MSU Pork Quarterly

Information for an Industry on the Move

September 2018 Vol. 23 No.3

In This Issue...

aai
ANIMAL AGRICULTURE INITIATIVE

This newsletter is edited by:
Dr. Madonna Benjamin, MSU Extension Swine Veterinarian, 517-614-8875, gemus@cvm.msu.edu
& Emily Schmitt MPPA, Program Director

Oh Rats…in my barn!!!!

As fall weather approaches, fine tuning your pest management approach can have positive impacts on your biosecurity and bottom line.

Beth Ferry, MSU Extension Educator
Casey Zangaro, MSU Extension Educator

As farmers, we know that raising livestock and growing crops comes with a number of challenges; some that are out of our control and things that we can control with our practices and protocols. Also as farmers, we are accustomed to doing as much as we can with as few people as possible, knowing that payroll is one of the largest costs for our operations. There are times that things fall through the cracks on farms or we just don't have time or funds to complete every little project or task we would like. Many times we focus on what saves or makes us money, meeting the pressures of a successful bottom-line. One of the areas that sometimes slips through the cracks on many farming operations is that of pest control. We know that rodents are an issue on every farm and very rarely do we make an effort to manage our pest populations to the best of our ability. The truth of the matter is, rodent problems and pest infestations can easily affect the bottom-line and trigger other issues on the farm. As winter approaches, farmsteads and barns are at greater risk to get some unexpected tenants and harbor pest populations. Rodents such as rats and mice tend to sneak their way into barns during the colder seasons and wreak havoc on barns and animals.

Rats and mice are known to cause considerable damage to the barns and indirectly to the animals that are housed inside the barns, however, the threat goes much beyond that. Rodents can cause structural damage to the fabric, cables and electrical systems in a barn. This can lead to fires, as well as insulation and wood damage. They are also destructive to animal feed and stored foods that may be present at the facility. This can increase the risk of disease outbreaks and biosecurity issues. More importantly, rodents do cause a risk to the health and hygiene of animals and people., They are vectors in which pathogens can be transferred to both farm animals and people. Rodents have been recorded to carry up to 45

diseases than can easily be transmitted to farm animals if they are in the same vicinity (Table 1, Timm 2010).

Table 1. Pig diseases spread by rodents		
Disease	**Agent**	**Host / carrier**
Bordetellosis	Bacteria	Rats
Encephalomyocarditis	Virus	Rats & mice
Leptospirosis	Bacteria	Rats & mice
Aujeszky's disease	Virus	Rats
Salmonellosis	Bacteria	Rats
Swine erysipelas	Bacteria	Rats
Toxoplasmosis	Protozoan	Various rodents
Trichinosis	Nematode	Rats

Instituting and maintaining a pest control program on your farm will go a long way in helping mitigate the risks associated with a rodent population at your facility. There are many methods of control and a robust pest control program should include a number of different physical and biological systems. Pest control should not be considered a one-step approach and time should be taken to assess your situation to determine if you are facing a routine control issue or infestation. Simple steps such as cleaning and rodent proofing the buildings should be taken prior to the employment of eradication methods. Without these steps, continued or reinfection of the site will remain an issue. The use of physical methods, such as trapping or non-toxic baits may be the only type of rodent control that is needed if you have a limited pest population. For facilities that may have an increase population or infestation of mice and rates, biological controls like rodenticides may be the best option. High-risk sites like farms should always maintain a pest control program that involves monitoring, evaluation and treatment of problems.

By employing a pest management plan at your farm, the environmental management of your site will improve. This can be done by using a 4-step approach of; increasing hygiene or cleanliness, proofing, maintenance and repair. Making these steps routine will help you avoid pest infestations, which when established, are difficult to eradicate. The overall goal of your pest management plan is to make your site or barn less attractive to rodents. This means removing places of shelter like garbage, old equipment or piled up junk and preventing access to food and water sources for rodents. Farmers can use best practices to target rodents and mitigate harm to untended animals and the environment including:

- Keep area clear of debris, old equipment, trash and junk.
- Deny access to food and water sources.
- Clear area of harborage, places where rodents may live and feel protected.
- Remove and maintain vegetation – this allows for natural predators to have better access to rodents, helping to control the population.
- Create and maintain hard surfaces around the site or barn; this will prevent rodent burrowing.
- When needed, use physical or biological methods to help reduce and control the rodent population.

Understanding Rodent Types

Many times people assume that all rodents can be treated the same and controlled with the same practices. However, specifically the behavior of mice and rats are very different and managed differently, depending on what type of pest issue you have.

Rats are generally larger in size than field/farm mice and can cause more damage. Physically, rats have smaller ears in proportion to their bodies and are known to live up to 2 to 3 years. The heads have a blunter snout and they have long hairless tails. Rats are known to have very poor eyesight, including being completely color-blind, they are typically shy and nervous animals and this results in them taking a familiar or similar route when they travel. Generally known as creatures of habit, rats stay close to walls and structural parts of the buildings and will follow the same path to and from a feed or water source. Rats easily exploit the structure weaknesses of a building, especially in the fall and winter months. Rats also require a water source to remain viable. Obvious signs of rat infestations are defects in the building structure, broken pipes, defective covers, and channels in brick work. Rats take time to approach new objects or materials and when baiting rats, it may be beneficial to use existing materials instead of introducing something new like a bait station. This will help decrease the time it takes a rat to approach and take the bait. It is also a good practice to find the

path that rats generally take, identified by droppings and to place the bait next to their typical path. Rats also tend to carry bait away and hoard it.

