Digestive System

In Figure 4.3, notice the pig's digestive system is similar to humans. The pig's stomach has one chamber, making swine **monogastric** animals.

Both humans and swine begin digesting food in the mouth, where saliva adds moisture and enzymes to begin to break down food particles. The tongue and teeth collect feed and break it down into smaller pieces to make it easier to digest. These smaller feed pieces move to the esophagus, a long tube that carries the feed from the mouth to the stomach.

The stomach serves as a reservoir for short-term food storage and digestion. Here, digestive enzymes begin to break down the feed components so they may be absorbed into the bloodstream.

The next step in the process takes the remaining undigested feed into the small intestine, where it is broken down further so nutrients can be absorbed into the body. The remaining material is waste. It passes into the large intestine and then into the rectum, where it is excreted from the body through the anus.

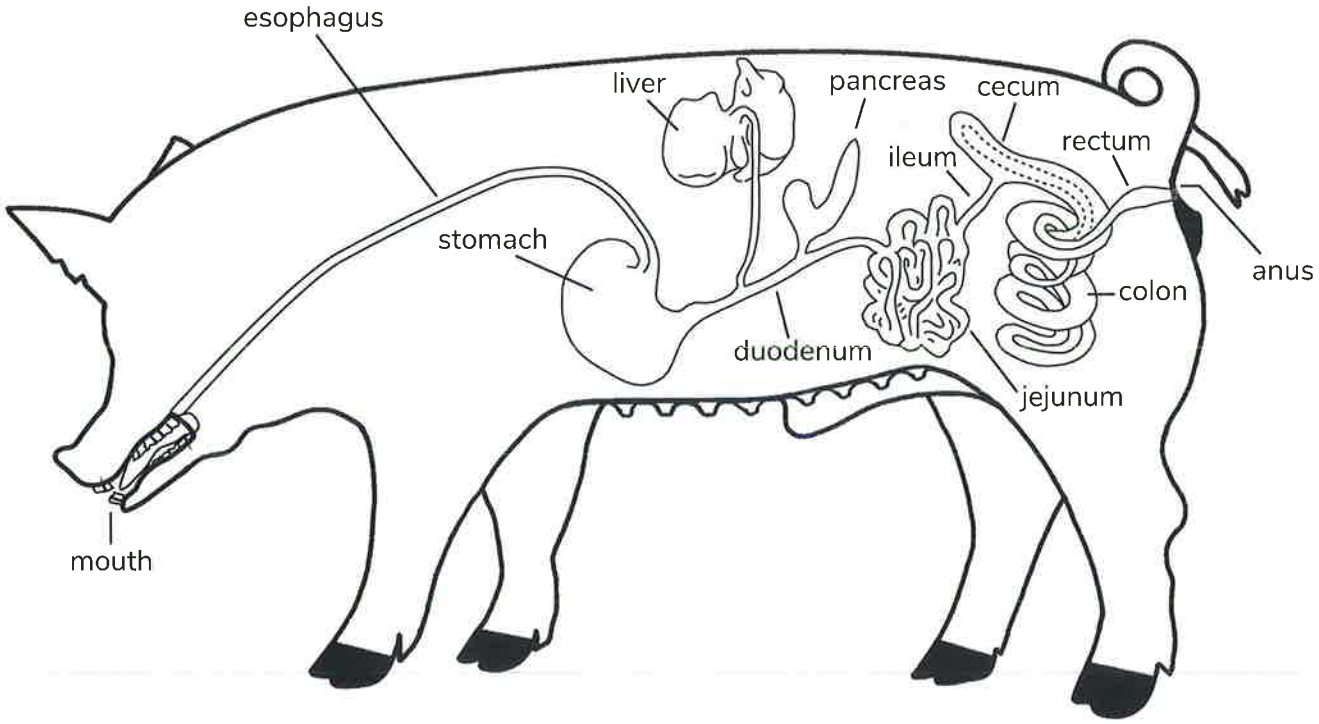


Figure 4.3 Digestive system of a pig

Mouth	The mouth is responsible for the first steps in nutrient digestion. There, the feed is moisturized with saliva, chewed into smaller pieces and mixed with some locally produced enzymes that break down complex sugars.
Esophagus	The esophagus moves food from the mouth into the stomach. This is done through the contraction and relaxation of muscles (peristalsis contraction). The first contraction is swallowing.
Stomach	The stomach is a muscular organ that serves as a reservoir for short-term food storage and digestion. It is divided into distinct areas, including the esophageal, cardiac, fundic, and pyloric regions. The esophageal region is the location of ulcer formation in hogs. This can be due to particle size, stress, or other environmental factors. In the cardiac region, mucus is secreted and mixed with the digesting food. The fundic region is the first major site for digestion. Hydrochloric acid and other digestive enzymes are secreted in this region, producing a low pH, which kills bacteria that might have been consumed with feed. The pyloric region is responsible for producing mucus to protect digestive membranes from the low pH as food passes into the small intestine. The stomach is the main site for protein digestion.
Small Intestine	The small intestine is composed of three parts: the duodenum, jejunum, and ileum. The small intestine further breaks down undigested feed. It is the major site for nutrient absorption.
Duodenum	The duodenum is approximately 12 inches long and has ducts to both the pancreas and the gallbladder. The duodenum is a major source for secretion and collection of digestive enzymes, where the digestive process is in full swing.
Jejunum	The jejunum is the middle section of the small intestine. It is responsible for further breakdown and initial absorption of nutrients. The jejunum is the longest part of the small intestine. It is about 600 inches long in a young adult pig.
Ileum	The ileum is the final section of the small intestine. It continues the absorption of nutrients. Within both the jejunum and ileum, absorption occurs through the intestinal mucosa, which contain finger-like projections, each called a villus. These intestinal villi contain more micro-sized projections called microvilli. They are responsible for the absorption of amino acids and simple sugars, which move directly into the liver via the portal vein.
Pancreas	The pancreas is a vital organ in the digestive process for secreting enzymes and preventing cell damage. It is involved in both exocrine and endocrine excretions. The endocrine function of the pancreas is responsible for maintaining blood glucose levels. This is done through the secretion of insulin and glucagon. The exocrine function secretes digestive enzymes for the breakdown of proteins, fats, and carbohydrates. In addition, the pancreas produces sodium bicarbonate as a buffer to increase pH of food from the acidic stomach.
Liver	The liver plays a central role in all metabolic processes in the body and serves to break down old or damaged blood cells. The liver also produces bile, which is stored in the gallbladder. Bile salts, a large component of bile, are used primarily for the digestion and absorption of fat and cholesterol. Bile is also used to aid in the absorption of fat-soluble vitamins.
Large Intestine	The main function of the large intestine is to absorb water. No enzymatic digestion occurs in this portion of the digestive tract. However, microbial enzyme activity does occur, forming VFA (Volatile Fatty Acids) absorbed by the large intestine.
Cecum	The cecum is divided into two sections. One section has a blind end where materials cannot pass through, and the other section connects to the colon.
Colon	The colon is the passage from the large intestine to the rectum and anus for excretion. Interestingly, the colon in swine is organized as a spiral.
Rectum	The rectum is the section of the digestive tract where remaining materials are condensed into semi-solids.
Anus	The final section of the swine digestive system, from which semi-solids are excreted.

CHAPTER 8

Nutrition

Proper nutrition helps your pig to grow and develop properly. Knowing the feed your animal needs at each stage of development will help you be a successful and profitable swine producer.

Learning Objectives

- Understand how different nutrients influence proper growth and development.
- Know how to read a feed tag.
- Understand feeding needs for swine at different stages of development.

Nutrients

Animals receive nutrients in the feed, or feedstuffs, we provide to them. Feed represents 60% to 75% of the total cost of producing a pig. Therefore, a carefully planned and managed nutrition program is important. You must supply your animals with enough nutrients to help pigs grow quickly and efficiently, from birth to market weight.

Common feedstuffs for pigs include corn, **soybean meal** (SBM), vitamins, and minerals. Each of these contain different amounts of nutrients to meet pigs' requirements. This is why mixtures of feedstuffs are fed to pigs. Mixing feedstuffs to get the right amount of the nutrients pigs need is called balancing the ration. A ration is the mixture of feedstuffs that supplies nutrients needed by the pig if it eats a normal amount each day.

In general, nutrients are divided into six categories:

1. Water
2. Protein
3. Carbohydrates — energy
4. Lipids (fats) — energy
5. Minerals
6. Vitamins

Macronutrients

On a percentage of the dietary ration, these nutrients make up the largest part of the pig's diet.

Protein and Amino Acids. Proteins are made of 20 simpler building blocks called amino acids. Pigs require amino acids for the formation of muscle. The term "**crude protein** content" indicates the amount of protein in a feed that meets a pig's requirement for amino acids in its diet.

Ten of the amino acids are called **essential amino acids** because these cannot be produced within the pig's body.

> The pig's growth or performance is limited if just one of the essential amino acids is in short supply in its diet.

The 10 essential amino acids swine need in their diets are: lysine, threonine, tryptophan, methionine, cystine, isoleucine, histidine, valine, arginine, and phenylalanine.

Most cereal grains do not contain enough lysine, threonine, tryptophan, and methionine to meet a pig's needs. For example, a pig will not grow well on corn alone. Part of the reason for this is that the protein in corn is low in essential amino acids, especially lysine.

Protein quality describes the amount and variety of essential amino acids found in feedstuffs. The protein quality of common feedstuffs fed to swine rank from highest to lowest in this order:

1. Animal-derived byproducts, including milk products, meat meal, blood products, and bone meal.
2. Oil-bearing seeds, such as soybean meal, linseed meal, sunflower meal, and so forth.
3. Cereal grains, such as corn, oats, wheat, barley, and so forth.

A common diet for swine includes corn (energy) and soybean meal (protein) because soybean meal is rich in the amino acids pigs need.

Carbohydrates and Fats (Energy). Carbohydrates and fats are the main sources of energy in a pig's diet. Energy is needed for growth, to maintain body temperature, and to produce muscle movement. Energy also is needed for all biochemical processes occurring within the body.

Because a growing pig needs energy constantly, its body stores some energy in the form of carbohydrates and fat. The carbohydrate component of grains in feed is the major source of dietary energy. Grains such as corn, sorghum, and wheat are excellent sources of carbohydrates.

Surplus protein in the feed may also be converted to energy. However, the use of protein as an energy source is not recommended. Protein sources are expensive and result in higher nitrogen content in the animal's waste, which has environmental concerns.

Lipids are greater than two times more energy dense (calories per pound of feed) than carbohydrates. Thus, they are useful to quickly boost energy levels in diets when needed, such as during lactation, rapid growth, immune challenges, or at breeding.

Micronutrients

These nutrients make up a small percentage of the ration but have large responsibilities in maintaining the growth and the life of the pig.

Minerals. Minerals are needed for proper growth of body tissues and to assist in many of the body's daily functions. In particular, **calcium**, **phosphorus**, and sodium chloride (salt)—often referred to as **macrominerals**—are important. Calcium is required for bone formation and strength. Phosphorus is also involved in building bones and plays an important role in energy use. Salt, a single feedstuff consisting of two macrominerals, sodium and chloride, maintains appetite and water consumption.

Other minerals, called trace minerals or **microminerals**, are needed in small amounts. These include iron, copper, zinc, magnesium, manganese, iodine, and selenium.

Many minerals are available in organic forms with greater **bioavailability** when compared with **inorganic** sources. Organic minerals are frequently bound to a protein or amino acid and are referred to as proteinates or chelates. These mineral sources are generally more expensive than the inorganic forms. Their value as part of the pig's diet depends on the specific mineral.

Of all farm animals, pigs are the most likely to suffer from mineral deficiencies for these reasons:

- Hogs are primarily fed cereal grains and their byproducts, which are low in minerals (especially calcium).
- The skeleton of the pig, in contrast to those of other animals, supports greater weight in proportion to its size, which means it needs more mineral content than most animals.
- Hogs do not consume great amounts of roughages (high-fiber products) to balance the mineral deficiencies of grain. Keep in mind most commercial diets are formulated with a vitamin and mineral premix to combat this potential issue.
- Hogs are fed to grow at a maximum rate and are marketed before they reach full maturity. Emphasis on rapid growth and lean meat production requires adequate mineral concentrations. **Most minerals are supplied in purchased supplements and commercial rations.**

Vitamins. Vitamins help the body convert nutrients to energy. They are described in two classes, fat soluble (A, D, E, K) and water soluble (the B vitamins). The body can keep reserves of the fat-soluble vitamins for a time, but water-soluble vitamins should be supplied in the diet daily.

All vitamins should be stored in a cool and dry place protected from light. All vitamins have a shelf life because they break down.

Some of the many purposes vitamins serve follow:

- **Fat Soluble**. Vitamin A (carotene) assists in maintaining the surface of epithelial cells, which make up the outer skin, as well as the lining of the digestive and respiratory tracts. Vitamin A also helps maintain healthy teeth, body tissues, and mucous membranes. Vitamin D has many biological functions in animals and a primary role in regulating

calcium use, which is important for bone formation and structure. Vitamin D also has a role in muscle contraction.

Vitamins E and K are involved in developing and maintaining body tissue. Vitamin E (alpha-tocopherol) is integral to the function of muscles and the reproductive, immune, and circulatory systems. Vitamin E is a powerful antioxidant, which also supports the membranes surrounding individual cells, influences the production of hormones, and defends against infection. Vitamin K helps the body process calcium and Vitamin D. The blood requires vitamin K to form clots.

- **Water Soluble**. Water soluble vitamins are supplied as chemical compounds in the feeds. They assist in converting nutrients into energy for growth. They may also assist in maintaining the health and soundness of the lining of the digestive organs. This group includes the B-complex group. The B vitamins typically added to swine diets include cobalamin, niacin, pantothenic acid, pyridoxine, riboflavin, and thiamine. Pigs can create other water-soluble vitamins, vitamin C, for example, within their own bodies and so those are not normally added to diets.

Medically important antibiotics are not allowed to be added to feed for any reason without veterinary oversight and approval and require a written Veterinary Feed Directive (VFD).

Water

Water is so common we seldom think of it as a true nutrient, but it is the most essential of all nutrients. Heat and stressful conditions make water even more important. Swine usually do not survive more than 24 hours without water.

Water is the largest single component of the pig's body. It also passes through the body, transporting nutrients and removing waste. Depriving pigs of water reduces feed consumption and limits growth and feed efficiency. Therefore, plenty of water should be provided at all times. A pig needs to drink at least ¼ to ⅓ gallon of water for every pound of feed it eats. Lactating sows consume more water because of the high water content of the milk they produce. Water restriction reduces milk production and may result in death if the restriction is severe.

Water is usually taken into the body at a lower temperature than the body itself, therefore, a portion of the body's heat or energy must be used to warm the water. In hot weather, this can be a comforting advantage, but in winter, it can be a serious disadvantage. If the water is ice cold, the pig drinks less. Reduced water consumption limits performance as much as a lack of any other nutrient.

You must make certain your animals always have all the fresh, clean water they need. It should stay relatively cool in the summer and warmer in the winter, approximately 68 F.

Feed Tag Information

Feed tags provide a list of the ingredients in the feed, along with important information about key nutrients and nutrient levels. They also provide feeding directions for the targeted age, weight, or production phase of the pig, offering valuable information for you to compare and use to make informed feed choices. All commercial feed purchased in bag or bulk must have a label or feed tag. Always read the feed tag to make sure you are getting what you want in the product. To provide your animals with the proper feed for the appropriate stage of production, you must understand what is written on the feed tag.

Federal regulations require feed with antibiotics to be available only with a proper veterinary **prescription** and only for treatment of veterinarian-identified acute or chronic swine disease conditions. The prescription process involves a written VFD issued under the professional supervision of a licensed veterinarian. It requires a valid veterinary-client-patient relationship and includes identification of a specific group of pigs for a limited length of time. Extra-label treatment is not allowed in feed, nor can a VFD approved feed be fed to other groups of pigs. The VFD guidelines are designed to protect animal health by reducing the incidence of antibiotic/antimicrobial resistance with continuous use of medicated feeds. Medicated feed cannot be used to improve growth rate.

