pesticide labels at 0.025% concentration for rodents (5X the concentration of the feral swine product), which likely accelerated approval of the product by the Environmental Protection Agency (EPA). Warfarin is not considered an acute toxicant and several feedings may be required to produce lethal effects. Anticoagulant toxicants cause death from internal bleeding. In pen trials, the average time to death was 8 days after consuming the product in both those conducted by the manufacturer (Poché et al. 2019), as well as independent trials (Beasley et al. 2021), which is consistent with the veterinary literature on warfarin toxicity at a higher dose in Australia(McLeod and Saunders 2013). Warfarin does not remain in the body long and minimal to no warfarin residues should be expected in feral hog carcasses killed by the toxicant, as the liver quickly metabolizes warfarin into compounds of reduced or negligible anticoagulant capacity. In the environment, it is thought that decomposition occurs through microbial means(Mercer et al. 2022).

Because feral swine may serve as a human food source, the manufacturer has added a chemical which causes a blue residue in many bodily fluids and tissues, including fatty tissues, synovial fluid, urine, and feces. The dye is apparent within hours of first ingestion(Poché et al. 2018), and would serve as an additional caution to anyone handling a feral swine carcass.

Beyond concerns regarding the use of the toxicant, the original label approved in 2017 contained language requiring the location and burial of all carcasses and the removal of grazing from areas where the toxicant was used. The portion of the label requiring these was amended by the EPA by the time this study began. A copy of the current Federal label is attached.

2.2 Project Objectives

I. Determine the efficacy of the product in multiple regions of Texas.
II. Determine efficacy of the product to assist landowners in mitigating economic harm and damage caused by feral hogs.
III. Determine the efficacy of the warfarin-based feral hog toxicant, Kaput® ©, to control feral hogs.
IV. Document non-target species access to product and identify potential impacts.
V. Provide results to the Legislature and Texas Department of Agriculture to assist in their work determining registration of the product.

2.3 Project Location Selection

Sites in Multiple Regions of Texas

Per the language that authorized this project, we located project sites across multiple regions of Texas to generally capture the variability in climate, weather, and landscape composition, both geologic and vegetative. An large set of properties were considered, but after logistical constraints and willingness of landowners to abide by project requirements were discussed, ultimately 11 properties in 10 counties across the state of Texas were used. These represented diverse agricultural and surface uses of the land, as well as exposed this project to the greatest diversity of non-target species of native and exotic wildlife as possible, to provide opportunities to evaluate the potential of non-target access to the product.

Identification of Properties

We identified a set of 11 properties with active damage from feral hogs, arranged across the various ecological regions of Texas to participate in this project. Those properties will be chosen according to a set of criteria, including, but not limited to: (1) ≥ 5,000 acres roughly arranged as a single block, (2) willingness to allow property access to Texas Wildlife Services (TWS) and AgriLife personnel as needed, and (3) landowner agreed to deploy warfarin toxicant according to labeled practices. Preference was given to landowners with current cooperative agreements with TWS, but not exclusively limited to these individuals. Landowners without TWS cooperative agreements set these up before the beginning of the project so TWS staff could provide support.

Landowner/Applicator Obligations

On each property, we had to assess the landowner was willing to allow ingress and egress by TWS and AgriLife personnel as needed. We further had to assess that the landowner's authorized private or commercial applicator, if not themselves, were willing to follow project protocol by establishing bait sites in consultation with AgriLife staff. Applicators were required to work with staff to establish the baiting and monitoring sites based on in-field scouting and their knowledge of feral hog activity on the property. Further, they were obliged to follow

instructions and training provide to apply the product in such a manner consistent with label requirements, and the requirements of this project, laid down in training provided to them.

Applicator Training

Scimetrics, Ltd. provided training in the proper application technique, according to the EPA label and their internal standards to Texas Wildlife Services and Texas A&M AgriLife Extension staff. These staff, in turn, provided training to private applicators, in the use of the product. We further supplied written guidelines, record keeping materials, and all other necessities for applicators to find success in use of the product.

Staff were on-hand throughout the course of the application to troubleshoot problems, answer questions, and otherwise provide all support requested by the applicator to ensure success in the project. Staff took an active role in reminding, prompting, and supervising applicators, within reasonable limits so as not to control the study.

2.4 Project Duration and Timing

From establishment to conclusion, we advised applicators to plan on projects requiring at least 8 weeks on each property to conduct. Projects were administered on each property every season of the year that landowners would allow. Landowners and applicators set the pace of the project on each property.

3.0 Project Design

Authors met with Texas legislative representatives to ensure the project met the intent of the legislature and met with the product manufacturer to ensure availability of the product, feeders and to obtain concurrence that the study design would not violate any label negotiations between the manufacturer and the Environmental Protection Agency (EPA).

The authors also virtually met with staff from the Texas Department of Agriculture (TDA) to coordinate regulatory issues with a field study. The Texas A&M AgriLife Extension Service's Texas Wildlife Services Unit holds a TDA Pesticide Dealers License (TDA 0102989) and served as the sole distributor of the product during the field trial.

The study design, as presented below, is consistent with the proposal document created by the authors of this report, and circulated with Scimetrics and members of the Texas Legislature prior to initiation of the study. Below, we provide specific details in how the data were obtained, collected, and analyzed.

3.1 Field Study Design

Due to the intent of the legislature to evaluate the efficacy of the product for landowners, the study involved private citizen application of the toxicant. Texas Wildlife Services provided feeders, corn pre-bait, non-toxic pre-bait and toxicant at no cost to cooperating landowners who enrolled in the field trial. Landowners provided posts and wire to exclude livestock and all the labor to fill feeders. Texas A&M AgriLife Extension Service staff did not act as applicators.

The federal Kaput® Feral Hog Bait ® label (Appendix A) and Scimetrics Feral Hog Stewardship Training (Appendix B) contains very specific instructions for selecting the bait site, placing and securing the hog-specific feeders, conditioning hogs to feeders, applying the bait and surveillance and follow-up. The manufacturer developed a specific training document (Appendix B) which details damage caused by feral hogs as well as additional instructions for baiting which the authors used as training documents for all participants.

Baiting Sites

Once trained, landowners selected feeder sites. Texas A&M AgriLife Extension and Texas Wildlife Services staff assisted in the establishment of the site due to the need to standardize data collection. A two-sided feeder was placed within a fenced livestock exclosure area with two motion-activated cameras (one facing each feeder door) placed on posts a standardized distance away.

Warfarin Bait Site

There was at least one bait site per property for the duration of the field study. The area was accessible enough to allow access by the applicators, Texas Wildlife Services, and Texas A&M AgriLife biologists for routine monitoring and maintenance. The bait site was placed in an area large enough for the feeder and cameras to be placed 16 ft. from the feeder with the doors facing north and south. The site was cleared of any vegetation that will interfere with animals reaching the bait within the feeder or obstruct game cameras from having a clear view of the feeder lids. Two cameras were placed at each feeder to monitor the activity at the feeders. One camera was facing each door to capture all visitors for the duration of the trial.

The feeder was required to be monitored and filled daily during pre-baiting as well as every 2-4 days during the deployment of the toxicant. Following the duration of the toxicant bait, the applicator was asked to post-bait with non-toxic bait for 10Days. Post-baiting was helpful in determining the continued presence or activity after the deployment of the toxicant. Feeders were to be monitored every 2–4 days during that phase.

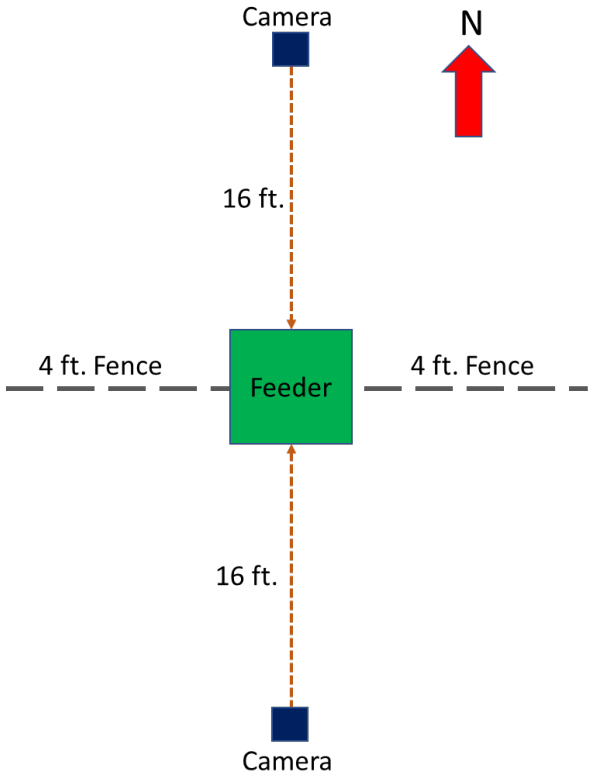

Figure 1. Bait Site Layout.

Figure 2: HogStopper Feeder Baiting Site

Monitoring Sites

A monitoring site was located within 100 meters of the baiting site. This site was established to determine if a lack of feral hog activity at a baiting site was due to lack of feral hogs, or lack of interest in the Kaput® product.

These sites involved a 4" PVC pipe, with holes drilled in it, (hereafter "feral hog roller"), filled with whole corn, and attached to a steel t-post. A motion-activated camera was placed 16 feet from the feral hog roller, on a t-post, 5 feet off the ground at a 75 degree downward angle. This system is currently the industry standard used by researchers in academia and agency service to determine the presence and activity patterns of feral hogs at a site.

A feral hog monitoring system was placed ~100 meters from the feeder to monitor relative activity in the area during and after the deployment of the toxicant. The monitoring system as also in an area easily accessible to the applicators, Texas Wildlife Services, and Texas A&M

AgriLife biologists. One camera accompanied the monitoring system and as be placed 16 ft. away. The monitoring system will need to be placed in an open area with at least a 20 ft. radius. Vegetation will be removed to ensure game camera photos are not obstructed. The monitoring site will remain active during pre-baiting, treatment, and post-baiting and will need to be checked and refilled every 10 days with corn while recording the data asked on the datasheets. Bait for the monitoring systems will also be provided by TWS.

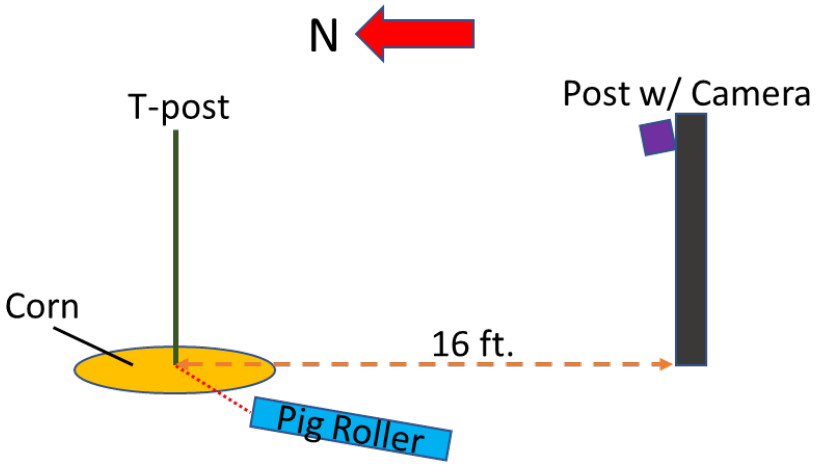

Figure 3. Monitoring Site Layout.

Figure 4: Feral Hog Roller Monitoring Site

3.2 Baiting Protocol

Following the training instructions, landowners were instructed to initiate conditioning to the feeder by feeding only whole corn with the guillotine-style door held open to the full 7" using a manufacturer-supplied stop hole and a steel pin.

The feeder manufacturer states that as soon as feral hogs began feeding regularly, the door could be closed. During early trials, applicators encountered a significant issue involving hogs that would feed when the door was held open, but refused to open the door once closed. Following some innovation by a Texas Wildlife Services employee, a second doorstop was established which resulted in a 3.5" opening. Once the feral hogs became accustomed to that, they were able to lift the door successfully. Following the initial difficulties and the success of the new door stop, all subsequent trials included a pre-baiting period with the initial 7" opening, a period at the 3.5" with various bait mixes to condition feral hogs to eat the Kaput® product, then a phase with the door fully closed and a mix of corn and Kaput® placebo product, then a final toxic bait (100% toxic Kaput® feral hog bait bait) with the door closed.

Pre-baiting was an iterative, developmental method to condition feral hogs to (1) consume the bait and (2) use the feeder systems. Pre-baiting conditioning took place using the following steps. (Prior to moving to the next steps ratio, feral hogs **must have been** using the feeder and consuming bait willingly. Scimetrics advised this process could take as long as three weeks. See flowchart, below, for details of decision process in advancing baiting steps.

Step	**Hog Stopper Feeder**	
1	Doors fully open; 100% corn	100 lbs. corn
2	Doors half open; 75% corn, 25% placebo	75 lbs. corn, 25 lbs. placebo
3	Doors half open; 50% corn, 50% placebo	75 lbs. corn, 75 lbs. placebo
4	Doors closed; 50% corn, 50% placebo	75 lbs. corn, 75 lbs. placebo

Step	**Commercial Feeder**	
1	Lid fully open; 100% corn	100 lbs. corn
2	Lid fully open; 75% corn, 25% placebo	75 lbs. corn, 25 lbs. placebo
3	Lid fully open; 50%corn, 50% placebo	75 lbs. corn, 75 lbs. placebo
4	Lid closed; 50% corn, 50% placebo	75 lbs. corn, 75 lbs. placebo

Table 1: Baiting Conditioning Protocol

<u>Training Feral hogs to Use Feeders</u>

Applicators opened the feeder doors on the Hog Stopper to the highest marked location; about 7 inches using the rod attached to the feeder for hogs to access the non-toxic bait easily, ensuring

the door will remain open for access. Following initial determination of the necessity of a second stop, a second hole had to be drilled using a 0.25" drill bit, drill the new hole 3.5" above where the feeder door meets the frame for the "half open" stage. The commercial feeder lid will need to be secured in the open position using a bungie cord to condition feral hogs to the bait.

Feeder doors were closed once feral hogs are regularly consuming placebo bait **and** operating half-closed doors on the HogStopper at the lowest mixture of corn and placebo. Applicators monitored feeders daily to ensure the feeder doors/ lid stay open and bait was available. Applicators replaced bait with the appropriate ratio as needed to keep feral hog's interest, because failure to allow adequate time for pre-baiting could result in poor toxic baiting results.

Toxic Baiting

Prior to toxic baiting, camera footage was thoroughly checked to ensure no non-targets were using feeder doors to access bait. Toxic baiting began immediately after the pre-baiting period has conditioned the feral hogs. Applicators removed all non-toxic feed from the feeders prior to baiting with toxic bait, and loaded the toxic Kaput® Feral Hog Bait into the bait compartment of each feeder with no corn added. Once the toxic bait was deployed, doors and lids were required to be kept shut to prevent non-target animals from accessing the toxic bait. Applicators were required to monitor the feeders every 2–4 days, checking the feeder systems, collecting and disposing any spilled bait. Applicators refilled feeders with Kaput® Feral Hog Bait accordingly.

When to cease using the toxic bait was the decision of the applicator. At least a 3-week deployment of toxic baiting as recommended, but we recommend that as long as feral hogs seem to be using the product, it makes sense to continue. Texas Wildlife Services staff consulted with the applicator if questions arose as to if feral hogs are using the product.