On the other hand, mice are smaller in size and also have poor vision, however they can distinguish all colors except for the color red. Their ears are larger and they have been recorded to live over 5 years in the wild. Mice have triangular-shaped heads with long, thin, and hairy tails. Compared to rats, mice are more inquisitive, more likely to approach new items and do not need to travel the same path. They are known to travel in zig zag patterns, not necessarily keeping next to walls. Mice exist in the "fabric" of a building, feeding and living in the same area. They are easily introduced through materials, feed and supplies that are brought into the farm. Different from rats, mice are less responsive to seasonal changes, do not need a water source, and the population typically exists year-round. When baiting mice, the proper technique is to place small amounts of bait over a large area or location, making it easier for the mice to find and eat the bait.

Signs of Rodents

There are several signs that rodents are present in your barns. Sounds, such as squeaking, are the most distinctive. Rats and mice are known to gnaw wood and wires and climb along walls. Rodent droppings will be seen around walls, behind objects and near the food supply. Rats and mice will also cause a dust-free spot where they have been traveling, preferably around the outer walls and floorboards. Along the outside of the building, burrow patterns will be seen as they are trying to get into the barn for warmth and food. Smudge marks on the pipes and rafters where the dirt and oil are rubbed off by their fur which will typically leave a greasy film also indicates rodents are inside the barn. Most likely rodents will be active outside during the day, and come into the barn during the night due to the quiet nature of the barn at night. It is important to note that rats typically follow the same path when traveling and evidence such as defecation will be seen in the same area.

Rodent Proofing the Barn

Taking the time to rodent proof your facility is an essential component to your pest management plan., This also helps maintain the integrity of your biosecurity practices and health of the barn. Having proper construction is the first line of defense. The initial construction footings should extend down around 19 inches into the ground to deter burrowing. Routine inspections and maintenance on the facility should be done to help deter rodent infestations. Usually, rodents are known to enter the barn from cracks around the door frames, under doors, broken windows or ripped curtains, water lines and utility hook-ups, vents, and holes surrounding the feed augers and bins. These areas, in particular, should be constantly looked at to decrease the risk of rodents in the barn. Installing baffles around cables and pipes and placing kick plates on the lower edge of the doors discourage rodents and help prevent gnawing. Flaps or crushed wire mesh on inlets will also help prevent rodents from entering the facility.

Going hand-in-hand with rodent proofing is maintaining the hygiene of your barn. Barns that are above average in cleanliness are less likely to attract rodents. Best practices include cleaning up feed spills quickly and disposing of spoiled or rotten feed properly, where rodents cannot access it. Removing trash and debris from the facility will also help maintain hygiene and limit exposure to rodents.

Rodent Control

Rodent control on farms and around livestock facilities should be a multi-pronged approach as there is no exact method that is 100% effective. Due to the make-up of farms and the availability of feed and materials, farm sites are high-risk areas for rodent populations. A solid rodent control plan includes the use of physical and biological methods to remove rodent populations. Physical methods, such as traps are an effective and humane way of getting rid of small populations of rodents either inside or around the perimeter of the barn. There are different types of traps that can be used for pest control. Snap traps or break-back traps are very common rodent control methods. The most effective way to lure rats or mice into these traps is to use food and leave the trap alone near a wall or door for 4 to 5 days. Glue boards are also very effective and are used in a similar way as the trap. However, the use can be severely decreased by dust being captured on the glue and not allowing the rodent to be trapped. This method also can be seen as inhumane by different groups. Sound devices, usually ultrasonic, are effective in causing rodents to leave the premises without catching them. Physical methods are best when used to help control a rodent population and to deter infestation, however, many times the effectiveness of these methods are debatable and depend on the creativity of the user.

A second method to control rodents and the best

method to use when dealing with in infestation is the use of rodenticides. Rodenticides are basically pesticides used to kill rodents, these products must be proven substantially effective by those that sell/ produce them and the efficacy data for the products must be available to the user. There are two types of rodenticides, anticoagulants and non-anticoagulants, also known as 1st and 2nd generation anticoagulants. Anticoagulants are used in 90% of all rodent baits with the most popular chemicals used being bordifacoum, bromadiolone, and difethialone. The most used non-anticoagulants are bromethalin, cholecalciferol, and zinc phosphide. It is important to know that Vitamin K_1 acts as an antidote to anticoagulants. The use of rodenticides alone does not guarantee the eradication of a rodent infestation. Many times, population numbers can quickly recover if secondary methods and subsequent treatments are not applied.

Table 2. U.S. Rodenticides Commercially Available

Compound	Classification	Trade Names	Applied Form
Warfarin	1st generation anticoagulant	Various	Meal, Water
Pindone	1st generation anticoagulant	Pival™ Pivalyn™	Meal. Water
Diphacinone	1st generation anticoagulant	Ramik™ Rampage™ Tomcat™	Blocks Blocks Liquid
Cholorphacinone	2nd generation anticoagulant	Rozol™	Pellets
Brodifocoum	2nd generation anticoagulant	Havoc™ Jaguar™	Blocks and Pellets Blocks
Bromadialone	2nd generation anticoagulant	Boothill™ Hawk™	Blocks Meal and Blocks
Difethialone	2nd generation anticoagulant	Hombre™ Fast Draw™	Blocks Soft bait
Difenacoum	Non-anticoagulant CNS toxin	DiKill™	Blocks and Pellets
Bromethalin	2nd generation anticoagulant	Cy-Kil™ Rampage™ Gunslinger™	Blocks and Pellets Blocks Blocks and Pellets
Cholecalciferol	Non-anticoagulant vitamin D3	$Agrid_3$™	Blocks and Pellets
Zinc Phosphide	Non-anticoagulant phosphine toxicity	Eraze™	Pellets