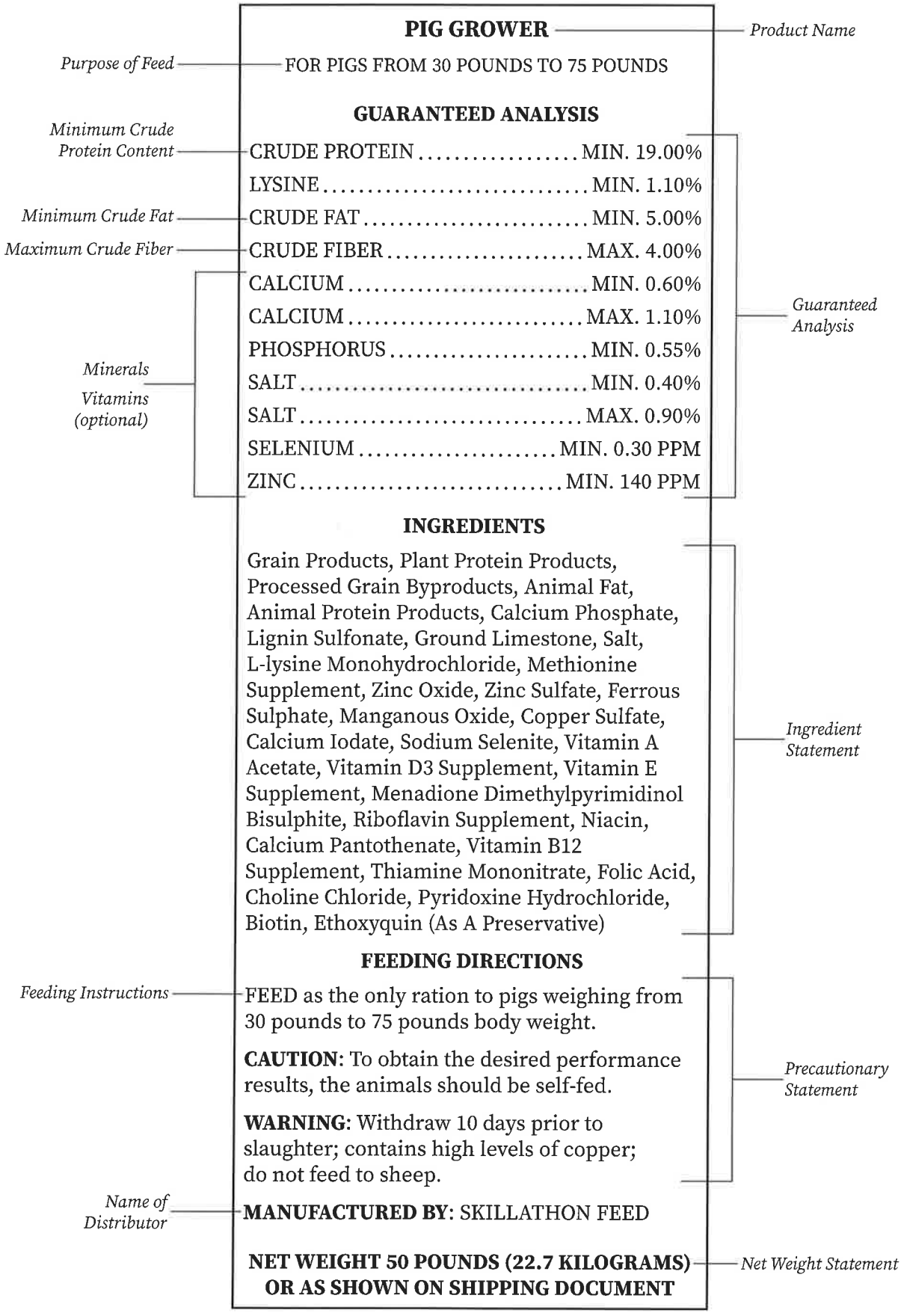


Figure 8.1 Sample feed tag

Livestock feeds can be classified as either complete feeds or supplements. Complete feeds contain all of the nutrients (except water) required by animals. Supplements are usually specialized ingredients added or mixed in relatively small amounts into the base feed ingredients, such as corn for energy and soybean meal for protein. Supplements commonly contain the required vitamins, macrominerals, trace minerals, amino acids, or nutrients and **additives** not found in the base feed ingredients. Supplements are not fed as the only ingredient in a pig's diet.

Feed manufacturers are required by law to provide the following label information on every bag, package, or bulk delivery of feed products:

1. **Product Name or Brand Name**. A product name is always on the feed tag and may be a specific brand or a generic name. A feed tag usually contains a unique product name, for example, Starter, Grower, and Gilt Developer, which identifies the feed. A brand name typically identifies the manufacturer's specific identification or marketing name for a feed product, which is often proprietary and trademarked, for example, Feed Companies Best® Swine Starter.
2. **Purpose of Feed**. Each feed must have a purpose statement, such as Formulated for Lactating Sow or Formulated for Pigs 30 pounds to 75 pounds, which specifies the species and animal class, or stage of production, for feeding.
3. **Purpose of Medication and Active Drug Ingredient**. If a drug is present in the feed, the word MEDICATED must appear below the product name. The tag must also have a statement about the medication's intended use, followed by a list of the active drug ingredients and the amount or dosage of drug in the product. For example, a statement and medicinal claim, "For reduction of the incidence of cervical abscesses; treatment of bacterial Swine Enteritis (caused by *Salmonella choleraesuis*). Active Drug Ingredient—Chlortetracycline. 100 g/ton."
4. **Guaranteed Analysis**. The guaranteed analysis on the label gives information about the type and amount of key nutrients present in the feed. Legally, the feed company is required to provide the nutrients listed and the amounts stated (for example, Minimum Crude Protein, Minimum Zinc, and Minimum and Maximum Calcium) on the feed tag. In other words, the feed tag must be truthful. The type of product and/or species and stage of production indicated on the feed tag determines which nutrients are required to be listed on the feed tag.
5. **What does the guaranteed analysis not tell you?** The guarantees do not reflect the quality or feeding value of a feed. There is a difference between the quality or bioavailability of feed resources in a diet. For example, copper from copper sulfate is 80–90% available (digestible; absorbed by the animal), whereas copper from copper oxide is only 5–10% available. You may need more details about the source of nutrients used in a diet. The feed supplier or a nutritionist can give you this information.
6. **Ingredient Statement**. The list on the feed tag starts with the ingredient in the largest amount (weight/concentration), often referred to as the main ingredient. The remaining ingredients are listed in order of decreasing amounts. Actual ingredients may be listed as a group, for example, corn, wheat, oats, and barley may all be listed individually or collectively as "grain products." Collective terms represent a general group of similar ingredients with a similar function, but do not imply equal nutritional or digestibility values. The list of ingredients can be useful or confusing. A collective term, such as "Grain Products" does not really tell you the specific sources. Therefore, it may be difficult to determine the quality and digestibility of the product. When you have questions, ask a nutritionist or other professional for advice.
7. **Feeding Instructions**. Feeding instructions provide information on how the product should be fed to the animal. For example, "self-fed" or "*ad libitum* fed" indicates pigs should have continuous access to the feed to eat as much as they choose on a daily basis. Other instructions may indicate a specific amount to be fed on a daily basis. A gestating sow, for example, is fed at a level for maintenance and fetal growth, while preventing too much weight gain.

8. **Warnings and Caution Statements**. The label includes statements about any risks associated with the feed. For example, if medications are added to the feed, if there is risk associated with feeding the diet during a different stage of production, or if there is risk feeding it to another species. "Contains high levels of copper; do not feed to sheep," or "Withdraw medicated feed 10 days prior to slaughter," are examples of warning and caution statements. For more information on withdrawal time, see page 108.
9. **Name and Address of Distributor**. The name and mailing address of the company responsible for making or distributing the feed must be listed on the tag.
10. **Net Weight Statement**. The net weight statement serves to tell the purchaser the weight of the feed in the bag or bulk shipment. This may be listed in pounds (lb) or kilograms (kg). A kilogram is equal to 2.2 pounds. Therefore, a 50-pound bag may be listed as 22.7 kilograms.

Check Your Understanding

Pig Grower Feed Tag Questions

1. What is the main ingredient in this feed?
2. What is the minimum crude protein level?
3. What is the minimum crude fat level of this diet?
4. Is ground limestone included in the ingredients of this diet?
5. At what stage of growth should this ration be fed?

To see how well you did, the correct answers can be found in the Answer Key on page 208.

Classifying Feed Ingredients Into Nutrient Groups

Complete pelleted feed is not listed under a specific category because it contains carbohydrates, proteins, minerals, and vitamins. Descriptions and images of many feed ingredients are shown on pages 82–87.

Energy (Carbohydrates and Fats)[1]

- beet pulp
- corn gluten feed
- cracked corn
- dried molasses
- fish oil
- ground corn
- hay and hay cubes*
- rice bran*
- steam-rolled barley
- tallow
- vegetable oil
- wheat middlings
- whey concentrate
- whole oats
- whole wheat

Proteins[1]

- blood meal
- corn gluten meal
- distiller's grain
- fish meal
- meat and bone meal
- rice bran meal*
- soybean meal
- soy isolate

[1]A protein concentrate is usually defined as a feed containing greater than or equal to 20% crude protein (dry matter basis). Some feeds, such as hay cubes and rice bran meal, marked here with an asterisk (*), may be described as protein or energy because they are moderate in fat (energy) and protein or because their concentration of protein may vary to being less than or greater than 20% crude protein. Therefore, those feeds marked with an asterisk are most commonly classified as listed above.

Minerals

- bone meal
- calcium carbonate
- copper hydroxychloride
- copper sulfate
- dicalcium phosphate
- ground limestone
- magnesium sulfate
- trace mineral salt
- white salt
- zinc chelate

Vitamins

None of the feeds listed is a vitamin-only premix.

Water

Feedstuffs Commonly Found in Swine Diets

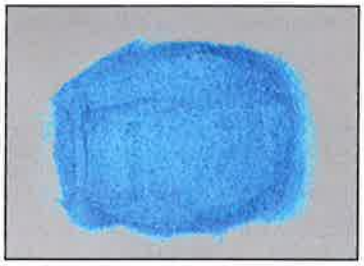
Beet pulp (byproduct, fiber carbohydrate). Beet pulp is made from leftover, shredded sugar beets. After the sugar is extracted, this rapidly fermentable fiber source remains. You can find it sold with or without some residual sugar or molasses added back in for flavor. Beet pulp is best identified by looking for the feedstuff which most closely resembles dried, shredded vegetables. The majority of sugar beets are genetically modified organisms (GMOs); thus, the byproduct (beet pulp) is not a GMO-free feedstuff.

Blood meal (byproduct, protein). Blood meal is a concentrated protein feedstuff, made from drying the blood of harvested animals—typically beef or pork. This feedstuff has a strong iron taste or smell but, assuming you will not taste it, the reddish-brown dust it leaves behind is a giveaway. Blood meal is not restricted related to bovine spongiform encephalopathy (BSE, or "Mad Cow Disease") because it does not involve the nervous system like bone meal. However, most blood meal used in swine feeds is typically of bovine origin while cattle diets will primarily use porcine blood meal.

Bone meal (mineral). Bone meal is not attractive to look at and certainly would not taste good. However, it is used as a way to supplement bioavailable calcium and phosphorus in animal diets. Depending on how finely ground the product is, it should be chunky but may not be very homogenous (chunks may be different sizes and shapes). This feedstuff is very hard (it is bone!) and pale in color. Compared to a soybean meal (also a pale, chunky feedstuff), bone meal should have little odor.

Calcium carbonate (mineral). Calcium carbonate is one of many calcium sources available for animal feed. The carbonate may also serve a buffering role depending on the diet and species fed. Carbonates are often powdery and white—similar to powdered sugar, but they would taste more like chalk powder.

Copper hydroxychloride (mineral). Once considered a byproduct because it was made from copper residual during computer motherboard fabrication, copper hydroxychloride is likely approaching "co-product" status as copper sources are gathered to create copper hydroxychloride from recycling operations. This form of copper is less reactive in the acidic stomach and therefore more likely to be available in the lower digestive system than sulfate sources. Unlike blue-colored copper sulfate, the hydroxychloride form is green.



Copper sulfate (mineral). Copper sulfate is a more traditional form of copper in animal feed and considered more bioavailable than oxides. Blue in color, this feedstuff is also used in animal footbaths to help kill bacteria. The crystal structure is very large (similar to magnesium sulfate) and may resemble sugar crystals, such as those used in cookie decorating during the holidays.

Copper sulfate is very caustic—do not taste it.

Corn gluten feed (blend of fiber/non-fiber carbohydrates). Corn gluten feed is much lower in protein than corn gluten meal (a commonly confused ingredient). And, while corn gluten meal is bright yellow, corn gluten feed can vary from light brown to very dark, depending on how intensely it was dried down. A byproduct of the same corn steeping process, corn gluten feed includes the bran, which contributes significant fiber. Wet corn gluten feed can be found in locations within short delivery distance to wet milling facilities. However, most of us are more likely to see dry corn gluten feed, and the feedstuff will be pelleted to reduce shrink losses during shipment.

Corn gluten meal (protein). Corn gluten meal consists primarily of proteins found mixed among the starch in the kernel. As the starch is extracted for products for human use and food products, the proteins are separated. This is a high-protein feed source but the feeding value (amino acid quality) of corn gluten meal is limited compared to a more traditional source, such as soybean meal. While many products from corn have a golden color, corn gluten meal is notably bold yellow and uniform in both color and particle size.

Cracked corn (non-fiber carbohydrate). Corn is the foundational energy source for animals fed throughout the United States. High in starch, a form of carbohydrate, corn is fed in various forms dictated by convenience, storage life, handling characteristics, and personal preference including whole, cracked, ground, and steam flaked. Generally, the more corn is processed, the more available (digestible) the corn becomes. Cracked corn will resemble whole kernel corn that has been struck with a hammer, exposing the starchy, white inside of the corn and yielding pieces of variable size and shape.

Dicalcium phosphate (mineral). Dicalcium phosphate is chalky gray in color and commonly confused with ground limestone. However, on closer inspection, dicalcium phosphate is actually tiny, round beads due to its synthetic nature. Because of the inclusion of phosphate, this feedstuff is commonly used when both calcium and phosphorus are limited in the diet. In many cases, swine rations already include high phosphorus levels from grains such as corn and wheat containing phytate—an insoluble phosphorus complex. Because high phosphorus excretion in manure is an environmental concern, many swine rations include an enzyme called phytase to break down the insoluble phytate. Where phytase is included in rations, dicalcium phosphate will be a less useful feedstuff than a calcium-only feedstuff such as ground limestone.

Distiller's grain (byproduct, protein). Distiller's grain varies in shades of golden to brown, depending on processing methods—especially drying time and temperature. A byproduct of the ethanol (think corn-based fuel replacement) industry, this feedstuff smells 'bready' or 'yeasty' when fresh and can be fed wet

or dry. However, it is most commonly found dried for improved shelf life. High in protein, this is a common byproduct protein replacement due to its energy value, but the fat or mineral composition can be limiting in some applications. As starch from the corn is used up for ethanol production, all of the other nutrients are increased in concentration compared to corn, often tripled or greater. Compared to corn gluten meal, look at particle size uniformity in the meal versus most distiller's grain. Compared to ground corn, the smell will be distinctively yeastier.

Dried molasses (non-fiber carbohydrate). It is initially easy to confuse dried molasses with either distiller's grains or blood meal based on color. However, dried molasses (often a co-product of the sugarcane industry) should smell (and taste) much sweeter than either. Look for shiny crystals of sugar that confirm your suspicions for this common feedstuff. This is a common feedstuff added for flavor in the diet or to give a boost of sugar (rapidly available carbohydrate energy).

Dried yeast (feed additive). Dried yeast is a tough feedstuff to identify as it commonly looks like any other dried, plain-colored powdered product, but it is also mixed with a carrier (and may have a bit of bright-colored tracer material as well). In pure form, dried yeast may look very similar to baker's yeast you can find in the kitchen or at the grocery store in the baking aisle, but may appear similar to dried, puffy bubbles that crush if you put pressure on them. If you saturate them in water, they should start to dissolve and perhaps make a bit of carbon dioxide gas if exposed to sugar. Dried yeast is commonly still alive and will activate when wet, thus it is a probiotic feed additive. The other categories of biotic feed additives are prebiotic (feeding a beneficial bacterial population in the digestive system) or postbiotic (dead cell fragments providing unique nutrients to the digestive tract).