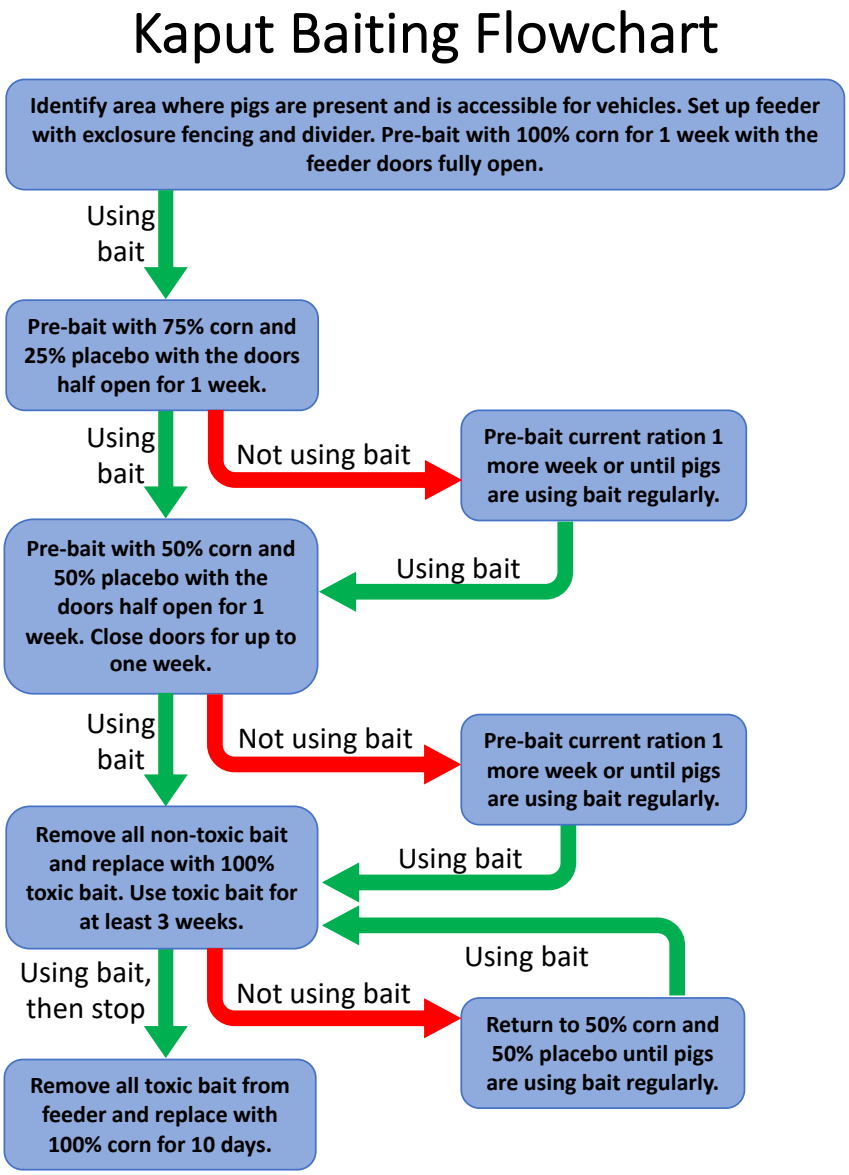

Figure 5: Kaput® Baiting Flow Chart

Post- Application Baiting

Once toxic baiting ceased, all remnants of toxic bait were removed. Following the duration of the toxic bait, landowner/ managers were asked to post-bait with 100% non-toxic bait for 10 days.

Post-baiting will be helpful in determining the activity after the deployment of the toxicant. Corn or placebo bait could be used for post-baiting and was provided by Texas Wildlife Services for post baiting deployment. Applicators left the lid closed to prevent access to non-target animals, and monitored feeders every 2–4 days, documenting the necessary data.

Post-Application Feral Hog Removal and Monitoring

Toxic bait was to be maintained by the applicator in the feeders until hogs stopped coming to the feed. Once they stopped coming, field searches were initiated to locate dead feral hogs. In many cases, small feral hogs were found before the larger feral hogs stopped feeding. The presence of blue tissue indicted consumption of bait. Feral hogs were located by walking transects around the feeders and by following scavenging birds. Some carcasses were also found from agency helicopters.

In some cases, the properties were flown following the project to remove remaining feral hogs through aerial shooting or ground shooting was initiated. Feral hogs removed after the project was over were opened in an effort to identify if any feral hogs had consumed bait (indicated by the blue tissue) but did not succumb to the toxicant.

Carcass Search Timing and Method

Beginning 6 days after the initiation of the Kaput® Feral Hog Bait application and continuing for an additional 5 days Texas Wildlife Services and/or Texas A&M AgriLife biologists conducted daily on-site searches for feral hog carcasses. These carcasses were investigated for the presence of blue dye in adipose tissue. Locations and status of feral hogs, as well as any other species found dead, were recorded.

Searching for carcasses started within the vicinity of the bait site. We expanded the search out to a 100-yard radius to look for additional carcasses. Applicators and other individuals working on the property were encouraged to record any carcasses found on datasheets provided. Presence of scavengers (e.g. vultures, caracara) was one indication of areas to focus searches for carcasses during this period. Once a carcass was found, Texas Wildlife Services checked for the presence

of blue dye in the adipose tissue by making an incision along the belly, and another along the spine.

Figure 6. Blue dye apparent in adipose tissue of juvenile feral hog.

Carcass Record Keeping

When a carcass was found, several data were recorded. With the datasheet provided, Texas Wildlife Services and/or Texas A&M AgriLife recorded:

1) Location/ property, site number, and feeder coordinates
2) Date and time the carcass was found
3) The species, age class, and carcass number
4) If blue dye was present in the adipose tissue
5) If there were any signs of scavenging
6) Provide a decomposition score based on the scale provided
7) Any notes about the carcass that would be of interest

8) Photograph the carcass with a whiteboard, showing blue dye if present, with items 1,2, and 3, above, written on board.

Rankings of decomposition followed the following scale:

Decomposition Scale:

1- Fresh; hasn't been scavenged on or decomposed yet
2- Mildly scavenged; some skin slippage, discoloration
3- Partly scavenged; muscle and viscera exposed and or partially consumed
4- Mostly scavenged; showing bones; some flesh left
5- Completely scavenged; flesh consumed or decomposed; mostly bones

3.3 Project Locations

We specifically located project on properties that met the following criteria:

- At least 5,000 acres in size, to minimize off-property feral hog movements
- Engaged in agricultural production and/or wildlife management as a primary property use.
- Representing typical conditions for the region of the state in which they are located.
- Must possess a TDA Private Pesticide Applicator's License, or be willing to hire a TDA-licensed Commercial Pesticide Applicator, and follow protocols of the project.
- Willing to allow property access to Texas A&M AgriLife Extension Service staff employed on this project to monitor sites for compliance.

Although a large number of landowners expressed initial interest, when the above criteria were presented, most declined to participate in the program. This yielded the final properties on which the project was conducted.

Field sites were distributed across the state and in a variety of seasons to evaluate if seasonal differences exist or if nontarget risks varied among the regions. To protect the privacy of private landowners, maps of properties are not presented in this report, as landscape features make identification of specific properties and ownerships possible when counties are known. We assured participating landowners of absolute privacy and protection from public knowledge of their participation in this field trial.

This yielded 23 sites on 11 properties in 10 counties, which are:

- Chambers
- Milam
- Jeff Davis
- Presidio

- Burnet (2 Properties)
- Sutton
- La Salle
- Taylor
- Anderson (2 Properties)
- Hall

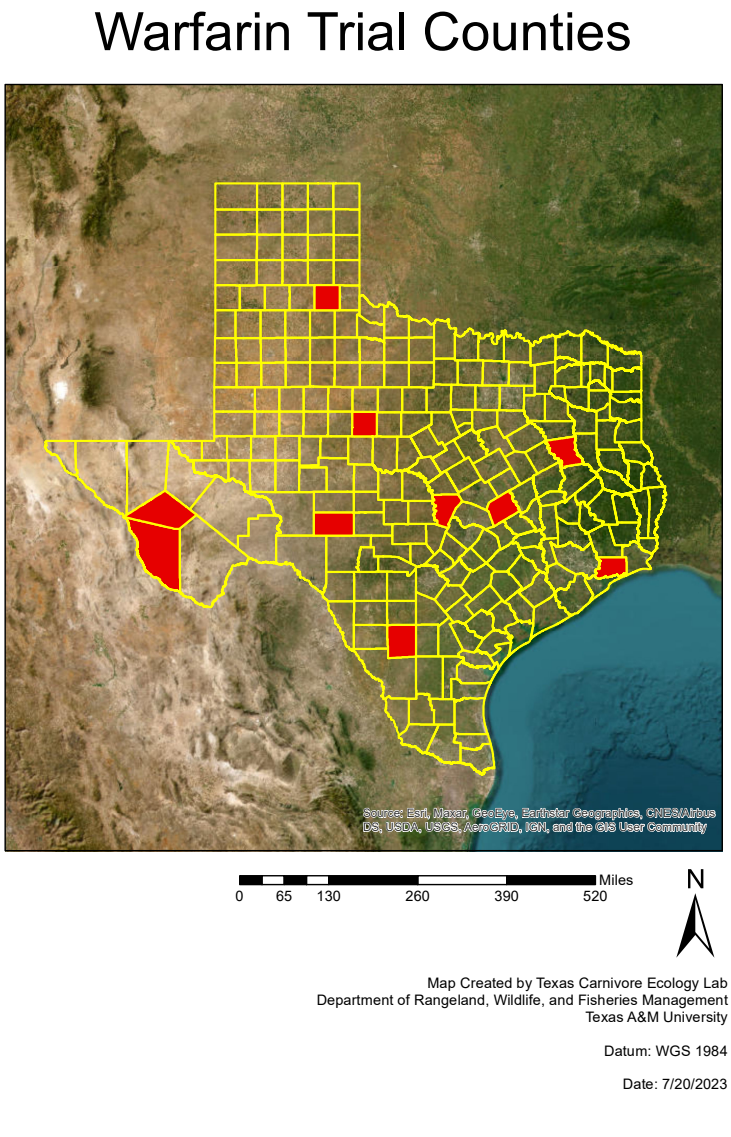

Figure 7. Map of Texas Counties where project was conducted

3.4 Data Collection and Processing

Applicator Records

Applicators in this project were required to keep records on the administration of the bait stations, as well as their progress through the specific phases of this project, described above. These included detailed reports including applications of corn, Kaput® placebo bait, and toxic Kaput® product on their property. These data included the amount of product added on which date.

Camera-collected Data

A total of 391,242 photos were captured by cameras monitoring bait sites during the course of this project. These photos were essential to determine if the success or failure of a trial was due to the applicator, the potential lack of feral hogs, malfunctions by the feeder devices, etc. Without these data, we could not accurately assess the ability of the product to assist landowners in Texas with feral hog damages.

Each photo was intensively assessed to acquire a variety of data. These included:

Feral hog Age Classes

Feral hog ages are split into 3 classes: Juvenile, Subadult, and Adult. Age classes are defined as:

- Juvenile: a feral piglet
- Subadult: an animal, clearly not fully grown based on body conformation
- Adult: a larger, breeding individual

Eating vs. Not Eating

When viewing photos, an item of focus was whether the feral hogs were actively eating from the feeder apparatus in the photo. Since we did not record video, it was important to set guidelines to define eating and not eating. These were defined as follows:

Doors open:

- Head down at feeder-eating
- Head up at feeder, chest facing feeder, chewing-eating
- Head up, chest facing feeder standing at feeder with doors open- eating
- Walking or running at/ around feeder- not eating
- Aggressive act towards another individual- not eating
- Facing any direction not near feeder- not eating.

Doors closed:

- Walking or running at/ around feeder- not eating
- Head up, chest facing away from feeder- not eating
- Aggressive act towards another individual- not eating
- Facing any direction not near feeder- not eating.
- Head down at feeder, lifting door- eating

- Head up at feeder, chest facing feeder, chewing-eating

Non-target Visitation
Any visits by non-target species to the feeders were recorded, and the behavior of the animal documented. Additionally, any human visits to the feeder were noted, as was the behavior of the human at the feeder (e.g. filling bait, checking feeder, etc.)

Counting Individuals
Multiple cameras monitored each site, as described above. Visits to the feeder were counted by the side of the feeder they visited, which was separated by a divider made of 4" utility panel, thereby preventing double-counting of animals present at the feeder. Below is an example of having animals on both sides of the divider. Due to this system, any estimates of feral hogs at feeders or killed by this product are inherently conservative estimates.

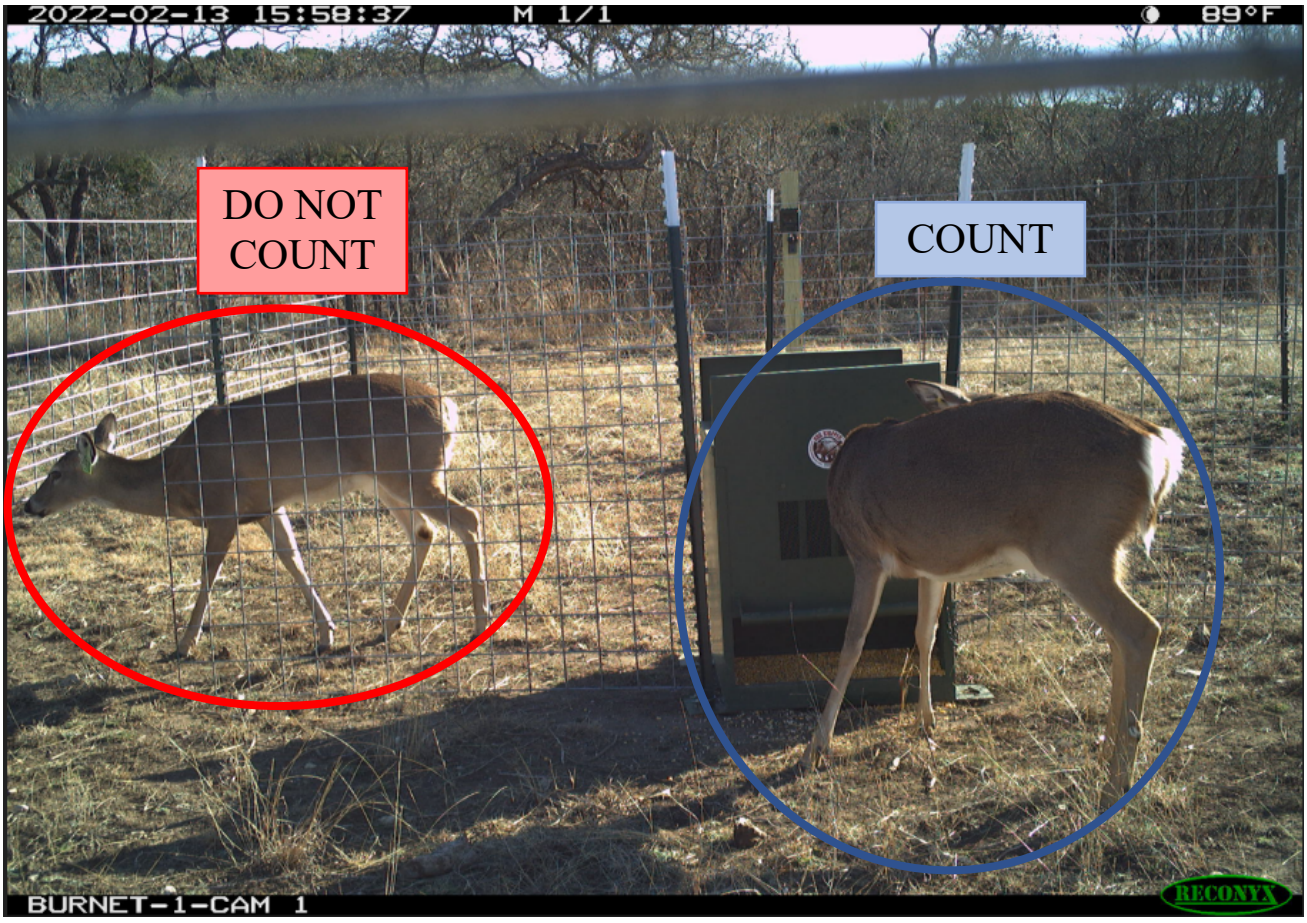

Figure 8: Example of animal observation method in camera photos.

Special Notes

Any behaviors that did not explicitly fall into categories above, but that were informative in understanding total operation of the toxicant and delivery system were noted. Although most are suitable to a formal analysis, this information helps improve our understanding of this system, and is discussed below.

