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Fueling Hog Barns with Corn

Jerry May, MSU Extension – Pork, Ithaca
Mark Seamon, MSU Extension – Field Crops, Saginaw

Corn has traditionally been accepted as the grain of choice for supplying energy in most swine diets but now corn is gaining recognition as an economical source of energy to heat the barns used to house those pigs. Corn, which is readily available on most swine farms, is a low cost, ease to handle and clean burning alternative to expensive fossil fuels.

Liquid propane, and when available natural gas, are the most popular fuels for heating livestock barns. Manufactures have designed propane heaters, blowers and temperature controllers that will withstand the conditions in hog facilities. Adapting corn burners to hog facilities is not as easy as replacing heaters and fuel supply lines.

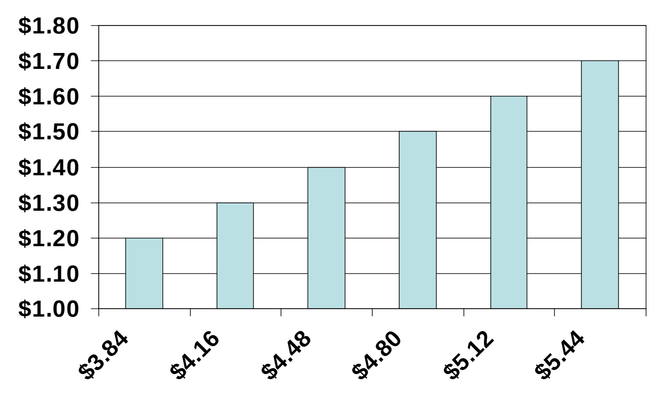
The most accurate way to compare fuels is on a Btu per unit basis. Propane contains 91,500 Btu's per gallon while dry shelled corn contains 380,900 Btu's per bushel. On a Btu basis, it takes over 4 gallons of propane to equal the energy in one bushel of corn.

One of the advantages that propane and natural gas have is the direct fire heaters that are used in barns. Through these heaters 100% of the energy (heat) they provide is utilized to warm the environment. By comparison corn heaters must use either a hot air exchanger or a boiler and hot water to distribute the heat. Most of these heat exchange systems have an efficiency rating of about 80%, where 80% of the energy given off by the corn is utilized to heat the barn. Because of this difference in efficiency, when comparing corn to propane based on Btu's provided to heat facilities, one bushel of corn will equal about 3.2 gallons of propane.

Table 1 compares the value of corn as an energy source on a per bushel basis to the price per gallon of propane. The table assumes a 100% efficiency rating for propane and an 80% efficiency rating for corn.

While the value of corn as a heat source is attractive, producers who are implementing the practice are currently forced to design their own systems of heat exchange. There is very little available information on installing corn heating systems for farm application. Additionally, swine industry equipment manufacturors do not handle equipment suitable

Table 1: Value comparison for corn vs. propane



Comparative value for corn per bushel

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What's Inside ...

This newsletter is edited by:
Ronald Bates, MSU Extension Swine Specialist
(517-432-1387) batesr@msu.edu
& Kathy Lau, MSU Animal Science Office Assistant III

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for heating barns with corn. So producers are left to their own ingenuity. On a small scale utilizing corn for heat may be as simple as installing a stand alone corn burner in the barn's service room. Large systems may require a sizeable capital investment in a boiler and heat transfer system. Because of the high capital expense, corn heating systems are finding their most practical application in farrowing and nursery units where they are used as a replacement for the propane heaters in hallways that preheat incoming ventilation air.

Heating hallways with corn involves an external boiler system, distribution pumps and a radiator system. Large boilers with outputs of 300,000 to 350,000 Btu, such as the one pictured, are commercially available and suitable for farm application. Distributing the heat in the barn's hallway is more challenging. Copper tube radiators with a blower for heat movement may not be suitable for swine facilities. Field information gathered from a producer experienced with such systems indicates that the copper tubing will not withstand the environment in swine buildings.

Fin tube radiator pipe may be more applicable. Fin tube is available in carbon metal or stainless steel. It may be purchased in varying diameters with the Btu output per foot of tube depending on pipe diameter and fin length. Installing a boiler system requires determining the Btu's required to preheat the hallway and then matching the boiler Btu output with the Btu output per foot of the fin tube. The pictured fin tube illustrates one producer's application. The fin tube runs the length of the hall just below the vent for incoming ventilation air. Cool air enters the barn then flows over the fin tube, providing an even heat transfer through out the hallway. This producer's early reports indicate that a 300,000 Btu boiler with appropriately matched fin tube will easily maintain the hallway at 60^0F.