Fish meal (protein). Fish meal serves a similar purpose in the diet (protein supplementation) and has a similar appearance to feather meal. Sometimes there are tiny bone fragments to help differentiate it from feather meal, in which you might see tiny bits of feather. However, the smell of a beach at low tide or a fish market will quickly give it away. Once considered a byproduct, some fish are now harvested specifically to create fish meal and the price on this feedstuff has gone up significantly. Therefore, fish meal is less common in diets today unless the user is seeking a protein source with a high content of omega-3 fatty acids, known for decreasing inflammation and improving reproduction.

Fish oil (fat). Fish oil can come from a number of freshwater fish, such as anchovies, herring, and salmon. This viscous (thick) liquid is golden yellow in color and allows light to pass through. Fish oil is rich in omega-3 fatty acids and might be supplemented to boost reproduction in pigs.

Ground corn (non-fiber carbohydrate). Corn is the foundational energy source for animals fed throughout the United States. High in starch, a form of carbohydrate, corn is fed in various forms dictated by convenience, storage life, handling characteristics, and personal preference including whole, cracked, ground, and steam flaked. Generally, the more processed corn is, the more available (digestible) it becomes. Ground corn is heavily used in swine nutrition because it has been ground to a powder to make the starch inside as available to the digestive tract as possible. The finer a corn is ground, the more digestible it will be to the pig.

Ground limestone (mineral). Ground limestone is the most common source of supplemental calcium in an animal's diet. If called "feeding lime" at the local mill, it will directly resemble chalk powder. However, ground limestone is traditionally a bit more coarse. Still chalky in feel (dusty), this feedstuff should look like finely ground driveway gravel. The majority of ground limestone is available as a calcium source if the digestive tract moves slowly enough for the calcium to be liberated during digestion.

Magnesium sulfate (mineral). Magnesium sulfate is an example of a critical mineral (magnesium) for bone and metabolism functions provided in a sulfate crystal form. Sulfates are a common mineral form that is very soluble in the digestive tract but can also be very reactive and lead to unintended mineral antagonisms. Magnesium sulfate commonly is confused with feed-grade salt, but the crystals are usually a bit longer and have a greater length to width ratio than salt (sodium chloride) crystals.

Meat and bone meal (byproduct, protein). Meat and bone meal consists of ground up remainders from the animal harvest industry. Often, the muscle fibers ground into the product tend to give it a bit of a "stringy" appearance, and if you look closely, you can see fibers that look like tiny bits of thread. Because nervous tissue can be included within the ground bone, there is a ban in the U.S. on ruminants consuming meat and bone meal of ruminant origin. However, there is no ban on swine consuming meat and bone meal from pork harvest. Meat and bone meal is notable for being a relatively high-protein feedstuff that is also rich in calcium and other minerals (from the bones).

Rice bran (byproduct, carbohydrate). Rice bran, a byproduct of rice milling, is typically fed as a carbohydrate source. This feedstuff has some fiber and fat as well, making it a multi-purpose filler and energy source useful in show animal feeds. To the taste, this feedstuff is semisweet but off-white to gray in color rather than a dark brown molasses. The particle size ranges from fine, similar to ground corn, to chunky. With higher fat content, the feedstuff will compact and stick together while with higher starch it will be more powdery.

Rice bran meal (byproduct, protein, carbohydrate). Rice bran meal, a byproduct of rice milling, is typically fed as a protein and carbohydrate source. This feedstuff has some fiber and fat as well, making it a multi-purpose filler and energy source useful in show animal feeds. To the taste, this feedstuff is a bit sweet but it is gray in color rather than a dark brown molasses color. Its particle size ranges from fine, similar to ground corn, to chunky.

Salt (mineral). Salt can be added to feed to help encourage water drinking (in moderation) or to help increase feed intake by adding a desirable taste. Alternatively, too much salt will decrease intake and could be useful for limiting free-choice mineral mixes. Some salt in human diets is fortified for iodine (iodized salt) but most livestock salt is not fortified, and iodine must be supplemented separately (commonly in your mineral premix). Salt is formed in crystals whereas urea (commonly confused with salt and toxic to swine) is spherical rather than crystalline.

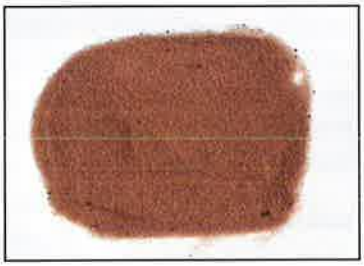
Soy isolate (protein). Soy isolate is a fine, plain, white powder that resembles the powder mix used in protein shakes or workout supplements for humans. Soy isolate is a highly concentrated protein source with a similar quality of protein (amino acids) to soybean meal. Due to the powdery nature of this feedstuff, it would be unlikely for soy isolate to be used in large quantities; instead, it may serve as a top-dressed protein powder to increase the protein provided to show pigs.

Soybean meal (protein). Soybeans are one of the most common crops grown in the U.S. When first processed for their oil, the crushed remainder was considered a byproduct: soybean meal. However, with time, cooking of soybean meal, increased consistency of the final product availability, and the widespread feed use have shifted this from a byproduct to a co-product. This means that there is enough value in soybean meal that soybeans are grown, in part, to provide as a quality feedstuff. Soybean meal is chunky, like crushed peanuts, tan/beige in color, and may smell a bit like solvent or baked grain, depending on its processing and handling. This concentrate feedstuff is the gold standard to which all other proteins are compared.

Steam rolled barley (non-fiber carbohydrate). Barley is one of several popular cereal grains in animal feeds used to add texture and a diversity of energy sources. Because of the higher fiber content than a similar-energy corn, steam rolled or crimped barley (different processing methods) is popular in show feeds. Compare the shape of barley to oats and you will see barley is shorter, rounder, and often darker. When rolled, there is more visible husk remaining versus steam rolled oats, which are lighter in appearance.

Steam rolled oats (non-fiber carbohydrate). Oats are one of several cereal grains or small grains that can be fed as a source of digestible energy. Steam rolled oats look very similar to the oatmeal found in the kitchen for breakfast. Processing, such as steam rolling, is used to increase the digestibility of the grain and provide more energy to the animal by breaking the protective outer layer of the grain and opening up the starchy inside to be ready for digestive enzymes. Steam rolled oats are commonly used to provide "texture," essentially bringing some diversity of flavor and particle size to the diet to make it more interesting for the animal to eat.

Tallow (fat). Tallow is typically taken from animals after harvest. Because animals deposit large amounts of saturated fats, tallow is also primarily saturated fat. Saturated fats stack more closely together at a molecular level, and this makes them more solid at room temperatures. Thus, while a vegetable oil blend is likely a liquid, a tallow product can be very solid (and white).



Trace mineral salt (or premix; mineral). Trace mineral salt refers to a mineral mix of microminerals (minerals needed in small quantities) mixed with salt and either mixed into a diet or offered free choice. Trace mineral salt is either fed loose, such as in a weathervane mineral feeder, or incorporated into a salt block that animals will lick. When identifying trace mineral salt, notice the large variation in particle size, shape, and color. This feedstuff incorporates a lot of minerals needed at low inclusion rates, and so the color and shape of the mix will vary greatly.

Vegetable oil (fat). Vegetable oil can come from a number of sources, such as corn, soybeans, or canola. However, it is reasonable to assume animal feed will be the most cost-effective form of vegetable oil and likely be a blend of several sources. This viscous liquid is light yellow in color and allows light to pass through. It looks very similar to the cooking oil in your kitchen—because it is essentially the same. Oils like this can help to decrease dust in feeds and provide a high energy boost to the ration.

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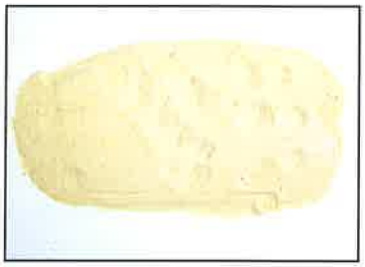
Wheat middlings (byproduct, fiber carbohydrate). Wheat middlings are a fiber source and byproduct of the wheat milling industry. This is a dry, flaky product that is tan/brown. Wheat middlings are incorporated into complete animal pellets to help provide some structure to the pellets, and in most animal diets you are unlikely to see it added as a separate ingredient because wheat middlings are very light (not dense) and take up a lot of space when not compacted into a pellet. However, wheat middlings can also be added directly into animal feed mixes if you pay attention to limiting the dust.

Whey concentrate (byproduct, non-fiber carbohydrate). Dried whey is a byproduct of the dairy processing industry and should be a nearly white powder in appearance. When wet, it should be very low in price, but the dry price typically reflects the investments in drying and transportation. This ingredient is useful as a cheap source of supplemental carbohydrates (sugars) in the diet and can be used to help transition weaned animals onto feed. Because of the sugar in this feedstuff, it may smell a bit sweet and will certainly leave behind a bit of sticky residue if handled in a humid or wet environment.



Whole oats (non-fiber carbohydrate). Oats are one of several cereal grains or small grains that can be fed as a source of digestible energy. Whole oats are often confused with barley, wheat, or rye. To help tell the difference between these small grains, oats are the longest, and most tubular-shaped of the small cereal grains. Whole oats are classified primarily as a non-fiber carbohydrate (energy) source; however, there is also some fiber in the hulls that helps keep the digestive tract of a pig moving in the right direction.

Whole wheat (non-fiber carbohydrate). Whole wheat is another cereal grain that can be tricky to identify. Typically husked (the outside hulls are removed), whole wheat appears small, round, and smooth. There is typically an accentuated dimple or crease in the grain as well. This grain is generally found in human food production, but some lots may end up in animal feed depending on quality.

Zinc chelate (mineral). Zinc is particularly valuable for immune function and foot health. However, what is unique about a chelate product (rather than a sulfate, for example) is that the zinc is bound to an organic source such as an amino acid chain or short carbohydrate chain. This causes the mineral to be less reactive in the digestive system until it is liberated by digestive enzymes in the duodenum. The mineral can then be absorbed by the animal in the small intestine. Many chelated mineral sources are difficult to identify. Note that zinc chelates in particular are often white and might resemble clumpy powder.

Diet Formulation Principles

Every nutrient needed by the pig must be present in the daily ration in the correct amounts to help the pig grow and stay healthy. You need to understand the pig's daily feed intake to choose which diet meets the pig's needs during each stage of growth. Nutrient requirements for pigs were developed from research conducted by university and feed manufacturing companies. The data are used to formulate diets that meet the genetic, health, and environmental conditions of the growing pig.

There are several feeding plans available for use in swine projects. You can purchase a complete feed or choose from options including the following:

- a corn/cereal grain base plus the addition of a purchased protein-vitamin-mineral supplement
- a corn/cereal grain base plus soybean meal plus a purchased base mineral mix
- a diet containing a corn/cereal grain base plus soybean meal plus the addition of calcium and phosphorus sources with a purchased vitamin and trace mineral premix

Complete feeds should be properly ground and mixed to increase the ability of the pig to absorb the nutrients in the ration. Purchasing a complete feed for each stage of production is an economical and effective way to feed your pigs if you have a small number of animals. Complete feeds are often available for purchase in small quantities at local supply stores.

For youth projects with a small number of animals, or for projects with only a few sows in the breeding herd, the most economical choice is usually the purchase of a complete feed.

You can also choose to use available corn/cereal grains and add a complete protein-mineral-vitamin supplement if you have access to a feed mill to grind and mix the feed. As the size of an operation increases, purchasing feed mill equipment to grind, mix, and deliver feed may be an economical choice. You must also properly store all the ingredients. Both a complete feed and use of a corn/cereal grain base plus supplements provide the proper amounts of nutrients for each age of pig when fed according to directions on the feed tag. If you have questions regarding your feeding program, consult your local county Extension office.

Tables 8.3 and 8.4 each describe three ration formulations which provide either an 18% or a 14% crude protein complete diet when mixed as indicated. The tables show the diets formulated to meet the crude protein, mineral, and vitamin needs of the pig. The diets may not fully address the energy needs of the pig when using corn grain as the primary energy source. For additional energy, fats or oils may be added. Note that protein supplements are formulated to meet all the nutrient needs of a pig based on its specific age and size. Different protein supplements are generally needed for growing and breeding pigs.

Formulated diets more precisely meet the dietary needs of the pig because they can be reformulated as the pig's weight changes. If you would rather use a formulated diet that contains corn/cereal grain, soybean meal, calcium, and phosphorus sources, and a vitamin-trace mineral premix, you will want to work with your county Extension office or your local feed dealer. These diets are formulated to specific genetics, environments, and stages of life to meet the pig's nutrient needs more accurately. Complete feeds are a form of formulated feed but cover a greater range of weight than formulated diets. If you choose a complete feed, making diet changes at the appropriate weight target allows you to meet the nutritional needs of the pig.

Feeding Your Grower-Finisher Pigs

Pigs raised for swine projects are fed during their grower-finisher period, which is a growth phase beginning at about 10 weeks of age. Pigs consume about 75% to 80% of their total lifetime feed during this period. Several factors influence the pig's growth rate and nutrient requirements, including its genetics, gender, health, environment, and stage of development. Most feeding plans adjust calories and nutrients based on the pig's weight.

Cost effective feeding plans consider both genetic traits and body weight to meet your pig's needs for growth and lean muscle development.

Feeding plans for grower-finisher pigs offer multiple phases with three to six different formulations. Diet changes—moving from one phase to the next—are based on your animal's weight and daily feed intake. Early grower-finisher diets generally contain a greater percentage of

crude protein (or lysine, an important amino acid), calcium, phosphorus, and trace minerals than the next phase in the feed program. As your animal approaches market weight, it needs a lower percentage of crude protein, calcium, phosphorus, and trace minerals.

You may think a bigger pig needs a greater percentage of crude protein, minerals, and vitamins simply because the pig is heavier. However, the opposite is true because as pigs grow, their daily feed intake also increases. As the pig eats more each day, the percentage of nutrients needed in its diet decreases. Changing its diet based on weight gain and expected daily feed intake is the most cost-effective way to meet the animal's dietary needs.

Table 8.1 Examples of Feed and Protein Needs by Weight

Weight of Pig (lb BW)	Feed Intake (lb)	Protein in Diet (%)	Amount of Protein Consumed (lb)
50	3.5	18	0.63
100	5	18	0.9
150	6	18	1.08

Barrows and gilts grow at different rates primarily because of daily feed intake. Barrows eat more than gilts each day, beginning just after they leave the nursery phase (7 to 10 weeks of age or 50 to 65 pounds). In addition, barrows tend to deposit fat at a faster rate and muscle at a slower rate than gilts. Phase feeding provides different diets based on both weight and gender.

Because barrows eat more, their diet at a given weight generally contains a lower percentage of protein, minerals, and vitamins. Gilts eat less on a daily basis. They tend to develop more lean muscle with less fat accumulation. To optimize their potential, gilts receive a diet with a greater percentage of protein, minerals, and vitamins.

Feeding a diet with too much protein is unnecessary and expensive for both the barrow and the gilt. The excess protein does not increase lean muscle; it increases the amount of nitrogen in the feces and urine, which ultimately increases the cost of raising the pig.

Table 8.2, on the following page, provides examples of a four-phase grower-finisher diet program for pigs with a genetic background for a high rate of lean muscle development, also called lean meat deposition. Note the differences in expected daily feed intake for each gender as the pig's weight increases. Remember, the difference in daily feed intake means different requirements for the percentage of crude protein including lysine, depending on the phase of growth and the gender of the animal. These numbers represent examples of industry targets. If you prefer, you can work directly with a swine nutritionist to modify and build your own diet for your pigs.

All numbers represented in Tables 8.2–8.5 are opportunities and targets within the industry. Always consult with your feed representative and nutritionist.

Table 8.2 Nutrient Recommendations for Grower-Finisher Pigs (High Lean-Gain, High Health)

Weight Range	50 to 100 lb		100 to 150 lb		150 to 200 lb		200 lb to Market	
Sex	Gilt	Barrow	Gilt	Barrow	Gilt	Barrow	Gilt	Barrow
Item	Expected Performance Response[a]							
Daily gain, lb	1.5–1.8	1.7–2.0	1.6–2.0	1.7–2.0	1.6–2.1	1.7–2.2	1.6–2.1	1.6–2.3
Daily feed, lb	3–4	3.5–4.5	4.5	4.5–5.5	4–6	4.5–7	4.5–7	5–8
Daily feed, lb (amount to obtain suggested lysine)	3.6	3.7	4.6	4.7	5.1	5.3	5.6	5.9
Nutrient Requirements								
Protein, %	18–22	17–20	17–20	16–19	16–19	15–18	14–17	13–16
Amino acids (total)[bc] Lysine, %	1.10	0.95	100	0.85	0.90	0.75	0.75	0.60
Macrominerals[sc] Calcium, %	0.72	0.72	0.72	0.72	0.58	0.58	0.58	0.58
Phosphorus (total), %	0.60	0.60	0.60	0.60	0.48	0.48	0.48	0.48
Salt, %	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25

[a] Range is denoted that reflects different environmental conditions.