Examples of these include, but are not limited to:

- Bait clogging the feeder system
- Bait altering form or consistency
- Feeder system malfunction or failure
- Non-targets eating placebo or toxic bait
- Animals sleeping at feeder
- Animals inside the feeder
- Sickly looking or lethargic animals
- Animals vomiting
- Animals acting aggressing/ fighting
- Non-targets opening the feeder doors when closed
- Non-targets consuming placebo or toxic bait

3.5 Analysis

From each site, we tabulated a variety of metrics to characterize the way in which feral hogs found, acclimated to the feeder and bait, and learned to use the placebo and toxicant product using:

- Days Until:
    - Feral Hogs Located Feeder
    - Days Until they First Used the Door (at half stop)
    - Days until toxic feeding began
    - Days of toxic feeding

We further tracked the effects on the abundance of feral hogs at project sites during trials. These included:

- Total Number of Feral Hogs at Feeder
- Estimated Number of Feral Hogs that Died from Toxicant
- Estimated Number of Feral Hogs Still Present after Trial
- Number of Carcasses Located
- Number of Feral Hogs Lethally Removed

Further, we noted the patterns of non-target use, feral hog behavior at feeder sites, and patterns of applicator use and attendance of feeder stations.

From varied notes of unexpected occurrences across trials, we developed a set of observations regarding the feeder apparatus, bait stability, and details that made the difference in trial success or failure.

Data from each trial were collated and analyzed. All results are presented in Section 4, below

4.0 Findings

4.1 Overall Findings

In general, we found the product and the delivery system to function as reported by the manufacturer from their own research and development trials, with noted modifications to the feeder apparatus. It is the opinion of the authors that, based on the data collected and analyzed in this project, the Kaput® product has the potential to reduce feral hogs as a meaningful addition to the management tools already legal for use in Texas.

In most cases, kill percentage of the documented feral hogs present at a feeding site was very high when protocol was followed diligently. The exceptions to this trend were generally related to (1) use of an unmodified feeder, (2) inconsistent application, and/or (3) human disruption of the project (e.g. shooting at feral hogs at the feeder during a trial).

These trends were clear across the state and throughout the year. In no case was there strong evidence of seasonal or geographic variability in the ability of the product to reduce feral hogs, except where an abundance of acorns or peanuts were present, discussed below, and feral hogs chose not to use the product. Otherwise, the process and timing of feral hog use of product, learning to access feeder device, and initiation of toxic product baiting were very consistent across the state, across all seasons of the year.

Although there was a single instance where a non-target species, a javelina, and another, a racoon, accessed the toxic bait, discussed below, these were extremely rare, and presented no cause for alarm, as there was no detected lethality to non-target species, nor any reason to suspect an unknown mortality occurred, due to the small quantity of bait consumed. In both cases, this access to the toxic bait occurred as a result of a feeder jammed open, discussed below.

It should be noted that modifications to the feeder apparatus were required to find success in the application of the product, and these modifications are the intellectual contribution of Texas Wildlife Services staff. Without these, we found no success in getting feral hogs to successfully access toxic bait, similar to the findings of (Beasley et al. 2021). Thus, no evaluation of the product could be conducted until modifications were made. Given this, the authors strongly encourage that feeders receive these simple modifications before use in application.

In no case was there an instance of a label violation, but some pesticide applicators chose a less rigorous or diligent approach to application than recommended. This resulted in variation in success of individual trials to reduce feral hogs on a property or the damages from those animals. It should be noted that this is not a shortcoming of the product itself, but rather of pesticide applicators. As instructed, we allowed private and commercial applicators to apply the product as they chose, as long as it was within label requirements.

Variation in the success of individual trials, discussed below in section 4.8, bear out that success is strongly related to the diligence of the pesticide applicator in following instructions as set down by the EPA label and manufacturer training, in addition to the best practices suggested by this project. We would add that success of this product in broad application across Texas would be improved if pesticide applicators were strongly encouraged to be diligent in their application. Just as with any pesticide, such as chemical herbicides, the percent of target pests killed is strongly related to diligence in adherence to best application practices.

In the subsections below, we discuss findings of this project in detail.

4.2 Bait Use

Feral hogs used the bait presented in this project. It was not unexpected that feral hogs took a small measure of time to begin eating the product, as it was a novel food item, but when fed alongside whole corn, a familiar food product, they learned to eat the bait within 3 to 5 days from first exposure, based on photographic evidence.

Interestingly, when feeding, we found very little spilled or crumbled bait upon inspections. When bait was spilled, photos indicate that feral hogs quickly consume the spilled bait, and total bait crumbles left on the landscape from ~300 pounds of bait weighed consistently less than 0.01 ounces when recovered by project staff. In most instances, no crumbled bait was found after an application. Feral hogs can be seen consuming such crumbles, when they occur, on cameras.

It is also worthy to note that the first animals to be detected deceased from the product tended to be juvenile animals, with larger and older animals following later. While we could not evaluate within the scope of this trial, this led us to consider whether or not the toxicant was also delivered to nursing young through mother's milk, or being smaller, these animals simply had a lower consumption threshold at which the product was lethal. Nevertheless, we noted that in some trials where some members of the sounder survived, it was younger animals that survived beyond the adults. This also leads us to wonder if adults out-compete younger animals for the bait in some cases, preventing them from using the toxicant at all.

4.3 Bait Acceptance

According to Scimetrics, Ltd. the matrix of the Kaput® bait contains a variety of animal and plant-based products to make it broadly appealing to feral hogs throughout the year. Although some time was required to train feral hogs to eat the product, they seemed to accept it readily, without adverse reaction. The timeframe of readiness to eat 100% Kaput® product varied, but times are similar to or faster than training cervids to consume high-protein pelletized feeds, a concept and practice to which many landowners and managers are accustomed.

Once feral hogs began to become visibly lethargic on cameras, presumably as a result of toxic effects of warfarin, they continued to eat the product, which indicates to us a high level of bait acceptance.

We did find that in times of the year and regions where acorns are abundant, feral hogs do not seem to have much interest in using the product. This is consistent with other methods of bait-based feral hog management (i.e. trapping), given that acorns are the highest-preference diet item for feral hogs and wild boars globally. Similarly, we found little acceptance of the product during times when peanuts were abundant and readily available. This is to be expected, given the high nutritional and energetic content of peanuts. These do not indicate a lack of use or acceptance, but rather, in the presence of such alternative food sources, applicators would be better served to not deploy the product. Instead, we would advise the product be used heavily before either of these items are available, the timing of which is generally predictable.

Overall, feral hogs do not seem to associate negatively with the product, and spend a great deal of time around the feeder sites. On multiple occasions, applicators had to wait for feral hogs to vacate the area before filling up the feeders, only to have feral hogs quickly return after they left. Even when they begin to approach death, we see no negative associations. In at least one instance, we observed a feral hog in its final days on camera. It showed a great deal of somnolence, eating from the feeder, and sleeping in front of it, until finally it did not rise again.

4.4 Bait Degradation

The toxic and non-toxic Kaput® products were surprisingly stable in the environment. Product in its original packaging (plastic buckets) were stored in normal conditions, including barns, storage rooms, and steel shipping containers. Despite extremely high and low temperatures, most bait retained its structure. In limited cases of extreme heat, the product slightly melted and became slightly aggregated, but was easily broken apart by striking the bucket on a hard surface once or twice, similar to how one would disaggregate a bag of ice. Crumbles could easily be cleaned up and disposed of properly. We detected no differences in efficacy based on storage conditions of the product.

Figure 9: Example of aggregated placebo Kaput® product.

When exposed to continual moisture in the feeder apparatus, following extremely heavy rainfall characteristic of some regions of Texas in some seasons, the product disintegrated within the feeder. This is unfortunate, but it should be remembered that the product is intended to be used fairly quickly by feral hogs. In cases where we experienced this outcome, the product had been sitting in standing water, unused, for several days.

Figure 10: Example of disintegrated and molded Kaput® product when exposed to water long-term.

4.5 Non-Target Access and Use

For the most part, non-target animals had no access to non-toxic or toxic bait once the feeder apparatus had been fully closed, providing the feeder doors did not become jammed open due to feral hog use.

When the feeder was open at the full stop (~7”), most non-target animals that would consume corn easily accessed the system, including livestock, wildlife, and birds. At the half-stop position (~3.5”), most non-targets ceased use of the feeder. Those that still used it were mostly smaller mesomammals, including skunks, raccoons, and opossums.

Notably, there were some instances of non-target access by javelinas at the half-stop position to the feeder. Although these animals never used the feeder from the fully-closed position, it seems noteworthy that applicators should carefully monitor use to ensure non-targets cannot operate the device.

Figure 11: Javelina opening HogStopper feeder door when opened at half-stop.

When the feeder door was jammed open on a few occasions due to use and abuse by feral hogs, non-target animals accessed non-toxic bait. In one instance, a door was jammed open during the toxic baiting phase, and a javelina accessed the toxic bait (photo below). Nevertheless, this product is not acutely toxic, and the javelina obtained a negligible amount of bait. This animal

continued to return to the site, although the toxic bait was removed and trial ended due to this access. We observed the animal for several weeks after, apparently healthy.

Figure 12: Javelina accessing Kaput® bait when feeder door was jammed open.

In one other instance, a raccoon accessed toxic bait due to a feeder door jammed open. This animal consumed very little of the bait. At this point, the trial was ended, and toxic bait removed. The raccoon continued to appear on cameras for weeks after, apparently with no ill effects.

It should be noted that warfarin is not an acute toxicant, and for all species, it must be consumed at a sufficient dose over a period of time to produce lethal effects. A single dose is unlikely to produce lethal effects in any animal, and thus, if feeders are monitored carefully, non-target mortality can be avoided, even when mechanical issues arise that unintentionally expose the toxic product.

Although this study was conducted in some regions of the state where black bears are known to exist, no black bears were present during any application of the product. Due to the strength and dexterity of the species, it is imperative that these feeders not be used to deliver such a toxicant

anywhere that black bears are present, as has been noted in other studies across the United States on similar toxicant delivery devices.

We remind the reader that this study was not tasked to monitor non-target use of the product, nor were we tasked with evaluating residue levels of warfarin in animals deceased from use of the product, nor any potential secondary toxicity from the product on scavenging animals. This is beyond the scope of our charge, design, and funding.

4.6 Delivery System

The delivery system for the toxicant supplied by Scimetrics Ltd consisted of two apparati, the HogStopper feeder, and a modified domestic swine feeder (herein referred to as "commercial feeder"). Both systems consistently produced lift-weights at or in excess of 17 pounds, based on measurements of each device taken in the field. We present some findings from the use of these devices, but it should be noted that this project specifically evaluated the ability of the chemical product to achieve results, not the mechanical delivery system.

HogStopper

The HogStopper feeder was able to successfully deliver the bait to feral hogs. In the use of this system, we noted a number of operational deficiencies that could be improved upon to improve performance of the application of the product, as well as extend the longevity of the apparatus itself. These are noted below.

When filling the feeder with product, it is noted that it can hold up to 300 pounds of placebo or toxic Kaput® Feral Hog Bait product, but in our experience, filling beyond 150 pounds results in intermittent clogging of the feed inside the filler. This could be remedied by refilling feeders more often, adding more feeders at a site, or perhaps manufacturer modification of the feeder. Regardless, it is critical to provide consistent product for feral hogs to access, no matter how it is achieved.

With the use of the HogStopper feeder, feral hogs were generally very adept at using this system, once the half-stop was provided. In our trials, feral hogs typically took ~20 days to use the feeder door at the fully-closed setting, but this is generally due to our long conditioning time. In some instances, feral hogs successfully used the feeder door within a week, where we presented the half-stop a day or so into feeding at fully-open, and then closed the door as soon as we witnessed feral hogs actively opening the door at the half-stop.

We discuss above that the bait can degrade when exposed to water for long periods of time. We recommend that the HogStopper feeder be modified with some way to drain water away from the feedpan, while not allowing bait to be spilled upon the ground. A grate and catchment pan, similar to those used in many industrial and food-service applications, may be an effective method, requiring applicators to periodically empty, clean, and refill such a device.

Commercial Feeder

Throughout several uses of the commercial feeder, we were unsuccessful in getting feral hogs to access and use any bait when the lid was closed. Given that this device features a steel bar attached to the lid of the apparatus, it is possible that feral hogs simply did not endure the weight on their head to access bait. Clearly, such feeders are useful for administering bait to feral hogs, as millions of domestic swine eat from them daily, worldwide. This is no failing of the toxic product, as other trials clearly indicated, but it does raise concerns as to whether or not an application using the commercial feeder would be successful.

We note that the manufacturer reports success using this type of device in their own research and development trials, but we could not find success with the feeder as-built.

Although this design is successful in feeding domestic swine with rations, we found that the Kaput® product frequently clogs in the funnel, and must be cleared manually to allow free flow of the product into the feed pan.

It is the opinion of these authors that such a feeder should be modified with magnets to provide a barrier to opening, but once open, make the feeder minimally cumbersome to hold open. This has been done on other such feeders used in research trials for another feral hog toxicant with success.

4.7 Applicator Compliance and Performance

All applicators complied with product label. Applicator adherence to best practices guidelines differed across locations and applicators. Once mechanical issues with feeders were overcome by the inclusion of the half-stop, applicators following our procedure diligently, and adapting with feral hog response to baiting practices, found high levels of efficacy.

Those applicators that did not follow our best practices recommendations found limited efficacy, or simply no efficacy, as feral hogs were never delivered a lethal dose of the product. In many cases, mixed success was found, with only 50% reduction in feral hogs in some cases due to applicator mismanagement or inadequate application. This often stemmed from going too long between refilling the feeder with bait, non-toxic or toxic, thereby not training feral hogs to the site, or by simply not adding enough toxic bait at each feeder check to deliver enough toxicant to enough feral hogs before they decided to end the application.

Because applicators were only required to supply the labor to apply the product, and did not incur any financial investment from having to purchase feeders, bait, or toxicant, we suspect that their level of investment in the trial was fairly low. Thus, it was not a priority for them when

other property management needs pressed their time availability. We are curious if this would be true if they purchased the product themselves.

The takeaway is not surprising: failure to follow instructions and diligently apply a pesticide results in low success, even though the pesticide itself is capable of achieving success.

4.8 Post-Baiting Lethal Removal and Carcass Location/Recovery

4.8.1 Lethal Removal Efforts

Where possible, Texas Wildlife Services staff engaged in lethal removal of feral hogs using aerial or ground-based methods. The purpose of this was to determine if any feral hogs that consumed placebo or toxic bait survived the study, so as to disambiguate feral hogs not receiving any toxicant versus those that consumed bait but received a sub-lethal dose. This would be clear to see given the blue dye in the product, described above.

In only a single case, described below in section 4.9.11 did we euthanize a feral hog showing a sub-lethal dose, which likely had yet to expire due to toxic baiting ceased rapidly. In that trial, we immediately ceased the trial and conducted lethal removals when a raccoon gained access to toxic bait. In no other case did we euthanize any feral hogs that contained blue dye. Thus, no feral hog gained access to the product, but survived the trial to the best of our knowledge. All feral hogs recovered in carcass searches, described below, exhibited blue dye.

4.8.2 Carcass Search and Recovery

Efforts were made to locate carcasses after a period of lethal baiting had elapsed that should result in lethality to feral hogs, based on data from earlier research on this product in pen trials.

In this trial, a lack of feral hogs at the feeder, combined with a lack of feral hog presence at the monitoring site, was used to infer that the feral hogs had been lethally removed. In most cases, even when carcasses could not be located, landowners and managers reported a lack of feral hog damage on-site following trials when no feral hogs were detected at baiting site or monitoring sites.