Points that producers should consider before installing corn burners include:

- ✓ Barn management and heat requirements vary. Calculate your own heat savings based on Btu's that may be replaced by the corn alternative. Realize that because individual room environment is critical, current swine farm applications have been using corn to preheat the incoming ventilation air while maintaining room temperature with existing propane heaters. This results in maintaining two heat systems for each barn.
- ✓ As additional corn is utilized for production of ethanol the economic advantage of corn over propane may be somewhat reduced. Producers considering installation of a corn burner should calculate potential savings using either a higher value for corn or lower cost for propane.

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- ✓ Under current market conditions a corn burner will result in significant savings but require a large capital investment in boilers, pumps and radiators.
- ✓ Because there is little experience with installing corn heating systems into livestock facilities producers should seek advice from a reliable local business familiar with applications of heating systems in commercial settings.
- ✓ Insure that the system you are considering will last an appropriate life time in the barn environment. Heavy black steel pipe, sealed pump motors, and external boilers have in the past held up under unfavorable conditions. Light copper tubing or aluminum finned radiators will most likely prove disappointing when installed swine facilities.

High utility costs will continue to be a concern to livestock producers. Alternative energy sources may in the future play a significant role in reducing the cost of heating swine facilities. Under current market conditions corn is a viable alternative to more expensive propane.

How Clean is Clean?

Beth Franz, Extension Educator, Pork AoE, Cassopolis, MI

On conventional swine farms there are everyday tasks that have to be completed in order to properly manage a swine unit. Some of those tasks are not the most desirable jobs to take on. One such activity on many pig farms is power-washing. This job is a necessary evil in the world of swine barn management and a chore that most employee's rank just above removing the dead animal from the barn.

While many employees share the responsibility of power-washing the barn or room, most employees do not fully understand the reason behind complete power-washing or grasp certain techniques that can improve the power-washing skills of that person and the overall effect of a job well done. For most employees their turn at power-washing often means a day that is wet, noisy and dirty. It is not looked upon as a chance to improve the health of the pigs that will be loaded into that area or the ability to remove negative impacts.

Washing, cleaning and disinfecting swine barns or rooms is a routine step in pig production. Power-washing cleans the area, removing the organic matter from the previous residents. Cleaning helps to remove the bacteria, viruses, molds and parasites that are a result of the last group of animals in that area. Finally, disinfecting uses chemicals that destroy microbial life in the barn. Combining these practices decreases the bacteria level in the room, which results in a lesser impact on the next group of pigs and improves productivity.

Are there optimal washing and disinfection techniques that should be utilized on swine farms? In a recent report Daniel Hurnik (2003), associate professor of heath and management at University of Prince Edward Island in Canada compared various washing methods and measured the effectiveness of each procedure.

The Study

20 pens were utilized during this study. Each pen was washed alternating hot water, cold water, or a soaping agent. During the first study all pens were immediately washed. For the second study the pens were presoaked with water prior to the washing procedure. The pen size was uniform; measuring 9' x 22', fully slatted and contain one two space wet-dry feeder in each pen. All pens were dirty from the previous group of pigs. The time taken to wash each pen was recorded (Table 1).

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Table 1. Average wash time per pen with varied washing protocols.

WASH PROCEDURE	Time to wash pen (minutes)	Difference (minutes)	Time Savings %
Cold Water No Soap No Presoak	68.03	0	0
Cold Water No Soap	59.80	-8.23	12.1
Cold Water Presoak	41.39	-26.64	39.1
Cold Water Presoak Soap	36.38	-31.65	46.5
Hot Water No Soap No Presoak	52.61	-15.42	22.6
Hot Water Soap	46.24	-21.79	32.0
Hot Water Presoak	32.01	-36.02	52.9
Hot Water Presoak Soap	36.81	-31.22	45.9

Adapted from Hurnick, 2003

Following the drying of the pen one of two disinfectants was applied. Those pens receiving the disinfectant treatment were compared to four pens that were washed only. Using a commercial sanitizing test kit, bacterial swab counts were recorded for each disinfectant (Table 2). These were 9 week old feeder pigs from the same source used to fill the pens and all pigs received the same diet. Days to market was then measured (Table 3).

Table 2. Bacterial swab count after washing and disinfection.

