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# Modern Heritage Swine Guide Series

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2021

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# Modern Heritage Swine Guide Series

## Keys to Cost Management

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By: David R. Stender, Iowa State University

Managing costs is one of the most important elements in earning a living on a small farm. Most farmers who raise heritage hogs assume that selling their hogs at premium marketing prices will improve profits; yet high production costs may negate any market price premium. Fortunately, many costs are well within the control of the farmer.

The cost structure of a small swine operation is influenced by a wide range of factors. Cost structure can be divided broadly into feed costs, and non-feed costs, which include labor, fuel, veterinary costs, and so on. Feed typically accounts for 2/3 of all expenses, and feed costs are directly tied to the number of animals raised. If fewer animals are raised, feed costs go down, and vice versa.

Some non-feed costs are fixed. Fixed costs remain constant and are not dependent on the number of pigs produced. An example of this is tractor payments. Because those costs are fixed, the impact on profitability of the pig operation depends on the number of animals, and may depend on other enterprises on the farm that use the same resource. For example, the percentage of that tractor payment cost per pig is lower if the farm has more pigs. The percentage of the tractor payment per pig is also lower if the tractor is used for other farm enterprises, such as harvesting hay for sheep, or preparing fields for vegetable crops, because some of that cost is assigned to those enterprises.

Cost structures may vary greatly between farms. In a 2007 Iowa study, the difference in cost structure between the most profitable and least profitable niche swine herds was about \$30 per head sold. The wide spread between profitable and unprofitable farms makes cost of production a critical component of financial success.

How many pigs does an operation need to produce to earn \$30,000/year? The answer may be in keeping good financial management records. There are two major reasons for keeping financial management records.

First, financial management records should be kept to benchmark management practices and the operation's cost of production. Benchmarking provides a way to understand a farm's normal costs, and allows for comparisons to other niche farms and even commodity

production. Farmers can learn how their farm performs relative to other niche herds, and even compare their costs to what is possible in a top commodity herd.

Second, financial management records can be used to identify which cost reductions will make the most difference to the profitability of the operation. To help identify the most influential cost factors for raising pigs, a record keeping program for niche producers was developed by Iowa State University in 2006 and 2007.<sup>1</sup> Niche swine producers used this record program to track and benchmark costs, and that information helped them to find targets for cost reduction.

When records from the participating farms were analyzed, no single factor could predict profitability, but, rather, multiple factors were involved (Table 1). Different factors can be problematic for different farms. In general, the farms that were consistently at or above average at controlling costs in several areas were the high profit farms.

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<sup>1</sup> The management record system used in this project was the Iowa State University Extension Swine Business record, available through Iowa extension or by sending an email to: [dstender@iastate.edu](mailto:dstender@iastate.edu)

Table 1. Major Factors that Influence Profitability

Note: data on each line come from different sets of farms	Top 15 farms	Lowest 15 farms	Difference between top and lowest farms per Cwt
Labor (hrs per Cwt)	0.47	1.28	\$12.15
Operating costs* (\$ per Cwt)	\$4.19	\$13.06	\$8.87
Feed efficiency (lbs feed/Cwt)	344	482	\$8.75
Pigs weaned per litter	7.8	5.6	\$8.52
Price of feed (\$ per ton)	\$105.40	\$143.60	\$7.03
Litters weaned per sow per year	1.9	1.1	\$6.93
Selling price for market animals (\$ per Cwt)	\$51.90	\$45.06	\$6.84
Fixed costs (\$ per Cwt)	\$0.53	\$5.73	\$5.20
Pig death loss, weaning to harvest (%)	2.3%	14.5%	\$3.07

*Cwt = 100 lbs live weight*

*\*Operating costs (for this study, these included veterinary costs, utilities, fuel, bedding, and financial charges on operating loans.)*

Labor, operating, feed, and fixed costs were very important to farm profitability in this study. Farmers can track and review expenses, then compare against the benchmarks established in the study to determine which of these costs may help profitability. For example, finding efficiencies that save labor or a lower cost source of feed are ways to reduce expenses. When searching for ways to control non-feed costs, both the short and long-term consequences should be kept in mind. For example, facility improvements may reduce labor, but the facility labor costs must be considered to determine whether there will be a long term cost benefit or not.

The study also offers some clear management guidance: improving feed efficiency (for example, reducing wastage), improved litter size, improved weaning rates, and reducing mortality are all areas where farms can improve their profitability.

Because feed cost is a driving factor, most small farms appreciate a simple approach to estimating cost per animal. For example, feed costs per market pig can be estimated using 15 bu corn (840 lb grain); 120 lb soybean meal (SBM); 20 lb vitamin/mineral base mix (VTN).

These estimates include feed for a breeding herd. An estimate of at least 75 dollars per head sold is used for non-feed costs. In this cost estimate method, changes in feed ingredient prices can be easily factored into the total cost estimate (Table 2).

Table 2. Quick and Easy Feed Cost Estimate

	Cost structure, example 1		Cost structure, example 2		Difference
Corn price	Per bushel	Per 15 bu.	Per bushel	Per 15 bu.	
	\$6	\$90/head	\$4	\$60/head	\$30/head
SBM price	Per ton	Per 120 lb.	Per ton	Per 120 lb.	
	\$500	\$30/head	\$400	\$24/head	\$6/head
VTM	Per ton	Per 20 lb.	Per ton	Per 20 lb.	
	\$1000	\$10/head	\$700	\$7	\$3/head
Total feed cost		\$130/head		\$91/head	\$39/head
Non-Feed cost minimum		\$75/head		\$75/head	
Total cost estimate		\$205/head		\$166/head	\$39/head

These two examples clearly show the impact of feed ingredient cost changes, with the price of corn having the largest impact. In some regions of the country, it may make sense to compare different energy sources, such as wheat or milo that may be substituted for corn.

### Summary of Key Cost Management Areas

1. Controlling feed costs will have the biggest impact on profitability.
  - a. Feed waste can be very expensive and is not an option for systems feeding high priced feed.
  - b. Processing feed correctly is very important to the bottom line because it reduces the amount of feed needed to meet the pigs' nutritional needs.

- c. Feeding the sow only the feed needed to maintain her weight and milk yield is critical. Furthermore, some heritage breeds are prone to fattening. Feed costs can be reduced and productivity improved through proper weight management.
2. Maintaining a healthy herd is essential. Management of colostrum, early lactation environment, biosecurity, healthy air, pig comfort (dry bedding, etc.), breaking disease cycles, and a discipline of rigorous parasite and disease control programs are all niche management strategies that have the potential to improve herd health and improve profitability.
3. Optimizing reproductive efficiency is important for both feed and non-feed cost. For example, a sow consuming 450 lb of feed at \$0.20/lb of feed during lactation (15 lb a day for 30 days) costs \$90 per litter. This cost must be assigned to each pig that reaches market weight. A litter of 10 piglets carries less cost than a litter of 5 piglets. At \$90 that is a \$9/head difference in cost for just one litter. The same cost distribution applies to non-feed costs of purchasing, housing and management of each sow. From the non-feed perspective, \$500/year cost per sow is \$50 per piglet from a sow producing 10 piglets, and half that cost for a sow producing 20 piglets in a year. Reproductive efficiency can be improved through good husbandry and culling.
4. Managing non-feed costs such as labor in the context of their impact on production, health, and long term profit can help control costs. If an extra \$500 is spent per sow per year in order to get 20 piglets from that sow, the non-feed cost per pig does not change. Therefore, for some farms with low non-feed costs, small herds may be cost-competitive with larger herds.
5. Understanding genetics may be important in cost management.
  - a. Traits such as foraging ability, feed efficiency, mothering ability, longevity, and hardiness affect costs and may impact the farm's choice of breed, and selection of breeding stock.
  - b. Some breeders use hybrid vigor to their advantage. Terminal (F1) crosses between two heritage breeds can still be called Heritage. Just keep in mind that purebred animals must also be maintained to replace breeding stock and conserve heritage breeds.
  - c. Genetics also may affect income. Effectively marketing the unique characteristics of heritage breeds can increase value (marketing price).

Understanding, and thus controlling, the costs for small herds is necessary to allow small numbers of pigs the potential to earn a living. There is no "best method" of cost management.

In the Iowa study, some of the most productive herds were low profit. Instead, each farm must determine the best way to raise pigs without increasing costs. This may be to improve feed conversion without adding to feed cost, to lower death loss without using lots more heating fuel or labor per pig, or to improve the number of pigs per sow per year without an expensive facility improvement or a large increase in labor per litter.

In summary, the Iowa niche production study identified these key factors where niche producers should focus to control their costs: minimizing feed wastage; proper feed processing; optimum sow feeding; managing for high herd health; improving reproductive performance; and finding a cost effective genetic program that fits your marketing plan. Controlling these factors helps hog growers achieve their goals. Maintaining records and benchmarking are not just for the big farms, but are essential for farms of any size that want to lower costs and increase profit margins.

**For more help understanding costs on your farm, check out these links:**

<b>Results from the Iowa record keeping project:</b>	<b>Iowa Pork Industry Center publications Livestock Conservancy publications</b>
<a href="http://www.leopold.iastate.edu/pubs-and-papers/2007-10-costs-returns-2006">http://www.leopold.iastate.edu/pubs-and-papers/2007-10-costs-returns-2006</a> <a href="http://www.leopold.iastate.edu/pubs-and-papers/2008-11-costs-returns-2007">http://www.leopold.iastate.edu/pubs-and-papers/2008-11-costs-returns-2007</a> <a href="http://lib.dr.iastate.edu/ans_air/vol656/iss1/87/">http://lib.dr.iastate.edu/ans_air/vol656/iss1/87/</a>	<i>Managing Feed Costs</i> <i>Managing Non-feed Costs</i> <i>Production Flow</i> <a href="http://www.ipic.iastate.edu/publications.html">www.ipic.iastate.edu/publications.html</a> <i>Enterprise Budget for Heritage Swine</i> <a href="http://www.livestockconservancy.org">www.livestockconservancy.org</a>

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# Modern Heritage Swine Guide Series

## Common Health Concerns and Diseases of Pastured Pigs

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By: Josh Schaeffer, University of Missouri

Regardless of how pigs are raised, they are inherently at risk for several diseases and conditions. Pigs raised in a traditional extensive manner, or what has been termed “transitional swine,” have higher risks for exposure to certain diseases and conditions in comparison to pigs raised in confinement. This guide will provide information on some of the more notable diseases and conditions of greater risk to transitional swine. Further reading and conversations with your herd veterinarian are encouraged for more complete coverage of the topic. To promote swine health and welfare, become acquainted with a swine veterinarian when you first purchase pigs, and employ a veterinarian in the diagnosis and treatment of ill pigs and in the development of disease control and prevention programs.

### Temperature Extremes

During cold months, production will often decline as the body requires more of the energy consumed to maintain an appropriate body temperature. Younger pigs are most at risk of chilling or hypothermia because they have a higher and narrower range of thermal comfort than adult pigs (e.g., see thermal comfort ranges for young versus adult pigs at <http://www.ipic.iastate.edu/publications/210.EnvironmentalPigNeeds.pdf>). When the pig becomes cold, its body systems, including the immune system, have the potential to become compromised. This can lead to increased susceptibility to disease and even death. To prevent unfavorable effects from cold weather, shelter that provides protection from wind, rain, and snow should be provided. Absorbent bedding, such as straw or wood shavings, should be placed in the shelter to offer additional insulation from adverse temperatures.

Hot months also pose a threat to swine health. Pigs experiencing heat stress will often be inactive and can have reduced feed intake. As the body temperature rises, heat stress may lead to embryonic and fetal mortality, abortions, infertility, and even sudden death. Pigs housed outdoors, regardless of skin color, are at risk of sunburn. Sunburn in pigs is often very painful and can make pigs reluctant to move. Covering the affected skin with a bland oil, such as mineral oil, and moving sunburnt pigs indoors can provide relief. To protect pigs from the heat and sun, adequate shade should be provided. Shelter structures should be open-ended to allow for appropriate air flow. Access to wallows, or shallow mud pits, provides cooling as well as protection from the sun.

Photosensitization may also be seen in pigs housed outdoors. This condition occurs when pigs are exposed to photodynamic agents which intensify the effects of the sunlight. Photodynamic agents are present in some plants, such as St. John’s wort and rape. Some pharmaceuticals, such as tetracyclines and sulfonamides, can act as photodynamic agents. Pigs suffering from photosensitization will initially appear as severely sunburnt. The affected skin will become thickened, and the pig will be itchy. As the condition progresses, strips of skin, and sometimes

the ears and tail, may start to slough, or fall off. Control this condition by preventing exposure to photodynamic agents or by grazing only at night. If photosensitization becomes a concern, consult a veterinarian for a more complete list of potential photodynamic agents.

## **Injury**

Care should be taken to minimize or eliminate risks of injury. Poorly maintained housing, fencing, and equipment, such as fences, feeders and waterers, can cause penetrating or cutting wounds. With access to pasture, transitional swine are also at risk to predation from other animals, such as foxes, coyotes, raptors and dogs. In addition, birds have been known to peck holes in the backs of pigs on pasture. Care should be taken to minimize exposure to other animals that pose a health risk. Pigs are also at risk of injury from fighting with each other. If this occurs, measures should be taken to separate the fighting pigs. Traumatic injuries can range from minor cuts to life-threatening deep wounds. If kept clean, minor cuts and abrasions will usually heal without further intervention, but it is important to note that any open wound can become an entry point for infection.

Inappropriate footing in the pasture can predispose transitional swine to lameness. Lameness can be caused by injuries such as a sprain, or even a fracture, but also by hoof disease, such as an abscess. All injuries and lamenesses should be evaluated quickly, and a veterinarian consulted if there is a question about the severity of the condition.

## **Parasites**

Because of increased potential for environmental exposure, transitional swine have an elevated risk for parasitic infection. Parasite loads can severely affect productivity of boars and sows in the natural setting, where they need to be highly durable. Information is provided below about some of the more common and clinically significant parasites of pigs. A veterinarian should be consulted to aid in developing a parasite control program, and integrated pest management may be part of that program. When using parasiticides or dewormers, be sure to follow label directions for administration and meat withdrawals.

### *Scabies*

Scabies, or sarcoptic mange, is caused by a mite, *Sarcoptes scabiei* var. *suis*. Pigs that come in contact with the mite usually begin to develop clinical signs approximately 3 weeks later. The most notable clinical sign is extreme itchiness. Affected pigs may have crusting around the eyes, ears, and snout. The skin of the back, flank, and rump will often be reddened with small raised areas, or papules. Chronically infected pigs often have thick, scaly skin and hair loss and can suffer substantial losses in growth and feed efficiency. Scabies is extremely contagious from pig to pig. The best prevention is protecting a clean herd from carriers of the disease.

### *Toxoplasmosis*

Toxoplasmosis is caused by the protozoan, *Toxoplasma gondii*. Based on the life cycle of *T. gondii*, only cats can pass the infective form of the protozoa in their feces. Pigs ingest the infective form (sporulated oocyst) through contaminated feed, water, or soil. Because the pig

is not the natural host, *T. gondii* forms cysts in the muscles of the pig. Most pigs do not show any clinical signs. However, the disease is of public health importance because humans can get toxoplasmosis from the consumption of undercooked infected pork. Control is best maintained by limiting exposure to cat feces.

### *Gastrointestinal parasites*

There are many gastrointestinal parasites of pigs. The major route of transmission is through ingestion of infective feces. It is important to provide appropriate manure management to control these parasites. Appropriately timed pasture rotation is one form of manure management. For brevity, only large roundworms and whipworms will be discussed here. In general, control principles will be similar; if more information is needed, please contact a veterinarian.