Table adapted from Timm, 2010

First generation anticoagulants like Warfarin and Pindone are less toxic and less persistent in animal tissues. Using this type of rodenticide has a lower risk to human hazard and non-targeted animals. These products can take longer to control rat populations and surplus bait should be available for the rats to feed on. It is important to note that resistance to first generation anticoagulants is wide-spread in mice. Second generation anticoagulants are considerably more toxic and have a longer half-life. These products have a greater risk to non-targeted animals when ingested and require considerable less bait to be consumed by the rodents to be effective. Second generational anticoagulants are highly effective when you are dealing with a rodent infestation. (Table 2)

The active ingredients in rodenticides vary from product-to-product and can be classified in 3 different ways; acute, sub-acute and chronic. Acute rodenticides are fast acting and normally are effective within 24 hours. If a non-lethal dose of acute rodenticides is taken, rodents can have bait shyness and not consume any more of the bait. Sub-acute rodenticides cause death after several days. The lethal dose of the rodenticide may be consumed early on and feeding of this bait may continue until death. Chronic rodenticides are slow acting and cause death as early as 2-3 days or on average from 5-7 days. Understanding what ways you will be using rodenticides, preventing, control or eradication, will help you decide what product best fits your need.

Along with the variation of active ingredients and classification of rodenticides, there are different types

of bait formations. Bait products are found in the form of meals, cut or whole grain, pellets, wax blocks, edible lards/pastes/gels, contact gels or foams and gases. Particulate baits are generally more palatable to rodents when compared to wax blocks, whereas wax blocks are better in adverse conditions and areas like sewers and drainage pipes. Depending on what types of rodents you are dealing with may dictate what bait formation you choose. When baiting outside, in burrows, grains are less likely to be moved or kicked out by the rodents. Care should be taken to cover baits or secure them so that the rodents are less likely to remove them.

Pest Control Records and Monitoring

Once you have your rodent control practices in place, you will want to make sure that you are keeping accurate written records. The type of bait, placement and how much bait should be recorded. When various employees are in charge of monitoring and maintaining the bait stations, a site map of all bait locations can be helpful. Bait stations or placement should be monitored bi-weekly or more frequently if needed. Tracking the amount of bait used will help you determine if a rodent issue has arisen. Rodent infestations are determined by increased use of bait and signs of rodents., Hoarding issues can be identified by an increased use of bait but limited signs of rodent exposure. Using intact pellets or blocks can help prevent hoarding by rodents.

When completing the monitoring process of your rodent control plan, there are some steps that should be taken. Each area of bait placement should be checked regularly and include the removal of carcasses. Bait stations should be checked to verify that enough bait is in place and that it is secure so that non-target animal access is limited. Signs of rodents should be documented and indications of increased populations should result in more bait locations. Bait should be replenished as needed. When dealing with an infestation, large quantities of bait may be utilized. Once eradicated, bait locations can be decreased and limited to those needed for prevention and control only.

Pest Treatment Failures

Pest treatment failures can happen because of a number of reasons, most often because of inappropriate, poor quality or old bait. Once bait is over a year old, it should be removed because it loses its effectiveness. Treatment failures can also happen because of inadequate quantities of baits and poor bait placement. Rodents can also suffer from bait shyness. This happens when a non-lethal dose of bait is consumed, causing the rodent to stop feeding on the bait. Other reasons for treatment failure include reinvasion or resistance. Resistance occurs when bait is eaten but there is no decrease in population. In some species of rats, there has been confirmed resistance to some bait products including, Warfarin, Chlorophacinonce, Coumatetraly, Bromadiolone and Difenacoum (Buckle et al., 2010). Behavioral resistance occurs when the rodents refuse to consume the bait. This requires a change in the pest control methods. Changing the placement of the bait, providing an alternative formation or providing different bait stations can all help alter behavioral resistance.

Conclusion

In conclusion, having an increased rodent population at your facility does come with some risks. It can be detrimental to the health of animals, reduce the structural integrity of facilities and could cause human health issues. Having a pest management plan in place with routine monitoring and being alert to the signs of an increasing rodent population will help diminish these risks. Using best practices to identify, monitor and target rodent populations will help control the pest population, mitigate risks to non-targeted animals, protect human health and improve environmental management on the farm.

References

Buckle, Alan, et al. “Anticoagulant Resistance in the Norway Rat and Guidelines for the Management of Resistant Rat Infestations in the UK.” Rodenticide Resistant Action Group, June 2010, www.pestmagazine.co.uk/media/246897/management-of-resistant-norway-rat-infestations-in-the-uk-rrag-june-2010.pdf.

“Rodent Control on Farms.” The Pig Site, 19 Feb. 2015, www.thepigsite.com/articles/4911/rodent-control-on-farms/.

Timm, Robert M. “Controlling Rats and Mice in Swine Facilities.” EXtension, 20 Apr. 2010, articles.extension.org/pages/27261/controlling-rats-and-mice-in-swine-facilities.