As noted in previous studies on this product, most feral hogs sought dense areas of vegetation for refuge prior to their death. Not all of these could be located or recovered, but some for each site were found and their locations marked. With a few exceptions, most carcasses located were within 200 meters of the feeder site. In several sites, the feral hogs become extremely comfortable, loafing and sleeping around the feeder site, so it is little surprise that they expired near the site as well. In a few cases, feral hogs were expired visibly on cameras as the feeder or the monitoring site. Clearly, feral hogs expiring from this product were very difficult to locate, and only a small subset could reasonably be located, even with ample people-hours invested from Texas Wildlife Services and AgriLife staff.

Figure 13: Blue dye in adipose tissue of feral hog.

The manufacturer states that the blue dye will show up clearly in adipose tissue, which it most certainly does. What was discovered in the course of this trial, quite unexpectedly, is that the product also dyes cartilage and synovial fluid blue. This dye is easily visible through thin skin over cartilage (e.g. ears), and in bones adjacent to joints, long after death. Thus, feral hogs can be determined to have consumed this product after having been scavenged by other animals.

Figure 14: Photos of remnant blue dye in joints, hide, and other areas from scavenged feral hogs.

4.9 Site-Specific Results

Below we detail the ways in which the study occurred on each specific site, to provide context in ways that different application styles affected results from each site, while still operating within product label and best practices guide. As a reminder, applicators chose when to switch to the next stage in the process, and when to cease activities on each application.

It should be noted that estimates of feral hogs present and killed are the most conservative estimate possible. Since most feral hogs look the same (e.g. black or brown coats), we present estimates based on the number of feral hogs seen at a single time at a feeder. The true measure of success is the lack of feral hog presence at a site, determined by monitoring the bait station and monitoring station, after the conclusion of the toxicant application.

In cases where we report "feral hogs present post-bait," it should be noted that these merely represent feral hogs that are still present at the bait site after the conclusion of the trial, during the post-baiting phase. These do not represent feral hogs that received sub-lethal doses. We clearly note the only instance of that in the Taylor County Property results, section 4.9.11, below.

In many cases, Texas Wildlife Services and AgriLife staff carefully supervised, assisted, and mentored applicators to achieve success. At locations with multiple trials, often the first trial was closely supervised, with subsequent trials left entirely to the supervision of the applicator. Variation in success of such trials on a single property across time was largely due to the applicator losing diligence when not closely supervised

4.9.1 Anderson County Property

Site Description:
Anderson county is located in the Post Oak Savannah region of Texas. This region contains gently rolling plains where belts oak trees are mixed in with open grasslands. The property the trials were conducted on is 16,500 acres and has an active livestock operation, mixture of agricultural fields, and wooded areas. Four total trials were conducted on the property. The property contains multiple small lakes, rivers, and creeks throughout the property. Three sites were conducted in the southeast section of the property and one site was conducted in the northwest section of the property.

Trial set-up:

Two types of trial set-ups were used during the field trials. Trials 1 and 2 were conducted using the Hog Stopper feeder with the guillotine style door while trials 3 and 4 were conducted using the commercial hog feeder with a hinged door. Each site was paired with a hog roller to assist with counting individuals visiting the area.

For trials 1 and 2, the Hog Stopper feeder was placed in the middle of the area. Two cameras are then mounted 4 ft. high, angled at 75°, 16ft. from the feeder doors on each side to capture visitors to the feeder. A 4 ft. cross fence was posted on each side of the feeder to assist with counting individuals at the site. The cross fence was not crucial to the success of the feeder, we added it to help prevent double counting of individuals on each camera. An exclosure fence was built for trial 1 to prevent any unwanted livestock from accessing the feeder.

Trials 3 and 4 were conducted using the commercial hog feeder. The setup using the commercial hog feeder was a simplified version since the doors are only on one side. The camera was also mounted 4 ft. high, angled at 75°, 16ft. from the feeder doors to capture visitors to the feeder. The hog roller was set up within 100m. of the feeder site. The feral hog roller is secured by a t-post 16 ft. from the camera where it is also mounted 4 ft. high at 75° to capture visitors.

Trial Personnel:
All four trials were conducted under close supervision of Texas Wildlife Services staff on property. Managers assisted with checking the feeders on occasions when TWS staff could not make it to the property.

Dates of the trial:
Trial 1 began on 2/10/2022 and concluded on 4/26/2022. Trial 2 began on 7/18/2022 and concluded on 8/26/2022. Trial 3 began on 8/17/2022 and concluded on 9/21/2022. Trial 4 began 11/2/2022 and concluded on 3/20/2023.

	Trial 1	Trial 2	Trial 3	Trial 4
Feeder type	Hog Stopper	Hog Stopper	Commercial	Commercial
Season of Trial	Spring	Summer	Summer	Fall/ Winter
Deployment Date	2/10/2022	7/18/2022	8/17/2022	11/2/2022
Door open date	2/10/2022	7/18/2022	8/17/2022	11/2/2022
Door half open date	3/17/2022	7/18/2022	8/18/2022	1/17/2022
Door closed date	4/6/2022	7/22/2022	NA	1/27/2022
Prebait date	2/10/2022	7/18/2022	8/17/2022	11/2/2022
75/25 date	3/3/2022	7/18/2022		
50/50 date	3/10/2022	7/22/2022		
Toxic bait date	4/6/2022	8/5/2022	NA	NA
Post bait		8/15/2022		
End Date	4/26/2022	8/26/2022	9/21/2022	3/20/2022
Total Days	**75 days**	**39 days**	**35 days**	**138 days**

Important metrics:

	Trial 1	Trial 2	Trial 3	Trial 4
Feeder type	Hog Stopper	Hog Stopper	Commercial	Commercial
Season of Trial	Spring	Summer	Summer	Fall/ Winter
Total of photos	24,713	13,900	8,863	11,684
Days until 1st feral hog	1	1	0	0
Days until door use	44	1	13	76
Days from start to toxic	55	18	NA	NA
Days of toxic feeder use	15	10	NA	NA
Days from toxic to end of trial	20	10	NA	NA
Estimated total feral hogs	67	22	18	30-36
Estimated deceased	67	20	NA	NA
Estimated present post-bait	0	2	NA	NA
Carcasses Located	7	0	NA	NA
removed lethally	7	0	NA	NA

Effectiveness of trial:

Trial 1:

At the end of trial 1, we saw successful results in killing feral hogs. However, due to the high density of the hogs, we saw little to no reduction in the quantity of hogs in the area, as more feral hogs appeared as the first sounder was killed out. As noted above, the second sounder did not learn how to operate the feeder from the first sounder. Applicator could not continue with trial

due to other work needs, but we are confident we would have continued to have results in killing feral hogs.

- 14 toxic buckets, 20 days
- 67 total feral hogs present
- 67 dead hogs
- 0 hogs present post-bait

Trial 2:

Trial 2 was also a success, resulting in the killing of feral hogs. We did see a reduction in the number of hogs in the area as long as we were monitoring the site.

- 10 toxic buckets, 10 days
- 22 total hogs present
    - Adults: 15
    - Sub-adults: 4
    - Juveniles: 3
- 20 estimated dead hogs
    - Adults: 15
    - Sub-adults: 3
    - Juveniles: 2
- 5 estimated hogs present post-bait
    - Adults: 0
    - Sub-adults: 1
    - Juveniles: 1

Trial 3:

Trial 3 was not as successful as the previous 2 trials. Trial 3 never reached the toxic bait stage. The commercial feeder exhibited multiple issues with the feeder and training of the hogs during the trial.

- 0 toxic buckets- never deployed
- 22 total hogs present
    - Adults: 7
    - Sub-adults: 2
    - Juveniles: 9

Trial 4:

Trial 4 was also not successful. Replacing the steel bar with magnets proved to be ineffective replacement.

- 0 toxic buckets- never deployed
- 22 total hogs present
    - Adults: 15
    - Sub-adults: 5
    - Juveniles: 12

Issues with trial(s):

Trial 1:
Trial 1 went on for an extended amount of time due to issues training feral hogs to use the feeder. We experienced no issues with feral hogs showing up, but once the Hog Stopper feeder doors were closed from the full, 7", open stage the feral hogs did not know how to open the feeder doors. To further teach the hogs how to use the feeder doors, we added a half-open stage to the feeder door where we dropped the door to 3.5".

Before, when the door was fully open, hogs could turn their heads to their side to access the bait inside the feeder. By adding the feeder door half-open stage, the hogs had to actually lift the feeder doors to eat the bait. The hogs learned how to use the feeder doors quickly after adding the half-open stage.

Interesting, before the last feral hog of the first sounder of feral hogs died from the toxicant, a second sounder arrived and fed with members of the first sounder. They were not successful in learning how to operate the feeder from the first sounder. At the conclusion of the trial, these feral hogs were still alive. Some were lethally removed by Texas Wildlife Services to determine they had no access to bait.

Trial 2:
Trial 2 was delayed due to lack of hogs showing up at the original trial 2 site. The feeder was moved to a new location and proceeded once hogs began showing up. The trial itself concluded with no issues regarding the feeder or bait.

We did experience an issue with our cameras and SD cards. Somehow, the SD cards became corrupted and were unreadable. The IT department for Texas A&M AgriLife Extension Service was able to recover the data on the SD cards and we were able to process the photos collected from the trial.

Trial 3:
Trial 3 was the first trial conducted using the commercial hog feeder. The commercial feeder required modification to meet the required 18 lbs. to prevent non-targets from accessing the bait. A steel bar was chosen to meet the weight requirements but the weight and noise from the steel bar made the feeder unappealing for use by the hogs. The noise from the slamming of the modified door and the weight of the door resting on their head may have made the door uncomfortable.

The feeder door is also something that requires training for the feral hogs to use. A half-open stage was added to the commercial feeder using carriage bolts, washers, and nuts to support the door partially open. However, the weight of the door at the half-open stage slamming down on the carriage bolts caused damage to the feeder and bolts causing the feeder to bend outward and allow the doors to close completely. The trial ended with only a couple hogs learning how to use the feeder.

Lastly, we experienced placebo bait clogging in the feeder, even with the restriction plate removed for open flow. The blocky shape of the bait prevents the bait from feeding into the bait tray efficiently.

Trial 4:

Trial 4 was a continuation of trial 3 using the commercial hog feeder. For trial 4 we replaced the 18 lbs. steel bar with a magnet with 18 lbs. resistance force. Replacing the steel bar with a magnet is good in theory but in practice, is not practical. After replacing the steel bar with a magnet, we estimated we were only getting ~ 5 lbs. of pull force resistance. We are unsure of the exact cause(s) but researching the issues we experienced, we think it could be a few things:

1. Magnet to steel attraction- lack of steel in the 16-gauge galvanized steel prevent proper magnetic attraction. (Experiencing magnetic saturation)
2. Magnet to magnet attraction- while the magnetic force of two magnets attracting is supposed to be the maximum pull force applied, this situation also did not yield the desired pull force of at least 17 lbs.
3. The angle of the doors prevents a straight upward force to reach the full magnetic attraction of the magnet.

Lastly, we experienced placebo bait clogging in the feeder, even with the restriction plate removed for open flow. The blocky shape of the bait prevents the bait from feeding into the bait tray efficiently.

4.9.2 Burnet County Property 1

Site Description:
Burnet County is located in the Cross Timbers and Edwards Plateau regions of Texas. The Cross Timbers includes areas with high densities of trees, plains, and prairies. The Edwards Plateau is a hilly area with multiple stony hills and steep canyons that include grasslands, juniper/ oak woodlands, and live oaks or mesquite savannahs. The first property the trial was conducted on was 5,000 acres where they run a native and exotic hunting operation. One trial was conducted on the eastern side of the property. The property contains multiple wildlife feeders for hunting, hills, steep banks, plenty of thick vegetation for cover, and a river running through the property.

Trial set-up:

The trial was conducted using the Hog Stopper feeder with the guillotine style door. The site was paired with a hog roller to assist with counting individuals visiting the area.

The Hog Stopper feeder was placed in the middle of an area believed to be frequented by feral hogs. Two cameras are then mounted 4 ft. high, angled at 75°, 16ft. from the feeder doors on each side to capture visitors to the feeder. A 4 ft. cross fence was posted on each side of the feeder to assist with counting individuals at the site. The cross fence was not crucial to the success of the feeder, we added it to help prevent double counting of individuals on each camera. An exclosure fence was built during the trial to prevent any unwanted livestock and exotic species from accessing the feeder.

Later, a commercial hog feeder was added to the bait site to test the usability of the feeder. The commercial hog feeder was placed on side 2 of the exclosure pen for hogs to eat from. No camera was placed directly facing the feeder but could be seen by camera 1.

Trial Personnel:
The trial was conducted with close supervision from Texas Wildlife Services staff. Managers assisted with filling and checking the feeders by themselves on occasions when TWS could not make it to the property.

Dates of the trial:
Trial 1 began on 2/2/2022 and concluded on 5/10/2022.

	Trial 1
Feeder type	Hog Stopper + Commercial feeder
Season of Trial	Spring
Deployment Date	2/2/2022
Door open date	2/2/2022
Door half open date	3/23/2022
Door closed date	3/28/2022
Prebait date	2/2/2022
75/25 date	2/16/2022
50/50 date	2/25/2022
Toxic bait date	3/28/2022
Post bait	4/20/2022
End Date	5/10/2022
Total Days	**97 days**

Important metrics:

	Trial 1
Feeder type	Hog Stopper + Commercial feeder
Season of Trial	Spring
Total of photos	16,737
Days until 1st feral hog	23
Days until door use	57
Days from start to toxic	57
Days of toxic feeder use	12
Days from toxic to end of trial	41
Estimated total feral hogs	25
Estimated deceased	16
Estimated present post-bait	9
Carcasses Located	3
removed lethally	0

Effectiveness of trial:
The personnel running the trial were very helpful in running the trials. Texas Wildlife Services staff were very responsive to updates and the manager of the property was helpful as time allowed. However, the site personnel responsible for this trial were slow in response time due to other job duties.

We do believe that the addition of the commercial feeder helped accelerate the presence of hogs to the feeder which created more opportunities for hogs to learn how to use the Hog Stopper feeder doors more quickly.

At the end of the trial, we saw a reduction in the population of feral hogs. The trial seemed to be 100% effective. After the trial ended, feral hogs with distinct patterns retuned to the bait site that had been present during the non-toxic baiting phase over a month after they disappeared from the area. We only captured these individuals because the cameras remained active until the site could be disassembled, long after baiting ended by the applicator. This highlights the need to continue to use the product until all feral hogs are gone from a property. The survival of these feral hogs is not due to a lack of product efficacy, but rather natural variation in feral hog movements on the landscape.

- 8 toxic buckets, 23 days
- 25 total hogs present
    - Adults: 15
    - Sub-adults: 4
    - Juveniles: 3
- 16 estimated dead hogs
    - Adults: 4
    - Sub-adults: 5-6
    - Juveniles: 3-6
- 9 estimated feral hogs present post-bait
    - Adults: 0
    - Sub-adults: 3
    - Juveniles: 6

Issues with trial(s):
The trial went on for an extended amount of time due to issues with feral hogs showing up and training feral hogs to use the feeder. Once the Hog Stopper feeder doors were closed from the full, 7”, open stage the feral hogs did not know how to open the feeder doors. To further teach the hogs how to use the feeder doors, we added a half-open stage to the feeder door where we dropped the door to 3.5”.

Before, when the door was fully open, hogs could turn their heads to their side to access the bait inside the feeder. By adding the feeder door half-open stage, the hogs had to actually lift the

feeder doors to eat the bait. The feral hogs learned how to use the feeder doors quickly after adding the half-open stage.

The trial also had an issue with getting feral hogs to show up at the very beginning. The property was replacing a fence east of the bait site making the area unhabitable for hogs to come to.

4.9.3 Burnet County Property 2

Site Description:
Burnet county is located in the Cross Timbers and Edwards Plateau regions of Texas. The Cross Timbers includes areas with high densities of trees, plains, and prairies. The Edwards Plateau is a hilly area with multiple stony hills and steep canyons that include grasslands, juniper/ oak woodlands, and live oaks or mesquite savannahs. The second property the trial was conducted on is 5,100 acres where they run a livestock operation. One trial was conducted on the in the central portion of the property. The property contains multiple livestock feeding stations, open pastures, water features, and brush motts throughout the property.