[b] If gilts and barrows are fed together, use an average of the values given.

[c] Values are total dietary levels. **NOTE:** DO NOT FEED THESE LOW CALCIUM AND PHOSPHORUS DIETS TO REPLACEMENT GILTS.

Table 8.3 Eighteen-Percent Crude Protein Diet Formulations

Diet	% Protein Supplement (meets mineral and vitamin needs)	Protein Supplement (lb)		Ground Corn (lb)	
1	36	34	plus	66	= 100 lb
2	40	30	plus	70	= 100 lb
3	44	26	plus	74	= 100 lb

Table 8.4 Fourteen-Percent Crude Protein Diet Formulations

Diet	% Protein Supplement (meets mineral and vitamin needs)	Protein Supplement (lb)		Ground Corn (lb)	
1	36	19.5	plus	80.5	= 100 lb
2	40	17	plus	83	= 100 lb
3	44	15	plus	85	= 100 lb

Table 8.5 shows diets formulated to meet the specific needs of high-lean and industry-average genetic lines for the grower pig from 80 to 150 pounds.

Table 8.5 Sample formulated rations for the Grower Stage of production containing corn, soybean meal, calcium and phosphorus sources, and a vitamin-trace mineral premix.

	High Lean Pig % Lysine		Industry Average Pig % Lysine	
Sex	Barrow	Gilt	Barrow	Gilt
Ingredient, lb/ton	0.85	1.20	0.80	0.95
Corn	1575	1337	1620	1501
Soybean meal 46.5%	365	605	320	440
Monocalcium phosphate	25	23	25	24
Limestone	19	19	19	19
Salt	7	7	7	7
Vitamin premix	3	3	3	3
Trace mineral premix	3	3	3	3
Added synthetic lysine Hcl[a]	3	3	3	3
Total lb	2,000	2,000	2,000	2,000
Calculated Analysis				
Lysine %	.85	1.20	.80	.95
Protein %	14.8	19.7	14.3	16.2
Calcium %	.66	.67	.66	.66
Phosphorus %	.59	.62	.59	.59

[a] Synthetic lysine is sometimes cheaper to add than getting necessary lysine from soybean meal. Up to 3.5 lb of synthetic lysine and 96.5 lb of corn can replace 100 lb of soybean meal. Soybean meal may be cheaper as a lysine source than a synthetic form.

Feeding the Developing Breeding Gilt

The feeding plan for the breeding gilt is different than the plan for the grower-finisher pig, and the differences begin at weaning. Gilts need a diet with increased levels of minerals and vitamins. Their bodies need to store nutrients for breeding, gestation (pregnancy), and lactation.

Several breeds and maternal lines of pigs used in swine production breeding herds are classified as high-producing animals. These animals should be fed diets that optimize their lean muscle growth during the first six months of life. After the gilt enters the breeding herd, body fat is emphasized more.

Breeding gilts require more vitamins and minerals than grower-finisher pigs. Developing gilts should be fed increased amounts of various micronutrients, including but not limited to vitamin A, vitamin E, calcium, phosphorus, selenium, copper, and zinc, compared with the amounts fed to market hogs. Their body reserves of these nutrients need to be at higher levels during their future reproductive cycles.

One feeding strategy used with high-producing breeding gilts is to increase the gilt's body fat content in the weeks just before breeding takes place. By feeding a lower protein, higher energy diet, the rate of muscle growth is slightly reduced, with an increase of body fat content. This extra body fat is generally achieved by feeding a greater quantity of feed for 11 to 14 days prior to breeding. This is called flushing, and it should result in an increased ovulation rate (egg production) and litter size (number of live piglets).

Feeding the Gestating Sow

The diet fed to pregnant gilts and sows is generally a mixture of corn and soybean meal fortified with vitamins and minerals. The content of the feed for the gestating gilt or sow provides nutrition with three primary objectives:

1. Control weight gain and body condition
2. Optimize fetal development and growth
3. Support the development of reproductive tissues

During gestation, gilts and sows typically receive limited feeding. Too much feed throughout gestation can result in three major problems:

1. Unnecessary expense
2. Reduced feed intake during lactation following birth of piglets
3. Poor mammary development

During the last few weeks of pregnancy, the fetus needs more protein and energy. Increasing the amount of feed for the sow is common during the last 10 to 14 days of gestation. The sow also produces colostrum, the first milk she feeds to her litter. The quality of her colostrum depends on good nutrition. Colostrum is the source of immunoglobulins, which are proteins used by the immune system to fight bacteria and viruses. Piglets that receive colostrum within 24 hours of birth are protected from many common bacterial and viral illnesses, some of which cause diarrhea and can kill piglets. The quality of the colostrum is influenced by feeding practices, vaccine use, and the health of the herd.

The energy content of the diet and the sow's body condition score (Table 8.6) are the primary factors which determine how much feed is given to the gestating gilt (Parity 1) and sow (Table 8.7). Producers commonly feed a gestation diet at about 4–6 pounds per day to gilts and sows under most environmental conditions. This amount of feed is only a target and should depend upon the energy content of the diet, sow age, body weight, housing (inside or outside), and body condition score entering gestation.

Table 8.6 Body Condition Scoring

Score	Condition	Body Shape
1	Emaciated	Hips, backbone prominent to the eye
2	Thin	Hips, backbone easily felt without applying palm pressure
3	Ideal	Hips, backbone felt only with firm palm pressure
4	Fat	Hips, backbone cannot be felt
5	Overfat	Hips, backbone heavily covered

BCS Score 1 BCS Score 2 BCS Score 3 BCS Score 4 BCS Score 5

PHOTOS COURTESY DR. KEN STAIDER AND THE NATIONAL HOG FARMER MAGAZINE

Score	Last rib backfat depth (in.)	Condition	Body Shape
1	< 0.6	Emaciated	Hips, spine prominent to the eye
2	0.6 – 0.7	Thin	Hips, spine easily felt without pressure
3	0.7 – 0.8	Ideal	Hips, spine felt only with firm pressure
4	0.8 – 0.9	Fat	Hips, spine cannot be felt
5	> 0.9	Overfat	Hips, spine heavily covered

Figure 8.2 Condition Scoring System for Sows

Courtesy of Whitney, Mark H. From "Lactating Swine Nutrient Recommendations and Feeding Management." Available at Pork Information Gateway, porkgateway.org/wp-content/uploads/2015/07/lactating-swine-nutrient-recommendations1.pdf.

Table 8.7 Estimated Feed Intakes for Gestating Sows Fed a Corn-Soybean Meal Diet.[a]

				Approximate Daily Feed Intake, lb[c]	
Parity	Gestation Weight Gain (lb)	Farrow Weight[b] (lb)	Body Condition Score (1–5)	Industry Average	High-Producing
1	90–125	350–400	3	4.0	4.3
2	70–100	380–425	3	4.3	4.6
3	70–100	420–450	3	4.5	4.9
4	70–90	450–480	3	4.8	5.2
5–7	70–90	480–520	3	5.0	5.5

[a] Based upon herd measurement averages, the daily feed intakes should be adjusted to match the housing environment and the sow's body score.

[b] Farrowing weight reflects the initial breeding weight plus gestation gain. Lean-maternal genotypes may be bred at a heavier body weight without becoming fat.

[c] Estimated gestation feed intakes to achieve the desired measurements. Adjustments may be needed based on body conditioning score.

Critical Points of Gestation Nutrition

Day 0 to 30. Several researchers have reported that high feed intake early in pregnancy reduces embryo survival. Research in other species is showing that higher-quality protein (especially methionine) will also ensure better embryonic survival in the first few weeks. Breeding females should be fed to meet a target Body Condition Score (BCS) of three. Thin females receive more than maintenance feed level, average-BCS females are fed maintenance feed level, and fat females have a reduced feed allocation.

Day 30 to 75. Feed a constant amount of feed to meet energy requirements of the sow and maintain body condition.

Day 75 to 100. Excessive feed may increase fat deposits in the mammary glands and result in lowered milk production.

Day 100 to 114. Feed intake should be increased by approximately 1 to 2 pounds per day to meet the rapid growth and development rate of the fetal piglets. You must avoid overly fat females in late gestation. Overly fat females can have greater chances for dystocia, which means difficulty giving birth, as well as an increased risk of death during farrowing and poor appetite in lactation.

Table 8.8 gives the nutrient recommendations for gestating gilts and sows based on productivity and age. Table 8.9 shows an example gestation diet designed to be limit-fed at a minimum of 4.5 pounds per sow per day. This diet is formulated to provide all adequate protein, amino acids, vitamins, and minerals.

Table 8.8 Nutrient Recommendations for Gestation Based on Productivity and Age

Item	Parity 1		Parity 2 and Later	
	Industry Average	High-Producing	Industry Average	High-Producing
	Expected Performance			
Feed intake, lb[a]	4.0	4.3	4.3–5.0	4.6–5.5
Feed intake (2 to 3 wk prefarrow), lb[b]	4.5–5.0	5.5–6.5	5.4–7.0	5.0–8.0
Gestation gain (0–114 d), lb	100	125	75–100	90–100
Body score at farrowing (1–5)	3.5	3.5	3.5	3.5
Backfat thickness (last rib), in.[c]	0.8–1.2	0.8–1.0	0.8–1.0	0.8–1.0
Breeding weight, lb	240–280	270–320	--	--
	Nutrient Requirements (As-Fed Basis)			
Energy, Mcal ME/lb	1.4	1.4	1.4	1.4
Protein, %	14	15	12	13
Lysine, %	0.65	0.75	0.55	0.60
Minerals				
Calcium, %	0.90	0.90	0.90	1.00
Phosphorus (total), %	0.70	0.70	0.70	0.80
Salt, %	0.50	0.50	0.50	0.50

[a]Housing outdoors increases feed (energy) intake requirements. The intake values presented in this table reflect feeding once daily under indoor conditions in individual feeding stalls.

[b]The quantity to be provided depends upon sow body score. For scores less than 3.5, feed at the upper level. If the body score is greater than 4.0, the lower levels should be fed.

[c]Measurements at the end of gestation. If backfat thickness is measured at the 10th rib, the value is about 10% higher

Table 8.9 Example Gestation Diet

Ingredient	Amount (lb)
Corn (.25% lysine)	1655
Soybean meal, 44%	260
Dicalcium phosphate (18.5% P; 21% Ca)	52
Limestone (39% Ca)	15
Salt	10
Vitamin premix	6
Trace mineral premix	2
	2000

Calculated Analysis	
Metabolizable energy, kcal/lb	1430.00
Protein, %	13.00
Lysine, %	.55
Calcium, %	.91
Phosphorus, %	.80

Feeding the Lactating Sow

Proper nutrition for the lactating sow helps her produce milk, maintain a healthy weight, and prevent the loss of nutrient reserves in her body. Milk production in the mammary gland is influenced by genetics and the amino acid supply in the feed. A lactating sow produces 15 to 25 pounds of milk per day to feed the piglets in her litter. A sow's daily nutrient requirements are about three times greater than during gestation. If sows do not receive proper nutrition, their bodies use tissue reserves to produce milk. The nutrients are robbed from stored fat and muscle, which causes weight loss and may result in reduced body function. Reduced function may prevent sows from being able to breed again following weaning.

Sows overfed during gestation while they are in the farrowing house tend to become fat. They then eat less during lactation compared with sows with a lower body fat content. This is another reason to carefully limit feed during gestation and increase feed in the last two weeks.

Young sows farrowing for the first time generally consume less feed during lactation than older sows. Because young sows must get enough properly formulated feed to produce milk, energy-dense supplements can be added to standard diets. These supplements increase calorie intake in the young females that do not voluntarily eat large quantities of feed daily.

A lactating sow consumes about 9 to 15 pounds of feed per day. Daily intake depends on diet composition, the sow's condition, previous gestation feed intake, and the temperature of the farrowing facility.

Sows should be fed at least twice per day and preferably three or more times per day to optimize their intake and minimize gastric distress or upset. Feeding multiple times per day increases sow activity, encourages water consumption, and allows you to monitor feed consumption more effectively. The goal is to reach a full-feed basis within four to five days post farrowing.

Increase feed by three to five pounds per day until the sow leaves only a small quantity of feed in the feeder between feedings. After reaching full-feed, the female's feed intake should continue to be monitored and remain at full-feed through the day of weaning. Make certain the feed remains fresh, with no spoilage.

The nutritional requirements for sows with differing productivity are listed in Table 8.10. These recommendations reflect normal sow feed intake during lactation.

When constipation is a problem, the addition of a fiber source in the feed, such as wheat bran, beet pulp, or alfalfa meal, may be helpful. It should be added at a 5% level. However, fiber lowers the energy value so it should be withdrawn a few days after farrowing. Fiber can be replaced with corn, which provides the sow with additional energy in each pound of feed to sustain high milk production. Another solution is to offer a highly available magnesium source.

Sow milk contains both macrominerals and microminerals. The concentrations of calcium and phosphorus are maintained in sow milk even when the diet is inadequate. The sow's body robs her bones of calcium and phosphorus to meet her needs for milk production. Unfortunately, sows that are high producers and those that lactate for a long time are more prone to prolapses, injuries, and broken legs and/or paralysis of the hind quarter, which is called Downer Sow Syndrome. This risk may be worse after weaning, when sows are grouped together, or if sows are mated to a large boar.

Table 8.10 Nutrient Recommendations for Lactation Based on Productivity and Age

Item	Parity 1		Parity 2 and Later	
	Industry Average	High-Producing	Industry Average	High-Producing
	Expected Performance			
Daily Feed Intake, lb				
0–14 day	8.5–10.0	9.5–10.5	10.5–12.0	11.5–14.0
0–21 day	9.5–10.5	10.0–11.0	11.0–13.0	12.5–16.0
Lysine intake/day, g	35	43	38	50
Lactation weight loss (Farrowing-Weaning), lb	10–20	15–25	0–15	0–20
Rebreeding interval, days	7 to 12	7 to 12	4 to 7	4 to 7
	Nutrient Requirements (As-Fed Basis)			
Energy, Mcal ME/lb	1.5	1.5	1.5	1.5
Protein, %	15	18	14	16
Lysine, %	0.75	0.90	0.70	0.80
Minerals				
Calcium, %	0.90	0.90	0.90	1.00
Phosphorus (total), %	0.70	0.80	0.70	0.80
Salt, %	0.50	0.50	0.50	0.50

Swine producers should work with their nutritionists (university or feed company) to ensure the diets for their reproducing animals are adequately fortified to meet the lactation performance of their sow herd. Table 8.11 shows an example lactation diet.

Table 8.11 Example Lactation Diet

Ingredient	Amount (lb)
Corn	1420.0
Soybean meal	510.0
Dicalcium phosphate	39.0
Limestone	15.6
Salt	8.5
Vitamin premix	4.9
Trace mineral premix	2.0
	2000.0

Calculated Analysis	
Metabolizable energy, kcal/lb	1482.00
Protein, %	17.70
Lysine, %	.94
Calcium, %	.80

Feeding Starter Pigs

Weaning age for piglets in the United States is commonly between 20 and 24 days of age, based on herd health and production schedules. The environment, the pig's gut maturity, herd health, daily management practices, and dietary nutrition all impact the success of the newly weaned pig.

Weaning is one of the most stressful times in a pig's life. Many stressors face the recently weaned piglet, or weanling. They are removed from the mother and socialized in the nursery, moved from a liquid (milk) diet to a solid diet, taught to eat from a feeder rather than the udder, and reduced from nursing up to 20 times per day to eating only three to four times a day.

Creep feeders are often used while the piglets are still in the farrowing crate and nursing on their mother. The purpose is to make the weaning process less stressful. Creep feeders get piglets familiar with pelleted or ground feed before being moved to the nursery. Using a creep feeder allows a piglet's gut time to adjust to nutrients not found in mother's milk before the source of milk is removed.