Disinfectant	Number of Bacterial colonies per swab
None	28.4[a]
Disinfectant 1 Hydrogen Peroxide	13.2[b]
Disinfectant 2 Quaternary Ammonium	19.6[a, b]

[a, b] Means with differing subscripts are different

Table 3. Pig Growth Rate.

Washing Method	Days to Market 25 kg to 110 kg
No Disinfectant	98.14[a]
Disinfectant 1	95.40[b]
Disinfectant 2	95.11[b]
Soap Only	95.59[b]
Soap and Disinfectant	92.96[c]
Soap and Disinfectant	92.66[c]

[a, b] Means with differing subscripts are different

Discussion about the study:

The results of this study showed that by utilizing different techniques wash time can vary. The use of hot water when power-washing will decrease the wash time by 22%, however when utilizing presoaked pens wash time between cold and hot water does not vary. Presoaking the room loosens the organic matter and seems to cut washing time in half. Also, the use of soaping agent will decrease wash time by 8 minutes per pen or 12%.

It can also be concluded that the use of a disinfectant is beneficial in the wash process because, it decreases the bacterial load in the pens. The choice of disinfectant should be based upon factors such as, surfaces to be cleaned, mechanical or scrubbing action occurring and what micro-organisms are causing a disease risk.

Comparing the growth rate of the pigs also allows us to make some conclusions. Implementing hot water as production procedure does not affect the growth rate of the pigs. Utilizing either disinfectant or a soaping agent

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does decrease the days to market when compared to washing only. The optimal procedure is to develop a washing method that uses both soap and the best determined disinfectant. This procedure recorded the lowest number of days to market.

Reviewing power-washing methods on your farm

Step 1 – Breakdown:
After all animals have been removed from the room completely breakdown the room. Remove leftover feed and trash from the room. If areas of the room can be taken apart (feeders, ventilation system, fan covers, etc.) dismantle room. Scrap any large quantities of organic matter into the pit.

Step 2 – Soak:
Prior to washing the room turn on sprinklers and allow room to soak until it is completely wet throughout.

Step 3 and 4 – Soap and Wash:
Some farms find it benificual to soap the room prior to the start of washing. This method help loosen any organic matter that may be in the room. A second method is to wash the room with water only, removing all of the organic matter from sight. Following the water wash, you then apply a soaping agent (degreaser). This soaping agent is intended to reach the biofilm in the room, hard water deposits, and mineral scale, anything that micro-organisms can cling too.

Step 5 – Rinse:
Completely rinse the room, making sure all surfaces are clean and organic matter is gone.

Step 6 – Disinfect:
Apply a disinfectant to the entire room. The proper disinfectant can be determined by evaluating the following criteria:

- Be free of offensive or strong odors
- Non-corrosive
- Not toxic or irritating following application
- Can be readily mixed with water
- In a easy to transport package and economical to use
- Has the ability to destroy micro-organisms that are present on your farm.

Step 7: Dry Time:
The length of survival of an organism depends on various factors including: protection by organic matter, sunlight and exposure to drying. If a completely washed and disinfectant room is not allowed proper drying time the pathogens in the room are not killed and can be transmitted to incoming stock.

Conclusion:
The power-washing methods that are present on your farm effect sanitation, prevent disease, influence growth rate and are associated with cost. Evaluation of your current washing practice should be done to maximize disease prevention by ensuring a complete wash and determine a proper disinfectant. Time should be taken to develop a washing protocol and properly train all employees in the production practice. In the end employing the proper washing and disinfectant techniques will influence the productivity on your farm.

Sources:

Hurnik, D., 2003, Investigations into optimal washing and disinfection techniques for pig pens - Atlantic Swine Research and Partnership Inc, 2005 Proceedings London swine Conference.

Hurnik, D., 1997, Epidemiology of enteric and respiratory diseases, Proc. Amer. Assoc. Swine Pract., Ouebec.

Linton, A.H., W.B., and Russell, A.D., 1987, Disinfection of veterinary and farm animal practice, Blackwell Scientific Publication.

McCallister, M, 1998, Disinfection of Swine Barns, Online at: http://www.engormix.com.

Announcing Pork Team State-Wide Winter Programs

Knowledge is power! To some it may be better said that knowledge is valuable or knowledge mobilizes. Knowledgeable people in this ever changing world are those that seek, sort, and accumulate information. Wise people use it! With this thought in mind the MSU Pork Team has plans for 2007 winter informational meetings. Be watching for more details as time gets closer.