The large roundworm of pigs is *Ascaris suum*. Pigs ingest *Ascaris suum* in the feces of an infected pig, and the larvae migrate through the gut wall and to the liver. This causes what is known as milk spots, which are seen in the liver when the pig is processed. If there is enough larval migration, severe liver disease may result. Next the larvae migrate into the lungs, where they are coughed up, and swallowed. High numbers of larvae in the lungs can cause pneumonia to develop. After the larvae are swallowed, they mature into adults and begin to create infective eggs, which are shed in the feces to begin the cycle again. Most pigs become naturally resistant at about 6 months of age. If other animals, such as cattle, become infected with *Ascaris suum*, the larvae often have prolonged migration within the lungs and may die there; this results in a severe, possibly life threatening, pneumonia.

Pigs become infected with the swine whipworm, *Trichuris suis*, by ingesting infective feces. The whipworm embeds itself into the wall of the large intestine. Infected pigs often develop diarrhea that contains blood and mucous. This will often slow or stunt their growth. Severe infestation may result in death.

### *Lungworms*

Lungworms of pigs belong to the genus *Metastrongylus*. Infected pigs cough up eggs, swallow them, and then pass the eggs in the feces. The eggs are then ingested by earthworms. The eggs hatch inside the earthworm, which is then eaten by a pig. The larvae then migrate through the gut wall and to the lungs. Once in the lungs, the larvae mature into adults and begin producing eggs. Migration of the lungworm through the lungs can cause pneumonia, especially if secondary bacterial infection occurs.

### *Pork Measles*

Cysticercosis, pork measles, is caused by the human tapeworm, *Taenia solium*. Humans infected with adult *T. solium* shed proglottids (egg sacs) in their feces. A pig becomes infected by eating human feces. The eggs hatch within the pig's gut and the organism penetrates through the small intestine and is carried throughout the pig's body. The parasite develops into a cysticerci (fluid filled cyst) within the muscles of the pig. Humans can then become infected by eating undercooked pork containing these cysts, or "pork measles." Cysticercosis

can be prevented by eliminating pig exposure to human feces, in particular waste lagoons, and use of proper cooking techniques for pork products.

### *Diarrhea*

Diarrhea is an important health concern for all groups of pigs. There are many causes of diarrhea in the pig (Table 1), and reporting the age group(s) affected, the percentage of sick pigs, and the characteristics of the diarrhea (blood, mucous, watery, tarry, etc.) can help the herd veterinarian narrow down the potential causes and prescribe a more efficacious treatment and control plan. Use of proper farm biosecurity is an important preventive measure.

The treatment for diarrhea is mostly supportive care. This includes ensuring that the affected pigs are receiving enough to eat and drink. For suckling pigs, bottle or eye-dropper feeding may be required as the pigs are often too weak to latch on to the sow. Older pigs may be enticed to drink by flavoring the water with fruit juice or flavored drink powders. Diarrhea often causes the pig to become low in salt, so having available salt blocks may aid the pig to maintain its own salt levels. Some sports drink powders contain salts and may help the pig maintain salt levels. Depending on the cause of the diarrhea, antibiotics and anti-inflammatories may need to be administered under the guidance of a veterinarian.

Table 1. Common causes of diarrhea in the pig, age groups affected and clinical signs.

Common Causes of Diarrhea	Age Group(s) Affected	Clinical Signs
<i>E. Coli</i>	<ul style="list-style-type: none"> <li>• Most common cause of diarrhea in pigs &lt;5 days old</li> <li>• Can be seen at weaning</li> </ul>	<ul style="list-style-type: none"> <li>• Watery diarrhea</li> <li>• May see edema (swelling) of eyelids</li> </ul>
Clostridial Enteritis	<ul style="list-style-type: none"> <li>• Preweaning pigs</li> </ul>	<ul style="list-style-type: none"> <li>• Bloody diarrhea</li> <li>• Sudden death</li> <li>• Chronic poor doer</li> </ul>
Transmissible Gastroenteritis	<ul style="list-style-type: none"> <li>• All age groups</li> <li>• If endemic to herd, may only see clinical signs in recently weaned pigs</li> </ul>	<ul style="list-style-type: none"> <li>• Vomiting</li> <li>• Diarrhea</li> <li>• May see high mortality in young pigs</li> </ul>
Porcine Epidemic Diarrhea	<ul style="list-style-type: none"> <li>• All age groups</li> </ul>	<ul style="list-style-type: none"> <li>• Vomiting</li> <li>• Diarrhea</li> <li>• High mortality in young pigs</li> </ul>
Proliferative Ileitis	<ul style="list-style-type: none"> <li>• Grow/Finish</li> <li>• Adult</li> </ul>	<ul style="list-style-type: none"> <li>• Dark, tarry diarrhea</li> <li>• Sudden death</li> <li>• Chronic poor doer</li> </ul>
Swine Dysentery	<ul style="list-style-type: none"> <li>• Grow/Finish</li> <li>• Adult</li> </ul>	<ul style="list-style-type: none"> <li>• Bloody diarrhea with mucous</li> <li>• Usually nearly entire pen affected</li> </ul>
Salmonellosis	<ul style="list-style-type: none"> <li>• Grow/Finish (often shortly after mixing pigs from multiple sources)</li> <li>• Adult</li> </ul>	<ul style="list-style-type: none"> <li>• Variable signs</li> <li>• Fever</li> <li>• Diarrhea</li> <li>• Septicemia (purple ears, systemically ill)</li> <li>• Pigs that recover may develop rectal strictures that inhibit the ability to defecate.</li> </ul>

## Erysipelas

Erysipelas is caused by the bacterium, *Erysipelothrix rhusiopathiae*, and is a disease of all swine, regardless of housing. Outdoor pigs are at an increased risk because the infective spores can survive for extended periods of time in the soil. Acutely infected pigs will often have red, diamond-shaped lesions on the skin. This is due to vasculitis, or inflammation of the blood vessels, which causes the vessels to become leaky. Prolonged infection or exposure to the spores can lead to more chronic clinical signs, including arthritis, heart infection, and sloughing of large portions of the skin. The chronic skin lesions may be difficult to differentiate from chronic sarcoptic mange or photosensitization. Control of Erysipelas should be considered within the vaccination program developed by your herd veterinarian.

## Conclusion

Only the more frequently occurring conditions that can affect transitional swine have been identified in this guide. It is important to remember that pigs raised outdoors may be more susceptible to these diseases and conditions than indoor swine. These include many bacteria and viruses that cause diarrheal disease, respiratory disease, and reproductive failure. To ensure animal health, production, and welfare, it is vital for any swine operation to develop proper biosecurity measures to protect the health of herd. Herd managers should work with a veterinarian to develop a herd health plan for the prevention, diagnosis, treatment, and control of disease.

When a pig does require treatment for a disease or condition, it is important to keep a careful record of the treatment. Records (e.g., Table 2) help ensure that pigs are not marketed before the appropriate withdrawal period has been fulfilled. In addition, good records allow for the tracking of diseases within a herd. This will aid the herd veterinarian in identifying risk factors and establishing a more effective herd health plan. Detailed record keeping can help to identify bloodlines or breeds that are more susceptible to disease, and can also help to pinpoint the effectiveness of management techniques.

Table 2. Sample treatment record template

Date	Animal ID	Reason for Treatment	Product Name	Amount Given	Route	Given By	Withdrawal Time

**For more information about diseases in pigs, check out these links:**

<p>Queensland Australia Department of Agriculture and Fisheries, Common pig diseases:  <a href="https://www.daff.qld.gov.au/animal-industries/pigs/pig-health-and-diseases/a-z-pig-diseases/common-pig-diseases">https://www.daff.qld.gov.au/animal-industries/pigs/pig-health-and-diseases/a-z-pig-diseases/common-pig-diseases</a></p>	<p>Pork Information Gateway:  <a href="http://www.porkgateway.org">www.porkgateway.org</a>            The Pig Site Quick Disease guide:  <a href="http://www.thepigsite.com/diseaseinfo">http://www.thepigsite.com/diseaseinfo</a>            Center for Food Security &amp; Public Health, Swine Diseases and Resources:  <a href="http://www.cfsph.iastate.edu/Species/swine.php">http://www.cfsph.iastate.edu/Species/swine.php</a></p>
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# Modern Heritage Swine Guide Series

## Biosecurity for Pastured Pigs

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By: Joshua Schaeffer

The root meaning of biosecurity is the securing or preserving of life. In an agricultural setting, the term is used to describe measures put in place to control exposure to pathogens, or disease causing entities, such as bacteria, viruses, fungi, or parasites. Many in the swine sector talk about 'internal' and 'external' biosecurity. There are three main biosecurity goals:

1. Prevent pathogens from entering the farm (bio-exclusion, external biosecurity).
2. Prevent the spread of pathogens from one part of the farm to another (bio-containment, internal biosecurity).
3. Decrease the severity of disease through controlled exposure and/or vaccination (bio-management, internal biosecurity).

These goals are met through either eliminating or minimizing the modes of transmission for pathogens. Instead of focusing on biosecurity practices for each disease, this document will highlight the different modes of transmission and factors that affect the risks associated with each. Veterinary input is crucial to the development of a biosecurity plan, especially when considering controlling risk factors for a certain disease.

### Fomites

A fomite is any inanimate object capable of carrying an infectious pathogen from one individual pig or farm to another. Fomites can be responsible for the introduction and spread of many diseases of pigs. On a swine operation, this can include any equipment being used, boots, clothing, vehicles and also feeders and waterers.

Several production practices can be implemented to decrease the risk of transmission through fomites. In an ideal setting, boots and coveralls would be changed before going from one group of pigs to another, though under many settings, this is not a viable option. A good alternative is to develop a work schedule that follows pig flow from the 'cleanest' to the 'dirtiest' pigs. Work with your veterinarian to determine where each group of pigs on your farm fits on this health continuum. (e.g., Farrowing → Gestation → Nursery → Grower → Finisher). Many veterinarians will consider nursery pigs the most susceptible because the immunity they have from colostrum is wearing off and their own immune system is not yet mature. Any group of pigs that is known to be suffering from disease should be left until last. Any pigs in isolation would also fall to the end of the list to minimize risk of transmitting pathogens they may have to other pigs on your farm. If the chores cannot be done in this order, then having separate boots for each phase, or at least cleaning boots of any organic material and disinfecting them between groups, is recommended.

Access of visitors to your farm, proximity of your farm to other, nearby farms, and the cleaning and disinfecting of equipment are some of the most important factors to consider in developing a biosecurity plan. Any boots or equipment being used should be cleaned and sanitized after use and before use on another group of pigs. Any livestock hauling equipment, such as trailers, should be thoroughly cleaned and disinfected after each use. When using a disinfectant, it is necessary to remove organic matter (manure, bedding) prior to application of the disinfectant, as most disinfectants do not work in the presence of organic debris. Manufacturer instructions on the use of the disinfectant should be followed carefully, not only to ensure efficacy, but also to prevent any unwanted human or animal health risks. When handled according to manufacturer instructions, a 5% solution of bleach is an economical and readily available disinfectant and can be used in the sanitation rotation.

## **Aerosols**

Depending upon the pathogen and environmental conditions, disease can be spread through the air over a considerable distance, in some instances, up to 10 miles. Location is a key biosecurity plan component for outdoor swine operations. Ideally, the farm should not be located within close proximity to major roads on which swine are routinely hauled or close to other swine operations. Hilly topography and windbreaks can be helpful in disrupting the air currents; thus, they can be used to decrease the distance that pathogens can travel through the air.

## **Oral**

Ingestion of infectious pathogens is a major mode of transmission for disease. Clean, fresh water should be provided to promote good animal welfare. Preferably, water from a water treatment facility should be utilized, but a deep well may be an acceptable water source. Using surface water, such as ponds, as a water source for pigs increases the risk of exposure to oral pathogens. Feed can also become contaminated and serve as a source of disease. Feedstuffs should be purchased from a reputable source and stored properly to prevent spoilage and rodent/pest access. To prevent contamination, do not use feed handling and processing equipment for other purposes unless they are thoroughly cleaned and disinfected before being used again for feed. Just like the feedstuffs, bedding materials should be obtained from a reputable source and stored appropriately to prevent contamination. Dirty bedding and manure should be removed regularly from confinement and feeding areas. Waste material should then either be hauled from the swine areas or stored/composted in a manner to prevent pig exposure. When handling waste, it is important to follow all federal, state, and local regulations. Waste management is also important when developing biosecurity plans for pastured pigs. Pastures should be designed and managed to minimize exposure to manure, and to prevent runoff from rains. Density (the number of pigs in a given area), frequency of pasture rotation, and the length of time a pasture is idle before pigs are returned to it are important management tools for minimizing infectious diseases.

Although not considered a source of transmission, colostrum management is important in decreasing the risk of disease in baby pigs. Colostrum, or the first milk, contains concentrated amounts of antibodies that are absorbed across the gut wall of the baby pig following consumption. To ensure colostrum protection, it is important that pigs nurse within the first 12

hours of life. Furthermore, correct vaccination of the sow is needed to ensure adequate antibody levels in the colostrum.

### Direct Contact

Pigs can become sick by having direct contact with other pigs, even when there are no signs of illness. The best method to control this mode of transmission is to practice all-in/all-out. Pigs that are at different stages of production (farrowing, gestation, nursery, grower, finisher) should be housed separately. Fencing and housing should be designed to eliminate any possibility for nose-to-nose contact from one group to another. Furthermore, animals should move as a group through the production cycle to limit disease transmission.

Purchased animals, and animals that leave the farm and return, should be quarantined for a minimum of 30 days before being placed in the general population. A veterinarian should be consulted to determine if any testing should be performed on these animals prior to entry to the production site. New pigs should be acclimated to the herd by moving pigs from your herd into a pen adjacent to the new pigs before they are allowed to enter the herd. This is commonly done at the quarantine facility after the isolation period. This allows the new pigs to become exposed to pathogens that are endemic in the existing herd and to develop an immune response to them.

### Vaccination

Technically a form of direct contact, vaccination is the key component for bio-management in a biosecurity plan. Vaccination aids in the control of disease by exposing the pig's immune system to small doses of either a weakened or killed pathogen. When an immunized pig becomes infected with the natural pathogen, the immune system can mount an efficient response to control or kill the now familiar pathogen. When implemented correctly, vaccination protocols can minimize and even eliminate the clinical signs of several diseases. To ensure efficacy, vaccine label instructions on handling and administration of the vaccine should be followed carefully. In addition, working closely with a veterinarian to determine what vaccines to use and when to administer them is important for developing an effective vaccination protocol. Table 3 lists some commonly recommended vaccines.

Table 3. Some common vaccines for pigs.

Stage of Production	Vaccine Agent	When to Administer
Gilts: Pre-Breeding	Leptospirosis	Twice before breeding
	Parvovirus	
	Erysipelas	
Sows: Pre-Breeding	Leptospirosis	Prior to breeding (at or near weaning)
	Parvovirus	
	Erysipelas	

Boars	Leptospirosis	Twice a year
	Parvovirus	
	Erysipelas	
Gilts: Pre-farrowing	<i>E. coli</i>	Twice before farrowing
	Clostridium	
Sows: Pre-farrowing	<i>E. coli</i>	Once before farrowing
	Clostridium	
Nursery, Grower, Feeder	Circovirus	Follow label directions and veterinary advice for schedule of administration
	Erysipelas	
	<i>Mycoplasma hyopneumoniae</i>	

## Vectors

A vector is a living organism that transmits disease from one individual to another. Biting insects, such as ticks and flies, are some of the most common examples of vectors, as they can potentially spread many pathogens directly. However, potential vectors on a swine operation also include rodents, birds, and other mammals. These vectors can either spread pathogens directly (for example, *Sarcocystis spp.* in dog feces) or indirectly (for example, transmissible gastroenteritis virus on contaminated feathers). Pigs housed outdoors have increased exposure to vectors. To help control spread and introduction of disease, measures should be taken to control or deter rodents, insects and birds in feeding areas. Also, pigs raised in dry lots should be housed separately from other livestock; from a purely swine health standpoint, contact with all other animals would be avoided, though this may be impractical in many settings.