Figure 8.3 Introduction of creep diets to nursing pigs

Starting pigs on dry feed quickly and reducing stress are key strategies to improving lifetime pig health, growth, and efficiency.

Diets to promote growth in weaned pigs are formulated with nutrients similar to those found in sow's milk. Dried milk products contain forms of protein (casein) and energy (lactose) easily digested by the young pig. Complex starter diets contain high levels of dried milk products, along with specially processed soybean products, animal byproducts, such as spray-dried porcine plasma, spray-dried blood meal, and fish meal, and carbohydrate sources, such as oat groats, in contrast to simple corn-soybean meal starter diets.

The quality of these ingredients varies greatly among suppliers. Use only high-quality ingredients in complex starter diets, even though they are more expensive. Contact a competent nutritionist for advice concerning quality of specialized feed ingredients for starter pig diets.

Feed complex starter diets to pigs weaned at less than four weeks of age. As the pig grows, its digestive system can better utilize protein and energy from plant sources, and you can transition to a simple diet. The performance boost gained by feeding complex diets decreases over time and simple diets are much less expensive.

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Figure 8.4 Wasting feed! Rule of thumb—if you cannot see the bottom of the feed trough, you are wasting feed.

Figure 8.5 Self-feeder with correct adjustment for proper feed let-down, so approximately one-fourth of the trough is not covered with feed.

Pigs weaned at fewer than 24 days old are very sensitive to anti-nutritional factors present in conventionally processed soybean meal, often developing an allergy to soy proteins, which increases diarrhea incidence and reduces growth rate (post-weaning lag). Therefore, the level of soybean meal fed to newly weaned pigs is commonly limited in first stage diets at weaning. After about two weeks, pigs become tolerant of soy protein, the allergy decreases, and growth performance improves, which allows soybean meal to replace more complex protein sources in nursery diets.

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Figure 8.6 Pelleted starter diet for weaned pigs. Note approximately one-fourth of the trough is not covered with feed.

Phase Feeding

As piglets grow, they are able to eat and digest more feed. Phase feeding plans in nursery diets are similar to phase feeding principles in the grower-finisher pig. Each phase of the diet is fed for a relatively short period of time.

Immediately after weaning, pigs receive an expensive, complex diet that contains a large proportion of high-quality, bioavailable ingredients as their digestive systems develop.

As the pig's digestive organs and body mature, those ingredients are gradually replaced with less-processed ingredients the growing pig can now fully digest. Nutrient and ingredient suggestions for a phase feeding program are presented in Table 8.12. Example starter diets follow.

Table 8.12 Suggested Nutrient Levels and Ingredients for Multi-Phase Nursery Diets

Feeding Programs for Starter Pigs				
Item	**SEW[a]**	**Phase 1**	**Phase 2**	**Phase 3**
Approximate Pig Age/ Weight Range	2.5 weeks < 11 lb	3 weeks 11–15 lb	4 weeks 1–25 lb	6 weeks 25–45 lb
Feeding period	About 1 week	About 1 week	About 2 weeks	About 3 weeks
Feed form	Pellet	Pellet	Pellet/Meal	Meal
Nutrient	Percent of Diet			
Lysine	1.70	1.50	1.25	1.25
Methionine + cystine	1.02	.90	.75	.75
Ingredient	Percent of Diet			
Dried skim milk	0–20	1–10	—	—
Dried whey	15–30	10–20	10–20	0–10
Fish meal	0–10	0–10	0–5	—
Special soy products[b]	0–20	0–20	—	—
Spray-dried porcine plasma	3–10	3–6	—	—
Spray-dried blood meal	—	—	2–5	—

[a] SEW—Segregated early weaning. Generally considered pigs weaned at less than 17 days of age and or pigs weighing less than 11 pounds at weaning.

[b] Soy protein concentrate, extruded soy protein concentrate, or isolated soy protein

The segregated early weaning (SEW) diet should be fed to pigs until they weigh about 11 pounds. The SEW diet is generally formulated to contain limited amounts of corn and soybean meal and large amounts of highly digestible ingredients, such as dried skim milk, fish meal, dried whey, and spray-dried porcine plasma. Pigs weaned onto this diet should have very limited exposure to soy protein because of the relative immaturity of the young pig's digestive system. High-quality fat from plant sources, such as soybean oil and corn oil, is usually added at a rate of 3% to process the feed into pellets.

The Phase 1 diet is commonly fed to pigs weaned at 17 to 24 days of age. Phase 1 diets generally contain high levels of dried milk products and plasma to match the pig's gut development. The Phase 1 diet should contain about 10% soybean meal, so pigs become accustomed to soy protein. This practice should ease the transition to the simpler Phase 2 diet of corn and soybean meal.

Phase 2 diets are fed for approximately two weeks and start the transition from milk-based proteins to plant-based proteins.

The Phase 3 diet is the last diet before transitioning to grower-finisher diets. It contains no milk products because the pig should be fully accustomed to a simple corn and soybean meal diet. Phase 3 diets perform well at a considerably lower cost than the previous phase diets.

These diets are provided as examples for the nutritional needs of the young pig. The first one or two phases (SEW and Phase 1) are typically pellets, which are more easily eaten by the young pig. Pellets also prevent problems with feeder flow due to the high levels of dried milk products and plasma. Because of the complexity of SEW and Phase 1 diets, commercially formulated and processed feed is easier to use. Contact your local dealer for the proper diets and availability of feed for your young pigs.

Diet and Feeding Considerations

Swine diets are typically combinations of ingredients that meet the protein and vitamin needs of the animal for the least cost. These diets are designed for the maximum rate and efficiency of weight gain or for maximum reproductive performance. Usually, a manufactured complete vitamin premix is added to the diet at a specified level. They contain vitamins A, D, E, riboflavin, niacin, pantothenic acid, choline, and cobalamin (B_{12}). Also, a trace mineral mixture is added at a specified level, or a trace mineralized salt is added at 0.35% of the diet. The trace minerals include iron, zinc, manganese, copper, iodine, and selenium. There are a number of premixes available that combine the vitamins and trace minerals. If one of these is used, regular salt should be added at 0.25% of the diet. Some commercial salt products do not contain selenium, in which case a separate selenium premix may be used at 0.05% or 0.1% of the diet.

Although most swine diets in the United States are primarily corn and soybean meal, other grains such as wheat, barley, and oats can be substituted, at least in part, for the corn. Protein supplements, such as linseed meal, cottonseed meal, peanut meal, meat and bone meal, and fish meal may substitute for at least some of the soybean meal. Choosing different feeds is usually based on availability and cost of ingredients as well as convenience and ease of mixing. Tallow or vegetable oils are frequently added at 0.5% to 2.5% of the diet to reduce dust.

Fats are added to diets to increase energy density during times of stress, such as weaning, a new environment, and hot temperatures. Also, sugar and milk byproducts are frequently added to increase acceptability of diets by young pigs. Other ingredients in swine diets include dairy, meat, grain, and distiller's byproducts.

In the Midwestern United States, corn and soybean meal are available and often less expensive than other grains. When supplemented with appropriate minerals and vitamins, corn and soybean meal provide a cost-effective and efficient diet for pigs in all stages of production. There are situations and geographical areas in which other grains and plant-based protein sources can reduce the feed cost without reducing the performance of the animals.

Wet feeding (gruel feeding), often referred to as "slopping" your pigs, can also increase growth rate. When wet feeding, only prepare enough for the pig to eat in a day or even just in a single meal. Wet feed can spoil quickly in warm and hot conditions and waste can be high. Wet feeding requires feeding the pig several times per day to increase consumption, in order to increase daily weight gain. Fat sources, flavoring, sugars, and milk byproducts have all been added to wet feeds to enhance growth rates for pigs that need the extra pounds to achieve the expected weight requirements for the fair.

The best method of getting pigs to their appropriate weight goal is to start with the right-size pig and estimate a 1.5-pound to 2-pound average daily gain. Make sure your pigs have a clean, dry environment that keeps them cool when the weather is hot and keeps them warm when the weather is cold. Feed your pigs the appropriate diet to maximize gain, and be sure clean, fresh water is always available.

Glossary

A

additive gene action. When neither of two alleles is dominant and each contributes equally to qualitative phenotype production.

additives. Substances or medications used in swine rations to stimulate growth, improve feed efficiency, secure uniformity or performance, and help to control infections.

allele. The alternate form of a gene at a given location.

all-in, all-out (AIAO). Describes the removal of all pigs from an area, which is cleaned and disinfected before a new group of pigs is introduced.

amino acids. Nitrogen-containing chemicals that are the basic building blocks for protein. Protein is found in lean muscle tissue, internal organs, blood, hair, and toenails.

anaerobic. Requiring or relating to an absence of oxygen.

antibiotics. Chemical substances produced by certain living cells, such as bacteria, yeasts, and molds, which are antagonistic or damaging to certain other living cells, such as disease-producing bacteria. Different antibiotics may kill disease germs or prevent them from growing and multiplying.

antibody. Protein in the blood modified by contact with a foreign substance (antigen) so that it exerts an antagonizing or neutralizing action against that specific substance. Antibodies are chiefly associated with gamma globulin in the blood and are key elements of the immunity mechanisms of the body. The antibody-antigen reaction is protective.

artificial insemination (AI). Depositing of sperm into the reproductive tract of a female other than by natural mating.

asphyxiation. Suffocation; a state of having too little oxygen, which can cause unconsciousness and death.

Average Daily Gain (ADG). The average number of pounds an animal gains in a day. This can be determined at any stage of growth, but it is usually determined from weaning weight to slaughter weight.

B

backfat. A layer of fat located between the skin and muscle along the back of the hog. It is generally measured over the first and last rib and the last vertebra on the carcass. It also may be measured by ultrasonic instruments on the live hog.

bailment relationship. When possession is granted, but ownership is not granted.

balanced food ration. The required amount of essential nutrients supplied to a hog during a 24-hour period.

barrow. A male pig that has been castrated and thus has no testicles.

bioavailability. The extent and rate at which a drug reaches the general circulation of an animal.

boar. An intact (uncastrated) male.

breed. A group of animals with similar external characteristics passed on from one generation to another.

C

calcium (Ca). One of the important minerals in a hog's diet.

capacitation. The next-to-last step in fertilization, which allows the sperm cell to penetrate the egg surface and complete fertilization.

carcass length. A measurement taken on the hog carcass from the aitch bone to the front edge of the first rib.

castration. The removal of both testicles.

catheter. A medical tube for insertion into a body cavity to keep a passage open or insert or withdraw fluid.

chine. The chine bone is the bone located between the shoulder blades of the pig. In older or staler-looking pigs, the chine bone can rise above the shoulder blades. If the chine bone is "deep" it represents a fresher, more immature-appearing pig, which is ideal.

chromosomes. Threadlike bodies in the nucleus of a cell, they contain the genes and DNA. The chromosomes separate during a stage of cell division. Stained and prepared specimens can be studied under a microscope.

Each parent contributes a chromosome to the pair. One pair contains the sex chromosomes. A dam contributes the X (female-determining) chromosome to the pair, and a sire contributes either an X or a Y (male-determining) chromosome.

closed herd. An area with a group of animals that have no contact with other livestock.

colostrum. The "first milk" secreted by the mammary gland shortly after birth. Colostrum is not "true" milk, but a clear-to-slightly cloudy fluid containing fats and sugars that have a slight laxative effect on the newborn piglet. Colostrum also contains immunoglobulins that pass on to the piglet some of the immunities acquired by the mother; passive immunity thus transmitted is not long lasting.

conception. The time when the male sperm fertilizes the female egg.

conformation. The general shape of the pig as determined by framework or skeleton and muscle structure.

congenital defect. A condition existing from the time of birth.

crossbred. A pig that is from parents of different breeds.

crude protein (CP). The raw protein content in a hog's diet.

cryptorchid. A pig with testicles that failed to descend into the scrotum during fetal development; the undescended testis remains in the abdominal cavity or groin.

D

dichromatic vision. Sight that detects two primary colors.

diestrus. The last stage of the estrous cycle.

dressing percentage. The carcass weight divided by the live weight.

dung. Animal urine and manure.

dunging area. The place animals urinate and defecate.

E

endometrium. The lining of the uterus.

energy. The body's fuel supply.

essential amino acids. Necessary amino acids an animal cannot produce and that must be provided to the animal in its diet.

Estimated Breeding Values (EBV). The value of an individual pig for a trait of interest.

estrous cycle. A female swine's reproductive cycle, which consists of four stages: anestrus, proestrus, estrus, and diestrus.

estrus. The stage in the estrous cycle when a female accepts a male for breeding.

Expected Progeny Differences (EPD). The value for a trait expected to be passed on from a parent to its offspring. Because half of an animal's genes are transferred from parent to offspring, an EPD is one-half of the parent's EBV.

F

farrowing. The process of birthing a litter.

feed efficiency. The number of pounds of feed required by an animal to gain one pound of body weight.

feeder pig. A young pig that has been weaned and is ready to feed out. The popular weights for feeder pigs are 40 to 60 pounds.

fertilization. Union of male and female sex cells to form an embryo.

fetuses. Unborn offspring from the date of implantation to the termination of pregnancy.

fomites. Objects that may be contaminated and transmit infectious agents.

G

gametes. Reproductive cells, such as eggs or sperm.

gene. Ultimate unit in transmission of hereditary characteristics contained in chromosomes.

genotype. The genes and combinations of genes in an animal.

gestation (pregnancy; gravidity). The period from implantation of the blastocyst in the endometrium until the termination of pregnancy.

gilt. A young female pig that has not farrowed.

H

harvested. Slaughtered.

heritability. A statistic used to describe the amount of variation within a population used to evaluate animals and to predict response. The higher the heritability of a trait, the more likely it is to be passed on to the offspring.

heterosis. The improvement in performance when a crossbred animal is compared to purebred parents. Also called hybrid vigor.

heterozygous. Individuals that have two different genes in a gene pair.

homozygous. Individuals that have the same genes in a gene pair.

hormones. Special chemicals made by the body that cause changes in the body.

hover. An overhead cover.

hurdle. A panel or board used to guide and move swine.

hybrid vigor. Heterosis.

I

inorganic. Not made from living matter or consisting of living matter.

insemination. Introduction of semen into the vagina by natural means or by artificial means.

intramuscular (IM). Into the muscle.

intravenous (IV). Into the vein.

L

lesions. Areas of tissue usually irritated by injury or disease organisms.

locus. The location of a gene on a chromosome.

loin muscle area. The number of square inches in a cross section of longissimus (loin) muscle. This is measured by cutting the loin between the 10th and 11th ribs and measuring the cut surface area of the muscle.

M

macrominerals. Minerals required in large amounts in the diet.

meat-type hog. A hog full-fed up to 220–280 pounds that exhibits a large amount of skeletal muscle with a minimum of fat. Meat-type hogs grow rapidly and convert feed into lean tissue efficiently.

microminerals. Minerals required in small amounts in the diet.

monogastric. Describes an animal with a stomach with one chamber.

N

nutrients. Chemical compounds needed by the body. Nutrient requirements vary by the age and weight of the pig.

O

Over the Counter (OTC). Medication that meets specific animal and handler conditions for safety. It is sold through retail outlets, such as farm supply stores.

ovulation. Release of egg from the ovarian follicle.

ovum. Egg cell. It is about one-fourth the size of the period at the end of this sentence.

P

personal protective equipment (PPE). Items used to protect you from contact with agents that cause disease.

pH. Symbol expressing hydrogen ion concentration. Practically, it is a scale of the acidity or alkalinity of substances. The neutral point is pH7; acidity increases below 7 and alkalinity increases above 7.

phenotype. The physical result or expression of a gene pair or genotype.

phosphorus (P). An important mineral in a hog's diet.

pregnancy. The period from implantation of the blastocyst until the expulsion or extraction of the fetus and placental membranes.

prescription (Rx). Medication requiring the diagnosis of a specific disease or condition by a licensed veterinarian, as well as special directions and safety precautions for administering it.

progeny. Identifiable offspring of a sire or dam.

protein supplement. A mixture of feeds containing high levels of proteins. The supplement is mixed with grain to provide the animal with enough protein.

purebred. An animal of a breed selected for a specific purpose, usually formally registered.

Q

qualitative trait. A trait, such as color, controlled by a single or few gene pairs.

quantitative traits. A trait, such as litter size, controlled by many gene pairs.