Sow Care Around the Time of Farrowing (a.k.a. The Peripartum Sow Program)

Co-sponsors: Pfizer Animal Health, and the Pig Improvement Company (PIC)
5 Regional Meetings in December and January (dates and locations to be announced, early evenings)
Topics:

- Feeding Plans Immediately Before and After Farrowing
- Farrowing Problems
- Manual Deliveries
- Sow Medications, Vaccines, Oxytocin and Other Pharmaceuticals
- Stillbirths
- Getting Sows Started Milking
- Sow Comfort
- Cross fostering
- Dead Sow Management

2007 Professional Pork Producers Symposium

Co-sponsors: Michigan Pork Producers Association, and Elanco Animal Health
Wednesday, February 21, 2007
The Lansing Center, Lansing, MI

Topics:

- Animal Rights, Animal Welfare, and Agricultural Politics
- Economic Update and The Economics of Contract Finishing
- Whole Farm Energy Management and Planning
- Auto-sort Grow-Finishing
- Emerging Diseases
- Environmental Compliance Update

2007 Niche Pork Production Conference

Co-sponsors: Ohio State University Extension and National Pork Board
Tuesday, January 23, 2007
North Central Ohio

Topics:

- Production record keeping
- Cost management
- Benefits of on-farm necropsy's
- Product differentiation and quality
- Networking

2007 Regional Pork Industry Information Meetings

Co-sponsors: Michigan Pork Producers Association, and Elanco Animal Health
March 26-29, 2007
Tentatively Dowagiac, Kentwood, Cass City and Jackson

Topics:

- Influence of nursery growth on subsequent performance
- Animal ID
- Feeding DDGS

Shoulder Lesions on Sows

Ronald O. Bates, State Swine Specialist
Michigan State University

It is not unusual for lactating sows to develop shoulder lesions or sores while lactating. It has been reported that during the first week of lactation sow will spend approximately 86% of daylight hours lying on their side and that increases to 98% at night. This prolonged time lying down causes the spinous process of the shoulder bone or scapula to press against the muscle and fat tissue of the sow's shoulder which then leads to the shoulder lesion or sore. Essentially the shoulder sore develops from the inside out. Among sows which develop shoulder lesions these wounds typically heal after females are weaned.

There has been much speculation to what environmental and sow management conditions will either worsen or improve the incidence of shoulder lesions in sows. Some have suggested that sow weight, age and body condition have an influence on the incidence of shoulder lesions while others indicate that time of the year, and the type of farrowing house flooring can impact the incidence of shoulder lesions. A study[a] was recently published that investigated sow management practices, sow age and housing conditions and related these varying factors to the occurrence of shoulder lesions in sows. In addition, treatment options were also compared.

This study was conducted over a six-month period on a farm that had Duroc, Yorkshire and Landrace sows. This farm has two different types of farrowing rooms. The first farrowing room type had cast-iron slotted flooring under 17" x 76" crates and did not provide drip cooling during the summer. The other type had "tri-bar" flooring under 25" x 78" crates and did provide drip cooling for sows during summer months. Data such as body condition score (1-5 scale), parity, flank to flank measurements, as a method to estimate weight (see Feeding Gestating Sows at the Pork Information Gateway), as well as litter weaning weight were recorded. In addition the amount of time a sow was determined to be "off-feed" was also noted.

From the results, items relating to size, age and condition did impact the incidence of shoulder lesions. Sows that had a body condition score of 3 or less at weaning had a greater risk of having shoulder lesions than those with a score of 4 or 5. In addition, heavier sows at weaning, those estimated to weigh 395 lb or more, (flank to flank measurement of 97 cm or greater) had a greater risk of having shoulder lesions. Interestingly enough, sows that were either parity 1 or parity 5 and older had a greater risk of shoulder lesions than did sows of parity 2 to 4.

Litter weaning weight also affected a female's risk for shoulder lesions. Sows with greater litter weaning weights also had a greater risk of shoulder lesions. Breed of sow also impacted the risk of shoulder lesions. Landrace and Duroc sows exhibited a greater risk of shoulder lesions than did Yorkshire sows.

The type of farrowing room also contributed to occurrence of shoulder lesions. There was a lower occurrence of shoulder lesions in the farrowing rooms that had the cast iron slotted floors than the rooms with "tri-bar" flooring. There were several difference between the two types of farrowing rooms which does not allow the opportunity to determine if the differences were due entirely to flooring type, crate width or drip cooling. However this does show that housing and environment does impact the incidence of shoulder lesions.