Feral swine are a particular risk that must be considered for pigs housed outdoors. Feral pigs have the potential to transmit any number of diseases to domestic pigs and two of these, brucellosis and pseudorabies, are a true threat to outdoor pigs. These diseases have been eradicated from domestic pigs but are still present in the feral population. When raising pigs in an area where feral swine are present, well-structured double-fencing is needed to prevent contact between domestic and feral swine.

## Zoonotic & Anthroponotic Diseases

There are several diseases that can be transmitted from pigs to people (zoonotic diseases) and diseases that can be transmitted from people to pigs (anthroponotic diseases). For example, some flu viruses can be transmitted between pigs and people. Practicing good personal hygiene and using personal protective equipment (clean coveralls and boots, gloves, masks, etc.) can greatly decrease the risk of transmission. Good hygiene practices include frequent washing of the hands and not eating, drinking or smoking when working with pigs. To prevent spreading disease from people to pigs, people who are ill should not be near pigs and should preferably not be on the production site. If a worker is ill, he should contact a physician for medical care and inform the physician that he works with pigs and whether or not the pigs

have been sick recently. Personal protective equipment should be used when directly handling sick pigs, carcasses, or cleaning contaminated equipment and quarters. It should also be used by farmers who are sick and have nobody to replace them for farm chores.

## Conclusion

A biosecurity plan is vital to control disease transmission on swine operations. Regardless of the type of operation, measures can and should be put in place to control disease. For example, one of the first steps in establishing some degree of biosecurity on any farm is to dedicate a separate pair of boots and coveralls for pig chores and clean these frequently. There is no one-size-fits-all approach to biosecurity. As a result, it is vital that a veterinarian be employed to develop biosecurity protocols based on the type of operation, available labor and capital, and diseases of concern.

**For more help understanding biosecurity, and resources to aid you in developing your own biosecurity plan, check out these links:**

<p>The Livestock Conservancy biosecurity resources:  <a href="http://www.livestockconservancy.org/index.php/resources/internal/biosecurity">http://www.livestockconservancy.org/index.php/resources/internal/biosecurity</a></p> <p>Biosecurity for today's swine operation, Seaman JS and Fangman TJ, University of Missouri Extension publication G2340.  <a href="http://extension.missouri.edu/p/G2340">http://extension.missouri.edu/p/G2340</a></p> <p>Biosecurity of Pigs and Farm Security. Levis DG and Baker DB, University of Nebraska Extension publication EC289.  <a href="http://ianrpubs.unl.edu/live/ec289/build/ec289.pdf">http://ianrpubs.unl.edu/live/ec289/build/ec289.pdf</a></p>	<p>Iowa Pork Industry Center Publications, <a href="http://www.ipic.iastate.edu/publications.html">http://www.ipic.iastate.edu/publications.html</a>  Pork Information Gateway.  <a href="http://www.porkgateway.org">www.porkgateway.org</a></p> <p>Good Practices For Biosecurity in the Pig Sector. FAO Animal Production and Health Paper 169.  <a href="http://www.fao.org/3/a-i1435e.pdf">http://www.fao.org/3/a-i1435e.pdf</a></p>
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# Modern Heritage Swine Guide Series

## Selecting Breeding Stock for Heritage Hogs

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By: Mark Knauer, North Carolina State University and Alison Martin, The Livestock Conservancy

Selecting animals for future generations is an important process to ensure herd productivity and profitability. In Heritage Breeds this involves two main aspects. One of these is assuring the integrity of the genetic structure of the breed. The second is considerations of productive potential. The following factsheet will outline important factors to consider when retaining replacement gilts and boars, emphasizing aspects of productive potential to be considered after the genetic value of individual animals for maintaining the breed has been determined. Selection criteria for the productive potential of breeding animals include: reproductive soundness, structural conformation, adaptive traits, growth rate and carcass characteristics.

### **Reproductive Soundness**

Reproductive soundness, including all factors affecting an animal's ability and willingness to reproduce, should be monitored at multiple ages for both boar and gilt replacements. Age at puberty varies among populations, and for some genetic populations can be less than 100 days of age. For most breeds, however, puberty would be expected to be later than 150 days of age. Separating males and females prior to puberty is critical to avoid unplanned matings and to avoid mating when gilts are too young.

Boars should be evaluated for mating behavior a couple months after they have reached a pubertal age, at least 7.5 months for many breeds; this age will vary for some breeds. Mating behavior can be determined by penning a boar with a gilt exhibiting the standing reflex and observing the boar's libido and mounting behavior (NSIF, 2002). A boar with a good libido will seek out the female and attempt to mount her. Selecting a male with a high libido is especially important for herds where matings may not always be attended. This assures that boars will seek out the sows and mate them.

Gilts should be assessed for vulva and underline soundness at the time they are expected to be approaching puberty. For conventional breeds this would be 5-6 months of age, though it will vary among genetic populations. A gilt's vulva should be well-developed (Figure 1). Small, infantile vulvas (Figure 2) should be avoided as they often indicate an underdeveloped reproductive tract that cannot function. At the same time, evaluate the underlines for teat spacing and quality. An example of a well-spaced, high quality underline is shown in Figure 3. Teats that are overly coarse (Figure 4) should be avoided as they may inhibit small piglets

from suckling. Teats and underlines should be evaluated in both gilts and boars, because these characteristics are inherited, and the boar with weakness in these traits will pass those to his daughters. Teat number is also important, and varies breed to breed. The essential element is that teat number is sufficient for the anticipated litter size the gilt will be producing. To an extent, “more is better” is a good rule.

Once the basics of breeding potential are deemed acceptable, actual breeding behavior and success can be evaluated. The wise farmer will keep records of matings to learn which gilts are successfully bred, and whether a boar is successful in impregnating sows and gilts. In herds where replacement rates are low, longevity may be key for capitalizing on the most productive years of a sow’s life, after third parity. Following a trial period, unsuccessful breeding animals should be culled from the herd in order to reduce unneeded use of resources.

The last element of reproductive soundness is litter evaluation. Selecting breeding stock that consistently give birth to and wean large, healthy, productive litters is the secret to herd improvement. There may be instances where maintaining the genetic diversity represented in a pig or litter means that animals are maintained despite low productivity. In this case, the goal should always be to correct the weaknesses in the next generation by using these animals carefully and mating them wisely.

### **Structural Conformation**

Structural conformation should be evaluated on all potential herd replacements. Learn to identify the expected conformation of the breed you are raising, and study the breed standard. Some structural defects impact soundness and breeding, and animals with such defects should be culled from the breeding population. Evaluate structural soundness at several times as animals grow, for example, at weaning, at 6 months, and prior to breeding. Conformation should be balanced, that is, head, neck, body, and legs should be uniform and symmetrical on the left and right. Examine each pig from the top, front and rear. The spine should be straight, as should be the legs when seen from the front and rear. Proper feet and leg structure in both sexes is especially important in natural mating settings. Emphasis should be placed on the side view of the front legs (Figure 5), because the conformation revealed in this view relates to mobility and the longevity of physical soundness. Weak pasterns seem to be tolerable, but weak knees need to be avoided because such pigs break down earlier than those with sound conformation. Pigs that are buck-kneed can further be identified as they generally have smaller front toes and take shorter strides on their front legs. Boars with buck-knees have more difficulty with mating, and both sexes have greater difficulty rising to a standing position as they mature. As a result, buck-kneed pigs should be culled unless absolutely necessary for maintaining genetic diversity. When evaluating rear leg conformation, pigs that are post-legged (Figure 6) should almost always be culled, because this conformation leads to

early structural problems, lameness, and a shortened productive life. Tail set is another trait that affects breeding ability. If tail set is too low it can impede breeding and birth.

For heritage breeds, considerations to preserve genetic diversity may occasionally require using an animal that has weak conformation, because it represents a very rare bloodline. In this case, all consideration should be made to match the animal with mates who are very strong in the conformational area where the rare bloodline is weak.

## **Adaptation**

Many niche pig producers decide to raise heritage breeds because of their adaptive traits, and these should play an important role in selection of breeding stock. Close observation of behavior and good record keeping are important in deciding which animals to keep and which to cull. Depending on the current state of the breed and the objectives of the breeding program, animals may be selected for mothering ability, litter size, temperament, foraging behavior, disease resistance, longevity/length of productive life, and adaptation to the environment. Individuals that do not meet farm criteria for these traits should be culled. Sons and daughters of individuals who are superior in these traits are favored when deciding on replacement breeding stock.

## **Growth Rate**

Perhaps the most basic trait to evaluate is growth rate. Pigs that grow faster require fewer days to market, and inferior growth can be an indicator of poor reproductive health. Good record keeping is the key to improving growth in the herd. Size differences among littermates can be distinguished by visual inspection, or with a scale, and the results should be recorded and tracked as the animals grow. Weight is commonly measured prior to or at weaning, and then again at market age. Unless a farm scale is available (Figure 7), farmers may have weights only on pigs that are processed. Alternatively, a hog weight tape can be used to measure heart girth circumference (Figure 8). By tracking the growth rate of the offspring of each sow and boar, farmers can select replacement gilts and boars from the families with the best productivity.

Selection should not be based on growth alone, but balanced against adaptive traits. Growth rate differences between litters can be highly influenced by environmental effects. One way to balance this is to compare each piglet to its littermates, selecting the best of the litter rather than selecting across litters that might have had different numbers, ages of dams, and other factors that influence growth rates. Hence farmers should consider selecting for growth rate within litters, always keeping the best performers from each litter as breeding stock. This practice also helps assure accumulation of inbreeding is reduced by maintaining as much genetic diversity as possible.

Carcass characteristics (i.e. backfat and muscling) can be estimated visually, or objectively by using ultrasound technology. The latter provides more precise assessment of leanness and muscling, but adds considerable expense. If it is available locally, work with the ultrasound technology provider in using the data in selection decisions. Ideal carcass characteristics for a farm may vary depending on the target market and for the breed. For example, a breeding objective for pigs that are very feed efficient would require selection for lean, meat type animals. Yet, heritage breeds originate from a time when the market valued more marbling and lard, so the farmer must be familiar with the ideal body type for their breed.

Visual appraisal of carcass traits should occur near the desired market weight. Figure 9 depicts sketches of a pig of lean body type, (A), a lard-type pig, (B) and a lean pig with inferior muscling (C). Although heritage breeds have more fat than modern lean breeds, excessive fatness is not desirable and affects health and reproduction. Breeds that are especially prone to obesity, such as Guinea Hog and Ossabaw Island, should be monitored and their feed intake adjusted to prevent obesity. Some breeders may wish to select breeding stock less prone to fattening, so long as they do not deviate too far from the expected conformation for the breed.

In a visual assessment for carcass characteristics, the farmer will evaluate the breadth (side to side), length (fore to aft) and depth (top to bottom) at various points of the animal against the body type for the breed or bloodline and compared to other animals in the herd. Standard points of evaluation for visual assessment include: breadth of the head and neck, uniform breadth of the back all the way through the hindquarters, body depth at the shoulder just behind the arm (heart girth), length of the body, and fullness of muscling in the shoulder, body, and hams. Pigs chosen for breeding should be medium boned, sufficient to carry their weight, but not heavy boned, as that reduces yield. An overall impression of harmonious and strong conformation nearly always accompanies animals with good production records.

### **Summary of Key Considerations for selecting breeding stock:**

- Reproductive soundness
  - Good libido and mating behavior
  - Well-developed vulva
  - Well-spaced underline with high quality teats of appropriate number
  - Breeding behavior
  - Fertility
  - Litter size and health
  - Longevity
  
- Structural conformation
  - Top, front, and rear view - straight and balanced
  - Front leg side view – normal or weak pasterns favorable
  - Rear leg side view – consider culling post-legged animals
  - Tail set

- Adaptation
  - Health
  - Mothering ability
  - Temperament
  - Foraging ability
  - Adaptation to local climate and weather
- Growth rate
  - Body weight or heart girth
  - Rate of growth from weaning to market weight
  - Consider growth within but not between litters
  - Balance selection for growth with genetic variability and selection for adaptive traits
- Carcass characteristics
  - Ideal may vary depending on your breed and target market
  - Breadth, depth, length and muscling can be estimated visually



Figure 1. A gilt with a well-developed vulva.  
(Photo courtesy of National Hog Farmer)



Figure 2. A gilt with an infantile vulva. This gilt should be culled.  
(Photo courtesy of National Hog Farmer)



Figure 3. A gilt with well-spaced, high quality teats. (Photo courtesy of National Hog Farmer)



Figure 4. Small piglets may have challenges nursing the coarse rear teats on this gilt. (Photo courtesy of National Hog Farmer)



Figure 5. Side view of the front leg for normal (left), weak pasterns (middle) and buck-kneed (right). Buck-kneed pigs should be culled. (Photos courtesy of National Hog Farmer)



Figure 6. Side view of the rear leg for a normal pig (left) and one that is post-legged (right). Post-legged pigs should be considered for culling. (Photos courtesy of National Hog Farmer)



Figure 7. A farm scale suitable for weighing pigs



Figure 8. Pig weight can be estimated using a hog weigh tape to measure heart girth circumference.

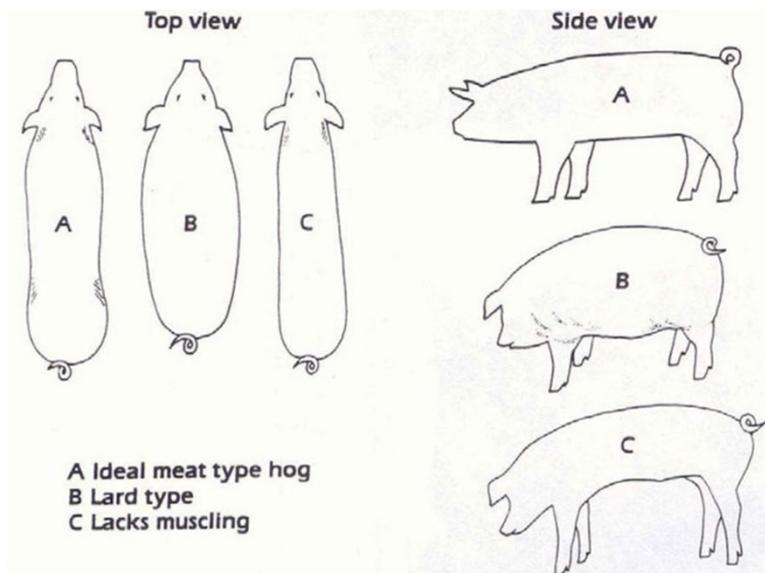


Figure 9. Examples of a lean pig of modern meat type (A), a lard type heritage pig (B), and a lean pig with inferior muscling (C).

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Application of Selection Concepts for Swine Genetic Improvement.