R

ration. The amount (weight or volume) of feed provided to a hog for a 24-hour period. Also, a formula for mixing a specific quantity of feed.

residue. From the standpoint of animal treatment, the medication that remains in the body after it is given. The medication level remaining following treatment is gradually reduced over time as the medication is utilized by the animal and removed from the animal through urination and defecation.

S

scrotum. Pouch covering the testes.

selection. The process of choosing animals that will pass desired traits onto their offspring.

selection indexes. The value estimated for two or more traits in combination.

sow. A female pig that has produced at least one litter of pigs.

soybean meal (SBM). A source of protein in a hog's diet.

sperm. The male reproductive cell.

subcutaneous (SQ). Under the skin.

T

testosterone. Male hormone. A steroid hormone produced by the cells of the testis independent from cells that produce spermatozoa.

trait. A quality or characteristic, such as eye color or growth rate.

U

ultrasound. High-frequency sound waves used to observe the internal anatomy of the hog without the need for surgery or invasive techniques. Ultrasound is often used in the swine industry to determine pregnancy status and for measurement of backfat depth and loin muscle area by qualified technicians or veterinary personnel.

umbilical cord. The long, flexible tube attached to the placenta at one end and to the abdomen of the fetus at the other. It is the lifeline of the fetus. Through vessels of the cord, the fetus receives nutrients and disposes of wastes. The cord continues to function until it is tied and severed at birth.

unkempt. A rough, messy, uncared-for appearance.

unthrifty. Not strong and healthy.

ureters. The tubes that carry urine from the kidneys to the bladder.

uterus. The female organ in which unborn young develop and grow.

V

vaccine. Any bacterial or viral material used for inoculation against a specific disease. Virus vaccines are of two types: live virus or killed virus vaccines.

vagina. The canal from the uterus to the outside of the body.

vector. A carrier of something that causes a disease, which moves it from an infected to a non-infected animal.

W

withdrawal time. The period of time that must pass before a product can be harvested after treatment with a medication.

Z

zoonotic diseases. Illnesses transferred between people and animals.

zygote. A fertilized egg.

Answer Key

Chapter 5

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	Rank		Rank		Rank		Rank			
Gilt	Days to 250 EPD		Backfat EPD		21-Day Litter Weight EPD		No. Born Alive EPD		Total	Placing
A	2	+	2	+	1	+	1	=	6	1
B	1	+	4	+	2	+	4	=	11	3
C	3	+	1	+	4	+	2	=	10	2
D	4	+	3	+	3	+	2	=	12	4

Placing is by lowest score. This class is placed 1-A, 2-C, 3-B, and 4-D.

Explanation of the Gilt Scenario Placing

One of the best methods available for evaluating a production scenario involves ranking each gilt by performance categories. This is not difficult if you remember that in some cases, you look for positive values, and in some cases, you look for negative values. For example, backfat, days to 250 pounds and feed efficiency are traits where negative EPD values are the goal. In contrast, when looking at the number born alive, 21-day litter weight, and the loin muscle area, positive EPD values are preferable.

Following the ranking process described, the Yorkshire gilt A is superior to the other three females when combining production and reproduction traits. Gilt C is ranked second and should be the second gilt chosen based on the combination of EPDs for the four traits. Gilts B and D would be culled.

Note: Your choice of replacements would differ if you looked only at reproduction (Number Born Alive and Litter Weight) as Gilts A and D would be chosen. If you selected only on the basis of one trait (Days to Market) you would select Gilts A and B. This example shows selection decisions are based on breeding objectives. Maintaining a commitment to breeding objectives allows you to make true genetic progress in a herd.

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Boar Scenario Placing

1. C; This boar has the highest overall rank.
2. B; This boar has the highest EPD for number born alive.
3. Both C and D have equal rank. If growth is more important, choose Boar D. If backfat reduction is more important choose Boar C.

Chapter 8

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1. grain products
2. 19%
3. 5%
4. Yes
5. pigs weighing between 30 and 75 pounds

Chapter 9

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Medication Label/Treatment Record Activity

1. The Treatment Record would be completed as shown. The information marked with an X was not supplied in this situation.
2. The withdrawal period will be complete at July 19, 20XX, at 2 p.m.

Animal ID:

Date and Time of Treatment (a.m. or p.m.) July 12, 20XX at 2 p.m.	**Estimated Weight** 200 lb	**Name and Contact Info for Veterinarian Prescribing Rx or Directing Extra-label Treatment** Bruce E. Losis, DVM 100 Quality Ave. Hometown, OH 43200 614–555–5050
Condition Being Treated Pneumonia	**Treatment Given*** Biomycin, 5 ml (cc) SQ	**Printed Name of Person Giving Treatment** Cal Jones
Instructed Withdrawal (hours or days) 7 days, meat		**Actual Date and Time Withdrawal Is Complete** July 19, 20XX at 2 p.m.
Results (recovered, sold, died) and Comments X		

*For Treatment Given, include product, amount, route of administration, and lot/serial number, if available.

Resources

Websites

The following websites were available at the time of printing:

Agricultural Libraries

- National Agricultural Library
  nal.usda.gov
- National Institute for Animal Agriculture
  animalagriculture.org

Animal Behavior

- Livestock Behavior, Design of Facilities and Humane Slaughter by Dr. Temple Grandin
  grandin.com

Breeding

- National Swine Improvement Federation (NSIF)
  swineimprovementfederation.com

Cooperative Extension Service

- National Directory of State Extension Services
  nifa.usda.gov/land-grant-colleges-and-universities-partner-website-directory
- North Carolina State University's Extension Swine Husbandry
  swine.ces.ncsu.edu/swinehusbandrytopics
- Ohio Pork Information Center
  porkinfo.osu.edu
- Ohio State University Extension
  extension.osu.edu
- Ohio State University Extension Ohioline
  ohioline.osu.edu
- Virginia Cooperative Extension
  sas.vt.edu/extension/vtswine

Government Departments of Agriculture

- Ohio Department of Agriculture
  agri.ohio.gov
- United States Department of Agriculture
  usda.gov

Meat Science

- American Meat Institute
  meatinstitute.org
- U.S. Meat Animal Research Center
  ars.usda.gov/plains-area/clay-center-ne/marc
- U.S. Meat Export Federation (USMEF)
  usmef.org

The Ohio State University

- College of Food, Agricultural, and Environmental Sciences
  cfaes.osu.edu
- College of Food, Agricultural, and Environmental Sciences Research
  oardc.osu.edu
- Department of Animal Sciences
  ansci.osu.edu
- Ohio 4-H Animal Sciences
  ohio4h.org/animalsciences
- The Ohio State University Agricultural Technical Institute
  ati.osu.edu
- Ohio State University Extension
  extension.osu.edu
- Ohio State University Extension Ohioline
  ohioline.osu.edu
- Ohio State University Extension Publications
  extensionpubs.osu.edu

Swine Associations

- National Pork Board
  pork.org
- National Pork Producer's Council
  nppc.org
- Ohio Pork Council
  ohiopork.org
- Pork Checkoff
  porkcheckoff.org
- Pork Information Gateway
  porkgateway.org

Swine Breeds and Organizations

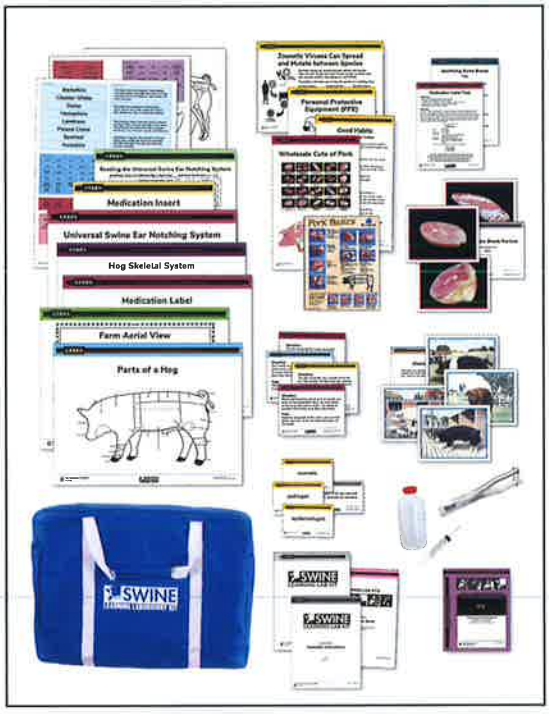
- American Berkshire Association
  americanberkshire.com
- Certified Pedigreed Swine
  cpsswine.com
- Chester White Association
  cpsswine.com/chester-white
- Duroc—National Swine Registry
  nationalswine.com/about/breeds/about-duroc.php
- Hampshire —National Swine Registry
  nationalswine.com/about/breeds/about-hampshire.php
- National Hereford Hog Record Association
  cpsswine.com/hereford
- Landrace —National Swine Registry
  nationalswine.com/about/breeds/about-landrace.php
- National Swine Registry
  nationalswine.com
- Poland China Record Association
  cpsswine.com/poland-china
- Spotted Swine Breeders
  cpsswine.com/spotted
- Tamworth Swine Association
  tamworthswine.org
- Yorkshire —National Swine Registry
  nationalswine.com/about/breeds/about-yorkshire.php

Veterinary Science

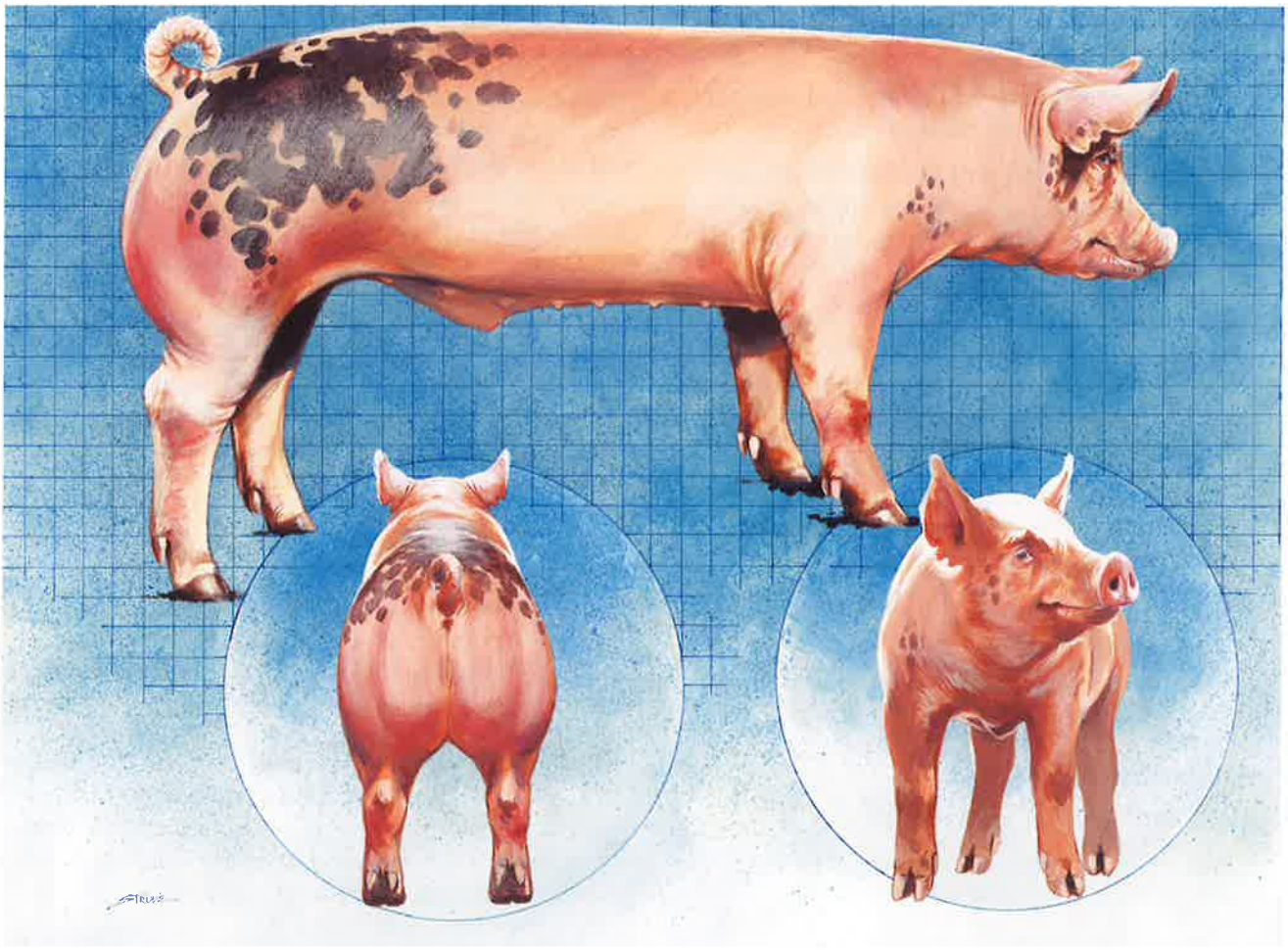
- The Ohio State University College of Veterinary Medicine
  vet.osu.edu
- Penn Vet, University of Pennsylvania School of Veterinary Medicine
  vet.upenn.edu

Swine Learning Lab Kit

For club leaders, agriculture teachers, and other active participants in swine education, the *Swine Learning Lab Kit* produced by Ohio State University Extension is a comprehensive, durable teaching tool with hands-on activities on anatomy, breeds, conformation, breeding, and much more.



extensionpubs.osu.edu



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SYMBOL III
A Standard of Excellence

To Make U.S. Pork the Consumer's Meat of Choice.

SYMBOL III is an ideal market hog that symbolizes profitability for every segment of the industry. This hog has correctness of structure, production, performance, function, livability, attitude, health, optimum lean yield, and produces the best quality, safest pork that provides the optimum nutrients for human nutrition.

Production Characteristics*

- Live-weight feed efficiency of 2.4 (2.4)
- Fat-free lean gain efficiency of 5.9 (5.8)
- Fat-free lean gain of 0.95 lbs. per day
- Marketed at 156 (164) days of age
- Weighing 270 pounds
- All achieved on a corn-soy equivalent diet from 60 pounds
- Free of internal and external parasites
- From a high health production system
- Immune to or free of all economically important swine diseases
- Produced with Environmental Assurance
- Produced under PQA & TQA Guidelines
- Produced in an operation which has been SWAP assessed
- Free of the Stress Gene (Halothane 1843 mutation) and all other genetic mutations that have a detrimental effect on pork quality
- Result of a systematic crossbreeding system, emphasizing a maternal dam line and a terminal sire selected for growth, efficiency and superior muscle quality

- From a maternal line weaning > 25 pigs/yr after multiple parities
- Free of all abscesses, injection site blemishes, arthritis, bruises and carcass trim
- Structurally correct and sound with proper angulation and cushion and a phenotypic design perfectly matched to the production environment
- Produced in a production system that ensures the opportunity for stakeholder profitability from the producer to retailer while providing a cost competitive product retail price in all domestic and export markets
- Produced from genetic lines that have utilized genomic technology to support maximum improvement in genetic profitability and efficiency

Quality Characteristics

- Muscle color score of 4.0
- 24 hr. pH of 5.9
- Maximum drip loss of 2.5%
- Intramuscular fat level of 3.0%
- Free of within-muscle color variation and coarse muscle texture
- Free of ecchymosis (blood splash)
- Provides an optimum balance of nutrients important for human nutrition and health
- Provides a safe, wholesome product free of all violative residues and produced and processed in a system that ensures elimination of all food borne pathogens

Carcass Characteristics*

- Hot carcass wt of 205 lb
- LMA of 6.5 (7.1) sq in.
- Belly thickness of 1.0 inches
- 10th rib backfat of 0.7 (0.6) inches
- Fat-free Lean Index is 53.0 (54.7)

***Note:** All numbers in parentheses represent gilt numbers corresponding to the barrow numbers shown.

Symbol History

Symbol III is the "symbol of perfection," a package delivering a phenotypically desirable hog and excellent production performance. It is the result of genetic selection and breeding for desirable performance and carcass quality traits; a production system that provides the ideal environment, health status and inputs for its efficient growth; and a management team of dedicated pork producers caring for its health and well-being.

Symbol III represents today's market hog and the evolution of the industry's product shaped by consumer preferences.