Trial set-up:

The trial was conducted using the Hog Stopper feeder with the guillotine style door. The site was paired with a hog roller to assist with counting individuals visiting the area.

The Hog Stopper feeder was placed in the middle of an area believed to be frequented by feral hogs. Two cameras are then mounted 4 ft. high, angled at 75°, 16ft. from the feeder doors on each side to capture visitors to the feeder. A 4 ft. cross fence was posted on each side of the feeder to assist with counting individuals at the site. The cross fence was not crucial to the success of the feeder, we added it to help prevent double counting of individuals on each camera. An exclosure fence was built during the trial to prevent any unwanted livestock and exotic species from accessing the feeder.

Later, a commercial hog feeder was added to the bait site to test the usability of the feeder. The commercial hog feeder was placed on side 1 of the exclosure pen for feral hogs to eat from. No camera was placed directly facing the feeder but could be seen by camera 2.

Trial Personnel:
The trial was conducted with close supervision from Texas Wildlife Services. The manager of the property assisted had previously agreed to fulfill applicator duties, but only assisted with the bait site one or two times. He was otherwise not helpful in running the trial, and left other of his staff to intermittently tend to the trial with frequent prompting by Texas Wildlife Services staff.

Dates of the trial:
Trial 1 began on 2/2/2022 and concluded on 5/10/2022.

	Trial 1
Feeder type	Hog Stopper + Commercial feeder
Season of Trial	Spring
Deployment Date	2/2/2022
Door open date	2/2/2022
Door half open date	3/23/2022
Door closed date	3/28/2022, 4/20/2022
Prebait date	2/2/2022
75/25 date	2/16/2022
50/50 date	2/25/2022
Toxic bait date	3/28/2022, 4/20/2022
Post bait	4/27/2022
End Date	5/10/2022
Total Days	**97 days**

Important metrics:

	Trial 1
Feeder type	Hog Stopper + Commercial feeder
Season of Trial	Spring
Total of photos	25,633
Days until 1st feral hog	22
Days until door use	50
Days from start to toxic	54, 77
Days of toxic feeder use	0
Days from toxic to end of trial	43, 20
Estimated total feral hogs	10
Estimated deceased	0
Estimated present post-bait	10
Carcasses Located	0
removed lethally	0

Effectiveness of trial:
The personnel running the trial were very unhelpful in running the trials. TWS personnel followed up with applicators and reminded them to fill feeders, but they would not do so. The site personnel response time for adjustments to the protocols were slow due to other job duties.

We believed that the addition of the commercial feeder would help accelerate the presence of feral hogs to the feeder like on the other Burnet County property but that was not the case here. At the end of the trial, we saw no reduction in the population of feral hogs. The trial was a failure due to the lack of the property manager's cooperation, and actions that dissuaded feral hogs from the feeder site, such as staff shooting at feral hogs near the site.

- 3 toxic buckets, 10 and 7 days
- 8-10 total feral hogs present
    - Adults:10
    - Sub-adults: 0
    - Juveniles: 0
- 0 estimated dead feral hogs
    - Adults: 0
    - Sub-adults: 0
    - Juveniles: 0
- 9 estimated feral hogs present post-bait
    - Adults: 10
    - Sub-adults: 0
    - Juveniles: 0

Issues with trial(s):
The trial went on for an extended amount of time due to issues with feral hogs showing up and training feral hogs to use the feeder. Once the Hog Stopper feeder doors were closed from the full, 7", open stage the feral hogs did not know how to open the feeder doors. To further teach the hogs how to use the feeder doors, we added a half-open stage to the feeder door where we dropped the door to 3.5".

Before, when the door was fully open, feral hogs could turn their heads to their side to access the bait inside the feeder. By adding the feeder door half-open stage, the feral hogs had to actually lift the feeder doors to eat the bait. The feral hogs learned how to use the feeder doors quickly after adding the half-open stage.

The trial had an issue with getting feral hogs to show up and consistently visit the bait site. Feral hogs would show up irregularly without adequate time to learn how to use the feeder doors. The site went toxic multiple times with no instances of feral hogs eating the toxic bait. The trial was finally discontinued after a property staff member shot at feral hogs near the feeder, and they never returned again. We suspect intermittent harassment of feral hogs on the property resulted in the irregular traffic we experienced.

4.9.4 Chambers County Property

Site Description:
Chambers County is located in the Gulf Prairies region of Texas. This region supports remnant tallgrass prairies and oak mottes mixed in with salt grass mashes, bays, and estuaries along the coast. The property the trials were conducted on is 3,100 acres and has an active livestock operation, mixture of agricultural fields, and wooded areas. Three total trials were conducted on the property. The property contains multiple small lakes, brush mottes and open pastures throughout the property. One site was conducted in the most northern piece of property and two sites were conducted in the southeastern piece of property.

Trial set-up:

All three trial set-ups were conducted using the Hog Stopper feeder with the guillotine style door. Each site was paired with a hog roller to assist with counting individuals visiting the area.

For trials 1, 2, and 3, the Hog Stopper feeder was placed in the middle of the area. Two cameras are then mounted 4 ft. high, angled at 75°, 16ft. from the feeder doors on each side to capture visitors to the feeder. A 4 ft. cross fence was posted on each side of the feeder to assist with counting individuals at the site. The cross fence was not crucial to the success of the feeder, we added it to help prevent double counting of individuals on each camera. An exclosure fence was built for trial 1 to prevent any unwanted livestock from accessing the feeder. Trials 2 and 3 did not require an exclosure fence since no livestock were in the pasture.

Trial Personnel:
All three trials were conducted with close supervision from Texas Wildlife Services staff, and the property manager was very diligent as an applicator. The manager took over and fully ran trials 2 and 3 with minimal TWS staff supervision. This property is an example of an invested property manager, and the potential of the product.

Dates of the trial:
Trial 1 began on 2/9/2022 and concluded on 5/2/2022. Trial 2 began on 7/12/2022 and concluded on 8/31/2022. Trial 3 began on 9/7/2022 and concluded on 12/7/2022.

	Trial 1	**Trial 2**	**Trial 3**
Feeder type	Hog Stopper	Hog Stopper	Hog Stopper
Season of Trial	Spring	Summer	Fall
Deployment Date	2/9/2022	7/12/2022	9/7/2022
Door open date	2/9/2022	7/12/2022	9/7/2022
Door half open date	3/17/2022	8/7/2022	10/23/2022
Door closed date	4/1/2022	8/12/2022	10/27/2022
Prebait date	2/9/2022	7/12/2022	9/7/2022
75/25 date	2/18/2022	8/7/2022	9/12/2022
50/50 date	3/3/2022	8/10/2022	10/25/2022
Toxic bait date	4/1/2022	8/15/2022	10/31/2022
Post bait		NA	
End Date	5/2/2022	8/31/2022	12/7/2022
Total Days	**82 days**	**50 days**	**91 days**

Important metrics:

	Trial 1	**Trial 2**	**Trial 3**
Feeder type	Hog Stopper	Hog Stopper	Hog Stopper
Season of Trial	Spring	Summer	Fall
Total of photos	29,195	19,193	15,868
Days until 1st feral hog	4	19	1
Days until door use	45	19	53
Days from start to toxic	51	34	54
Days of toxic feeder use	15	16	9
Days from toxic to end of trial	31	16	37
Estimated total feral hogs	43	24	14
Estimated deceased	42	16	7
Estimated present post-bait	1	7	7
Carcasses Located	6	0	0
removed lethally	26	0	0

Effectiveness of trial:
The personnel running the trial performed excellently, and were very responsive to changes in protocol and updates to increase effectiveness. We discovered six carcasses that we confirmed ate the toxic bait. After the end of the trial, 26 additional feral hogs were lethally removed, but had no signs of consuming the toxic bait. Overall, the landowner reported clear results in terms of significant reductions in feral feral hogs on property over the course of the year of trials. This was likely due to the diligence of the landowner in administration of the product.

Trial 1:
At the end of trial 1, we saw successful results in killing feral hogs. There was a reduction in the number of feral hogs in the area from the trial and some remaining feral hogs in the area were removed lethally.

- 14 toxic buckets, 31 days
- 43 total feral hogs present
    - Adults: 15
    - Sub-adults: 0
    - Juveniles: 28
- 42 estimated dead feral hogs
    - Adults: 14
    - Sub-adults: 0
    - Juveniles: 28
- 1 estimated feral hog present post-bait
    - Adults: 1
    - Sub-adults: 0
    - Juveniles: 0

Trial 2:
Trial 2 was also a success, resulting in the killing of feral hogs. We did see a reduction in the number of feral hogs in the area but the trial was not 100% effective. The surviving feral hogs were present for the following trial, with some identifiable with unique coat patterns.

- 11 toxic buckets, 16 days
- 24 total feral hogs present
    - Adults: 9
    - Sub-adults: 8
    - Juveniles: 7
- 17 estimated dead feral hogs
    - Adults: 5
    - Sub-adults: 4
    - Juveniles: 7
- 7 estimated feral hogs present post-bait
    - Adults: 2
    - Sub-adults: 5

- Juveniles: 0

Trial 3:
Trial 3 was also successful in reducing the population of feral hogs in the area. The property manager reported a significant change in feral hog presence and damage, even though the trial seemed to only be 50%. It is likely that our methods under-counted feral hogs, and more were killed than we could clearly identify. It is also possible that feral hog numbers had been so far reduced by this point that these were some of the only feral hogs present after most of a year of efforts.

We also believe that effectiveness could have been increased if we had included a longer period of training feral hogs to use the HogStopper, or re-trained the new sounder. This is gleaned from lessons learned on other sites where new feral hogs showed up mid-trial, and did not learn how to use the HogStopper from the original sounder that discovered the site.

- 11 toxic buckets, 37 days
- 14 total feral hogs present
  - Adults: 4
  - Sub-adults: 7
  - Juveniles: 3
- 7 estimated dead feral hogs
  - Adults: 1
  - Sub-adults: 3
  - Juveniles: 3
- 7 estimated feral hogs present post-bait
  - Adults: 3
  - Sub-adults: 4
  - Juveniles: 0

Issues with trial(s):
Trial 1:
Trial 1 went on for an extended amount of time due to issues training feral hogs to use the feeder. We experienced no issues with feral hogs showing up, but once the Hog Stopper feeder doors were closed from the full, 7", open stage the feral hogs did not know how to open the feeder doors. To further teach the feral hogs how to use the feeder doors, we added a half-open stage to the feeder door where we dropped the door to 3.5".

Before, when the door was fully open, feral hogs could turn their heads to their side to access the bait inside the feeder. By adding the feeder door half-open stage, the feral hogs had to actually lift the feeder doors to eat the bait. The feral hogs learned how to use the feeder doors quickly after adding the half-open stage.

After the end of the trial, 26 feral hogs were lethally removed from the property, with no evidence of having consumed the Kaput® product.

Trial 2:
Trial 2 was delayed due to lack of feral hogs showing up at the trial 1 site, likely due to post-trial lethal removals. The feeder was moved to a new location and proceeded once feral hogs began showing up. The trial itself concluded with no issues regarding the feeder or bait. This was an example of an excellent trial.

Trial 3:
Trial 3 was a continuation of trial 2 in the same location shortly after the end of trial 2, attempting to avoid the issues present with Trial 2. Trial 3 took longer than trial 2 due to feral hogs not showing up to the bait site. Feral hogs were present from the beginning, but new ones began showing up that extended the training period. The trial concluded with no other issues.

3.9.5 Hall County Property

Site Description:
Hall county is located in the Rolling Plains region of Texas. The Rolling Plains includes prairie grasslands but much of the ecoregion is described as a mesquite- shortgrass savannah where agricultural fields dominate the landscape. The properties for this trial were separated by other agricultural fields but consisted of 8,050 acres where they grow agricultural products such as peanuts, corn, and cotton. One trial was conducted on the in the southeastern property. The properties contain multiple agricultural fields spread across the area with a wooded area and river south of the bait site.

Trial set-up:

The trial was conducted using the Hog Stopper feeder with the guillotine style door. The site was paired with a hog roller to assist with counting individuals visiting the area.

The Hog Stopper feeder was placed in the middle of an area believed to be frequented by feral hogs. Two cameras are then mounted 4 ft. high, angled at 75°, 16ft. from the feeder doors on each side to capture visitors to the feeder. A 4 ft. cross fence was posted on each side of the feeder to assist with counting individuals at the site. The cross fence was not crucial to the success of the feeder, we added it to help prevent double counting of individuals on each camera.

Trial Personnel:
The trial was conducted by the landowner of the property with no supervision from Texas Wildlife Services at his request. The landowner was helpful and creative in trying different pre-baiting bait types. He was very responsive with updates and changing of protocols and troubleshooting.

Dates of the trial:
Trial 1 began on 2/13/2023 and concluded on 3/31/2023 but the site remained active until 5/3/2023 until the site could be closed down.

	Trial 1
Feeder type	Hog Stopper
Season of Trial	Winter
Deployment Date	2/13/2023
Door open date	2/13/2023
Door half open date	3/9/2023
Door closed date	3/20/2023
Prebait date	2/2/2023
75/25 date	3/24/2023
50/50 date	NA
Toxic bait date	NA
Post bait	NA
End Date	5/3/2023
Total Days	**46 (86) days**

Important metrics:

	Trial 1
Feeder type	Hog Stopper
Season of Trial	Winter
Total of photos	21,400
Days until 1st feral hog	21
Days until door use	NA
Days from start to toxic	NA
Days of toxic feeder use	NA
Days from toxic to end of trial	NA
Estimated total feral hogs	1
Estimated deceased	0
Estimated present post-bait	1
Carcasses Located	0
removed lethally	0

Effectiveness of trial:
The landowner running the trial was very helpful in running the trial. He was responsive when contacted and was creative in coming up with new pre-baiting bait types for the area. The bait site was unfortunately a bust due to the lack of activity from feral hogs.

- 0 toxic buckets, 0Days
- 1 total hog present
    - Adults: 1
    - Sub-adults: 0
    - Juveniles: 0

Issues with trial(s):
The trial had an issue with getting feral hogs to show up to visit the bait site. It took 3 weeks for a hog to show up and he would still not consistently show to the feeder. The boar never learned how to use the feeder doors, so the site never went toxic. We think the feral hogs did not show up due to the abundance of food sources in the agricultural fields in the surrounding areas, particularly peanuts. Although a failure, it presented valuable data.

Another issue we discovered later on was that a local member of the community had permission to shoot feral hogs at night in some of the surrounding agricultural fields. The added pressure from the lethal removal of feral hogs from the area could have influenced their behavior to avoid bait sites as well as reduced the population to where there were not enough feral hogs in the area. This raises a very valid point: any feral hog management tool cannot be successful if other tools are actively dissuading feral hogs from the site.

The only issue we experienced with the landowner was after checking the camera the first week, he deleted the photos from the SD cards. We quickly remedied the situation and did not experience any other issues.

3.9.6 Jeff Davis County Property

Site Description:
Jeff Davis county is located in the Trans-Pecos region of Texas. This region has diverse habitat types and vegetation from desert valleys and plateaus to mountain slopes. The property the trials were conducted on is 7,000 acres and has an active livestock operation, and hunting operation. Two total trials were conducted on the property. The property contains multiple mountains, canyons, creeks and water tanks. One site was conducted in the northern portion of property and the other site was conducted in the southwestern portion of the property.

Trial set-up:

Both trial set-ups were conducted using the Hog Stopper feeder with the guillotine style door. Each site was paired with a hog roller to assist with counting individuals visiting the area.

For trials 1 and 2, the Hog Stopper feeder was placed in the middle of the area thought to be frequented by feral hogs. Two cameras are then mounted 4 ft. high, angled at 75°, 16ft. from the feeder doors on each side to capture visitors to the feeder. A 4 ft. cross fence was posted on each side of the feeder to assist with counting individuals at the site. The cross fence was not crucial to the success of the feeder, we added it to help prevent double counting of individuals on each camera. Trial 1 did not require an exclosure fence since no livestock were in the pasture but an existing exclosure fence was used during trial 2 to prevent any unwanted livestock from accessing the feeder.