<https://swine.extension.org/category/breeding-and-genetics/>

<https://porkgateway.org>

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# Modern Heritage Swine Guide Series

## Control of Inbreeding for Productivity and Genetic Conservation in Swine

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By: Mark Knauer, North Carolina State University and Tim Safranski, University of Missouri

Maintaining productivity in livestock breeds is best accomplished by combining two sometimes separate strategies: preserving genetic diversity, and direct selection for productivity. In other words, some traits of economic importance (i.e., survival, fertility, growth, etc.) can be sustained by minimizing inbreeding, which requires genetic diversity. Other traits, like growth rate and meat quality, depend on selection for production. The following guide will outline the importance of minimizing inbreeding and provide a framework for controlling inbreeding on the farm with special consideration for heritage breeds.

What is inbreeding? Inbreeding can be defined as the mating of individuals more closely related than the average of the breed. Extreme examples would include breeding a gilt to her brother or to her father, or breeding a sow to her son. In each of these examples the animals share 50% of their genes in common because of their relationship with each other. These extremely close matings result in rapid accumulation of inbreeding (by 25%) and must be avoided for producers of breeding stock. Half siblings, or animals that share a common father or mother, share 25% of their genes and result in 12.5% inbreeding per mating. In general it is advisable to plan matings so that all pairs of animals are less closely related than second cousins. Because many of our heritage breeds are small populations, and many also have incomplete pedigrees, avoidance of inbreeding for even less related matings may be prudent. While inbreeding can be a useful strategy in conservation breeding, it should always be used strategically and deliberately, and always comes with risks.

Why is inbreeding harmful? Inbreeding is detrimental because it impairs productivity. People often consider the fact that inbreeding results in more animals expressing recessive mutant genes. Those are the obvious effects of inbreeding, but perhaps more important are the impacts on production traits that go unnoticed. A gene represents a possible protein the animal can produce. When genes from both parents are identical, it means the progeny only have one option for what proteins can be produced from that part of the DNA. That means it has fewer options to respond to environmental insults (i.e., it has one option for that gene rather than having two options). The result is that animals with high inbreeding can have reduced performance. It is especially noticeable for traits that are sensitive to the environment, or traits with low heritability. Traits in that category include nearly all reproductive traits (conception rate, litter size, etc.) as well as general viability and disease resistance.

Evidence for the negative effects of inbreeding on productivity was demonstrated by agricultural researchers long ago, and some of the 'classic' papers are good examples of why inbreeding should be avoided. Increasing inbreeding reduces litter size<sup>1-3</sup>. Bereskin and coworkers reported that a 10% increase in inbreeding reduced average litter size by 0.25 pigs. This means a sow resulting from a father-daughter mating would be expected to farrow an average of 0.625 fewer piglets per litter when compared to a female that is not inbred. Growth rate is also impaired by inbreeding<sup>1-2</sup>. Bereskin and coworkers further reported that a 10% increase in inbreeding reduced weight at 154 days of age by 5.7 pounds. This indicates that offspring from a father-daughter mating would weigh 14.25 pounds less at market than pigs from a litter without inbreeding. So not only are there fewer piglets, they also grow slower! Besides litter size and growth rate, conception rate is greatly affected by increased inbreeding<sup>4</sup>. This means that high rates of inbreeding lead to decreased productivity and vigor. When high rates of inbreeding accumulate across the breed, this reduced productivity and vigor can accelerate the rate of disappearance of rare breeds. Collectively, past research suggests productivity in rare breeds cannot be maintained without controlling inbreeding.

How can inbreeding be avoided? Several strategies are available to control inbreeding. Schemes include avoiding the mating of close relatives, introducing genetics from other herds, and planned selection strategies, all of which require good pedigrees be maintained. As previously indicated the continuous mating of close relatives rapidly increases inbreeding and will lower herd productivity, especially in the areas of health, vigor and reproduction.

A good strategy to avoid mating close relatives is to incorporate genetic material from other herds. This can be accomplished by purchasing or leasing boars or gilts from another breeder or through the use of artificial insemination. Semen used for artificial insemination can be either fresh or frozen. Contact your local or state extension agent for more details on collecting, handling and using fresh or frozen semen.

Planned selection strategies also will help avoid the mating of close relatives. One strategy is to only keep offspring from old boars and sows that have farrowed many litters. Fundamentally, this slows the accumulation of inbreeding in your herd by increasing the interval between generations. It also promotes pigs with a long productive lifespan. Unfortunately it can result in loss of diversity; some boars and sows do not live long lives or become infertile, for example, due to accident, and their genes are lost from the herd and perhaps the breed if they have no progeny on the ground. Therefore this strategy works best in conjunction with other strategies for avoiding inbreeding.

A second selection strategy is to use multiple boars for breeding instead of using only a single boar. This approach will help slow the accumulation of inbreeding because it greatly reduces the number of half siblings in your herd. The challenge to this system, of course, is that for small farms it means maintaining a larger number of boars than may be practical. For some

farms, this may be overcome by working with nearby farms raising the same breed, or through artificial insemination. Breeding sows to the same boar only every other or every third year ensures diversity in her offspring. A third strategy is to retain no more than two gilts per litter. If sows are mated to different boars each year, this approach will reduce the relatedness of individuals in your herd.

From the perspective of the breed, the strategy that maintains the greatest amount of genetic diversity is to assure every breeding animal leaves a replacement: at least one boar from each boar and one gilt from each sow in the foundation population produce at least one litter. The 'foundation animals' can be the original breeding animals in your herd or, for greater effectiveness at the breed level, the same approach can be taken for animals within the breed. This results in the least accumulation of inbreeding possible.

### **Summary of Key Strategies for Maintaining Genetic Diversity:**

- Avoiding the mating of close relatives
- Incorporating breeding stock from other herds
- Planned strategies for propagating breeding stock
  - Retaining offspring from older boars and sows
  - Using multiple boars for breeding vs. a single boar
  - Retaining no more than two gilts per litter
  - Assuring every boar leaves at least one son who sires litters and every sow leaves at least one daughter who farrows litters

More information about conservation breeding can be found in these books:

Sponenberg, D.P., A. Martin, and J. Beranger, 2017. *Managing Breeds for a Secure Future: Strategies for Breeders and Breed Associations*. Available from: [www.livestockconservancy.org](http://www.livestockconservancy.org)

Sponenberg, D.P. and C.J. Christman, 1995. *A Conservation Breeding Handbook*. Available from: [www.livestockconservancy.org](http://www.livestockconservancy.org)

Or contact The Livestock Conservancy at [info@livestockconservancy.org](mailto:info@livestockconservancy.org)

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<sup>2</sup>Culbertson, M. S., J. W. Mabry, I. Misztal, and J. K. Bertrand. Effects of inbreeding and outbreeding in purebred Hampshire and Duroc swine. *Prof. Anim. Sci.* 13:194-197.

<sup>3</sup>Köck, A., B. Fürst-Waltl, and R. Baumung. 2009. Effects of inbreeding on number of piglets born total, born alive and weaned in Austrian Large White and Landrace pigs. *Archiv Tierzucht*. 52:51-64.

<sup>4</sup>Johnson, R. K. 1981. Crossbreeding in swine: Experimental results. *J. Anim. Sci.* 52:906-923.

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# Modern Heritage Swine Guide Series

## Insemination

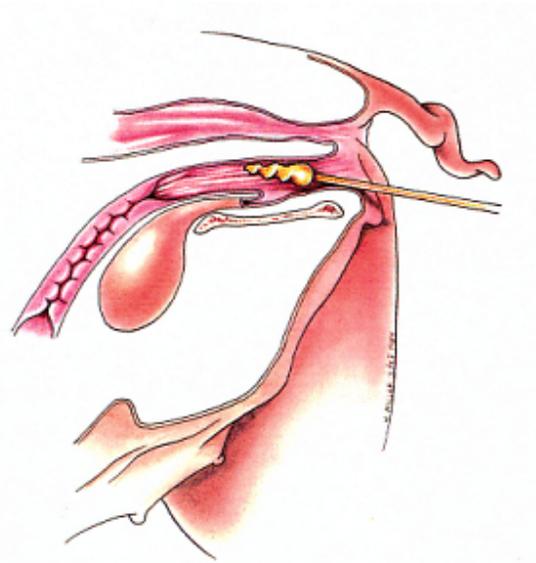
By: Wayne L. Singleton, Purdue University

Artificial insemination (AI) is a tool that can be used by heritage swine breeders to introduce new genetics into their herd with reduced cost and health risks compared to introducing live animals. Timing of insemination is critical, and females should be inseminated at the onset of standing heat and again about 24 hours later. Best results are expected when the semen dose is less than 48 hours old, contains about 2.5 billion viable cells and has been stored at 17-18 °C (60-64 °F). Either spiral or foam tipped insemination catheters are available from specialty suppliers. Some AI suppliers offer smaller catheters designed for gilts, and these may be more desirable when inseminating sows of smaller heritage breeds.

The following steps describe the insemination process. (Another process is available, intrauterine insemination (also called post-cervical AI), but is appropriate only if some training is available, and that procedure is not discussed in this guide.)

### Step 1:

Identify the female in standing heat. Provide face-to-face, fence-line contact with a mature boar. If boars are not present on the farm, consider using a washcloth with boar saliva if available. Inseminating without a boar is also possible, though often reduced fertility is expected. If the sow is in standing estrus she will stand solid to be inseminated. Without a boar present there is a little subjectivity, and the breeder should be prepared to follow the female with the insemination catheter. If necessary, clean the vulva with a soft paper towel.



- Lubricate the catheter tip with a small amount of sterile, water soluble, non-bactericidal, non-spermicidal lubricant. These are specifically designed to be effective lubricants and to not harm sperm survival, and you can ask the semen or catheter supplier what brand they carry. Standing on the left side of the female, facing

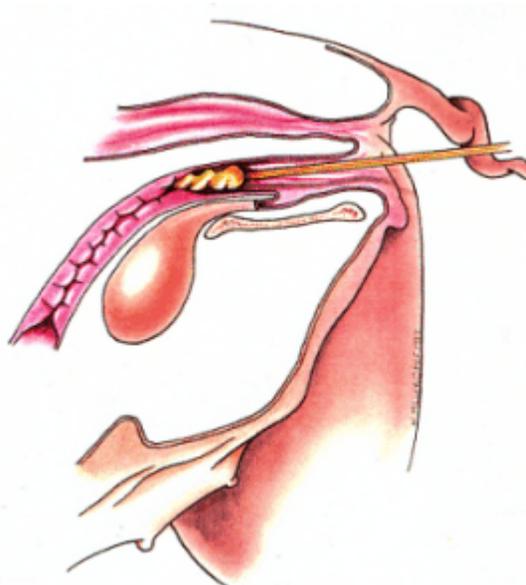
backwards, use left hand to spread the vulva lips, insert the catheter about 3 to 4 inches.

- Reposition yourself to the rear of the female.
- Position the catheter at a 20 to 30 degree angle with the tip pointed upwards. Gently push forward and backward until the tip is about 4 to 6 inches forward. (This will avoid entering the urethral [bladder] opening).

### Step 2:

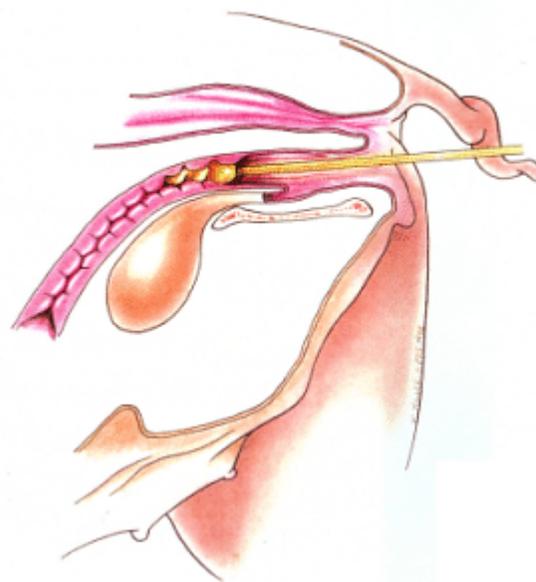
Position the catheter more horizontally and continue to gently move it forward until resistance is felt. This should indicate that the tip is at the cervical opening.

- Gently rotate the catheter counter-clockwise as the cervix is entered. Rotation is not necessary with foam-tipped catheters. Obtain a firm lock which is indicated when the catheter feels tight and will spring back about 1/4 turn. Do not force it too much.



### Step 3:

Connect the semen bottle/tube to the shaft of the catheter and hold in an upright position. Initiate semen flow by application of gentle pressure on the bottle/tube. Gentle, alternating movement of the catheter may enhance flow of semen. Stimulate the female via back pressure and rubbing the underline and flank area. Be patient, some females will "take" the semen with little or no pressure being applied to the bottle/tube, while others may require alternating slight pressure on the bottle/tube. Allow 3 to 5 minutes, minimum, per female. Some require more time than others. DO NOT RUSH.



When completed, gently rotate the catheter in a clockwise fashion and remove. The sow should be allowed to relax at least 30 minutes. Properly dispose of the equipment (i.e., they are plastic so non-biodegradable and should go to a sanitary landfill). DO NOT REUSE CATHETER. Record and score the mating.

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# Modern Heritage Swine Guide Series

## Detection of Estrus

By: Wayne L. Singleton, Purdue University

Artificial insemination (AI) is a tool that can be used by heritage swine breeders to introduce new genetics into their herd with reduced cost and health risks compared to introducing live animals. A key factor in the success with AI is the ability to accurately identify standing estrus or “heat”. Signs of estrus in gilts and sows can be classified as either primary or secondary, as outlined below.

**Signs of Estrus** (see Figure 1):

- Primary:
  - Stands for the boar, other females or for the “back pressure test”
- Secondary:
  - Red, swollen vulva
  - Mucous discharge from the vulva
  - Seeks the boar
  - “Grunts” and “growls”
  - Mounts and sniffs other pen mates
  - Erects ears when stimulated

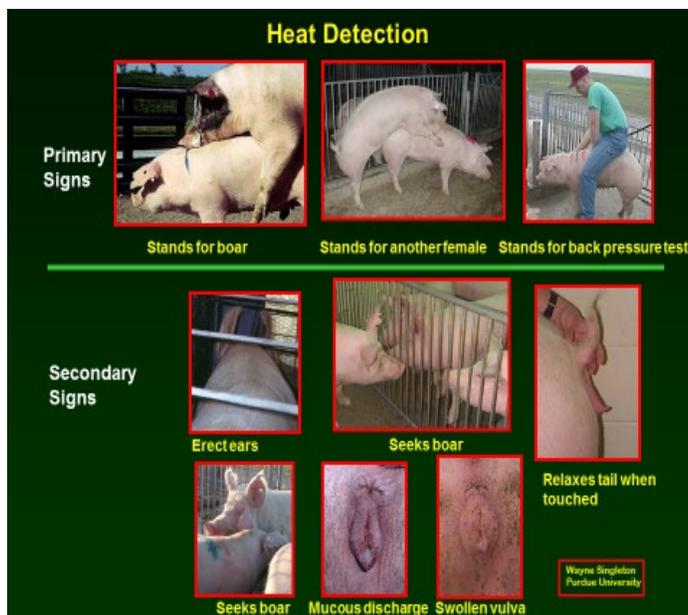


Figure 1. Primary and secondary signs of estrus.



considerable variation in the time to return to estrus when lactation lengths are beyond 28 days, litter sizes are small, or when groups of sows and litters are comingled during lactation. In many instances sows may return to heat while nursing during long lactation lengths or with small litter size. This is a fertile estrus, and if the goal is to produce another litter as quickly as possible, sows can be mated at this estrus. For first parity sows, waiting until the following estrus often results in larger subsequent litter size.