Impressions from Livestock Truck Rollover Emergency

Dave Thompson and Beth Ferry, Michigan State University - Extension/Pork Working Group

Sometimes the unexpected happens, but hopefully we are well-prepared for the unexpected. Farmers are used to rolling with the punches and taking things as they come. They are experts at dealing with things out of their control like the price of hogs or Mother Nature's mood swings as they plant, grow and harvest crops. Sometimes we can be as prepared as possible, but unexpected events still take us by surprise, like on August 8th, 2018 in Jackson County, Michigan.

It was just another summer day; the Branch county fair was in full swing and I, Dave Thompson, was talking to some 4-H kids in a barn at the fair when Dr. Madonna Benjamin's text message came in around 4:00 p.m. on August 8. A livestock transportation truck carrying sows had been involved in a rollover accident south of Jackson. "There is a rollover at Moscow and Hanover Roads. Dr. Christine Kostesich is on her way. Pigs require euthanasia in the trailer and outside. She only has a shotgun or rifle. If police are there she will ask them to use a pistol. I sent a photo of euthanasia cards."

Our MSU Extension Team had recently dedicated time and efforts into preparing for events like these, developing materials and hosting trainings for law enforcement officers and first responders. It was something that we wanted to be prepared for but never wanted to happen in our area. Knowing that I could be of assistance, I drove as fast as I could and arrived as close to the scene as was allowed at about 4:45 p.m. State police and the local sheriff's department were already on hand and as expected very strict about maintaining the integrity of the accident scene. Uniformed officers, squad cars and lots of yellow tape were strung up to prevent motorists from entering the area, with traffic being redirected along a different route. I was able to speak with law officers in charge and informed them that I work for MSU Extension and had expertise in this area. I could help with rounding up animals and, if necessary, assist with humane euthanasia of pigs that might need it. They let me park on the side of the road and walk on the grass to the accident scene a quarter mile down the road.

By this time, drivers from both vehicles involved in the accident had been taken to a local hospital. Over the course of the accident, the top of the trailer hauling the pigs had been peeled back, allowing for mobile animals to leave the trailer. Activities in progress included clean-up of glass from the streets, containment of animals and search of a nearby cornfield for stray pigs. There was some luck in this unlucky situation as the area where the accident took place was a rural community and home to several farmers. The community was able to respond to the accident with at least eight state police and county sheriff officers, a dozen neighboring farmers (some with gating, sorting boards, trailers and a front end loader) and 8-10 plant workers from the Bob Evans processing plant located 8-10 miles away in Hillsdale helping at the scene. Through the quick work of many, the accident scene took on some sense of order and the work to clear the scene and care for the animals was taking place.

It was no longer a chaotic scene, but the condition of the livestock truck and a small van involved in the accident was shocking. The truck had rolled over on its right side, and was perched, partially on the northbound lane, but mostly on a yard. Most of its metal roof had peeled back or was completely off. The cab was badly smashed on its right side and much of the glass

was missing. The left side of the van was very badly damaged. It was easy to see that with the condition of the truck and trailer, some animals would need attention.

When times of need happen, farmers lend a hand as was the case in this situation. Pigs had been rounded up and were being transferred to a neer by dairy farm. Here they would be given proper medical treatment and care until they could be moved. It was unknown how many pigs were accounted for and if there were any missing animals, so I asked an officer who seemed to be in charge if all pigs were accounted for. He said he wasn't sure, and that it's possible some were still roaming about in a nearby corn field. I asked for and was granted permission to look through the corn field, after 20 minutes of exploring no signs of pigs were found. Speaking with some of the officers and neighbors, I learned that the accident had occurred at around 2:45 p.m., and that lots of folks, including neighboring farmers, had converged on the scene to help quickly.

I waited to speak with Dr. Kostesich, who was being interviewed by a newsperson at this time. Dr. Kostesich is a local veterinarian who was contacted right after the accident and was managing pig care at the scene. My impression was that she did a great job describing her role and how folks there were trying to do the right things for the animals, advocating for agriculture. When she concluded, I introduced myself and asked if there was anything I could do to help. She asked me to go with her to the nearby farm where surviving pigs were being kept and provide a second pair of eyes to decide if additional pigs required humane euthanasia. She said that approximately 24 pigs had died at the accident scene or were badly hurt and required humane euthanasia on the spot.

We went to the farm and discussed the situation with a management representative from Bob Evans (where the load of pigs was headed). The pigs were mostly huddled in the basement area of a small barn; a few were milling around outside. Local farmers and farm staff were feeding and watering the animals and giving them excellent care. We identified a total of six additional pigs that required euthanasia. An expert animal handler from Bob Evans had a captive bolt gun and performed the humane euthanasia process by the book-- spot on with what we would have recommended. After that, we counted 68 surviving pigs, which would be sent on for processing later that evening.

Dr. Kostesich concluded that her biggest takeaway was how helpful all the neighbors were throughout the entire process, which included several farmers in the area, the Bob Evans crew and the law enforcement officers. Their willingness to help and provide manpower and equipment made this chaotic situation manageable. Although I wasn't there for the critical period following this accident, my strongest impression in the aftermath was consistent with Dr. Kostesich's.

As I reflected on this event and think about how challenging this situation would have been, from an animal rescue perspective, if a rollover like this one had occurred along a major highway like I-94 or I-69. The thought of this many 400+ pound sows, frightened and many injured, roaming along a busy highway at any time of day, is alarming. The probability would be very low that a reasonable number of farmers highly skilled in animal handling, with available equipment would be able to help law enforcement officers who are usually the first emergency responders at the scene. This leads me to believe that there would have been little chance that equipment critical to managing lose animals or humanely euthanizing those badly injured in the accident would become available in a timely fashion, if at all.