Treatment of Shoulder Lesions

This study also evaluated three different shoulder lesion treatment protocols. The first treatment served as a control and no changes in management were provided for sows within this treatment group. The second treatment was a 23.6" x 23.6" rubber mat, 1.5 inches thick and secured to the floor under the front portion of the sow. The mat was secured

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[a]Zurbrigg, K. 2006. Sow shoulder lesions: Risk factors and treatment effects on an Ontario farm. J. Anim. Sci. 84:2509-2514.

Pork Quarterly

1. **Jerry May, North Central Pork Educator**
   Farm Records, Productions Systems
   (989) 875-5233

2. **Ron Bates, State Swine Specialist**
   Michigan State University
   (517) 432-1387

3. **Dale Rozeboom, Pork Extension Specialist**
   Michigan State University
   (517) 355-8398

4. **Barbara Straw, Extension Swine Veterinarian**
   Michigan State University
   (517) 432-5199

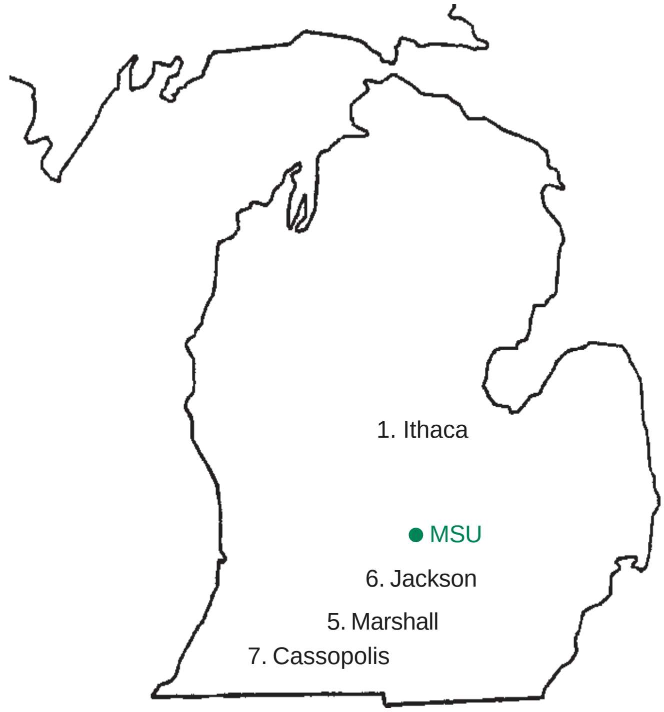
5. **Roger Betz, Southwest District Farm Mgt.**
   Finance, Cash Flow, Business Analysis
   (269) 781-0784

6. **Tom Guthrie, Southwest Pork Educator**
   Nutrition and Management
   (517) 788-4292

7. **Beth Franz, Southwest Pork Eduator**
   Value Added Production; Youth Programs
   (269) 445-4438

All comments and suggestions should be directed to:

MICHIGAN STATE UNIVERSITY EXTENSION



6" back from the feed trough to reduce feed spillage onto the mat. The third treatment was 0.1 in. thick stainless steel plate with the same dimensions as the rubber mat and secured the same distance away from the feeder. The metal plates had a cross-hatched pattern to improve traction.

Days from treatment initiation to healing was 32 for the controls, 25 for the sows which had rubber mats installed in their farrowing stalls and 39 for sows which had the stainless steel, cross-hatched plates installed into their stall. Sows which had the rubber mats installed did heal faster than either the controls or the sows with the installed cross-hatched, stainless steel plates. It was observed that sows had a more difficult time standing on the steel plates when compared to the controls or to the sows with rubber mats. This did become an animal safety issue and this treatment was discontinued part way through the study for this reason.

Conclusion

Several factors impact the onset of should lesions in sows. Some of which are breed, body condition, weight and level of production as measured by litter weaning weight. These results indicate that body condition for the age of the sow is important. Proper feeding in both gestation and lactation so that sows come into farrowing in the proper condition and are fed to maintain condition during lactation may help reduce the incidence of shoulder lesions.

This study also illustrated the use of rubber mats as means of shoulder lesion treatment. Placement of rubber mats under the sows can reduce the time of healing of shoulder lesions. Placing rubber mats under sows is an inexpensive solution to reduce the healing time for shoulder lesions.