**For more information:**

Heat Detection:

<http://porkgateway.org/FileLibrary/PIGLibrary/HowTos/Heat%20Detection.pdf>

Heat or Estrus Detection:

<http://porkgateway.org/FileLibrary/PIGLibrary/Factsheets/PIG%2008-01-01.pdf>

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# Modern Heritage Swine Guide Series

## Preparing for Farrowing

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By: Wayne L. Singleton, Purdue University

Farrowing is one of the most critical stages of the reproductive cycle, and it is important to have a good understanding of the normal farrowing process. Prompt detection and correction of problems can prevent sizable losses due to baby pig death at or around the time of farrowing. Extra care during this phase can impact the overall profitability of the operation.

### Pre-Farrowing

Many types of farrowing pens or huts may be used, depending on what seems best adapted to the conditions on the farm. Pens or huts should be oriented with the door away from prevailing winds, and to take advantage of sunlight or shade in the appropriate season. The size should be sufficient for the sow to lie down on her side fully extended, with room for a large litter of growing piglets. Pen designs often include a guardrail or slatted space where piglets can escape the risk of crushing when the sow lies down. Maximum pen size depends on the climate and management practices. Smaller farrowing pens are better for retaining heat, while larger, taller pens are better for preventing the pen from getting too hot in warm seasons and climates. A hanging cover, such as burlap over the door to the pen, can be used in cold weather to help keep out the cold. Give consideration to the need to use artificial heat if winter lingers longer than expected.

Many breeders prefer to isolate the sow where she will not be bothered by other sows; however, some heritage breed pigs will naturally assist new mothers. If farrowing will take place where other pigs are present, keep a close watch until it is clear whether the culture of the herd is to help or hinder. Some heritage breeds in outdoor systems prefer to build their own nest. Use of the huts can be encouraged by having them in place with a thin layer of straw or other absorbent nesting materials at least 5 days before the expected farrowing date. If the hut is reasonably portable without a floor and the sow has begun nesting, the hut can be put in place over the nest.

Clean farrowing quarters greatly reduce the incidence of disease in newborn piglets. If farrowing is inside of a building, the area can be thoroughly cleaned and disinfected a few days before the sow enters. In outdoor systems, huts should be cleaned, disinfected and moved to a clean, dry area. Treat pregnant females for internal and external parasites about two weeks prior to farrowing. Wash the sows with warm, soapy water and move them to the farrowing quarters about 4 to 5 days prior to the expected farrowing date.

## Phases of Farrowing

Normal farrowing is a continuous process. For descriptive purposes it is usually divided into three stages.

Stage 1. Preparatory Stage. This stage begins with muscular contractions and ends with complete cervical dilation that allows the fetuses to enter the pelvic or birth canal. The only outward signs of this stage are abdominal discomfort and restlessness.

Stage 2. Fetal Expulsion. This stage begins when the first fetus enters the pelvic canal, with visible abdominal contractions and ends with delivery of the last fetus. The time period from the first observed contractions until birth of the first pig is usually one to three hours, but may vary from several minutes to several hours.

Stage 3. Expulsion of Placental Membranes. Stage 3 completes the farrowing process. In the majority of farrowings, the placental membranes (afterbirth) are passed in one mass within one to two hours after the last pig is born. On occasion, a clump of placenta may be expelled before the last pig is born. Occasionally a piglet is born wrapped in its placenta.

## Outward Signs of Imminent Farrowing

If farrowings are to be attended or if special management changes are to be made (i.e., provision of supplemental heat) it is important to be able to predict, within a few hours, when a sow is about to farrow. In situations where breeding dates are known, gestation length can be of use in predicting the time of farrowing. However, the gestation length of sows can range from 109 to 121 days. Some commonly observed signs and when they often show up are listed below. These may be useful in management decisions, especially if breeding dates are not known or if attending farrowing is important.

Signs that farrowing is imminent:

1. Abdominal contractions (typically sow is in labor)
2. Nest building/restlessness (starts 2-3 days before farrowing)
3. Change in rectal temperature (increases 1 to 2 °F)
4. Expulsion of blood stained fluid from the vulva (typically sow is in labor)
5. Milk letdown (droplets often expressed for 2-3 days, if streams of milk expressed, farrowing will occur within 12 hours)
6. Expulsion of fetal fecal pellets from the vulva (sow is in labor)
7. Tail twitching (piglet is in birth canal)

## **Sow Behavior during Farrowing**

Increased activity of sows during Phase 2 can have implications upon piglet survival because of the increased risk of trampling or overlying (sow lying on piglets). Newborn pigs are likely to be in close contact with the sow where they are at risk when the sow rolls from side to side or stands and lays down. As farrowing nears completion the sow normally becomes more docile and less active.

## **Duration of Farrowing and Time Interval between Pigs**

Duration of farrowing, or time interval from the birth of the first pig to the last pig, may range from one to eight or more hours. There is a relationship between duration of farrowing and number of stillborn pigs in the litter. Sows which complete farrowing within two to two and one-half hours tend to have fewer stillborns than sows that have a longer duration. The average interval between live pigs is about 15 minutes, though they can come simultaneously or several hours apart. Recording birthing ease can be valuable when making culling decisions. A gilt with high incidence of farrowing difficulty or a sow with a high proportion of stillborn piglets, for example, should be carefully evaluated before giving them another chance to breed.

## **Presentation of Pigs at Birth**

Pigs are born in both anterior (head) and posterior (tail) first positions in about equal numbers. There is no relationship between the type of presentation and the frequency of stillbirths of other farrowing problems.

The umbilical cord of most pigs remains attached to the placenta until the pig is delivered. After delivery the cord pulls apart, and the placenta usually remains in the uterus until farrowing is complete. However, as farrowing progresses, the incidence of ruptured umbilical cords increases, which contributes to an increased number of stillbirths toward the end of farrowing.

Pigs are born according to their location in the uterine horns. The pig closest to the uterine body is born first. Pigs in the left and right horn are delivered at random. Pigs may be born alternately between horns; i.e., two or three may be delivered from one horn and then two or three from the other, or occasionally all pigs may be expelled from one horn before any are expelled from the other horn.

## **Attended Farrowings**

Studies have shown that attended farrowings result in at least an extra pig weaned per litter. Of course it may not be practical or economical to provide for supervised farrowings around

the clock. However, by understanding what is "normal" and what is "abnormal", it is often possible to save pigs during the normal working hours. Examples include: removing the placenta from newborn piglets to prevent suffocation, moving a newborn piglet that is caught under the sow or one that has wandered to a cool corner of the farrowing area, assisting a newborn piglet that has the umbilical cord around its neck, and providing assistance to piglets that are having difficulties in obtaining their first breath of air. Oxytocin, a hormone, may be helpful in sows experiencing a difficult birth. Oxytocin stimulates contractions of the uterine muscles and helps in expelling the piglets. Massaging the udder can release endogenous oxytocin and is a preferred first attempt at increasing contractions, though oxytocin is also available to be used as an injectable. Never administer oxytocin until it is determined that there are no pigs stuck in the pelvic birth canal.

### **Stillborn Pigs**

The incidence of stillborn pigs in many herds is five to ten percent of all pigs farrowed. Stillbirths are usually classified as prepartum (before farrowing) or intrapartum (during farrowing). Intrapartum deaths are the major cause of stillbirth pigs. Below are some observations related to stillborn pigs resulting from intrapartum complications.

1. Stillborn pigs have the outward appearance of live littermates, but their lungs do not float in water.
2. They are usually the result of noninfectious causes.
3. Stillbirths increase as duration of farrowing increases. More stillbirths occur toward the end of farrowing, in the last third of the litter. This is especially true for older sows and for larger litters.
4. Pigs located at the ovarian end of the uterine horn have a higher incidence than those located near the uterine body because they are born later in the birth order. More pigs located at the ovarian end are born with ruptured umbilical cords.
5. Pig fetuses have a low tolerance for anoxia (lack of oxygen). Brain damage or death can occur within five minutes after umbilical rupture or impeded umbilical blood flow (crimped cord). Many pigs born weak have suffered from anoxia, and their survival rate is low.
6. Stillbirths tend to be either the lightest or heaviest pigs.
7. In one study, the average time interval between one live pig until the next live pig was 17 minutes, and the time interval from a pig to a stillborn pig was 47 minutes.

### **Post-Farrowing Pig Behavior**

Following birth, pigs get to their feet and instinctively make attempts to reach the udder within minutes. Most pigs suckle within 45 minutes following birth. Within a few hours, piglets begin to establish a "teat order". This is a tendency for larger piglets to select or "claim" front teats while smaller piglets are relegated to the rear teats, and by 2-3 days post-farrowing piglets will nurse exclusively their select teat the remainder of lactation. Front teats are more popular for the following reasons:

1. Greater security. Piglets are safer from kicking.
2. Front teats secrete more milk.
3. Milk "let-down" may be more easily stimulated.
4. Spacing between teats is generally greater.
5. Teat length is longer.
6. Front teats are more available and better exposed.

Remember there is a considerable difference in size between the sow and her piglets, so care should be taken to reduce crushing. Creating a warm creep area away from the sow, using 'guardrails' in the farrowing pen or a farrowing crate, and keeping piglets dry and free of drafts help save pigs. Keeping the area dry can dramatically reduce bacterial contamination. Bacterial loads lead to increased incidence of scours, and piglets can become dehydrated quickly once scouring. The sow should be fed a highly palatable diet balanced for her expected level of milk production. The goal is to work her up to full feed rather quickly, and feeding sows more frequent meals can help achieve that. Assuring the sow also has ample cool, fresh water will go a long way to increasing feed intake. Remember that she will prefer a temperature of 55-65 °F, while for the first few days her piglets are more comfortable in the 90-95 °F range. Sows will normally lay on their side once piglets are born. When it is time to nurse, about once hourly, they initiate a distinctive grunting that alerts the piglets. The stockperson needs to recognize what is normal so they know when it is time to call for help. In many areas of the country help is available from local Extension offices, the herd veterinarian or other farmers. Some additional resources to consider reading are listed below.

**For more information:**

Natural farrowing behavior of the sow and her piglets

<http://porkgateway.org/FileLibrary/PIGLibrary/Factsheets/a6555v1-0.pdf>

How to Raise Pigs. P. Hasheider, 2008. Voyageur Press.

Storey's Guide to Raising Pigs. K. Klover, 2008. Storey Press.

Stockmanship. Lammers, P. J., D. R. Stender, and M. S. Honeyman, 2007. Niche Pork Production publication NPP710. Available from:

<http://www.ipic.iastate.edu/publications/710.Stockmanship.pdf>

Care of the sow during farrowing and lactation. Pork Industry Handbook, PIH 46

Baby pig management- birth to weaning. Pork Industry Handbook, PIH 18

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# Modern Heritage Swine Guide Series

## Feeding Pigs in Extensive Production

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By: Dale W. Rozeboom, Michigan State University

### Introduction

Extensive pork production<sup>2</sup> is often driven by the objectives of a market niche, what may be easiest to do when beginning to farm, and what generates some profit, rather than what is most efficient and costs the least. Extensive farmers may be willing to accept biologically inefficient production methods and more costly inputs compared to commodity producers, and consequently seek markets willing to compensate them for the unique product they produce. Their farms are not large enough to take advantage of economies of scale.

Like in the mid-20<sup>th</sup> century, today's extensive pork producers are raising pigs outdoors or in low-cost buildings. Initially, they manage feeds and feeding in those settings. New farmers are excited and may be willing to spend extra money if needed for the principles and beliefs they adhere to. They successfully sell to like-minded consumers. The excitement begins to wear off if customers stop buying because products are too expensive. If this happens, the new farmer must find ways to reduce costs or find customers willing to pay more in order for the farm business to be profitable. They must ask how they can decrease cost of production, and search for the most valuable change they can make to their current feed procurement plan; realizing that feed is the most expensive input.

In this bulletin, several management and procurement approaches are discussed relative to feeding pigs in extensive settings. Feed is available in ready-to-feed bags, ready-to-feed bulk, or growers can purchase ingredients and formulate their own. The cost of feed decreases with increasing responsibility for grinding, formulating, mixing, storage and quality control. Taking on responsibility for devising the nutritional program and making the feed must result in equivalent or improved production and a cost improvement that accounts for the added time and knowledge (more time formulating, buying individual ingredients, more automation for bulk procurement of ingredients, equipment and power to manufacture feed, automation for delivery to bins, and delivery to feeders).

### Meet Nutritional Requirements

Desirable growth, animal health and product quality are most readily obtained by providing pigs their daily nutrient requirements, each day. Feed ingredients are included to provide nutrients in one of four major categories: energy (often grains, cereals or high quality

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<sup>2</sup> The descriptive term used here is 'extensive' and represents the niche, small farm, back-yard, local, heritage, out-back, and (or) part-time producers who want to do it themselves, on their own property. Typically, the numbers of growing and reproducing pigs are 3-100.

forages), amino acids/protein (often soybean meal, or animal products), vitamins/minerals (often diet is balanced by adding a specific pre-mix of these) and water (fresh and clean unlimited). We think of growing pigs needing more protein to support muscle growth, with protein levels decreasing as the pig grows. Breeding animals normally are limit fed to prevent them becoming too fat, but once they farrow ad libitum feeding is best to support milk production.

Daily rations should be specific to the stage of growth and (or) reproduction, and they should provide minimum daily requirements suggested by the National Research Council (NRC)<sup>3</sup>. Understand that NRC guidelines are aimed at the majority of pigs, more of which are higher lean growth than most heritage breed pigs, and more often raised indoors. Because extensively reared pigs are typically outdoors for part each day, the requirements of NRC, which are minimum requirements, are sufficient because feed intakes are generally greater in extensive/outdoor situations. Further discussion about the basics of nutrition, ration formulation, intake allowances, and the contribution of grazing may be found *Swine Nutrition*<sup>4</sup> and the *National Swine Nutrition Guide*<sup>5</sup>, and a review about feeding swine in niche situations by Dr. Allen Harper (2012)<sup>6</sup>.

### **Buying Complete Feed**

Feed that is ready to be fed to pigs is referred to as a ‘complete feed’, as it contains all required nutrients. The ingredients may be grains, grain by-products, forages, dried animal products, minerals, and vitamins. These complete feeds are made at a feed manufacturing facility, which is sometimes a local grain elevator and sometimes a regional commercial feed mill. Complete feeds may be purchased from the local elevator, farm stores, or from an area feed dealer. Local elevators will provide feed in bulk or bagged. Feed from farm stores or dealers is typically in bags and referred to as ‘floor stock’. The potency of vitamins and minerals in a complete feed decreases with time, exposure to heat and moisture, and sunlight if in clear plastic. This is referred to as ‘shelf-life’, and the sellers and buyers of complete feed share responsibility for the quality of feed presented to the pigs. When you purchase a complete feed, you are buying their expertise in knowing the dietary requirements, nutrient availability in the feedstuffs used in the mix, grinding and mixing, and quality control. With the purchase of the complete feed, you do not grow or buy the feed ingredients. You do not have to store feed ingredients and be concerned about loss of nutrition, pest infestation, and spoilage.

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<sup>3</sup> NRC. 2012. Nutrient Requirements of Swine. 11th rev. ed. Natl. Acad. Press, Washington, DC.

<sup>4</sup> Swine Nutrition, Second Edition, Ed's Austin J. Lewis and L. Lee Southern, CRC Press 2000. Print ISBN: 978-0-8493-0696-9. eBook ISBN: 978-1-4200-4184-2.

<sup>5</sup> National Swine Nutrition Guide. 2010. U.S. Pork Center of Excellence. 1202 NSRIC, Iowa State Univ., Ames IA 50011.