Dr. Kostesich was calm, professional and very good with the animals (and the people) throughout. This was the first livestock truck rollover emergency in her career. She said she was grateful for having the opportunity to consult with Dr. Benjamin early-on in the process. She was also grateful for all the assistance provided by the professional animal handlers who rushed to the scene from the Bob Evans processing plant. The fact that the Bob Evens plant provided a fully functional captive bolt gun to use to euthanize the animals was critical. She added that, after this experience, she would campaign to get more captive bolts in the hands of first responders in her area and encourage more folks to get trained in their use. We talked about a recent class organized by MSU Extension and taught by Jennifer Woods for first responders to livestock truck rollover emergencies. The Extension staff are pushing ahead with several follow-up activities, including collaborating with Farm Bureau to equip a livestock emergency response trailer for Branch County. Eventually, the group aims to extend that high level of preparedness to other neighboring counties along the I-94/I-69 intersection, which has become a nexus for the livestock industry in Michigan.

Potential Use of Essential Oils as an Alternative to Feed Grade Antibiotics in Pork Production

Casey Zangaro, MSU Extension

Following implementation in the U.S. of the Veterinary Feed Directive in January 2017, which bans the use of medically-important antibiotics (i.e., those also used in human medicine) in livestock except for treatment or prevention of disease, researchers have intensified their search for alternative agents that promote gut health, especially in early post-weaned piglets. A wide variety of products are being tested, including organic acids, enzymes, probiotics, antimicrobial peptides, medium-chain volatile fatty acids, spray-dried plasma products and essential oils (also known as phytogenic plant products), as alternatives to antibiotics in swine rations. This review focuses on results from studies testing selected essential oils, and describes evidence suggesting that these products could become viable alternatives for antibiotics because of their potential for consistency, high safety factors for pigs and consumers, cost-effectiveness, and the fact that they are environmentally-friendly. Essential oils have been used by pig producers in the E.U. for several years, with mixed results reported.

Essential oils are defined as natural bioactive compounds that are derived from plants. They include aromatics, volatile, oily liquids extracted from materials such as seeds, flowers, leaves, buds, twigs, herbs, bark, woods, fruits, and roots. Essential oils that have been fed to pigs in multiple research studies include carvocrol, thymol, citral, eugenol, and cinnamaldehyde which are derived from thyme, lemongrass, clove, nutmeg, cinnamon, basil, oregano, and bay leaf.

The oily and evaporate nature of essential oils leads to challenges in their effectiveness within diets and absorption to the pig's gut. Although the mechanisms underlying essential oil effects on intestinal function remain to be determined, researchers think the mechanisms have to do with the anti-oxidant and anti-inflammatory effects on the intestinal lining of mammals. These effects positively interfere with the processes by which E. coli may disrupt the pig's immune system causing post-wean diarrhea (Li et al., 2012).

In the United States, the amount of research with essential oils for sows, nursey pigs and grow-finishers is increasing (discussed in greater detail below). Aa clear path to their widespread adoption by pork producers has not been delineated. In addition to lack of definitive information around the pharmacodynamics effects (i.e., relationship between dose and the mechanistic beneficial actions), key challenges facing the use of essential oils in pork production include: some unexpected off-target/ undesirable effects (odor prevents pigs from eating feeds containing some essential oils), potential regulatory concerns, high inclusion costs, formulation and effective delivery methods.

Sows

Essential oils have been tested in sow diets in an effort to increase overall reproductive performance; key performance indicators typically measured in these studies include sow feed intake, number of piglets born alive, and sow milk production. Sows provided essential oils in their feed have shown small but significant indications of improved gut health, when compared to untreated controls, in terms of intestinal lining changes (especially microvilli density and length), lymphocyte proliferation, and various blood parameters. However, significant improvements in sow health or performance have not accompanied these changes in gut morphology (Ariza-Nieto et al., 2011; Miller et al., 2009; Allan and Bilkei, 2005). Still, some important secondary effects have been observed in pre-weaned piglets coming off of treated sows; piglets have been healthier and shown higher weaning weights. For example, Miller et al. (2009) reported that supplementation with 2 g/kg of a blend of essential oils (Biomin P. E. P., BIOMIN), from 10 days before the estimated farrowing date through weaning, improved early lactation feed intake in sows, decreased sow weight loss during the first week of lactation and enhanced piglet body weight at weaning. In a study involving 2100 sows, Allan and Bilkei (2005) reported that sows fed diets containing 1 g/kg oregano had higher voluntary feed intake, lower annual mortality rate (4.0 vs. 6.9%), reduced sow culling rate during lactation (8 vs. 14%), increased farrowing rate (77.0 vs. 69.9%), increased number of live born piglets per litter (10.49 vs. 9.95) and decreased stillbirth rate (0.91 vs. 0.81). However, Ariza-Nieto and others (2011) noted that in their study of 70 second-parity sows, feeding 250 mg/kg oregano essential oil blend during gestation and farrowing did not

result in increased growth or immune responses in the piglets.