It is preceded by Symbol and Symbol II. Symbol represented the market hog of the 80s. Developed as part of the Pork Checkoff's Pork Value Program, in its description, Symbol has established production traits and some mention of performance and carcass characteristics.

Symbol II was adopted in 1995. This market hog evolved into a leaner, better muscled hog that could be marketed on the newly developed carcass merit programs. Its job description mentions, but does not elaborate on, carcass and pork quality.

In 2005, Symbol III incorporates into its description the science-based standards and practices producers have adapted into their production, such as PQA™ and SWAPSM. Carcass and meat quality have also become important traits for the new Standard of Excellence, Symbol III.

CHAPTER 9

Health and Herd Management

Health management is a key part of raising and producing pigs. Nutrition, environment, and genetics play a big role in preventing diseases and keeping your animals healthy, but they alone are not enough. Even at a small scale, you need to be aware of diseases your hog may encounter. Disease can destroy an entire herd in a short amount of time if proper management practices are not used.

Learning Objectives

- Define zoonotic diseases.
- Describe biosecurity practices and explain their importance to animal health and human health.
- Establish and follow a biosecurity protocol with your animal(s).
- Know when to call your veterinarian.
- Understand when and how to administer medications.
- Identify major diseases and parasites in swine.

Herd Health Programs

You should prepare and follow a herd health program regardless of the size of your herd—even if you have just one animal. Diseases can enter a farm through the addition of animals. Diseases can be transmitted on **fomites**, which are the surfaces of objects like gates or doorknobs. Diseases can be spread by **vectors**, which include pests such as flies and mosquitos. Humans can transmit diseases on their skin, hair, clothing, boots, and so forth. Diseases also can be spread by equipment, such as a delivery truck or maintenance vehicle, which has not been properly sterilized.

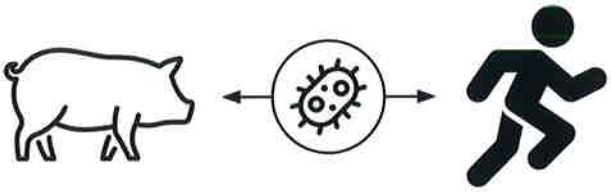
Zoonotic Disease Risk and Prevention

Diseases spread among swine. Some diseases also spread between pigs and people. As a responsible livestock owner, you can take measures to reduce the spread of pig-to-pig, pig-to-human and human-to-pig diseases.

Controlling diseases specific to pigs is essential for pig health and welfare.

What Is a Zoonotic Disease?

A zoonotic disease is an illness or infection that can spread between animals and people. Many diseases that cause illness in people come from animals. Some diseases, such as influenza, can get to pigs from people they are in contact with. Viruses, bacteria, fungi, and parasites can cause zoonotic diseases.



How Do Zoonotic Diseases Spread?

Zoonotic diseases spread in a variety of ways:

- through the air
- through contaminated food and water
- from direct or indirect contact with:
  - —another person or animal
  - —contaminated objects, such as doorknobs or equipment
  - —skin or mucous membranes, saliva, urine, blood, or body secretions

Disease can spread through contaminated air (aerosol transmission), objects (fomites), fecal-oral matter, or insects (vector-borne).

ADOBE STOCK

Examples of Disease Transmission

Airborne droplets from the nose and throat. Some diseases are spread when an infected person or animal sneezes or coughs out tiny airborne droplets. Another person or animal may breathe in the droplets and get sick. Or the droplets may land on the surfaces of objects and another person or animal may get sick through contact with the droplets on those surfaces. One example of an airborne disease is influenza.

Fecal-oral transmission. Some infections are spread when microscopic amounts of feces from an infected person or animal are swallowed by another person or animal. The infected person, called a carrier, may not have signs of disease. Feces may be passed directly from soiled hands to the mouth. Feces may also be passed indirectly—by way of soiled objects, surfaces, food, or water.

These are examples of diseases spread from feces:

- gastrointestinal infections
- hepatitis E

Contact with skin or mucous membrane. Some infections are spread directly when skin or mucous membranes (lining of the nose and mouth) come into contact with other skin or mucous membranes. Infections are spread indirectly when skin or mucous membranes come in contact with contaminated objects or surfaces.

These are examples of diseases spread by skin or mucous membranes:

- erysipelas
- leptospirosis
- ringworm
- *Streptococcus suis*

Disease Transmission Prevention

Now that you understand how diseases spread, you can take steps to protect your animals from getting sick.

What Is Biosecurity?

Biosecurity is a set of preventive measures which reduce the risk of spreading infectious diseases. You should follow industry suggestions and create a set of rules to follow that keeps you and your animals safer. These safety rules are also called a biosecurity protocol.

Biosecurity includes many responsibilities. Protecting your animals from all types of infectious agents, such as viruses, bacteria, fungus, or parasites, also protects you and your family.

Some infectious agents can live in the environment for a long time. Your biosecurity protocol should include keeping your animals' environment clean, using PPE, and thoroughly washing your hands both before and after you work with your animals.

Keep new animals separated from the rest of the herd. Remember that animals may be infected and able to spread a disease, even if they do not have symptoms of illness. The new animals should be examined by a veterinarian before you introduce them to the other animals on your farm.

Always follow directions for best standards for sanitation, space, proper nutrition, feed storage, and medical care. Remember that healthy animals are more likely to stay well, while stressed, cold, underweight, and crowded animals may be more susceptible to illness.

Figure 9.1 Ask visitors to cover their shoes with plastic boots before they enter the barn. This measure prevents visitors from bringing dirt and microbes to your facilities.

NATIONAL PORK BOARD

Figure 9.2 Clean your boots every time you finish your chores at the swine barn. This way, the dirt will not stick easily, and the boots will be ready to use the next time you need to access the barn.

NATIONAL PORK BOARD

Figure 9.3 This image shows the pig barn under a cleaning procedure. It is important to maintain clean facilities at all times, but you can give it a deeper cleaning when there are no pigs housed.

These biosecurity measures are recommended:

- Purchase your animal(s) from a breeder or farm with a good reputation for providing healthy animals.
- Avoid contact with your pigs if you have been around other pigs in the past 24 hours.
- Avoid contact with your animals if you are ill; stay away until you are fever-free for 24 hours.
- Keep a **closed herd** (do not bring in other animals) if possible.
- Quarantine new animals that arrive on the farm.
- Do not mix age groups, if possible. Diseases that affect one age group may not affect a different age group.
- Feed and care for existing animals before you care for new or returning animals.
- Prevent rodents, other animals, and insects from entering your barn, especially the feed and manure storage areas.
- Develop protocols for visitors to your farm.
  - —Limit visitors to your barn.
  - —Be sure visitors wear clean boots and were not exposed to swine in the previous 24 hours.
  - —Ask visitors if they have traveled internationally in the past five days and do not let them enter your barn if they have.
- Do not share equipment used in animal care or manure hauling.
- Clean and disinfect all equipment between uses. This includes feeders, waterers, hurdles, and show supplies.
- Use proper sanitation after animals leave the barn.
- Clean, sanitize, and properly store medical supplies, tools, and other equipment.
- Observe proper needle storage and disposal.

For more tips speak to your club advisor, specialist, veterinarian, local pig producer, or your county's Extension office.

AMERICAN LUNG ASSOCIATION

Figure 9.4 Follow these steps when washing your hands: 1) Wet your hands; 2) Add soap; 3) Lather and scrub for 20 seconds. 4) Rinse for 10 seconds; 5) Dry your hands; 6) Turn off the tap. Don't forget to wash between your fingers, wash under your nails, and wash the tops of your hands.

What Is Proper Hand Hygiene?

Hand washing—proper hand hygiene—is the most effective method to reduce the spread of disease. To reduce the spread of zoonotic disease between you and your pig, properly wash your hands before and after touching animals or animal husbandry items.

Wash your hands after being in a barn or trailer, even if you did not touch a pig. Objects, such as gates, can serve as fomites for disease.

What Is Personal Protective Equipment?

Personal protective equipment, or PPE, refers to items used to protect you from contact with agents that cause disease. You should consider wearing PPE when caring for pigs, especially when they are ill.

These common types of PPE should be used in a swine barn:

Rubber boots protect your feet from manure and moisture. They are also easy to clean and disinfect.

Gloves protect against infectious agents entering the body through small cuts on your hands.

Protective clothing protects against direct contact with infectious agents.

Face masks protect from inhaling airborne droplets.

NATIONAL PORK BOARD

Figure 9.5 In commercial pig farms, it is common to keep spare pairs of clean boots and coveralls for employees and visitors. This measure decreases the possibility of people bringing bacteria, viruses, and parasites to the pigs.

Preventing Disease Transmission at Swine Shows

Exhibition swine are more frequently exposed to disease because they encounter other pigs and people at fairs and shows. Keep yourself and your animals healthier by following these suggestions before, during, and after the show.

Before the Swine Show

- Develop and follow biosecurity protocols and swine health practices at home.
- Clean and disinfect facilities, feeders, and PPE, especially boots.
- Limit your pig's exposure to people and traffic.
- Control exposure to wildlife, birds, and other pests.
- Take only clean and disinfected equipment to the show.
- Do not show a pig or pen-mates for at least seven days after returning from an exhibition.

Figure 9.6 Direct contact can be avoided with the use of personal protective equipment (PPE), including gloves.

- Never bring an unhealthy animal to exhibition; sick pigs and sick people need to stay home so they do not infect other pigs or people.
- Evaluate your pig's health daily by answering these five questions:
    1. Is your pig eating normally?
    2. Is your pig coughing or having trouble breathing?
    3. Does your pig have a fever? (Normal body temperature is between 101.5 and 102.5 F.)
    4. Does your pig appear depressed?
    5. Does your pig have loose stool?

If you answer "Yes" to at least one of these questions, you might not bring your pig to an exhibition. Be sure to talk with your veterinarian—or the show veterinarian—if your pig becomes sick.

Before participating in a show, check the exhibition rules for any requirements. You may need to check with a veterinarian about required vaccines. Swine vaccinated for infectious diseases may be less likely to become ill, and if they become sick, they may be contagious for a shorter time.

During the Swine Show

Continue to evaluate your pig's health daily, using the five questions above. If you become ill during the show, see your doctor and tell them you have had pig exposure. People who are sick should stay away from pigs until they are fever-free for at least 24 hours without the use of fever-reducing medication.

In addition, remember the following:

1. Report any suspected illness to the designated exhibition veterinarian or the appropriate exhibition staff so your pig can be evaluated.
2. Use precautions such as PPE and proper hand hygiene when caring for sick pigs to prevent spreading the disease to others.
3. Do not borrow or share equipment with other exhibitors.
4. Clean your area and equipment.
5. Wash your hands after contact with pigs and equipment.
6. Do not eat or drink in the animal areas.
7. Do not sleep in the animal areas.

ISTOCKPHOTO.COM BY GETTY IMAGES

Figure 9.7 Wash boots between visits to different facilities.

After the Swine Show

After you return home from the show, you should watch for signs of illness in your pigs and yourself. Be sure to do the following:

1. Isolate and observe animals for signs of illness for at least seven days before allowing contact with other animals.
2. Clean and disinfect equipment, clothing, shoes, vehicles, and trailers that were at the exhibition.
3. Contact your veterinarian if your pigs become ill.
4. Consult a healthcare provider and public health official as soon as possible if you or your family members develop illness.
5. Inform the healthcare provider of close contact with swine and/or exhibition attendance.

Zoonotic Diseases in Swine

You can promote good pig health and reduce the chance of human infection by understanding the signs of disease. Observe your pig daily for changes in behavior and appearance. If you see clinical signs of zoonotic diseases, follow these steps:

1. Talk to your veterinarian.
2. Practice good biosecurity to prevent disease transmission to other animals.
3. Use proper PPE to prevent transmission to humans.

Refer to the Infectious Diseases section beginning on page 116 for more information on these zoonotic diseases:

- erysipelas
- gastrointestinal infections
- hepatitis E
- influenza
- leptospirosis
- ringworm
- *Streptococcus suis*

Providing Medical Care

In addition to knowing about diseases and ways to prevent them, a herd health management plan includes giving medications. You will learn about the following in the next sections in this book:

- administering medications as prescribed by your veterinarian
- reading drug labels
- keeping treatment records
- understanding withdrawal times

Elements of Good Treatment Records

Veterinarian-Client-Patient Relationship (VCPR). A herd management plan includes a relationship with a veterinarian who knows about your animal's health. They take charge of the medical decisions about your animal's treatment. Your veterinarian has to be available for follow-up in case your animal does not respond to treatment as expected. You, as your animal's caretaker, must follow your veterinarian's instructions regarding its treatment plan. When the VCPR is part of a Veterinary Feed Directive order, the Veterinarian of Record (VoR) and client must have a signed agreement.

Veterinary Feed Directive (VFD). Antibiotics are not allowed to be added to feed used for production or show purposes without oversight and approval by a veterinarian. Medically important drugs are only used for treatment, control, and prevention of disease. A veterinarian with a VCPR can write a Veterinary Feed Directive. Only directives in writing can be used to obtain the medicated feed. **Remember**: You must follow the feeding instructions exactly as directed on the VFD and only for the length of time listed.

You can read more about Veterinary Feed Directives in the Ohio 4-H VFD fact sheet online at **go.osu.edu/4h-vfd-factsheet**.

Withdrawal Time. After medications are administered, a small amount remains in the animal's tissues. A specific period of time must pass from the last treatment until the **harvest** of the animal for human consumption. This time period is called withdrawal time.

Extra-label Drug Use. Veterinarians can prescribe use of a medication different than the instructions on the label. This is called extra-label use. Extra-label drug use is allowed only under the direction of a licensed veterinarian, by prescription, and when a VCPR is in place. Examples of extra-label drug use include:

- using a medication as a treatment for a disease not listed on the label
- using a medication to treat a species of animal not listed on the label
- increasing the dose of a medication beyond the dose listed on the label
- increasing the frequency of delivery of a medication
- changing the type of administration

Extra-label drug use, if not directed by a veterinarian with an established VCPR, is illegal.

Extra-label use is not permitted when using a Veterinary Feed Directive.

Veterinary drugs are available in two categories, **over-the-counter** (OTC) and prescription (Rx). To be an OTC product, the medication must meet specific safety conditions for both the animal and the person handling the product. The OTC medications may be sold through retail outlets, such as farm supply stores.

Some medications require the diagnosis of specific diseases or conditions, as well as special directions and safety precautions for administration of the drug. Prescription products are identified by this statement on the container:

Caution: Federal law restricts this drug to use by or on the order of a licensed veterinarian.

Veterinarians prescribe animal medications only where a valid VCPR has been established, just as they are allowed to authorize extra-label drug use only with a valid VCPR. The prescription medications are available only on the order of a veterinarian, just as prescriptions for drugs used by people are only available from physicians.

Suggestions for Proper Administration of Animal Drugs

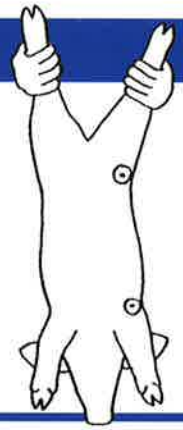
- Give medications according to label instructions. Routes for administering drugs include:
  - —**Topically** (top)–generally means on the skin or mucous membranes
  - —**Orally** (po, per os)–means by mouth, this could be via food or water as well; (MF) indicates medicated feeds
  - —**Subcutaneous** (SQ)–means under the skin
  - —**Intramuscular** (IM)–means in the muscle
  - —**Intravenous** (IV)–means into the blood
- If necessary, properly restrain the animal before giving a medication.
- For injections:
  - —When the label directions permit, give injections under the skin (subcutaneous) so the muscle tissue is not injured.
  - —Use sterilized needles and syringes. Keep the bottle cap clean.
  - —Give injections at clean, dry sites on the animal, avoiding the areas where the muscles (meat cuts) are of high value. The most common areas for injection in a pig are the lateral sides of their necks.
  - —Do not transfer needles back and forth from animal to bottle because you may carry bacteria from the animal's skin back into the bottle.

To help you fully understand injection types and procedures, Figures 9.8a and 9.8b show Pork Quality Assurance handouts from the National Pork Board. Review these charts and make sure you understand them. Either make copies or contact the Pork Checkoff to obtain poster-size copies. Hang them where you administer medication, such as in the barn, or where you store your medications and supplies. Keep them in an easy-to-reference location.

pork **Quality Assurance**

Administer All Injectable Drugs and Oral Medications Properly

Injection Reference Chart



Subcutaneous (SQ):

Deposits the Drug Under the Skin:

Inject only into clean, dry areas.