<sup>6</sup> Harper, A. F. 2012. Feed and feeding options for small-scale and niche market pork production. Proc. Small-Scale and Niche Market Pork Production Conf. Tidewater Agricultural Research and Extension Center (TAREC), Suffolk, VA, October 26 – 27, 2012. Available at: <http://www.arec.vaes.vt.edu/tidewater/files/proceedings-pork-production.pdf>.

The complete feed made by small local grain elevators is typically in meal form. Larger commercial feed mills often make feeds in pellet form. Pelleted feed is more expensive. The first advantage of pelleted feed is that pigs cannot sort through their feed, so each bite represents the balanced diet as designed. The second advantage of pelleted feed is that the pigs waste less feed and the feed-to-gain ratio is more desirable. With a well-designed feeder, more frequent small meals, and less feed wastage, the feed-to-gain ratio of pigs receiving feed in meal form can be equal to those received pelleted feed. Taking measures to minimize feed waste, regardless of feed form, may have far greater economic payback than changing your procurement approach from buying complete feed to some degree of at-home mixing. If you see feed on the ground around a feeder you know you are wasting over 10%.

### **Shop for Best Feed Price**

One day in December of 2014, three elevators and one local farmer (with 6000 sows and an on-farm mill) were asked the cost of one ton of a 15% crude protein finishing ration. The answers received were \$251, \$320, \$256, and \$141 per ton. Take time to call or visit elevators in your vicinity to shop for a less expensive price. Investigate if it is possible to negotiate feed price based on a larger quantity and a commitment to buy for an extended period of time. When buying from a mill or elevator that you have not used before, ask other customers how their pigs have performed on the ration you are considering.

Do your best to evaluate nutritional equivalency when shopping by comparing feed tags. All commercially available feeds must be labeled, and that label must include a guaranteed analysis stating the nutrient concentrations guaranteed by the manufacturer<sup>7</sup>. Concentrations of all trace minerals (copper, zinc, iron, selenium, manganese, and iodine) and vitamins (A, D<sub>3</sub>, E, K, B<sub>12</sub>, riboflavin, pantothenic acid, niacin, choline, biotin, folic acid, and pyridoxine) may not be presented on the feed tag, but they are important and rations must be balanced for them. The feed tag must also include the common name of each ingredient. Some states permit use of 'collective terms' for ingredients of similar type (common origin and similar function). This allows the manufacturer to substitute one ingredient for another as market prices fluctuate. In contrast, some feed manufacturers use a locked formula where feed products are made using the same ingredients time after time. Feed milled according to a locked formula may fluctuate more in price with ingredient availability. Additional information needs to be included on the label (Figure 1) if a medication has been added to the feed.

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<sup>7</sup> Nutrients which must be guaranteed are determined by each state's government agricultural agency.

## Phase 4

### Feeding Program

For starter pigs weighing 25 to 45 pounds.

#### Guaranteed analysis

**Crude Protein min. 21.1%**

**Lysine min 1.3%**

**Crude fat min. 3%**

**Crude fiber max 3.5%**

**Calcium min 0.7%, max 0.9%**

**Phosphorus min 0.59%, max 0.8%**

**Salt min 0.2% max 0.4%**

**Selenium max 0.3 ppm**

**Zinc min 2700 ppm**

#### Ingredients

Grain products, plant protein products, vegetable and animal fat, animal protein products, bakery by-product, dicalcium phosphate, calcium carbonate, salt, vitamin A acetate, vitamin D<sub>3</sub> supplement, vitamin E supplement, menadione as MPBa, vitamin B<sub>12</sub> supplement, riboflavin, d-calcium pantothenate, biotin, folic acid, pyridoxine hydrochloride, zinc oxide, ferrous sulfate, manganese oxide or sulfate, copper sulfate, thylenediamine dihydriodide, sodium selenite, lysine hydrochloride, DL-methionine.

#### Feeding directions

Feed as sole ration to pigs weighing 25 to 45 pounds.

Manufactured by Barton Farm Co, Homer MI

MM.DD.YY

Net weight bulk.

Figure 1. Example of the information found on a feed tag.

## Bulk or Bagged

Feed bins, wood, metal or plastic, allow for the storage of 'tons' of feed. The price benefit of buying complete feed in bulk may be significant. The cost advantage may pay for a used or new bin in a few years if the number of pigs you feed annually is large enough. The price difference between bulk and bagged complete feed will be specific to the feed mill and the distance from the mill to your home. The price advantage with purchasing bulk feed is obtained with quantities of one ton or more. Many local elevators cannot make smaller quantities easily and accurately. Most mixers are not made to uniformly mix 500 pound batches, and the charge to make a batch of less than one ton has either the same "mix" cost as one ton, or may even be greater. Building your own bins from wood may be cheapest. Wood, however, is very difficult to sanitize if that becomes necessary following exposure to a pathogen, mold, mycotoxin or other anti-nutritional factor.

For an example, let's say that the price of bagging is \$15 per ton, and the price of a new galvanized steel bin is \$1250, the purchase of about 84 tons of feed in bulk instead of bags would pay for the bin. The cost of the bin may be spread over several years, making the prospect of payback achievable with even fewer pigs. Thus, the factor in making a decision to

purchase a bulk feed bin, is having enough pigs to consume at least a ton of a specific diet. North Carolina State University in their Swine Nutrition Guide<sup>8</sup> states that a sow and her 18.5 pigs will consume 7.3 tons of feed annually in a distribution (column heading “% of total”) as shown in Table 1. The right-hand column shows the estimated number of animals (pigs or sows) that need to be in a cohort to consume one ton of feed. So it takes at least 254 nursery pigs to consume one ton of their first diet and it takes at least 5 nursing sows to consume a ton of lactation feed. Likewise, only 20 feeder pigs will justify the purchase of bulk feed for rearing to harvest weights.

Diet	Typical weight, lbs.	% of total	Number of animals to consume one ton of feed
Starter 1	12-15	1	254
Starter 2	15-25	2	127
Starter 3	25-50	3	85
Grower 1	50-125	13	20
Grower 2	125-200	20	13
Finisher	200-mkt	45	6
Gestation	350-500	10	3
Lactation	350-500	6	5

If one ton of feed is too much for the number of pigs you plan to feed, then various consequences need to be considered. With too few pigs being fed in a given growth period on the small farm, then you may feed them a diet longer, which is over-fortified for them. Or you may feed an under-fortified diet early, as it is cheaper. Underfed pigs grow more slowly and deposit less lean mass, particularly when 2 to 4 months of age. This results in less product, and the butcher or customer saying that the hogs are “too fat and there is not enough ham.” Overfeeding is a waste of money and a greater environmental responsibility as excess nutrients are excreted. If one ton of feed is too much, consider whether it may be possible to split orders with other farms in close proximity. Many small farms will need to purchase starter feed in bags, but may be able to take advantage of bulk pricing for feed for market hogs or sows.

### Mixing Complete Feeds

If one ton of feed is too much, you may consider planning ahead for the mixing of two different complete feeds. This can be advantageous as it still allows you to purchase feeds in one-ton quantities which is less expensive than buying smaller quantities. Mixing two complete diets together eliminates the over-feeding of nutrients as pigs get older and the under feeding of pigs in cases where the price of feed encourages the avoidance of purchasing too much of the expensive starter diet. Mix proportions of a “dense” ration with a “less dense” ration to get a “moderately dense” ration. For example, a grower 1 diet containing 1.1% total lysine could be mixed 1-to-1 with a finisher diet containing 0.8% lysine, and the resulting feed would be 0.95% lysine and appropriate as a grower 2 diet. This simple example assumes that other amino acid concentrations will be portioned similarly and that the minerals and vitamins in both the grower 1 and finisher diets are equal. If not similar, then the ‘mixed diet’ should be

<sup>8</sup> Swine Nutrition Guide. Feed processing. North Carolina State University, Available at: [http://www.cals.ncsu.edu/an\\_sci/extension/swine/nutrition/nutritionguide/default.htm](http://www.cals.ncsu.edu/an_sci/extension/swine/nutrition/nutritionguide/default.htm).

evaluated for any estimated concentrations that do not meet the minimum of NRC guidelines (2012)<sup>2</sup>. You can blend by the scoop, bucket or bushel basket full. You use the feed quickly and avoid loss of available nutrients with extended storage. You do not have to store feed until the next reproductive cycle, when you have pigs of a given maturity once again. And you do not have to own a grinder-mixer.

### **Topdressing**

Purchasing one ton of bulk complete feed may still be an option, even if you do not have enough pigs to eat all of it in an appropriate amount of time. With topdressing, one ton of a “less dense” ration is purchased, and then daily portions are top-dressed with soybean meal or another protein source with each feeding. You may buy one bag of soybean meal at a time. The amount of soybean meal will vary and decrease as pigs grow; anywhere from a quarter to one full cup (about 150 grams) per pig per day. One cup of 47.5% soybean meal provides about 4.7 g of lysine. The farmer who grows soybeans or other protein sources can use these to topdress, keeping in mind that soybeans must be cooked or steamed prior to feeding.

### **Grind and Mixing Feed at Home**

A farmer may grind and mix their own rations if they have accurately determined that the cost savings in doing so are real. The cost of procuring all ingredients, equipment, delivery, processing, interest, depreciation and labor must be considered. The decision to process feed on the farm must not only be cost effective, but also requires that the owner be responsible for being knowledgeable about formulations and feed quality.

Feed processing on the farm can be done with varying amounts of complexity. Most simply, a PTO drive grinder mixer may be used to grind grains and mix with a purchased complete supplement, often called a ‘vitamin and mineral mix’, or ‘vitamin-mineral pre-mix’, which includes all other ingredients. As the size of the swine enterprise increases, justification for complexity increases, and a farmer may consider purchasing individual lots of a protein source, a calcium source, a phosphorus source, salt, a trace mineral premix, and a vitamin premix. In an older Pork Industry Handbook bulletin, Bloome and others<sup>9</sup> suggests 200 to 400 tons per year (30 to 60 sows farrow-to-finish) as the break-even volume of feed for a PTO grinder-mixer. The North Carolina State University Swine Nutrition Guide <sup>7</sup> suggests that 500 to 750 tons of feed per year justify use of a stationary mill and mixer for on-farm feed processing. It takes about 70 to 100 sows in farrow-to-finish production to justify raising corn, oats, or other grains and the costs of labor, transportation, feed manufacturing, and feed storage. Other questions to consider when deciding whether to process feed on-farm are presented in a Pork Information Gateway resource by Holden and Starkey<sup>10</sup>.

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<sup>9</sup> Bloome, P., A. Jensen, L. Rottman, and E. Rothenberger. 1990. On Farm Feed Processing. Pork Industry Handbook, E-1064.

<sup>10</sup> Holden, P. and C. Starkey. 2012. Should I purchase or make my own feed? Pork Production How-To: Pork Information Gateway  
[http://www.porkgateway.org/FileLibrary/PIGLibrary/HowTos/Should%20I%20Purchase%20or%20Make%20My%20Own%20Feed%20WITH%20NEW%20NUMBER\\_.pdf](http://www.porkgateway.org/FileLibrary/PIGLibrary/HowTos/Should%20I%20Purchase%20or%20Make%20My%20Own%20Feed%20WITH%20NEW%20NUMBER_.pdf)

## Alternative Feedstuffs

Periodically, extensive producers have access to a surplus low-cost byproduct which they would like to feed to swine. These vary considerably in nutrient profile and availability based on location and season, making general guidelines for their use challenging. The challenges with feeding these alternative feedstuffs are: knowing nutrient availabilities and amino acid relationships in that alternative feedstuff. Thaler and Holden<sup>11</sup> have provided upper inclusion limits (amount or percentage) for various alternative feedstuffs. Farmers should seek the advice of a nutritionist, extension specialist, or consultant to evaluate ingredient and finished feed quality. When managed appropriately, there are many local sources of vegetables, dairy whey, root crops, and other alternative feeds that add variety to pigs' diets and may reduce feed costs. Older swine husbandry books, some now available electronically, have nutritional values for some of these alternatives, but growers must recognize that there can be considerable variation around these averages.

## Pasture and forage

Many extensive producers raise their herds on pasture or in woodlots, and the right kind of forages can add significant nutrients to swine feeding programs. For example, sows on good quality pasture can be fed less often and with a smaller amount of concentrate<sup>12</sup>. Forage adds protein, fiber, and essential vitamins and minerals to the diet, but should not be considered as a substitute for a grain-based complete diet. The nutritional value of forages depends upon the type and quality of plants in the pasture. As a rule of thumb, high quality forage can substitute for up to 20-30% of the diet. At the 20% mark, the farmer should consult with a nutritionist to make adjustments in formulation of the complete diet to ensure all nutritional requirements are being met. Opportunities for foraging grain or crop fields after harvest may be available seasonally. Silage may also be fed to sows<sup>13</sup>, if protein and energy levels are maintained at appropriate levels in the overall diet.

## Feed Co-op

In the history of swine production in North America, we can read about the formation of producer cooperatives. This is another historical approach which extensive swine farmers can consider. Like-minded extensive farmers can more easily experience the economies of scale by cooperatively buying complete feed or feed ingredients in larger quantities. Historically, this was referred to as a 'feed co-op.' If large enough, they could save substantial amounts of

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<sup>11</sup> Thaler, B. and P. Holden. 2010. By-product feed ingredients for use in swine diets. Pork Information Gateway Factsheet PIG 07-06-01. Accessed at: <http://www.porkgateway.org/FileLibrary/PIGLibrary/Factsheets/a6467v1-0.pdf>

<sup>12</sup> Kephart, K.B., G. R. Hollis, and D. M. Danielson, 2006. Forages for swine. Pork Information Gateway Factsheet 07-06-04. Accessed at: [http://www.porkgateway.org/FileLibrary/PIGLibrary/Factsheets/07-06-04g\\_c052006.pdf](http://www.porkgateway.org/FileLibrary/PIGLibrary/Factsheets/07-06-04g_c052006.pdf)

<sup>13</sup> Wheaton, H.N. and J. C. Rea, 1993. Forages for Swine. University of Missouri Factsheet G2360. Accessed at: <http://extension.missouri.edu/p/G2360>

money by buying other supplies and equipment together as well. Of course the co-op needs to be managed and records maintained, so this benefit is not without some expense or effort.

### Summary

Often mentioned in nutrition discussions is the fact that feed typically represents 60 to 75% of variable production costs in pig production. Extensive farmers looking to decrease feed costs must decide if the reduction in all costs with using a potential alternative does exist, and that they have the ability to control the quality of processing and presentation. The feed procurement approach should achieve desirable nutrition, health and productivity.

### Additional information:

<http://www.clemson.edu/psapublishing/pages/ADVS/EC509.PDF>

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# Modern Heritage Swine Guide Series

## Meat Processing

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By: Gregg Rentfrow, University of Kentucky

### Introduction

Raising heritage pig breeds is becoming a popular niche market. Farmers are using more historical management and feeding strategies to create a unique product. To capture the full economic value of the animal, most heritage pork is marketed through on-farm and/or farmer's market sales, or to white table cloth restaurants. Federal laws and regulations must be followed to sell meats. In addition, heritage pig carcass yields are different when compared to traditional market hogs. Understanding the laws and the carcass differences will aid farmers in decision making.