Nursery Pigs

Most research on essential oils in pigs has been directed toward nursery pigs, due to the dietary changes and other stresses they present at this crucial time, which often negatively impacts health and performance. Based on numerous studies, it appears that feeding essential oils during this period results in changes to the gut environment favoring a healthier bacterial population (Li et al., 2012; Franz et al., 2010; Huang et al., 2010). This proliferation of healthier bacteria appears, in some cases, to over-ride the harmful bacterial pathogens that cause diarrhea and decreased feed intake and performance within the first few weeks of weaning. Li and others, (2012) noted that encapsulated essential oils (thymol and cinnamaldehyde tested in these studies) improved performance, immunity and gut microflora in 240 piglets that were 36 days old (at start of study) over a 35-day period; results showed reduced E. coli counts in feces, increased lymphocyte transformation, and reduced occurrence of diarrhea. Huang and others (2010) reported that dietary supplementation of blended essential oils fed 6 weeks to 90 weaned nursery pigs resulted in an improvement in post-weaning final ADG (487g vs 476g, $P < 0.1$) without any apparent negative effects on health or other performance indicators. However, Neill et al. (2006) showed that in-feed antimicrobials increased growth performance more effectively than a diet with essential oils in a piglet study conducted over a 28-day period after weaning at day 21. In that study, 210 piglets were fed either an oregano essential oil diet or a neomycin and oxytetracycline-supplemented diet. The antimicrobial diet slightly improved body weight (17 kg vs 15.4 kg, $P = 0.09$) significantly more than the essential oil diet. Neill and others (2006) noted that ADG, ADFI, G:F, and 28-day weights of pigs fed oregano essential oil diet (25, 50, or 100 g per ton) were similar to those of pigs fed the control diet ($P > 0.05$), and there was no effect on growth parameters of increasing dose of essential oil ($P > 0.05$).

Grow-Finish Pigs

The addition of essential oils to grow-finish pig diets has impacted growth performance and carcass merit (Janz et al., 2007; Yan et al., 2010). Feed intake increases from 9 to 12% with dietary supplementation of essential oils according to a review of European essential oil use of Franz et al., (2010). Furthermore, Zeng et al., (2015b) reported the same impact on feed intake; ranging from 3 to 19% in their review of essential oil use in Europe. While most research has found that adding essential oils to grow finisher diets increases feed intake, interestingly Janz et al., (2007) and Yan et al., (2010) failed to observe any improvement in performance generated by essential oil blends in finisher pigs in the United States. Yan and others (2010) noted that for 96 grow finish pigs starting around 24 kg to market, essential oil diets increased the longissimus muscle area. Janz and others (2007) concluded that carcass and meat quality attributes were unchanged when comparing oregano essential oil diets to conventional diets in 64 finisher pigs. There are concerns if the concentration of the essential oils within the diet could alter the flavor of the final pork product, which is now being studied. It was also noted in the same study that sensory panelists were unable to detect a flavor or aroma differences between the conventional-fed and essential oil diets (Janz et al., 2007).

Cost

Yang et al. (2015) and others have noted that the cost effectiveness of essential oils is generally not achieved in pigs when products are used at concentrations required to affect health or performance. As interest in alternatives for in-feed antibiotics in pig production grows, however, and more research and information becomes available regarding the most effective products and dose regimens, it is reasonable to speculate that economies of scale in their production and formulation will be achievable, leading to wider use of essential oils in pork production.

Conclusion

Essential oils may become useful alternatives to feed-grade antibiotics. They are being studied for their health and performance benefits for swine in all phases of production. To this point, however, none of the essential oils tested in pigs have provided the same level of consistent positive benefits in disease prevention or performance that is achievable using antibiotics. Knowledge around how these molecules lead to improvements in gut health and growth parameters in pigs is emerging from research underway on a global basis, especially in the E.U. and Asia. However, expanded use of essential oils in pork production will likely depend on more research focused on cost of production, formulation, and effective dosing/presentation.

References available upon request

Swine Erysipelas

Scott A. Kramer, Supervisory Public Health Veterinarian with the Food Safety and Inspection Service at the US Department of Agriculture

Swine erysipelas is a common and preventable disease of swine caused by infection with the bacterium, Erysipelothrix rhusiopathiae (1,2). While the bacterium may affect a variety of mammalian species including sheep, cattle, horses, dogs, turkeys as well as wild and domestic species of birds and fish; the pig is recognized as the most important reservoir of the organism (3). This particular bacterium is very pervasive, can be found on most swine farms, and is capable of surviving in soil or in fecal matter for 6 months or more (2,8, 4,5). Consequently, total elimination of the bacterium from the environment is not a practical consideration (6).

The mechanism of how the bacterium causes disease remains unclear; however, it is understood that the bacterium may gain access to the body and bloodstream through the tonsils, gastrointestinal tract, or through skin abrasions (5-8). Pigs of any age group may be affected however; it is less common in pigs under 8 weeks of age due to protection by maternal antibodies (9). Stressed or immunocompromised pigs are more likely to show clinical signs as a consequence of sudden changes in diet, transportation, and exposure to extreme temperature variations to name a few (9). Infected pigs shed the organism in feces and urine while 30-50% of asymptomatic carriers may harbor the bacterium in their tonsils (10).

The bacterium is capable of causing an acute to chronic disease in pigs.

Acute Infection (Severe and Sudden in Onset)

Acute infection may be observed within 24 hours of infection and may be characterized by sudden death and/or general signs of septicemia (11). Diamond skin lesions are an inconsistent feature however; very suggestive for E. rhusiopathiae infections (2) (Figure 1).

Sub-Acute Infection (Less Severe)

Sub-acute infections are less severe than the acute form and pigs may appear asymptomatic (11-12). Diamond skin lesions, which may occur within a few days of infection, regress and disappear with no detectable effect within 1-2 weeks (11-12).

Figure 1: "Diamond Skin Lesions" are common in the acute phase (9).