Trial Personnel:
The trial was conducted by the landowner of the property. The landowner followed the protocol very well and was very responsive with updates and changing of protocols and troubleshooting.

Dates of the trial:
Trial 1 began on 7/19/2022 and concluded on 9/21/2022. Trial 2 began on 9/21/2022 and concluded on 12/5/2022.

	Trial 1	**Trial 2**
Feeder type	Hog Stopper	Hog Stopper
Season of Trial	Summer	Fall
Deployment Date	7/19/2022	9/21/2022
Door open date	7/19/2022	9/21/2022
Door half open date	8/17/2022	10/17/2022
Door closed date	NA	10/31/2022
Prebait date	7/19/2022	9/21/2022
75/25 date	8/17/2022	10/26/2022
50/50 date		10/31/2022
Toxic bait date	NA	11/2/2022
Post bait	NA	NA
End Date	9/21/2022	12/5/2022
Total Days	**64 days**	**75 days**

Important metrics:

	Trial 1	**Trial 2**
Feeder type	Hog Stopper	Hog Stopper
Season of Trial	Summer	Fall
Total of photos	9,985	15,644
Days until 1st feral hog	11	4
Days until door use	29	27
Days from start to toxic	NA	34
Days of toxic feeder use	NA	8
Days from toxic to end of trial	NA	32
Estimated total feral hogs	0	15
Estimated deceased	0	15
Estimated present post-bait	2	0
Carcasses Located	0	0
removed lethally	0	0

Effectiveness of trial:
The landowner ran the trial with minimal supervision He was responsive when contacted and was cooperative with another site in Presidio County when they needed help during their toxic baiting stage. This highlighted the benefits of peer-assistance and cooperative efforts among landowners. In this extremely arid, environmentally sensitive region of Texas, the total number of feral hogs may be fewer than eastern Texas, but the damage incurred per hog is generally much higher.

Trial 1:
Trial 1 was unfortunately a bust due to the lack of activity from feral hogs. The feral hogs did not visit the feeder enough to learn how to use it and because the quantity of feral hogs was so low, we decided to move the bait site for trial 2.

- 0 toxic buckets, 0 days
- 2 total feral hogs present
    - Adults: 2
    - Sub-adults: 0
    - Juveniles: 0

Trial 2:
Trial 2 saw success after the trial, resulting in the killing of feral hogs. We did see a reduction in the number of feral hogs in the area near 100% effective. Hunters on the property saw no signs of feral hogs when hunting in the area the following months after the trial. Feral hogs never showed up in the area during the timeframe to conduct a third trial.

- 8 toxic buckets, 32 days
- 15 total feral hogs present
    - Adults: 6
    - Sub-adults: 9
    - Juveniles: 0
- 15 estimated dead feral hogs
    - Adults: 6
    - Sub-adults: 9
    - Juveniles: 0
- 0 estimated hog present post-bait

Issues with trial(s):
Trial 1:
Trial 1 had an issue with getting feral hogs to show up to visit the bait site. It took 2 weeks for feral hogs to show up but they would not consistently show up to the feeder. The feral hogs never learned how to use the feeder doors, so the site never went toxic. We are not sure as to the

cause of the inconsistency of the feral hogs showing up, but we think one of the neighbors may have been feeding on their property during the off-season. Because there were no consistent feral hogs showing we decided to move the site for the second trial.

Trial 2:

Trial 2 began with no issues. Feral hogs showed up quickly, but javelinas were also present at the bait site. Javelinas were a species of concern for this project, that may have the ability to use the feeder door if given the same training as feral hogs to use the feeder doors. Javelinas were documented using the feeder doors when the doors were positioned at their half- open stage. It is unsure if it was one individual or multiple that learned to open the feeder, but we observed that a single javelina can open the feeder doors of the Hog Stopper feeder when open to the half-stop. However, once the bait site went toxic with toxic bait and the door closed all the way, we experienced no issues with javelinas accessing or even attempting to get into the feeder.

3.9.7 La Salle County Property

Site Description:
La Salle county is located in the South Texas plains region of Texas. This region contains a mosaic of thorny shrubs and tree and grasslands. The property the trials were conducted on is 2,526 acres and has an active livestock operation, and hunting operation. Two total trials were conducted on the property. The property contains multiple wildlife feeder locations for hunting, tanks, and a major river flowing north of the property. Both sites were conducted in the same locations in the northern portion of property.

Trial set-up:

Both trial set-ups were conducted using the Hog Stopper feeder with the guillotine style door. Each site was paired with a hog roller to assist with counting individuals visiting the area.

For trials 1 and 2, the Hog Stopper feeder was placed in the middle of the area thought to be frequented by feral hogs. Two cameras are then mounted 4 ft. high, angled at 75°, 16ft. from the feeder doors on each side to capture visitors to the feeder. A 4 ft. cross fence was posted on each side of the feeder to assist with counting individuals at the site. The cross fence was not crucial to the success of the feeder, we added it to help prevent double counting of individuals on each camera. Trial 1 did not require an exclosure fence since no livestock were in the pasture but an existing exclosure fence was used during trial 2 to prevent any unwanted livestock from accessing the feeder. An exclosure fence was built for both trials to prevent any unwanted livestock from accessing the feeder.

Trial Personnel:
The trial was conducted by the manager of the property. The manager followed the protocol very well and was very responsive with updates and changing of protocols and troubleshooting. AgriLife personnel provided minimal mentoring, and monitored the bait station only as required by our protocols.

Dates of the trial:
Trial 1 began on 7/5/2022 and concluded on 12/7/2022 but remained active until 2/20/2023 when trial 1 materials could be collected. Trial 2 began on 2/28/2023 and concluded on 5/24/2023.

	Trial 1	**Trial 2**
Feeder type	Hog Stopper	Hog Stopper
Season of Trial	Summer/ Fall	Winter
Deployment Date	7/5/2022	2/28/2023
Door open date	7/5/2022	2/28/2023
Door half open date	8/2/2022	3/20/2023
Door closed date	8/21/2022	4/8/2023
Prebait date	7/5/2022	2/28/2023
75/25 date	8/12/2022	3/20/2023
50/50 date	8/21/2022	3/30/2023
Toxic bait date	9/15/2022	4/15/2023
Post bait	11/27/2022	4/25/2023
End Date	12/7/2022	5/24/2023
Total Days	**155 days**	**85 days**

Important metrics:

	Trial 1	**Trial 2**
Feeder type	Hog Stopper	Hog Stopper
Season of Trial	Summer/ Fall	Winter
Total of photos	21,622	24,975
Days until 1st feral hog	22	3
Days until door use	41	23
Days from start to toxic	72	46
Days of toxic feeder use	15	11
Days from toxic to end of trial	83	39
Estimated total feral hogs	12	11
Estimated deceased	12	5
Estimated present post-bait	0	6
Carcasses Located	0	0
removed lethally	0	0

Effectiveness of trial:
The landowner running the trial was great in running the trial. He was responsive when contacted and was cooperative and was able to fix any issues with the feeder or bait he was experiencing. He was committed to success, but unfortunately had to travel unexpectedly, and did not have back-up for when he was gone.

Trial 1:
Trial 1 was a success seeing a reduction in the number of feral hogs in the area. We did see a reduction in the number of feral hogs in the area giving the bait a near 100% effective rate. Despite the slow start and slow consumption of toxic bait, the trial was a success and saw a very slow increase in hog presence in the following months.

- 4 toxic buckets, 73 days
- 12 total feral hogs present
    - Adults: 4
    - Sub-adults: 8
    - Juveniles: 0
- 12 estimated dead feral hogs
    - Adults: 6
    - Sub-adults: 8
    - Juveniles: 0
- 0 estimated feral hogs present post-bait
    - Adults: 0
    - Sub-adults: 0
    - Juveniles: 0

Trial 2:
Trial 2 saw success after the trial, resulting in the killing of feral hogs. We did see a reduction in the number of feral hogs in the area, but the bait was only around 50% effective. This is most likely due to the manager being gone for an extended period during the toxic baiting stage, and not resuming toxic baiting on his return.

- 4 toxic buckets, 10 days
- 11 total feral hogs present
    - Adults: 7
    - Sub-adults: 0
    - Juveniles: 4
- 5 estimated dead feral hogs
    - Adults: 3
    - Sub-adults: 0

- Juveniles: 2
- 6 estimated feral hogs present post-bait
  - Adults: 4
  - Sub-adults: 0
  - Juveniles: 2

Issues with trial(s):

Trial 1:

Trial 1 went on for an extended period of time because it had an issue with training feral hogs to use the feeder at the bait site. It took 3 weeks for feral hogs to show up but they would not consistently show up to the feeder at first. The feral hogs were slow to learn how to use the feeder for some reason unknown to us or the applicator. It is possible they were still turning their heads to squeeze between the door and the frame of the feeder, rather than lift the door, as we saw at other sites.

Javelinas were present at the site but we documented no use of the feeder after the feeder doors dropped to the half-open stage. This is in contrast from other regions, where javelina learned to use the feeder at the half-open stage.

The feeder at the site began to split at welds and seams, and break apart during the trial. The welds holding the hinges of the top loading door broke on one side, and the top edges of the feeder began cracking during the trial.

Due to the high summer temperatures during this trial, we also discovered that the placebo (and most likely the toxic bait) will slightly melt and stick together if they get too toxic. Luckily this happened in the bucket, and we were able to disaggregate it easily by striking the bucket against a solid object, such as a pickup bed or the ground.

Trial 2:

Trial 2 began with no issues. Feral hogs showed up quickly with minimal javelina presence. Unfortunately, the trial was not as effective as it could have been due to the manager leaving the site for 6 days, allowing the feeder to run out of toxic bait, and not continue upon his return home due to other job duties. After this, the feral hogs lost interest in this site. This is not dissimilar from what occurs with traditional baiting of traps—if the site goes too long without consistent food resources, feral hogs adjust their movement patterns.

The feeder at the site began to split and break apart more during this trial as well. The other welds holding the hinges of the top loading door broke causing the manager to use rocks and cinderblocks to keep non-targets from accessing the toxic bait. The top edges of the feeder began cracking more as well during this trial.

3.9.8 Milam County Property

Site Description:
Milam county is located in the Post Oak Savannah and Blackland Prairie regions of Texas. The Post Oak Savannah region contains gently rolling plains where belts oak trees are mixed in with open grasslands. The Blackland Prairie region contains fertile black soils that support tall grass prairies. The property the trials were conducted on is 5,000 acres and has an active livestock operation with some hunting on the property. Four total trials were conducted on the property. The property contains multiple small lakes, open pastures with tall trees abd brush motts. Two sites were conducted in the central part of the property, one site was conducted in the northern part of the property, and one site was conducted in the southern part of the property.

Trial set-up:

All four trial set-ups were conducted using the Hog Stopper feeder with the guillotine style door. The first trial also included the commercial hog feeder during the latter half of the trial. Each site was paired with a hog roller to assist with counting individuals visiting the area.

For trials 1, 2, 3, and 4, the Hog Stopper feeder was placed in the middle of the area. Two cameras are then mounted 4 ft. high, angled at 75°, 16ft. from the feeder doors on each side to capture visitors to the feeder. A 4 ft. cross fence was posted on each side of the feeder to assist with counting individuals at the site. The cross fence was not crucial to the success of the feeder, we added it to help prevent double counting of individuals on each camera. An exclosure fence was built for trials 1 and 4 to prevent any unwanted livestock from accessing the feeder. Trials 2 and 3 did not require an exclosure fence since no livestock were in the pasture.
Later during trial 1, a commercial hog feeder was added to the bait site to test the usability of the feeder. The commercial hog feeder was placed along the exclosure fence with a camera mounted 4 ft. high, angled at 75°, 16ft. from the feeder doors on each side to capture visitors to the feeder. The commercial feeder was also deployed during trials 2 and 3 but the applicator did not use the feeder. So, it was not monitored by a camera.

Trial Personnel:
The first trial was conducted by with significant mentoring from TWS personnel to the applicator. Trials 2–4 were conducted by the applicator with minimal involvement from TWS staff.

Dates of the trial:
Trial 1 began on 2/22/2022 and concluded on 6/30/2022. Trial 2 began on 7/1/2022 and concluded on 9/1/2022. Trial 3 began on 10/1/2022 and concluded on 11/17/2022. Trial 4 began 11/17/2022 and concluded on 2/7/2023.

	Trial 1	**Trial 1**	**Trial 2**	**Trial 3**	**Trial 4**
Feeder type	Hog Stopper	Commercial	Hog Stopper	Hog Stopper	Hog Stopper
Season of Trial	Spring	Spring	Summer	Fall	Winter
Deployment Date	2/22/2022	3/29/2022	7/1/2022	10/1/2022	11/17/2022
Door open date	2/22/2022	3/29/2022	7/1/2022	10/1/2022	11/17/2022
Door half open date	3/24/2022	NA	7/7/2022	10/10/2022	NA
Door closed date	4/19/2022	NA	7/18/2022	NA	NA
Prebait date	2/22/2022	3/29/2022	7/1/2022	10/1/2022	11/17/2022
75/25 date	4/2/2022	NA	7/8/2022	NA	NA
50/50 date	4/11/2022	NA	7/13/2022	NA	NA
Toxic bait date	4/19/2022	NA	7/28/2022	NA	NA
Post bait		NA	8/25/2022	NA	NA
End Date	6/30/2022	6/30/2022	9/1/2022	11/17/2022	2/7/2023
Total Days	**Days**	**days**	**Days**	**Days**	**1Days**

Important metrics:

	Trial 1	**Trial 2**	**Trial 3**	**Trial 4**
Feeder type	Hog Stopper + Commercial	Hog Stopper	Hog Stopper	Hog Stopper
Season of Trial	Spring	Summer	Summer	Fall/ Winter
Total of photos	28,129	15,362	4,170	4,849
Days until 1st feral hog	4	2	1	5
Days until door use	59	8	9	NA
Days from start to toxic	63	27	NA	NA
Days of toxic feeder use	9	9	NA	NA
Days from toxic to end of trial	22	28	NA	NA
Estimated total feral hogs	37	20	18	45
Estimated deceased	37	2	0	0
Estimated present post-bait	0	2-6	18	45
Carcasses Located	2	0	0	0
removed lethally	0	0	0	0

Effectiveness of trial:
The personnel running the trials varied. The Wildlife Services and AgriLife Extension Services – mentored trial was the most effective, where the applicator's only investment was to fill bait stations with toxic bait when prompted. Once the trials were turned over to the ranch manager, the effectiveness of the trials began to decline.

Trial 1:
At the end of trial 1, we saw successful results in killing feral hogs. No feral hogs were seen on camera after the toxic bait was removed from the feeder. The manager report no feral hogs in this area for a long time. We discovered two carcasses that we confirmed to have eaten the toxic bait.

- 12 toxic buckets, 10 days
- 37 total feral hogs present
    - Adults: 31
    - Sub-adults: 3
    - Juveniles: 3
- 37 total feral hogs present
    - Adults: 31
    - Sub-adults: 3
    - Juveniles: 3
- 0 estimated feral hogs present post-bait

Trial 2:
Trial 2 was marginally successful, resulting in the killing of some feral hogs. The applicator clearly rushed this trial, and did not allow sufficient time for feral hogs to learn to use the feeder.

- 3 toxic buckets, 10 days
- 20 total feral hogs present
    - Adults: 6
    - Sub-adults: 12
    - Juveniles: 2
- 2 estimated dead feral hogs
    - Adults: 2
    - Sub-adults: 0
    - Juveniles: 0
- 18 estimated feral hogs present post-bait
    - Adults: 4
    - Sub-adults: 12
    - Juveniles: 2

Trial 3:

Trial 3 was not as successful as the previous 2 trials. Trial 3 never reached the toxic bait stage. The feral hogs appeared to have been avoiding eating from the feeder. They would come to it and sleep next to it, but only rarely ate from it. We cannot say why this is, but suspect due to improper application, the feral hogs did not want to use the feeder or bait.