### Meat Inspection

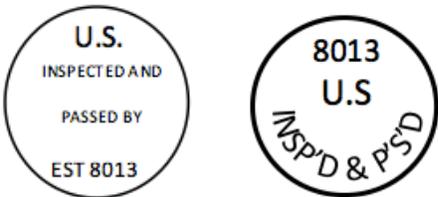
Chicago's Union Stockyards and Transit Company opened its doors in 1865, signifying the beginning of the modern livestock and meats industry. The spirit of the original business model, along with some of the techniques developed at Union Stockyards, are still practiced today. Union Stockyards' most significant contribution is the Federal Meat Inspection Act. Author Upton Sinclair penned a book called *The Jungle* in 1906, which described some unappetizing methods used by the industry. Public outrage forced the U.S. government to pass the Federal Meat Inspection Act of 1906, which mandated that all meat intended for interstate commerce be inspected by the government. Basically, all meat and meat products intended for sale must be inspected, regardless of the size of the farm or the amount of product sold. No exceptions. The meats industry still operates under the heart and soul of the original document; however, the original Federal Meat Inspection Act and new acts and regulations are continually being added and up-dated.

Meat inspection, in general, is designed to ensure the wholesomeness of fresh and processed meats. The inspector oversees the humane handling and slaughter of the live animals, verifies that the meat is fabricated and processed in a clean, sanitary environment, and that all meats and meat products are properly labeled. There are three types of meat processors: federally inspected, state inspected, and custom.

### Federal and State Inspection

The United States Department of Agriculture – Food Safety and Inspection Service (USDA-FSIS) provides federal meat inspection. Fresh and processed meats made under federal

inspection can be sold in all 50 states, and will display the round inspection legend on each package.



Traditionally, state departments of agriculture provide state meat inspection services. State meat inspection must be equal to or better than federal inspection. Fresh and processed meats from state meat inspected plants can only be sold within said state. For example Missouri inspected meats can only be sold in Missouri and not in Illinois, Iowa, Kansas, etc. Working with state inspected meat plants can limit the market for heritage pig farmers, especially those close to a state borders or those selling via mail order. Normally, state inspection legends are in the shape of the state, rather than the round USDA inspection legend. A listing of states and contacts within those states can be found at:

<http://www.fsis.usda.gov/wps/portal/fsis/topics/inspection/state-inspection-programs/state-inspection-and-cooperative-agreements/state-officials>

### **Custom Processors**

Custom processed meats cannot be sold legally. The vast majority of meat processors are custom operators. The farmer pays the custom meat processor to slaughter and fabricate the animal, which is stamped 'Not for Sale', and the meat is intended to be consumed by the owner of the animal. Selling custom processed fresh and processed meats is illegal.

### **State and Local Health Departments**

On-farm sales and farmer's markets are common venues to sell local meats. The local and/or state health department should be notified before selling meat off the farm. The health department wants to make sure only inspected meats are sold, as well as evaluate how it is packaged, labeled, and stored. Furthermore, most organized farmer's markets have rules that must be followed. Farmer's markets will follow the aforementioned rules, assuring that frozen meats stay frozen and refrigerated meats stay cold throughout the sales day. Contact the farmer's market organizers for specific rules.

### **Working with meat processors**

The heritage pig farmer/direct marketer may find working with meat processors to be challenging. Most meat processors may be booked months in advance, which is a common

complaint. Some meat processors will work with direct marketers to establish a recurring appointment on the slaughter schedule, but processing needs will have to be communicated clearly to the processor.

Meat processors have their own language and assume you understand the vocabulary. Not knowing the terms can be frustrating; below are a few of the most common terms:

**Dress or Dressing Percentage** – the percentage of the hot carcass weight in relation to live weight, or how much of the live pig is left hanging as a pork carcass ( $\text{Hot carcass weight} \div \text{Live weight} \times 100$ ). The average pork carcass dressing percentage will be around 70% of the live weight. The dressing percentage can be affected by gut fill, time the live weight was recorded (pigs can lose 10+lbs overnight), and the amount of fat/muscle.

**Shrink** – due to evaporative cooling, carcasses can lose 3 to 5% of the hot carcass weight during the first 24 hours. Meat is 70 to 75% water, which makes it susceptible to evaporative loss. Fat on the carcass acts as insulation/protection against shrink, therefore fatter carcasses are more protected and may be expected to shrink less during cooling.

**Yield** – the amount/percentage of retail product from the carcass; i.e., after you cut the carcass into what you would put on the plate (remove spine, excess fat etc.), what's left?

**Trim loss or cutting loss** – the amount of the carcass weight lost during fabrication. Fatter carcasses will have a higher cutting loss. And heritage breeds of pigs tend to be fatter than traditional breeds, there will be a higher trim loss. This can be thought of as the opposite of Yield.

The quality of the retail cuts is another common complaint when working with processors. Most USDA inspected facilities have a retail sales area. The quality and/or craftsmanship of the cuts on display are a reflection of what you will receive. Open communication is the key to a healthy working relationship. If you are not happy with the quality of the work, discuss your frustrations with the meat processor and give them the opportunity to rectify the problem. Take time to choose a meat processor you can work with.

### **Carcass Quality Characteristics and Yields**

Decades of genetic selection have created a faster growing, leaner modern pig. However, the growth and carcass characteristics of heritage breeds of pigs are different; below are tables comparing some genetic sources. Research conducted at the University of Kentucky and Berea College evaluated characteristics of various heritage hog breeds.

Eight heritage pig breeds ( $n = 7$  per breed; Guinea, Hereford, Large Black, Mulefoot, Gloucestershire Old Spot, Ossabaw, Red Wattle, and Tamworth) were raised outdoors on 1.5

acres of fescue pasture, along with other grasses and broadleaf weeds, at Berea College (Berea, KY). Deep-bedded hoop structures ( $n = 3$ ) were provided to protect animals from the elements. Pigs were provided a diet consisting of ground corn, soybeans, and Fertrell swine premix (Bainbridge, PA), along with water, *ad libitum*.

Pigs were transported to the University of Kentucky Meat Science Laboratory (Lexington, KY; approximately 45 miles) for humane slaughter under USDA–FSIS inspection. Carcasses were allowed to chill (38°F) overnight before carcass data were collected on the lefthand side of the animal (last lumbar, last rib, and first rib backfat depth, along with 10<sup>th</sup> rib backfat and loin eye area) (Table 1). Carcasses were fabricated into fresh wholesale cuts according to Institutional Meat Purchasing Specifications (IMPS); Boston Butt (IMPS 406), Picnic (IMPS 405), Loin (IMPS 410), Sparerib (IMPS 416), Belly (IMPS 408), and Ham (IMPS 401; Table 3). Note that carcass measurement and yields are averages of seven animals per breed; data have not been statistically analyzed for comparison.

**Table 1.** Carcass characteristics of eight heritage pig breeds ( $n=7$ /breed).

Breed	HCWT <sup>1</sup>	1 <sup>st</sup> Rib FD <sup>2</sup>	Last Rib FD <sup>2</sup>	Last Lumbar FD <sup>2</sup>	10 <sup>th</sup> Rib FD <sup>2</sup>	Loin Eye Area <sup>3</sup>	%Muscle <sup>4</sup>
Guinea	140.4	3.11	2.13	2.2	2.5	2.9	24
Hereford	252.1	2.19	1.91	1.66	1.99	6.8	42
Large Black	229.4	2.66	2.07	2.61	2.66	4.2	32
Mulefoot	208.8	2.55	1.87	1.82	2.18	4.18	36
Old Spot	156.0	2.05	1.40	1.20	1.25	5.3	46
Ossabaw	187.9	3.49	2.03	2.16	2.53	4.3	31
Red Wattle	223.8	2.75	1.92	2.07	2.12	4.53	37
Tamworth	231.0	2.09	1.59	1.41	1.81	6.09	43

<sup>1</sup> HCWT, Hot Carcass Weight, lbs.

<sup>2</sup> FD, Fat Depth, measured in inches.

<sup>3</sup> Loin Eye Area, measured in square inches at the 10<sup>th</sup>/11<sup>th</sup> rib interface.

<sup>4</sup> % Muscle,  $(7.231+(0.437*HCWT)-(18.746*10^{th} \text{ Rib FD})+(3.877*LEA))/HCWT$ .

**Table 2.** Pork loin eye quality data evaluated at the 10<sup>th</sup>/11<sup>th</sup> rib interface.

Breed	Color <sup>1</sup>	Marbling <sup>2</sup>	Firmness <sup>3</sup>	L*-value <sup>4</sup>	a*-value <sup>4</sup>	b*-value <sup>4</sup>
Guinea	3.4	5.1	3.5	55.40	9.25	14.24
Hereford	3.6	2.7	3.5	55.36	10.72	15.16
Large Black	3.7	3.1	3.7	54.26	10.33	14.81
Mulefoot	3.5	3.1	2.7	45.08	9.34	12.99
Old Spot	3.7	2.8	3.7	56.96	7.88	14.86
Ossabaw	4.7	2.7	4.0	58.98	11.67	11.98
Red Wattle	3.0	4.0	3.7	55.77	9.74	14.78
Tamworth	3.7	3.1	3.6	57.71	9.52	17.41

<sup>1</sup>Color (NPPC), 1=Pale pinkish gray, 2=Grayish pink, 3=Reddish pink, 4=Dark reddish pink, 5=Purple pink, Dark purple red.

<sup>2</sup>Marbling (NPPC), subjective measurement of the percentage of marbling within the loin eye.

<sup>3</sup>Firmness (NPPC), 5 point scale where 1=soft to 5=very firm.

<sup>4</sup>CIE L\*-value 0=black, 100=pure white, a\*-value measure of red (+) to green (-), b\*-value measure of yellow (+) to blue (-).

**Table 3.** Pork carcass wholesale cut yields by breed.

Breed	Boston Butt (lbs) <sup>1</sup>	Picnic (lbs) <sup>2</sup>	Loin(lbs) <sup>3</sup>	Sparerib (lbs) <sup>4</sup>	Belly (lbs) <sup>5</sup>	Ham (lbs) <sup>6</sup>
Guinea	3.89	5.4	9.34	1.78	14.49	11.66
Hereford	9.14	11.66	22.56	3.99	20.85	26.91
Large Black	7.42	9.50	19.86	2.76	18.90	21.22
Mulefoot	6.63	8.71	13.02	3.59	17.77	20.05
Old Spot	6.95	6.68	13.35	2.98	9.33	16.10
Ossabaw	5.37	8.29	13.81	2.77	18.26	16.01
Red Wattle	7.00	7.88	13.89	3.73	19.19	21.43
Tamworth	8.44	11.08	21.06	3.68	18.34	23.93

Wholesale cuts fabricated according to Intuitional Meat Purchasing Specifications (IMPS).

<sup>1</sup>Boston Butt = IMPS 406, <sup>2</sup>Picnic = IMPS 405, <sup>3</sup>Loin = IMPS 410, <sup>4</sup>Sparerib = IMPS 416, <sup>5</sup>Belly = IMPS 408, <sup>6</sup>Ham = IMPS 401.

Among the heritage breeds, the Guinea hogs were the smallest framed breed in the study, which explains why they had the lightest hot carcass weight. Furthermore the Guinea breed was the fattest at all depots and the lightest muscled, as indicated by the percentage of muscle. The Old Spot (Gloucestershire Old Spot), Tamworth, and Hereford were the only breeds with a percent muscle above 40%; industry average for commodity breeds is around 50%. The NPPC color, marbling, and firmness scores, along with L\*, a\*, and b\*-values, are within industry averages for all breeds evaluated. The wholesale yields are an average for the breeds evaluated in this study and should only be used as a guide for how much to expect from the meat processor.

**Table 4.** Carcass characteristics from conventional maternal swine genetic lines mated to Duroc boars, for comparison.

Breed	HCWT <sup>1</sup>	10 <sup>th</sup> Rib FD <sup>2</sup>	Loin Eye Area <sup>3</sup>	% Muscle <sup>4</sup>
ADSG	189.6	0.94	6.4	51.2
DB	191.8	0.79	7.0	50.1
DK	191.8	0.91	6.7	53.9
GPK347	185.2	0.91	6.4	55.2
NH	187.4	0.79	6.8	53.7
NSR	189.6	0.87	6.6	52.4

<sup>1</sup> HCWT, Hot Carcass Weight.

<sup>2</sup> FD, Fat Depth, measured in inches.

<sup>3</sup> Loin Eye Area, measured in square inches at the 10<sup>th</sup>/11<sup>th</sup> rib interface.

<sup>4</sup> % Muscle,  $(7.231 + (0.437 * \text{HCWT}) - (18.746 * 10^{\text{th}} \text{ Rib FD}) + (3.877 * \text{LEA})) / \text{HCWT}$ .

Adapted from Cassady et al., 2004, percentage of muscle calculated from reported averages.

ADSG = American Diamond Swine Genetics (Prairie City, IA), DB = Danbred USA (Seward, NE), DK & GPK347 = Monsanto Choice Genetics (St. Louis, MO), NH = Newsham Hybrids (Colorado Springs, CO), NSR = National Swine Registry (West Lafayette, IN; Landrace x Large White).

Table 4 shows the results of the National Pork Producers Council maternal line genetic evaluation study (Cassady et al., 2004). Pigs were fed a traditional corn – soybean meal diet and penned by sex, rather than breed. The pigs were harvested when the pen live weight

averaged  $253 \pm 13$  lbs. The pigs were on test for  $75 \pm 17$  days, and the carcasses were allowed to chill for 24 hours before carcass measurements were taken. These data are provided to give an idea of how the heritage breeds differ in carcass composition from commodity pigs. This will be valuable to understand as you work with the meat processor and with your customers.

### **Packaging and Labeling**

Historically, fresh meats were packaged, sold, and frozen in waxed butcher paper. However, frozen meats wrapped in butcher paper are susceptible to freezer burn. Air interacts with the surface of frozen foods, causing dehydration and/or ice crystal formation on the surface. Freezer burn is not a food safety issue, but the dark, dehydrated spots on the surface have been reported to have undesirable, oxidized, cardboard flavors. Vacuum packaging provides an air tight seal, thus reducing or eliminating freezer burn. The average consumer may purchase a side or a large quantity of pork and store it frozen for future meals. Vacuum packaging will ensure that the last piece of pork out of the freezer will taste as good as the first package. Vacuum packaging may cost more, but the repeat sales and consumer satisfaction are often worth the extra costs for the added customer satisfaction for those selling large quantities of meat.

Labeling meat can be as simple as the total price on the package, but as the business grows into other markets, labeling can become more complex. Traditionally, labels display the name of the retail cut, the weight of the meat, and price per pound, along with the total price, and 'expiration' date; however, labels also may display the inspection legend, the name of the farm, and safe handling instructions. Check with your local farmer's market and health department on the regulations for proper labeling where you plan to sell meat. Most meat processors will be willing to work with you on proper labeling and packaging.

### **Processed Meats**

Over 70% of the pork carcass can be further processed into items such as bacon, ham, and sausage. Heritage pig breeds are ideal for processed meats. There are several artisan meat curers, throughout the country, that are using old-world European techniques to produce high quality products. These processors are looking for heritage breeds to help them further create unique, high quality cured pork products. Heritage pig farmers should make contact with these artisan meat curers and hopefully create a new revenue stream for the farm.

### **Conclusion**

Heritage pigs are becoming more popular in the local food movement and are an excellent way to add value to the farm. Some breeds tend to be fatter and lighter muscled when compared to the modern, conventional market hog. Therefore, these animals are not intended for the commodity market, but should be marketed through farmer's markets, on-farm sales

and/or white table cloth restaurants or direct to chefs and curers in order to capture the full economic value. Although a farmer may only sell a small amount of meat annually, it still has to be inspected prior to sale. Successful heritage breed farmers will cultivate a positive relationship with their meat processor. Please contact your local Extension agent for aid.

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# Modern Heritage Swine Guide Series

## Marketing your Heritage Pork Products

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Marketing is the process of generating goodwill toward your farm and products. Through communications and activities, you and others promote a favorable relationship with your customers. To be successful with heritage breeds, it's important to understand the dynamics of marketing. It seems obvious to say, but unless farmers have customers for their animal products, they cannot make a living. Fortunately, interest in local foods continues to grow throughout the country, and heritage breeds aptly fit within this growing niche.