Chronic infection (Persistent)

Chronic erysipelas infections persist over months, and may manifest with arthritis as well as vegetative endocarditis (11-12). Affected pigs are lame and reluctant to rise. Additionally, affected sows may abort and boars become infertile (11).

Prevention of swine erysipelas is best accomplished through good management practices including a tailored infectious disease prevention program including proper immunization (6,13,14). Consult your swine veterinarian for the appropriate vaccine for your current production setting. Several vaccines are currently available including both injectable and oral based vaccines delivered via the drinking water. E. rhusiopathiae is also very susceptible to penicillin during the early presentation of the disease while there is no treatment for pigs affected during the chronic form of the disease (13).

Swine erysipelas continues to be associated with condemned swine carcasses, and ranks in the top 10 causes for swine condemnations and as a consequence may have a significant economic impact on both swine producers as well as packers (15). In plant condemns, skinning of carcasses, associated deductions and extra labor are recognized as costly and preventable consequences of the disease at the abattoir.

Swine erysipelas is also considered a zoonotic

disease meaning that it may affect people as well as swine (4,11). Individuals at highest risk include butchers, abattoir workers, veterinarians, farmers, and consumers in which infection may occur through open wounds and/or abrasions following exposure to the bacterium (15,16). The human infection is recognized as a localized painful inflammation and reddening of the skin known as "erysipeloid" (17) (Figure 2). Considering the occupational risk associated with this infection; several steps may be undertaken to reduce the risk of infection including containment, control, maintaining good personal health, sanitation and hygiene (18).

Figure 2: In humans, E. rhusiopathiae infection results in a characteristic inflamed reddened rash known as "erysipeloid". Image courtesy of Thomas Habif, MD (17).

Conclusion

Swine erysipelas is a common yet preventable bacterial infection of swine. A tailored infectious disease program may prevent illness as well as economic losses at the abattoir. Furthermore; an understanding and recognition of the disease caused by the bacterium, E. rhusiopathiae, may help prevent occupational zoonotic infection. Consult your local veterinary professional to maximize your protection.

Resources

1. Wood, R. L. and L. M. Henderson. (2006). Erysipelas. In: Straw, B. E., Zimmerman J.J., D'Allaire S., and Taylor, D. J. (ed.), Diseases of Swine, 9th ed. Blackwell Publishing, Professional, Ames, Iowa, 629-638. 2. Opriessnig, T. and Wood, R.L., (2012). Erysipelas, Chapter 54 In: Diseases of Swine, 10th ed., Edited by Zimmerman, J.J., Karriker, L., Ramirez, A., Schwartz, K.J. and Stevenon, G.W. pp. 821-833, Wiley-Blackwell, Ames, Iowa. 3. Wang, Q., Chang, B. J., and Riley, T. V. (2010). Erysipelothrix rhusiopathiae. Vet, Microbiol, 140, 405-417. 4. Swine Erysipelas, Iowa State Veterinary Diagnostic and Production Animal Medicine, https://vetmed.iastate.edu/vdpam/FSVD/swine/index-diseases/erysipelas, last accessed September 18, 2018. 5. Erysipelas, NADIS Health Skills, http://www.nadis.org.uk/bulletins/erysipelas.aspx, last accessed September 18, 2018. 6. Taylor, D.J. Pig Diseases, 9ed. 2013 Swine Erysipelas, p. 236-240. 7. Balootaki, P.A., Mansour Amin, Haghparasti, F., Rokhbakhsh-Zamin, F., 2017 Isolation and Detection of Erysipelothrix rhusiopathiae and Its Distribution in Humans and Animals by Phenotypical and Molecular Methods in Ahvaz-Iran in 2015, IJMS, Vol 42, No 4. 8. To H, Nagai S. Genetic and antigenic diversity of the surface protective antigen proteins of Erysipelothrix rhusiopathiae. Clin Vaccine Immunol. 2007;14:813-20. doi: 10.1128/ CVI.00099-07. PubMed PMID: 17475766; PubMed Central PMCID: PMC1951066. 9. Swine Erysipelas, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/436440/Swine-erysipelas.pdf, last accessed September 18, 2018. 10. Wood, R. L. (1984). Swine erysipelas--a review of prevalence and research. J Am Vet Med Assoc, 184, 944-949. 11. Sarno, Eleonora, 2013, Veterinary public health aspects of hazards occurring along the pig production line, http://www.fedoa.unina.it/9209/1/SARNO_ELEONORA_25.pdf, last accessed September 18, 2018. 12. Muirhead, M.R. and Alexander, T.J.L., 2013, Managing Pig Health, 2ed. Chapter 7, Carr, J. ed.p. 243-244 13. Erysipelas, The PigSite Pig Health, http://www.thepigsite.com/pighealth/article/181/erysipelas/, last accessed September 18, 2018. 14 Erysipelas in Pigs, http://www.farmhealthonline.com/US/disease-management/pig-diseases/erysipelothrix-rhusiopathiae/, last accessed September 18, 2018. 15. Bender Joseph S, Irwin Christa K, Shen Hui-Gang, Schwartz Kent J, Opriessnig Tanja (2011). Erysipelothrix spp. genotypes, serotypes, and surface protective antigen types associated with abattoir condemnations. Journal of veterinary diagnostic investigation : official publication of the American Association of Veterinary Laboratory Diagnosticians, Inc 23: 139-42. 16. Balootaki, P.A., Mansour Amin, Haghparasti, F., Rokhbakhsh-Zamin, F., 2017 Isolation and Detection of Erysipelothrix rhusiopathiae and Its Distribution in Humans and Animals by Phenotypical and Molecular Methods in Ahvaz-Iran in 2015, IJMS, Vol 42, No 4. 17. Erysipelothricosis, Merck Manual Professional Version, https://www.merckmanuals.com/professional/infectious-diseases/gram-positive-bacilli/erysipelothricosis, last accessed September 18, 2018. 18. Brooke, C.J. and Riley, T.V. 1999 Erysipelothrix rhusiopathiae: bacteriology,epidemiology and clinical manifestations of an occupational pathogen J. Med. Microbiol. Vol. 48, 789-799.