- 0 toxic buckets- never deployed
- 18 total feral hogs present
    - Adults: 7
    - Sub-adults: 11
    - Juveniles: 0

Trial 4:
Trial 4 was also not successful. Feral hogs took too long to visit consistently for an unknown reason, and the property manager decided to end this trial before its natural conclusion. Thus, this trial never went to the toxic phase, despite great potential.

0 toxic buckets- never deployed

- 45 total feral hogs present
    - Adults: 19
    - Sub-adults: 0
    - Juveniles: 26

Issues with trial(s):
Trial 1:
Trial 1 went on for an extended amount of time due to issues training feral hogs to use the feeder. We experienced no issues with feral hogs showing up, but once the Hog Stopper feeder doors were closed from the full, 7", open stage the feral hogs did not know how to open the feeder doors. To further teach the feral hogs how to use the feeder doors, we added a half-open stage to the feeder door where we dropped the door to 3.5".

Before, when the door was fully open, feral hogs could turn their heads to their side to access the bait inside the feeder. By adding the feeder door half-open stage, the feral hogs had to actually lift the feeder doors to eat the bait. The feral hogs learned how to use the feeder doors quickly after adding the half-open stage.

Precipitation leaked into the feed pan, causing both the placebo and toxic bait to disintegrate and spoil. Feral hogs did not seem to consume the spoiled bait. Such spoiled bait was disposed of safely, and replaced with fresh bait, which the feral hogs readily used.

We documented raccoons accessing bait when the feeder doors became stuck open. Thankfully, the deployment of toxic bait was completed, and post-baiting had begun by the time the raccoons

were seen accessing the open feeder. Young livestock were also able to get inside the exclosure fence during the trials but were not able to access the feeder once the feeder doors closed.

We noticed lots of vultures present at the bait site after the feral hogs stopped coming to the feeder. We are unsure if this was related but if it is, it could be an issue during the birthing season for livestock.

Trial 2:
Trial 2 was moved to a new location and proceeded once feral hogs began showing up. The trial itself concluded with no issues regarding the feeder. The bait however had issues clogging in the funnel due the high temperatures during the summer. The placebo bait was sticking to the sides of the feeders funnel, preventing the bait from dropping into the bait pan. We also experienced the

Trial 2 seemed to be rushed by the ranch manager. The manager was quick to shut the doors and deploy the toxic bait causing the bait to not perform as well as it should have. This resulted in feral hogs being poorly trained. The manager stated that he was looking at the photos before moving on to the next step, but it is unclear how closely he was studying the photos.

During trial 2 we also experienced more moisture getting into the feeders feed pan causing the placebo and toxic bait to disintegrate and spoil. The spoiled bait was not useful for the feral hogs to consume and had to be removed and disposed of. New bait was used to replace the spoiled bait. The corridor where the feeder was set up was also used to move livestock between pastures. The livestock did not attempt to access the feeder during their time in the corridor.

Trial 3:
Trial 3 was a continuation of trial 2. The manager restarted the pre-baiting stage of the trial and quickly attracted feral hogs. However, the feral hogs did not seem to want to eat from the feeder as much as the previous trial. There is no way to be sure due to the timing of toxic bait and the standard black coloration of the feral hogs in the area, but we believe the feral hogs in trial 3 are the same feral hogs that survived trial 2.

We also saw a decrease in attention to the bait site from the manager. Feeder and hog roller checks became less frequent, despite the feeder being on the main road that runs across the property. The corridor where the feeder was set up was also used to move livestock between pastures. The livestock did not attempt to access the feeder during their time in the corridor.

Trial 4:
Trial 4 was in a new location on the ranch after the feral hogs seemed to be actively avoiding the feeder. The site was moved, and pre-baiting began immediately to a lack of hog activity. Hog activity was sporadic until the end of the trial when the applicator decided to close the site down. The manager made little to no effort to check the feeder at this site as well. Texas A&M AgriLife was doing the majority of the bait site monitoring, and prompted the applicator as needed. This was another reason for the site being closed down. Livestock were also able to get inside the

exclosure fence during the trials but were not able to access the feeder once the feeder doors closed.

More than 40 feral hogs began frequenting the feeder 2 weeks before the closing of the trial. This trial represents a great amount of unrealized potential due to lack of applicator diligence and patience.

3.9.9 Presidio County Property

Site Description:
Presidio county is located in the Trans-Pecos region of Texas. This region has diverse habitat types and vegetation from desert valleys and plateaus to mountain slopes. The property the trials were conducted on is 14,000 acres and has an active livestock operation. Two total trials were conducted on the property. The property contains multiple mountains, canyons, and creeks running through the property. Both trials were conducted in the southern portion of the property.

Trial set-up:

Both trial set-ups were conducted using the Hog Stopper feeder with the guillotine style door. Each site was paired with a hog roller to assist with counting individuals visiting the area.

For trials 1 and 2, the Hog Stopper feeder was placed in the middle of the area thought to be frequented by feral hogs. Two cameras are then mounted 4 ft. high, angled at 75°, 16ft. from the feeder doors on each side to capture visitors to the feeder. A 4 ft. cross fence was posted on each side of the feeder to assist with counting individuals at the site. The cross fence was not crucial to the success of the feeder, we added it to help prevent double counting of individuals on each camera. Trial 1 did not require an exclosure fence since no livestock were in the pasture but an existing exclosure fence was used during trial 2 to prevent any unwanted livestock from accessing the feeder. An exclosure fence was not built for the trials, as no cattle were in the pasture the trials were conducted in.

Trial Personnel:
The trials were conducted by the manager of the property with minimal mentoring from TWS or AgriLife staff. The manager followed the protocol very well and was very responsive with updates and changing of protocols and troubleshooting

Dates of the trial:
Trial 1 began on 7/18/2022 and concluded on 9/22/2022. Trial 2 began on 9/22/2022 and concluded on 12/14/2022.

	Trial 1	**Trial 2**
Feeder type	Hog Stopper	Hog Stopper
Season of Trial	Summer	Fall
Deployment Date	7/18/2022	9/22/2022
Door open date	7/18/2022	9/22/2022
Door half open date	8/7/2022	9/22/2022
Door closed date	8/21/2022	10/8/2022
Prebait date	7/18/2022	9/22/2022
75/25 date	8/7/2022	9/22/2022
50/50 date	8/14/2022	10/4/2022

Toxic bait date	8/26/2022	10/13/2022
Post bait	9/6/2022	
End Date	9/22/2022	12/14/2022
Total Days	**66 days**	**83 days**

Important metrics:

	Trial 1	**Trial 2**
Feeder type	Hog Stopper	Hog Stopper
Season of Trial	Summer	Fall
Total of photos	26,597	15,013
Days until 1st feral hog	13	2
Days until door use	22	2
Days from start to toxic	38	20
Days of toxic feeder use	10	10
Days from toxic to end of trial	10	62
Estimated total feral hogs	16	13
Estimated deceased	10	13
Estimated present post-bait	6	0
Carcasses Located	2	0
removed lethally	0	0

Effectiveness of trial:
The landowner ran the trial very well with minimal supervision. He was responsive when contacted and to the changing of protocols due to the unforeseen non-target issues we experienced.

Trial 1:
Trial 1 was a success seeing a reduction in the number of feral hogs in the area. We did see a reduction in the number of feral hogs in the area but due to the high consumption rate of the bait, the effectiveness was not as high as we were hoping due to having to end this trial prematurely due to javelina access.

- 15 toxic buckets, 10 days
- 16 total feral hogs present
- 10 estimated dead feral hogs
- 6 estimated feral hogs present post-bait

Trial 2:
Trial 2 also saw success after the trial, resulting in the killing of feral hogs. We also saw a reduction in the number of feral hogs in the area but the situation of the high consumption rate of some feral hogs may have reduced the effectiveness to other individuals.

- 18 toxic buckets, 10 days

- 13 total feral hogs present
    - Adults: 8
    - Sub-adults: 3
    - Juveniles: 2
- 13 estimated dead feral hogs
    - Adults: 6
    - Sub-adults: 3
    - Juveniles: 2
- 0 estimated feral hogs present post-bait

Issues with trial(s):

Trial 1:

Trial 1 began well. Feral hogs found the site and learned how to use it quickly, and we had no issues with the feeder or bait. Later during the trial, we noticed the feeder was cracking in the same places as other trials and that the feeder doors were beginning to become stuck in the open position. The manager adjusted the door tracks to prevent the feeder doors from opening, and it appeared to work for a while.

During the toxic bait stage, the feeder door became stuck open, and a single javelina accessed the toxic bait. Once we noticed this, we halted the toxic baiting stage and moved to the post baiting stage to avoid possible poisoning of the javelina. We did confirm the javelina survived on camera several weeks after the toxic bait was removed from the feeder. It did not access the feeder again.

The feral hogs at the site also consumed an exceptional amount of bait in a short amount of time. The manager also noticed that there were purple urine spots in the immediate area during the toxic baiting stage of the trial. This was the first documentation of this, but we believe it was caused by the blue coloring in the toxic bait. Maverick (feral) cattle visited the bait site on a few occasions but did not access the feeder. The mavericks were unknown to the manager to be in the pasture.

Trial 2:

Trial 2 began with no issues. We replaced the feeder at the site due to the damage it sustained and the malfunctioning doors. However, the replacement feeder also began to form cracks in the same places as the previous feeder after a short time. We experienced no issues with the javelina using the feeder during this trial. We did experience the exceptional consumption of toxic bait during this trial as well, likely leading to the accelerated failure of the feeder due to high levels of use.

At the end of the trial, we discussed continuing more trials on property, but due to the time constraints of the managers primary job, he could not commit to running more trials on property.

3.9.10 Sutton County Property

Sutton County is located in the Edwards Plateau region of Texas. The region is a hilly area with multiple stony hills and steep canyons that include grasslands, juniper/ oak woodlands, and live oaks or mesquite savannahs. The property the trials were conducted on is 3,500 acres and has an active livestock operation and hunting operation. Two total trials were conducted on the property. The property is very brushy with cleared roads for hunting and traveling purposes. Both trials were conducted in the southern portion of the property.

Trial set-up:

Both trial set-ups were conducted using the Hog Stopper feeder with the guillotine style door. Each site was paired with a hog roller to assist with counting individuals visiting the area.

For trials 1 and 2, the Hog Stopper feeder was placed in the middle of the area thought to be frequented by feral hogs. Two cameras are then mounted 4 ft. high, angled at 75°, 16ft. from the feeder doors on each side to capture visitors to the feeder. A 4 ft. cross fence was posted on each side of the feeder to assist with counting individuals at the site. The cross fence was not crucial to the success of the feeder, we added it to help prevent double counting of individuals on each camera. Trial 1 did not require an exclosure fence since no livestock were in the pasture but an existing exclosure fence was used during trial 2 to prevent any unwanted livestock from accessing the feeder. An existing exclosure fence was used during both trials to prevent any unwanted livestock from accessing the feeder.

Trial Personnel:

Both trials were conducted with extensive supervision from TWS staff. At any time that TWS staff could not directly supervise the applicator, they were not diligent in maintaining the bait station.

Dates of the trial:

Trial 1 began on 7/21/2022 and concluded on 11/3/2022. Trial 2 began on 11/3/2022 and concluded on 12/14/2022.

	Trial 1	**Trial 2**
Feeder type	Hog Stopper	Hog Stopper
Season of Trial	Summer/ Fall	Fall/ Winter
Deployment Date	7/21/2022	11/3/2022
Door open date	7/21/2022	11/3/2022
Door half open date	8/4/2022	11/3/2022
Door closed date	9/20/2022	NA
Prebait date	7/21/2022	11/3/2022
75/25 date		11/3/2022
50/50 date		NA

Toxic bait date	9/30/2022	NA
Post bait	10/29/2022	NA
End Date	11/3/2022	12/14/2022
Total Days	**105 days**	**41 days**

Important metrics:

	Trial 1	**Trial 2**
Feeder type	Hog Stopper	Hog Stopper
Season of Trial	Summer/ Fall	Fall/ Winter
Total of photos	21,451	6,225
Days until 1st feral hog	2	0
Days until door use	15	NA
Days from start to toxic bait	70	NA
Days of toxic bait feeder use	10	NA
Days from toxic bait to end of trial	28	NA
Estimated total feral hogs	54	17
Estimated deceased	54	0
Estimated present post-bait	0	17
confirmed deceased	0	0
removed lethally	0	0

Effectiveness of trial:
This trial was extremely productive and economical in terms of killing a large number of feral hogs quickly and efficiently when the applicator had the time to commit to the trial. Were surprised by the high level of lethality with relatively little toxic bait used.

Trial 1:
Trial 1 was a successful despite the time constraints TWS staff had on their ability to closely mentor the trial. It is possible that the additional corn outside of the feeder contributed to the attraction of the feral hogs to the area.

- 5 toxic bait buckets, 10 days
- 54 total feral hogs present
    - Adults: 12
    - Sub-adults: 23
    - Juveniles: 19
- 54 estimated dead feral hogs
    - Adults: 12
    - Sub-adults: 23
    - Juveniles: 19
- 0 estimated feral hogs present post-bait

Trial 2:
Trial 2 was a failure due to lack of applicator diligence. Based on the previous trial at this property, we suspect it could have been equally successful.

- 0 toxic bait buckets- never deployed
- 17 total feral hogs present
    - Adults: 5
    - Sub-adults: 10
    - Juveniles: 2

Issues with trial(s):
Trial 1:
Trial 1 began slowly, but performed well. Unfortunately, TWS staff had a busy schedule that hindered the trial from running as efficiently as it could have, owing to the need of TWS staff to frequently remind, prompt, and supervise applicators to ensure diligence. Once the toxic bait was deployed there is evidence of additional baiting with corn in the area to attract feral hogs to the feeder, which likely reduced feral hog willingness to consume product from the feeder.

Feral hogs in this trial took a while to learn how to use the feeder. We suspect that the abundance of feral hogs at this site simply required a longer period of time to train them all to use the feeder.

The exclosure fence did not work to keep the livestock out of the bait site. The exclosure fence was able to keep donkeys out of the bait site but sheep and goats were still able to get in under the fence.

Trial 2:
Trial 2 began with no issues, but applicator had other work commitments that prevented him from being able to properly administer this trial, thus it had to success.

The exclosure fence did not work to keep the livestock out of the bait site. The exclosure fence was able to keep donkeys out of the bait site but sheep and goats were still able to get in under the fence.

3.9.11 Taylor County Property

Site Description:
Taylor County is located in the Rolling Plains and Edwards Plateau regions of Texas. The Rolling Plains includes prairie grasslands but much of the ecoregion is described as a mesquite-shortgrass savannah where agricultural fields dominate the landscape. The Edwards plateau region is a hilly area with multiple stony hills and steep canyons that include grasslands, juniper/ oak woodlands, and live oaks or mesquite savannahs. The properties for this trial were a collection of neighboring properties that all contained contracts with Texas Wildlife Services totaling 4,489 acres where there is a mixture of livestock operations, agricultural fields, and hunting operations. One trial was conducted on the in the northern property. The property the bait site was set up on contained an agricultural field, a livestock operation, multiple water sources, and lots of brush for wildlife.

Trial set-up:
The trial was conducted using the Hog Stopper feeder with the guillotine style door. The site was paired with a hog roller to assist with counting individuals visiting the area.

The Hog Stopper feeder was placed in the middle of an area believed to be frequented by feral hogs. Two cameras are then mounted 4 ft. high, angled at 75°, 16ft. from the feeder doors on each side to capture visitors to the feeder. A 4 ft. cross fence was posted on each side of the feeder to assist with counting individuals at the site. The cross fence was not crucial to the success of the feeder, we added it to help prevent double counting of individuals on each camera. AN exclosure fence was not needed at this bait site since there were no livestock in the pasture.

Trial Personnel:
The trial was mentored closely by Texas Wildlife Services staff on property. The landowner assisted by checking and filling the feeders with toxicant, but generally had to be prompted by TWS staff to do so.