Consumers are becoming more and more interested in the origins and impacts of the food that they purchase, and want to buy more locally produced foods. Finding these potential customers and communicating about your product in a way that encourages people to buy is what marketing is all about.

### **Who are your customers? Where will you find them?**

By understanding why consumers purchase local meats, farmers raising heritage breeds can communicate to customers how their products fit these interests. Your potential customers are “Big Picture” people concerned with flavor, quality, and environmental and social factors in their food purchase. Your customers consider more than savings when making food choices. They will pay more for your pork and sausage because they believe in buying local food from local farms, because your pigs represent an important link to biodiversity, and because they love the flavor and texture.

Most of your customers will come from urban areas. USDA data indicate that more than 84% of direct-to-customer farm sales occur in counties immediately adjacent to metropolitan areas (Martinez et al., 2010). Urban areas are more affluent, may be more influenced by food trends, and just plain have more people. If you aren't lucky enough to be near these markets, you will need to investigate marketing methods that help get your products to where they are most likely to find an appreciative audience.

### Why do they buy from you?

Potential consumers may be divided into three categories: traditional, foodies, and green consumers. *Traditional* consumers have always bought from their neighbors and may base food buying on personal relationships with farmers. Traditional also includes consumers with cultural connections to their food – for example, first generation immigrants seeking pork that tastes like what they knew as a child. These buyers often purchase whole or half pigs, or even on the hoof, and seek price and value over a story or social cause. They are often loyal to the first farm that they have a good experience with. *Foodies* are enthusiastic about foods and seek out new flavor experiences. They have become wholehearted supporters of heritage pork products. Foodies tend to be the least sensitive about the price of food, and are often the most involved. *Green* consumers turn to local foods to reduce environmental impacts, and may be concerned with health and nutrition. They want information about how animals are raised and treated on the farm, such as whether your pigs are pasture raised. *Green* consumers also want to support the local economy and social causes. They want to hear the stories of heritage breeds, the farms they are raised on and the farmers who raise them.

*Drawn from "Tips for marketing in the local meats market", M. LeRoux, 2010.*

Accessed at

<http://publications.dyson.cornell.edu/docs/smartMarketing/pdfs/SmrtMktg%20Sep2010.pdf>

### Direct marketing strategies

There are many ways to sell heritage breed products, and with some planning and experimentation you will find the ones that are right for you. Using several strategies is likely to improve your chance of financial success with heritage breed products. It can help to even out your income, and prevent relying too much on any one customer. Developing different customer bases also helps make sure you aren't left with too much of any one product in the freezer, and your kids don't have to help eat it up *every* day.

### Friends & neighbors

Sales to people you already know are often the first sales of a new farm, and can be a great way to get started. Use these opportunities to get comfortable with selling, practice your marketing message, and ask for feedback about price; the feedback you get may help highlight some of the positive attributes of your product and be used as testimonials in future marketing efforts. Be sure you are compliant with state and local regulations, such as obtaining a meat handler's license, before arranging sales. If your customers will pick up orders at your farm, find safe ways for customers to visit your farm without threatening the health and security of your pigs. To plan for biosecurity on your farm, visit: <http://bit.ly/1On470V>

Promotion to people you already know is mostly via word of mouth and business cards. Sell whole or half pigs and sausage. This doesn't mean your customer has to butcher their own pig, just that they have reserved all of the cuts from a whole or half pig ahead of time. You may even ask them to pick up the pig directly from the processor, which would allow you (and the customer) to use a custom processor. Selling the entire pig means you don't have to fuss with selling individual cuts. Selling to friends and neighbors can be very profitable if you are good at marketing, so spread the word through all your social networks such as your schools, gym, church, and businesses who know you.

### **Farmers markets**

Farmers markets attract customers who are keen on buying local and healthy products. Market policy and local ordinances may limit whether you can sell meat on the spot at the market, and the number of customers at different markets can vary, so plan well in advance. In most states, a meat handler's license is required, and you will need a means to keep products at safe temperatures. With these in place, a variety of products can be sold with broad appeal to regular customers and those just "stopping by". A black board or other signage informs customers what products are available this week, or what to expect next week.

First time customers at farmers markets typically want to buy cuts and products they are already familiar with. Less popular cuts can be harder to sell, so a combination of pricing, education (recipes, etc.), and taste tests will help make sure you aren't overstocked.

Most markets require stalls to be manned during regular hours, and this time off-farm must be considered. On the other hand, farmers markets offer the opportunity to develop relationships with one's customers. Customers enjoy hearing about you, farm happenings, and the story of why and how you farm. These personal relationships are important to building a base of repeat customers. Getting acquainted with your customers has other benefits, too. You will learn their tastes and needs, and receive feedback to make your products more appealing and to set prices right. There are many ways to connect and speak to people, which make farmers markets a great place to turn a profit and do market research simultaneously.

#### **Your marketing story**

No matter how or where you sell, it's important to develop your story. The farm life holds endless fascination for your urban customers, even if it seems ordinary to you. Your story should be no longer than 5 sentences and tells about you, the animals you raise, why you raise them, and how you farm. Pictures of your farm, family, and animals help customers connect with your story. A good story shows your passion for what you do and why you do it, and will make a connection and start a conversation. The relationships you build will lead to more sales.

## Community Supported Agriculture (CSA)

This form of direct marketing is very popular with urban customers. Based on mutual support and trust, this arrangement allows customers to pay the farmer a sum in advance, usually at



the beginning of the growing season, but sometimes paid in increments throughout the season. In return the customers receive a weekly (or monthly) selection of goods. CSA customers are often focused on food origin and are willing to pay for those goods. CSA customers can be adventuresome, so consider including less well known cuts from time to time, and a variety of charcuterie will be appreciated. Trying out new products in a CSA box is a great way to get feedback on these offerings and find out if they will catch on. A nice way to get started is to partner with other farmers who already offer a CSA. You can add product diversity while taking advantage of an existing customer base. Depending on how they are structured, CSA's provide either regular income in the form of monthly payments, or payment in advance. With wise financial

management both of these can be advantageous for the farmer.

## Restaurants

Restaurants have discovered the flavor and attributes of heritage pork and are an excellent avenue for sales. Chefs at fine-dining restaurants are especially in tune with local food culture, and farm-to-fork is now considered essential. If you don't have much time to develop your customer base, this is the first place you should spend your time.

Restaurants are a different world from farming, and you may find yourself learning new means of communication. Begin by calling or visiting the restaurant - mid morning and early afternoon are good times. Be prepared to explain what products you will have and production schedules. Many restaurants will purchase whole animals to prepare special "nose to tail" dinners or to use creatively on their specials menus. When working to establish a restaurant as a customer, providing samples or a one-time discount can be an incentive for chefs to try the products. Know your costs before discussing pricing, and explain how the attributes of pigs you are raising differ from what they are buying wholesale. Don't finalize a price until they have tried your pork. Some restaurants don't have any flexibility in costs or vendors, in which case, be sure to end the visit by providing your business card and asking them to call you if the situation changes. If your visit goes well, be sure to ask the chef the best way to keep in touch. Follow up soon, and invite them to tour your farm.

Chefs and their staff are looking for reliable farms that will communicate with them regularly and are dependable suppliers who deliver what is promised on time. In return, you will learn a great deal about preparing your pork and how to make it shine. For the farmer who is flexible, when working together with a chef you may also discover how different methods of finishing your pigs can affect the final product on the plate. Sell whole pigs to restaurants, whole, halved, butterflied, or butchered to their specifications. As your farm grows, you should be able to increase the number of pigs per month that you provide to a restaurant. Once a chef has committed to a farm's meats, he or she can be a great marketing partner, featuring your farm name on the menu and even hosting a tasting for other chefs.

## Internet Marketing

There are a number of ways farmers can market their products to consumers through the internet and social networking. These provide a way to reach a much larger audience, and for people from far and wide to connect. Many farmers use webpages and Facebook to provide a hub of information, pictures of animals, updates on farm progress, and a place where potential visitors could go to look up hours and contact information. Some take it a step further and offer product sales via their websites.

You can register your farm free of charge on website lists maintained by the following national organizations. Be sure to find and promote your farm on similar lists for your state and region.

- *Heritage Breed Marketplace*, The Livestock Conservancy, (919) 542-5701, [www.livestockconservancy.org](http://www.livestockconservancy.org) info@livestockconservancy.org
  - must be a member to list
- *Local Harvest Farm Listings*, Local Harvest, (831) 475-8150, [www.localharvest.org](http://www.localharvest.org)
  - Many heritage breeds are featured through the Ark of Taste link on Local Harvest.
- *Pastured Products Directory*, Eat Wild, (866) 453-8489, [www.eatwild.com/products/index.html](http://www.eatwild.com/products/index.html)

If you choose to sell via direct mail, test out your packaging and shipping ahead of time by shipping to friends and family. What will you do if a customer has a bad experience with what they receive? Be sure to check shipping regulations with your post office, and tuck in two business cards with each order so that satisfied customers can pass the word to their friends. Although mail order can be challenging, if you live remotely it may be the best way to get your products to customers, and offers flexibility whether to sell individual cuts or specific packages.

## Online Farmers Markets

This exciting trend offers farmers some help in getting their products into the hands of customers. The online farmers market establishes a website and the infrastructure for

### Social Media Engages Your Customers

Using social media to let your customers know what's happening on the farm is fast and easy, and will keep them coming back. Applications such as Facebook and Twitter allow you to quickly update customers on the daily operations of the farm or what you will have at the Farmer's Market. These websites also allow you upload pictures. Everyone wants to see photos of your cute baby animals! Remember, the day-to-day activities on your farm are fascinating to people who seek to reconnect to the land, small farms, and animal stewardship, and they are your niche market!

If you would like to encourage customers to see what life is like on the farm, consider making YouTube videos. This would allow people to see what your farm looks like, how you care for your animals, and to view your happy animals in their natural environment.

Email newsletters or blogs also keep customers thinking about you. Include a few words about activities going on at the farm, or a pork based recipe and instructions on proper cooking methods. Newsletters and blogs deliver the engaging, inviting tidbits about small farm life, healthy environment, the seasons, quality and stewardship – all values that attract the people you want to be your loyal customers. They also remind customers that you are there if they need you.

consumer orders and delivery. Each week, farms post their available products on the website. Usually, each farm will be responsible for delivering the goods to a central location, and the online farmers market handles getting the products to the customers. This has the advantage of getting your products to customers in urban areas that may be more distant from your farm, in return for a percentage of the sales. Online farmers markets offer the opportunity to sell whole, half, cuts, or cured meats.

### Regional Collaborations and Promotions

Join regionally based marketing efforts created by collaborative organizations to support local producers. These groups may have promotional events such as "Farm Days" and follow up by publishing lists of members and products, often with maps to locate growers of local products. Groups such as these deliver a strong, place-based message: *Eat locally and support small farms.*

Regional and state certifications or logos that promote locally raised farm products also help distinguish your products. Your extension agent for food may be aware of these, or you can check out local food products at the grocery and farmers markets. Collaborative marketing is a powerful tool. You can be an interesting,

dynamic fish in a school of other fish, and you can swim places you wouldn't go alone.

## **Retail**

The qualities of heritage pork and the national publicity that has accompanied its return to the market has created interest from natural food co-ops, independent butcher shops, and other retail stores. Explore these outlets in your locale. Although you may not realize the benefit of full retail price, these opportunities offer great exposure for your product. If these outlets look promising, talk to your meat processor about getting a custom label certified for your meat that includes your farm name, the name of the breed, and any third party certifications you hold such as pasture raised, humane certifications, organic, and so on. These will draw more attention to your product and lead satisfied customers to your farm. Sausage sales are a good place to start with retail. If you are fortunate enough to have a local butcher shop, be sure to promote your products to them. Butcher shops will often take whole animals and some do their own curing, and thus may create interesting new products from your pork.

## **Options for Larger Farms**

Marketing your own pork has both economic and social benefits for you and your customers. You get top dollar and the gratitude of the people who value your product. In return, direct contact gives your customers the satisfaction of knowing the origin of their food. They will know they have purchased product from a conscientious farmer whom they know personally.

If you just don't want the hassle of marketing and are interested in selling mostly to a single larger buyer, consider selling pigs or products wholesale. There are some tradeoffs, as these buyers often require farmers to commit to supplying a certain volume per week, and you will be paid wholesale prices. If you don't have a large herd, maybe teaming up with a few other farms will enable you to get into these markets.

## **Working with a Professional Marketer**

A professional distributors or marketers will typically purchase your whole processed animals, and sell to their network of commercial and individual customers. National companies include Niman Ranch, D'Artagnan, Dean & DeLuca, and Heritage Foods USA, Small grocery chains may also fall into this category, and many regional companies have sprung up to distribute locally produced foods to customers, particularly around urban areas. For example, Firsthand Foods in North Carolina buys pasture-raised livestock from small North Carolina farms, and markets the meat under the Firsthand label to restaurants, retailers, and individual consumers. By working with many farmers, Firsthand Foods can supply larger restaurants and stores. The volume of product needed for a professional distributor could be

filled by a larger farm, or several farms with the same breed of pigs working together. There is usually an application process, and there may be requirements for specific husbandry, welfare certifications, or a designated slaughterhouse.

### **Selling your pigs on the hoof**

A traditional model for farmers raising pigs is to synchronize farrowing so that batches of piglets will get to about the same weight at the same time, and selling these piglets live to niche pork companies. Niche pork companies buy the batch of pigs on a specified date, the pigs are loaded onto the company trailer and you can get back to farming. Most niche marketing groups pay market price for your pigs, plus a premium designed to reward the farmer. Market prices for slaughter weight pigs can be found here:

<http://www.ams.usda.gov/AMSv1.0/LPSMarketNewsPage>

A few niche pork marketing groups specialize in heritage breeds, and their premium may reflect this. If you consider working with a niche marketing group, be sure to review their carcass standards against what you can expect from your heritage breed. Standards that are designed for lean breeds will be challenging for many heritage breeds to achieve. If you are raising pigs that meet the carcass standard, the minimum batch size, and at a price that covers your production cost, selling your pigs wholesale can be a low-impact way to market your pigs. If you want consumers to understand your breed and farming methods, though, this is generally not possible when selling wholesale.

### **Conclusion**

There are many ways to develop a strong base of customers for your farm. Using the information in this guide, decide who you will approach first, and do some research to learn what they want. Spend the time to develop a compelling story that will make you memorable with potential customers, then practice telling that story until it comes naturally. Finally, learn as much as you can about your products in order to educate your customers, and use feedback from your existing customers to keep them coming back and to recruit new customers. Learning to market your products, your farm, and yourself will contribute positively to your bottom line.

**For more help planning your marketing approach, check out these links:**

#### **Livestock Conservancy Marketing Toolkit**

<https://www.livestockconservancy.org/index.php/heritage/internal/pig-marketing-budgeting>

**Appropriate Technology Transfer for Rural Areas (ATTRA):**

<https://attra.ncat.org/publications/attra-topics/marketing-business/business-planning-management/>

**Agriculture Marketing Resource Center:**

<https://www.agmrc.org/commodities-products/livestock/pork/niche-ethnic-pork>

**Carcass Characteristics of Heritage Hogs:**

<https://www.livestockconservancy.org/index.php/heritage/internal/heritage-pig-carcass>

**National Directory of Farmers Markets, CSA's, and Food Hubs**

<http://www.usdalocalfooddirectories.com/>

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