All comments and suggestions should be directed to the:

MSU Pork Team

Dale Rozeboom: Extension Specialist
(517) 355-8398, *rozeboom@msu.edu*

Madonna Benjamin: Extension Swine Vet
(517) 614-8875, *gemus@cvm.msu.edu*

Melissa Millerick-May: MSU, Division of Occupational and Environmental Medicine
(517) 432-0707, *melissa.may@hc.msu.edu*

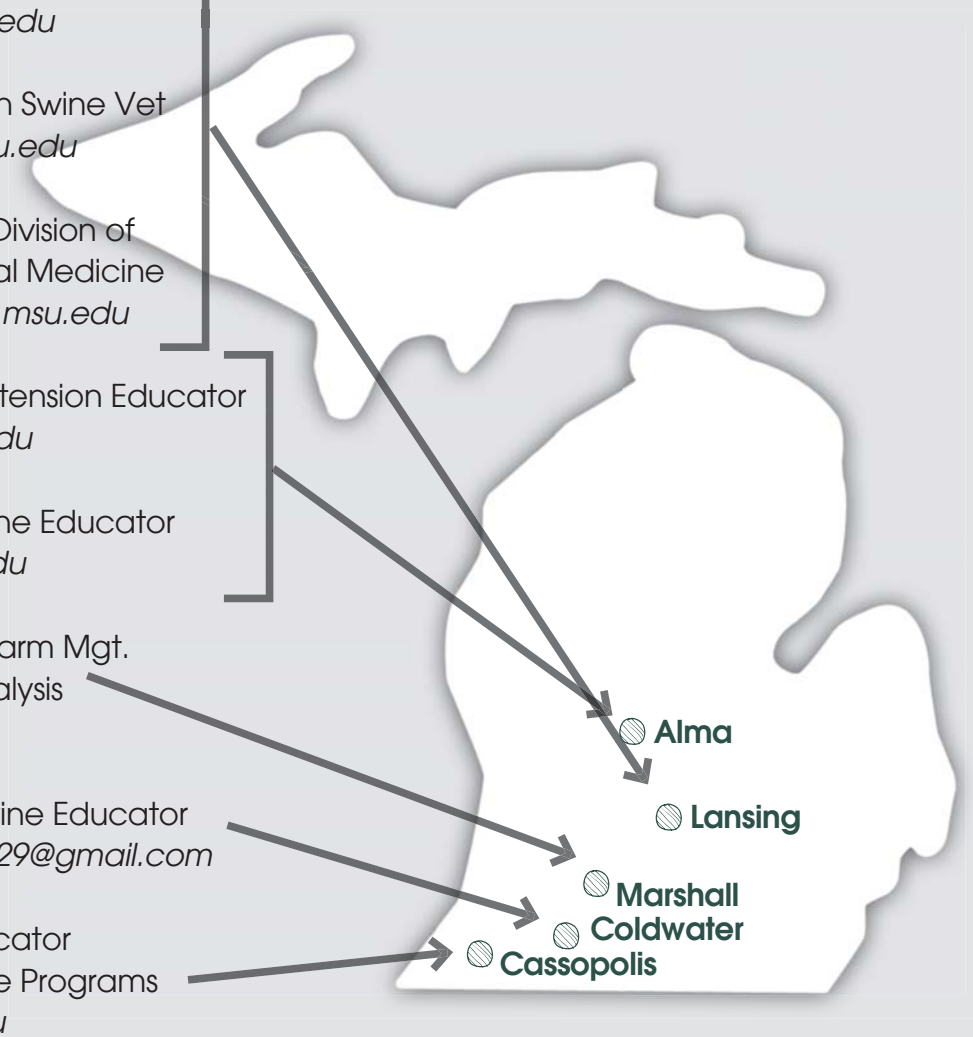
Erica Rogers: Environmental Extension Educator
(989) 875-5296, roger392@msu.edu

Casey Zangaro: Extension Swine Educator
(989) 875-5292, zangaro@msu.edu

Roger Betz: Southwest District Farm Mgt.
Finance, Cash Flow, Business Analysis
(269) 781-0784, *betz@msu.edu*

Dave Thompson: Extension Swine Educator
(269) 832-8403, davethompson729@gmail.com

Beth Ferry: Southwest Pork Educator
Management, Quality Assurance Programs
(269) 445-4438, *franzeli@msu.edu*



Sign Up for the Latest News for Agriculture

Want to stay updated on various MSU Extension topics? Sign up for news digests online! Visit bit.ly/MSUENews, and follow the prompts to get customized email digests. Digests are electronic newsletters of recent articles published on the MSU Extension website. You can unsubscribe or change your areas of interest anytime. The digests contain information on categories including agriculture, business, community, family, food and health, lawn and garden, 4-H and youth, and natural resources. Each category has multiple subcategories, so subscribers can narrow down their choices to fit their specific interests.

MICHIGAN STATE UNIVERSITY | Extension