Dates of the trial:
Trial 1 began on 2/14/2023 and concluded on 4/7/2023 but the cameras on site remained active until 5/3/2023 until the site could be closed down.

	Trial 1
Feeder type	Hog Stopper
Season of Trial	Winter
Deployment Date	2/14/2023
Door open date	2/14/2023
Door half open date	3/1/2023
Door closed date	3/10/2023

Prebait date	2/14/2023
75/25 date	3/1/2023
50/50 date	3/6/2023
Toxic bait date	3/15/2023
Post bait	3/28/2023
End Date	5/3/2023
Total Days	**52 (78) days**

Important metrics:

	Trial 1
Feeder type	Hog Stopper
Season of Trial	Winter
Total of photos	10,020
Days until 1st feral hog	2
Days until door use	24
Days from start to toxic	29
Days of toxic feeder use	7
Days from toxic to end of trial	49
Estimated total feral hogs	61
Estimated deceased	29
Estimated present post-bait	6
Carcasses Located	3
removed lethally	28

Effectiveness of trial:
Applicator was excellent, and updates were frequent. He would have been a great applicator for more trials.

- 8 toxic buckets, 7 days
- 61 total feral hogs present
  - Adults: 13
  - Sub-adults: 8
  - Juveniles: 40
- 56 estimated dead feral hogs
  - Adults: 11 (4 removed lethally)
  - Sub-adults: 8
  - Juveniles: 37 (24 removed lethally)
- 6 estimated feral hogs present post-bait
  - Adults: 3

- Sub-adults: 0
- Juveniles: 3 (new juveniles born during trial)

Issues with trial(s):
The trial started off with no issues. Once the feeder doors were dropped to the half-open stage the doors started to become stuck open. Staff adjusted the track multiple times throughout the course of the trial, believing to have fixed the issue multiple times. Once the feeder doors were closed all the way the door issues continued, feral hogs would eat from the open door as well as the working door. Toward the end of the feeder being used during the toxic baiting stage, raccoons were documented eating the toxic bait from a door that was jammed open. Due to this, we ended toxic baiting and proceeded to post baiting and lethal removal. Had we continued, we expected 100% lethality, as surviving feral hogs had been eating toxic bait for ~7 days.

The malfunctioning feeder was inspected, and we concluded that the door was warped causing too much surface area and tension to effectively fall when the upward pressure was removed. The track was bent out more and the issue seemed to be resolved. The warped doors are a major issue for the feeder since we have seen feeder doors become stuck on multiple locations on multiple occasions.

Multiple sows gave birth to sounders during the trial. The sows were lethally removed the day after the trial and showed evidence of consuming the toxic bait. This is something to consider since they did not reach a lethal dose before giving birth. It is likely that they had not yet succumb to the toxicant when we decided to lethally remove them, following the cessation of the trial.

5.0 Lessons Learned

5.1 Efficacy of Product

It is clear that the product can be effective at lethally removing feral hogs when applied in a manner consistent with manufacturer instructions, and attention is paid to diligently maintaining the bait site with regard to proper function of feeder and keeping bait available for feral hogs. An applicator must be reflexive to changing conditions and feral hog behaviors to achieve success, as with any feral hog management tool. Often, as we have seen, feral hogs become so accustomed to the use of the feeder, they will spend much of their time at the bait site, loafing around and feeding throughout the day.

5.2 Requirements of Applicators

This product requires a commitment of time on the part of the applicator. Specifically, applicators must be diligent in maintaining a consistent baiting schedule, so that the feral hogs have ad libitum access to baits, non-toxic, as well as toxic, and do not lose interest in the site. Applicators must also ensure that the feeder is properly functioning, and that modification or repair is not necessary. This often results in frequent visits to feeder sites, preferably when feral hogs are least active, to check, maintain, and refill with bait as necessary. This also allows applicator to respond to issues that could result in a label violation, such as non-target access to toxic bait. It is a delicate balance one must strike, as too-frequent visitations are thought to dissuade feral hogs from the site. Scimetrics recommended every 2–4 days.

Interestingly, even when applicators were less than diligent, feral hogs still show a period of time where they come to the feeder and use it, presumably looking for bait. In one instance at the La Salle County site, the applicator was out-of-town due to an emergency for 6 days during the toxic baiting phase. While gone, the feral hogs continued to come to and access the feeder, even when the bait ran out. When the applicator returned home, he did not continue the application.

Even in the case of successful trials, many applicators became fatigued from administering the bait sites more than 1 or 2 trials. Only in a few cases did applicators consistently use the product in a manner that could confer success. When they did, feral hogs across their property noticeably declined. Certainly, as with all other feral hog management, some will invest the time, whereas others may not.

One item that became clear during this trial is that applicators must exercise diligence in securing the feeder, and maintaining this security, such that it does not become damaged or dislodged during trials, aligned horizontally with the ground, where bait could be spilled or the doors easily

opened due to a lack of gravity holding them closed. As shown below, feeders attached to loose soils, such as sand, must be diligently tended to prevent large feral hogs from damaging them.

Figure 15: HogStopper Feeder damaged and misaligned due to feral hog abuse.

5.3 Duration of Feral Hog Control

Although this project did not set out to document the time period following elimination of feral hogs from a bait site, we received reports from applicators, following a trial that successfully eliminated feral hogs from the area around the bait site, about the length of time that this effort successfully kept an area feral hog-free. Given that the product successively kills every member

of a feral hog sounder that is using the bait, it stands to reason that the area occupied by these feral hogs would be feral hog-free for some period of time if the product is used continually until there are no more feral hogs at the location. In some cases, property owners and managers reported such long durations between sightings of feral hogs on their property that had not been previously achieved.

Notably, at 3 different properties, feral hogs were noticeably fewer in number, and their damages very low, at the end of a year of successive trials. In these cases, where property owners were diligent in application, they experienced tangible, clearly recognizable benefits from this project. This alone answers the question originally posed to this project: can the product be effective at reducing damages to Texas properties from feral hogs.

5.4 Modifications to Feeder Apparatus

HogStopper Feeder Door Half-Stop

In a previous field trial on this product, (Beasley et al. 2021) were unable to successfully train feral hogs to use the feeder apparatus, thus unable to get feral hogs to ingest toxic bait, although the manufacturer had apparently succeeded in doing so during their own trials(Poché et al. 2018). In early stages of this project, we encountered the phenomenon that feral hogs would readily eat from the feeder apparatus when fully open (~7" opening), but when closed, as per manufacturer instruction, they seemed unable to open the feeder. An employee of Texas Wildlife Services experimentally created a "half stop" to provide an opening of ~3.5". After a period of several days, the door was fully closed, and feral hogs successfully opened and fed from the device.

Figure 16: Half-stop position for HogStopper feeder.

Widening of Door Tracks

In early periods of this trial, it became apparent that the feeder apparatus was susceptible to having its door misaligned through use by feral hogs, and subsequently, the door would become jammed open. This allowed non-target species to access the bait freely, and inhibited feral hogs from learning to use the feeder. We found that this can be minimized through the widening of door tracks. In the field, we used common pry bars to achieve this result, and then greased the door tracks using any commonly-available commercial grease. Additionally, maintaining the levelness of the feeder throughout the trial is essential, as intensive use by feral hogs over time tends to degrade the soil around the feeder, leading to a greater risk of the door jamming open.

We recommend future feeders be modified to minimize this risk, reminding also that no mechanical device is perfect and cannot last forever. Even with regular maintenance, these feeders should be carefully monitored for signs of wear, and replaced when doors begin to jam open. This will minimize nontarget exposure to toxicant.

Lifespan of Feeder Apparatus

Feral hogs are inherently rough on feeders. These feeders operate as designed, with above-noted modifications, but after enough days of use by feral hogs, we note that cracks begin to form, mostly in door track guides, hinge points, and other places where stress would load. These may be repaired by those competent with basic metal fabrication methods, or the feeder would need to be replaced to prevent a catastrophic failure which might result in non-target access to feed.

Figure 17: Photos of representative feral hog damage to feeder door pin holes, door track, and lid.

5.5 Concerns for Livestock Raisers in Areas of Use

In some applications, especially those in the first half of the year, applicators in some areas noted a large aggregation of black vultures in areas adjacent to feeders. While this is not surprising, as the vultures likely were drawn to the area by the smell of deceased feral hogs, the applicators raised concerns for livestock raisers, particularly cattle raisers, having calves at that time of year. While we could not specifically evaluate the time after baiting that black vultures stayed at feeder sites, we can recommend that those concerned with predation of black vultures on calves avoid using this product at a time and place where calves may be within the vicinity of the baiting site.

Further, we attempted to exclude livestock from feeder sites with a variety of measures, while still allowing feral hog access. While we had success in excluding cattle from sites, smaller ruminants (e.g. sheep, goats, deer) were able to access the feeder site, but could not access the bait once doors were dropped to the half-stop position or fully-closed position.

6.0 Future Needs

This report addresses the items requested by the Texas Legislature in regards to efficacy of this product to reduce feral hogs when applied by private or commercial pesticide applicators. As often occurs, this effort also yielded a variety of insights that may help inform future efforts or be needs for future work.

6.1 Knowledge Gaps Identified

In the course of any study, gaps in knowledge may be identified, which are either filled in the course of the work, or remain unfilled at the end of the study.

This work did not ask detailed questions about the behavior of feral hogs in relation to the bait site, in terms of their patterns of movement, or how far from bait they would range before expiring. These questions were outside the scope of possibility with the funding and time afforded this project, but may be of interest for some that wish to put this product into service, particularly in a more fragmented landscape with smaller properties than we did.

This work did not possess sufficient resources to concretely measure movements of feral hogs in relation to the bait site, or to conduct controlled, manipulative assessments of different baiting regimes and styles to determine the most efficient process, due to the process being controlled by private applicators following the product label. This could be accomplished, if desired, but would require the program to be administered by AgriLife employees during a research program.

6.2 Feral Hog Cooperatives or Government Assistance

Like any feral hog management tool (e.g. corral trapping), this method will operate best when used by experienced individuals across broad areas of the landscape to effectively manage feral hogs. Whether using this tool or any other tool, a group of trained, private users can achieve results in reducing feral hog populations. To this end, private landowner cooperatives, where individuals may be intensively trained by government agency staff (i.e. Texas A&M AgriLife Extension Service or Texas Wildlife Services), and from this seed, peer-teach their neighbors within established cooperatives that seek to eradicate feral hogs across the land in their membership. This is a concept that has been long-discussed by those interested in feral hog management, but has yet to see realization. Texas has a unique opportunity to blaze a trail in this arena.

6.3 Training Needs

What became clear throughout the course of this project was the need for applicators to be properly trained in the site selection of the toxicant delivery site, the setup of the feeder, and adaptive baiting. Although not the purview of this project or the Texas A&M AgriLife Extension Service to suggest regulatory items, we believe that training, whether in-person, recorded, and textual, should be offered to help applicators maximize the efficacy of application, should this product be labeled for use in Texas by the Texas Department of Agriculture.

6.4 Items Not Evaluated

Just as it is important to note the items that this project addressed, it is equally important to reiterate the items it did not, but we suspect will be sources of inquiry by interested parties. We must stress that this project was, as directed, an effort at a practical field application to determine if use of this product could result in changes to the experience of feral hog damage on properties. Our scope of work did not include in-depth assessments of feral hog abundance, movement on landscape, and other metrics that might be considered important. Further, we note that we were not asked to investigate (1) cost-effectiveness, (2) humaneness, or (3) public perception of the product, or support for its use. We detail some thoughts on these topics, below.

6.4.1 Cost-Effectiveness

It is important that tools used to manage hogs be not only efficacious, but also cost-effective, in order for them to find widespread adoption. Cost-effectiveness is a matter for each individual to determine based on their finances, attitudes, and values about feral hog management. Thus, it should be noted that simply because an item is inexpensive, it does not mean that it will be efficacious, or even that a tool that is useful in some scenarios will work in all scenarios. We cannot calculate the specific cost per feral hog, as in our trial, we did not know concretely how many feral hogs were present at sites. As noted throughout this document, we likely underestimate the number of feral hogs in an effort to be conservative. Whether this is more or less cost-effective than other methods is subject to specific property situations, feral hog density, and the individual landowner/manager to decide—not all tools may fit every situation. It should

also be noted that our efforts may have required more of the toxicant than strictly necessary during times when we were adapting feeder devices.

Scimetrics provided all required products to us at the rate schedule below, but this may or may not be representative of final end-user costs, should the product be commercially available in Texas, or any other State.

Scimetrics
Limited Corp.

July 1, 2021

Texas A&M AgriLife Extension
Kaput Feral Hog Bait Study Project

Pricing Information

Item Description	Item No.	Price/ea	Qty/pallet
Kaput Feral Hog Bait 25 lb. bucket EPA Reg. No. 72500-26	260025	$58.00	36
Hog Stopper® Heavy Duty Hog Feeder Double-sided	302000	$480.00	2
Commercial Hog Feeder with weighted lid	303000	$160.00	6

Freight charges are not included
Terms: Net 30 days
Prices and terms are subject to change without notice

PO Box 1045 • Wellington, Colorado 80549-1045
970-482-1330 Phone • 970-482-1885 Fax
www.kaputproducts.com

Figure 18: Rate schedule for products from Scimetrics Ltd.

6.4.2 Humaneness

We were not asked to evaluate humaneness of this product. We are not experts in the area of animal welfare or measures of humaneness. This was outside our charge, and thus, we cannot comment in this report.

6.4.3 Secondary Toxicity and Non-Target Impacts

Although we diligently monitored feeders to determine if any non-target species gained access to the non-toxic or toxic bait, we were not asked to evaluate secondary toxicity of the impacts on non-target species, either in consuming bait directly, or through scavenging of carcasses of feral

hogs that died from the bait. While it is generally accepted, as noted above, that residue levels of warfarin in the carcasses of deceased, target animals is fairly low, this project did not conduct any such evaluations, as well as beyond the scope of available funding to quantify. We therefore cannot comment on it in this report.

7.0 Concluding Remarks

This project sought to evaluate the efficacy of the warfarin-based feral hog toxicant, Kaput® , to control feral hogs in Texas, and make a meaningful difference in damages experienced by Texas landowners and land managers. It is clear from this project that the product has the ability to do these things throughout the state, and throughout the seasons of the year. When applied according to the label and manufacturer recommendations, it successfully excludes nontarget species from accessing the product, given modifications to feeders described above.

When we set out on this project, our goal was to make this product succeed in removing feral hogs on properties across Texas, and throughout the seasons of the year, if possible. If we could not make this product work, despite exhaustive efforts, then one may conclude it could not work. We found unequivocable evidence that the product can succeed in doing what it is intended to do, when applied correctly and diligently.

Although a number of items that may be of interest to those interested in the administration of this product were outside the scope of this study, we found that this product requires significant investment of time, and due diligence on the part of the applicator. This is not unlike any of pesticide product—instructions must be followed precisely to achieve the desired level of control. Our experience is that most applicators did not follow due diligence to the level required to find success in this product, and when success was found on a project site, it was usually due to Texas Wildlife Service or Texas A&M AgriLife Extension Service staff assisting applicators with their efforts.

Ultimately, it is up to private individuals to assess if a tool fits their property, feral hog problems, budget, and available time. We hope that insights from this study will allow those who might use such a product to critically evaluate if it fits their needs and abilities.

This product can work as described by its manufacturer, and we found no concerns for non-target species safety when all relevant equipment functioned properly. We acknowledge that this study was a practical field trial, not a detailed research project, and thus there are potential areas for improvement or management lessons to be learned that did not occur during the course of our work.

In conclusion, although this product can successfully remove feral hogs, we remind those interested in feral hog management to remember that in the war on feral hogs, there is no one tool that will universally be successful. An Integrated Pest Management (IPM) approach must be

followed, using the right tool for the right situation, to successfully reduce feral hog abundance and range across Texas, with the ultimate goal of eradicating these animals from the landscape.

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