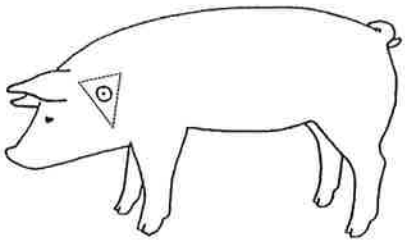
Use the loose flaps of skin in the flank and elbow of small pigs.

Use the loose skin behind the ear of sows.

Slide needle under the skin away from the site of skin puncture before depositing the compound.

Intramuscular (IM):

Deposits the Drug Into the Muscle:



Use a spot on the neck just behind and below the ear.

The neck area should be used for IM injections. (*See area outlined in figure to the right.*)

Damage to the ham or loin can result in condemnation of the meat cut.

Use proper needle size to ensure medication is deposited in the muscle.

Intraperitoneal (IP):

Should be used only upon veterinary instruction and guidance as serious injury to abdominal organs can occur.

Correct Injection Techniques:

Ensure proper restraint of the animal prior to injection.

Ensure proper syringe adjustment.

Ensure proper needle placement onto the syringe.

Prevent swelling and/or abscessation at the injection site by:

1. Using sterile needles.
2. Injecting only into clean and dry areas.
3. Preventing contamination - don't use the same needle to inject pigs and remove product from multidose vials.

Consult with your veterinarian about potential adverse drug and vaccine reactions.

To enroll in the PORK QUALITY ASSURANCE™ Program or for more information, contact:

NATIONAL PORK BOARD
pork.org

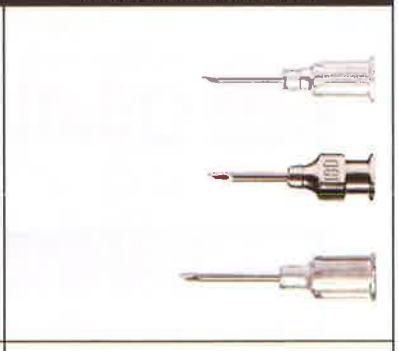
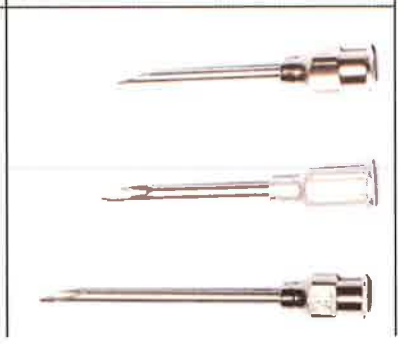
Consult product label for approved routes of administration.

Figure 9.8a Injection reference chart

COURTESY OF THE NATIONAL PORK BOARD

PQA PLUS
Our Responsibility, Our Promise.

NEEDLE SIZE REFERENCE CHART

STAGE OF PRODUCTION	IM NEEDLE RECOMMENDATION	ACTUAL NEEDLE SIZES
 Piglet	18 or 20 Gauge 1/2 or 5/8 inch Length	
 Nursery	16 or 18 Gauge 3/4 or 5/8 inch Length	
 Market/Finish	16 Gauge 1 inch Length	
 Breeding	14 or 16 Gauge 1 or 1.5 inch Length	

COURTESY OF THE NATIONAL PORK BOARD

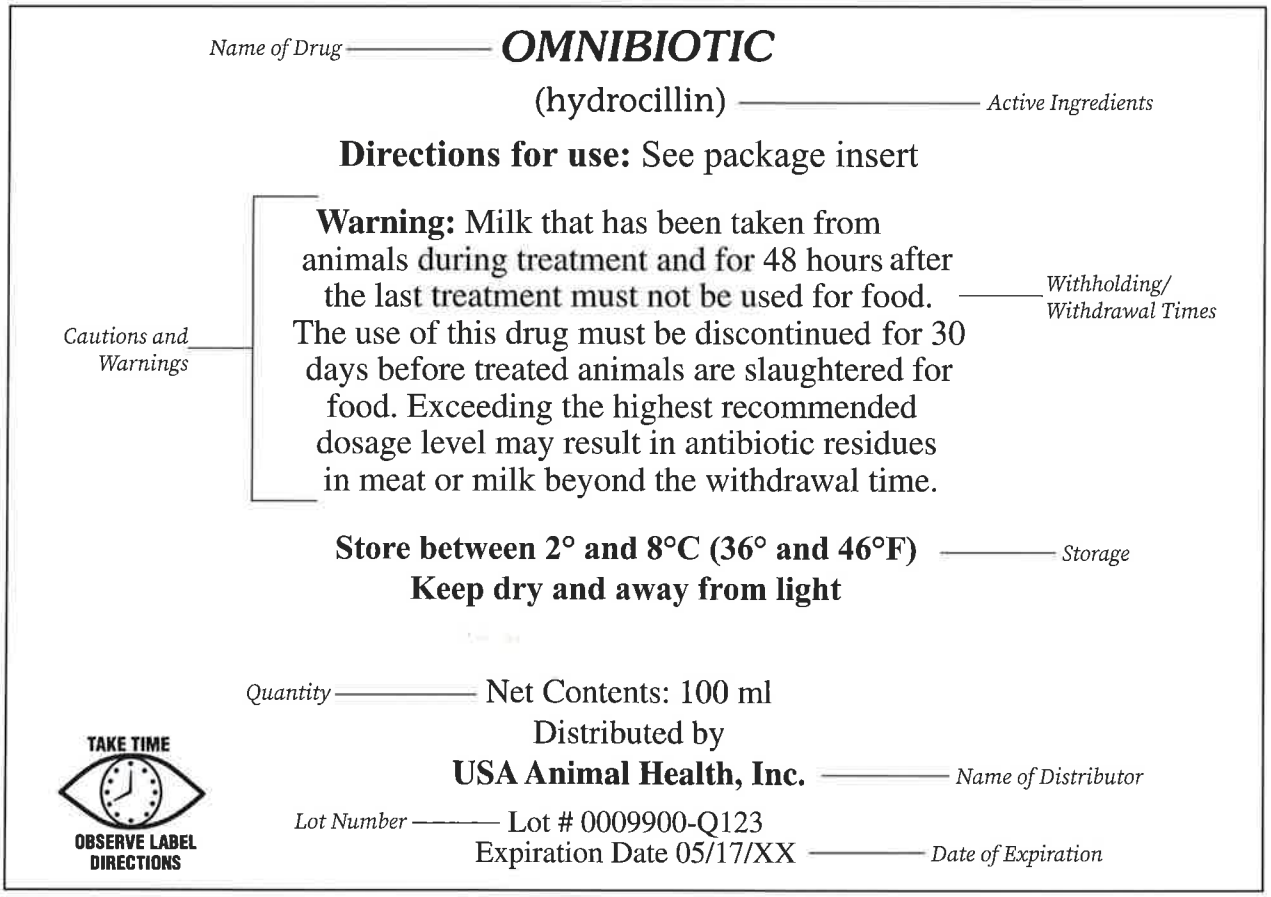
Figure 9.8b Needle size reference chart

Guide to Reading Medication Label on Outside of Container

- **Active Ingredients**. Chemical name(s) of what is in the drug.
- **Withdrawal Time**. The specific period of time that must pass from the last treatment of medication given to an animal until the harvest of the animal (slaughter) for human consumption. After medications are administered, a small amount remains in the animal's tissues.
- **Storage**. Directions for keeping the medication while not in actual use. Many medications may lose their potency when exposed to moisture, direct light, or temperatures that are too warm or too cold. Most medications also lose effectiveness with time. The label indicates how the product should be stored to retain maximum strength.
- **Quantity**. Tells how much is in the container. Usually in metric units. Liquid measure: 1 fluid ounce = 29.6 milliliters (ml); 1 cubic centimeter (cc) = 1 milliliter (ml). Dry measure: 1 pint = 551 milliliters (ml).
- **Lot Number**. A manufacturer's reference number indicating the date of manufacture or batch in which the product was made. This number is needed if the product is recalled. It may also be referred to as a serial number.
- **Date of Expiration**. This indicates when the drug is no longer effective and should be disposed of properly.

Remember, you are responsible for everything your animal consumes, even if it is by accident.

Medication Label



Adapted from information in the *Beef, Sheep,* and *Swine Learning Laboratory Kits*

Before administering any drug to an animal, you must understand the information found on the drug label and insert. Make sure you review the medication label and medication insert.

Medication Insert

Name of Drug — **OMNIBIOTIC**

(hydrocillin in Aqueous Suspension) — *Active Ingredient*

For use in Beef Cattle, Lactating and Non-Lactating Dairy Cattle, Swine and Sheep — *Species and Animal Class*

Read Entire Brochure Carefully Before Using This Product

Active Ingredient(s): Omnibiotic is an effective antimicrobial preparation containing hydrocillin hydrochloride. Each ml of this suspension contains 200,000 units of hydrocillin hydrochloride in an aqueous base.

Approved Uses — **Indications:** Cattle - bronchitis, foot rot, leptospirosis, mastitis, metritis, pneumonia, wound infections. Swine - erysipelas, pneumonia. Sheep - foot rot, pneumonia, mastitis, and other infections in these species caused by or associated with hydrocillin-susceptible organisms.

Recommended Daily Dosage

The usual dose is 2 ml per 100 lb of body weight given once daily. Maximum dose is 15 ml/day.

Body Weight	*Dosage*
100 lb	2 ml
300 lb	6 ml
500 lb	10 ml
750 lb or more	15 ml

Dosage

Continue treatment for 1 to 2 days after symptoms disappear.

Cautions and Warnings

Caution: 1) Omnibiotic should be injected deep within the fleshy muscle of the neck. Do not inject this material in the hip or rump, subcutaneously, into a blood vessel, or near a major nerve because it may cause tissue damage. 2) If improvement does not occur within 48 hours, the diagnosis should be reconsidered and appropriate treatment initiated. 3) Treated animals should be closely observed for at least 30 minutes. Should a reaction occur, discontinue treatment and immediately administer epinephrine and antihistamines. 4) Omnibiotic must be stored between 2° and 8° C (36° to 46° F). Warm to room temperature and shake well before using. Keep refrigerated when not in use.

Route of Administration

Storage Requirements

Warning: Milk that has been taken from animals during treatment and for 48 hours (4 milkings) after the last treatment must not be used for food. The use of this drug must be discontinued for 30 days before treated animals are slaughtered for food.

Withdrawal/ Withholding Times

Quantity — **How Supplied:** Omnibiotic is available in vials of 100 ml.

Adapted from information in the *Beef, Sheep,* and *Swine Learning Laboratory Kits*

Guide to Reading Medication (Package) Insert Label

(sometimes found on outer label)

- **Species and Animal Class**. The species and animal class in which the drug is to be used. For example, cattle (lactating or non-lactating), sheep, or swine.
- **Approved Use (Indication)**. The situations for which the drug is to be used. Indicates the particular type of animal, conditions, illnesses, and so forth.
- **Dosage**. How much to give and how often to give.
- **Route of Administration**. This is the recommended method for delivering the medication to the animal. Basically, there are three routes of administering medications:
    1. **Oral Route**. Administering drugs through the mouth. Tablets, pills, capsules, and liquid medications are easily administered orally. A drenching tube, balling gun, or oral dosage syringe is usually used to place the liquid or pill at the base of the tongue at the back of the mouth. Make sure the medication goes down the throat, and the animal swallows it. Take care the animal is not choked by the medication going down the trachea (windpipe). You can also administer medication in the animal's feed or water.
    2. **Topical Route**. Applying the medication to the skin or to the mucous membranes of the eyes, ears, or nasal passages. Such medications are available as ointments, aqueous solutions, powders, and aerosols (sprays). Do not allow these products to come in contact with the animal's eyes, nose, reproductive tract, or mouth unless they are specifically formulated for that use.
    3. **Injectable Route**. Administering the drug directly into an animal's body with a syringe and needle. Injections are the most common method of administering medications to individual animals. The label specifies which of these injection methods to use:
        - —**Subcutaneous (SQ) injections**. The needle is inserted just under the skin and not into the muscle. This is important because SQ injectables are designed for a slower rate of absorption or are highly irritating to muscle tissue.
        - —**Intramuscular (IM) injections**. The needle is inserted straight into the skin and deep into the muscle. This is the most common type of injectable medication.
        - —**Intravenous (IV) injections**. IV injections are sometimes used. Some medications are labeled for "intravenous injection only" because they are strong irritants to muscle tissue and can cause damage. The IV route of administration provides a rapid means of getting the medication into the system of a sick animal as well as eliminating the chance of tissue damage. IV injections are given directly into the bloodstream.

Check Your Understanding

Quality Assurance Medication Label/Treatment Record Activity

Today is July 12, 20XX, and your name is Cal Jones. Two days ago, the market hog "Spot" (a 200-pound blue-butt barrow with the ear notch 36-7) you have been raising since April started having breathing difficulty.

Yesterday, Spot failed to eat and would not move around unless forced to do so. At your request, Dr. Bruce E. Losis, the local veterinarian, examined your hog and diagnosed his problem as pneumonia. He administered medications during the exam and recorded the treatment on your chart (not shown). He also left you with more medicine for you to give today at 2 p.m. You have just finished giving the follow-up medication as Dr. Losis directed.

JULY 20XX

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Bruce E. Losis, DVM
100 Quality Ave.
Hometown, OH 43200
614.555.5050

Owner: Cal Jones **Date:** July 11, 20XX

Animal ID: Hog #36–7 **Indications:** Pneumonia

Directions: give 5 ml (cc) subcutaneously on July 12

Precaution: Use care in giving injections to avoid infections

Warning: >>>Use of this drug must be discontinued for 7 days before slaughter or market for food<<<

Product/Active Ingredient(s): Biomycin

Expiration Date: August 01, 20XX

Medication Label

Complete the following activity and answer the questions.

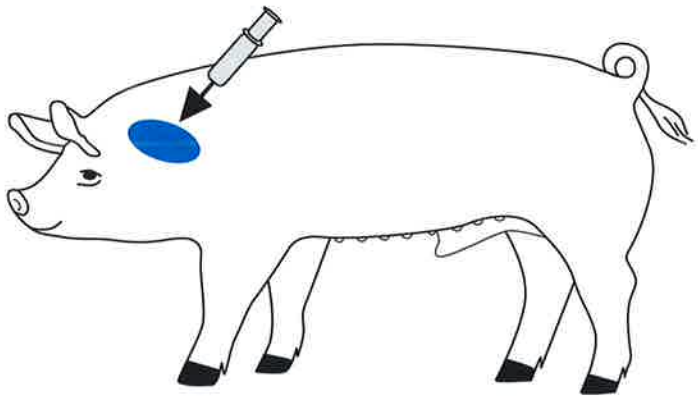
1. How would you complete the treatment record on page 115 for the medication you gave your hog in this scenario?
2. On what date and at what time will the withdrawal period be complete?

The correct answers and explanations can be found in the Answer Key on page 208.

Suggestions for Proper Injection of Animal Drugs

- Properly restrain the animal before giving an injection
- Give injections according to label instructions. Subcutaneous (SQ) means under the skin; intramuscular (IM) means in the muscle; intravenous (IV) means into the blood; orally (PO and/or O) means in the mouth or in water; and (MF) indicates medicated feeds.

SQ, IM, IV, O, PO, & MF are examples of routes of administration.



- When the label directions permit, give injections under the skin so that the muscle tissue is not injured.
- Use sterilized needles and syringes. Keep the bottle cap clean.
- Give injections at clean, dry sites on the animal, avoiding the areas where the muscles (meat cuts) are of high value.
- Do not transfer needles back and forth from animal to bottle because you may carry bacteria from the animal's skin back into the bottle.

Treatment Record for Vaccines, Drugs/Medications, and Medicated Feeds

Animal ID:		
Date and Time of Treatment (a.m. or p.m.)	Estimated Weight	Name and Contact Info for Veterinarian Prescribing Rx or Directing Extra-label Treatment
Condition Being Treated	Treatment Given*	Printed Name of Person Giving Treatment
Instructed Withdrawal (hours or days)		Actual Date and Time Withdrawal Is Complete
Results (recovered, sold, died) and Comments		

*For Treatment Given, include product, amount, route of administration, and lot/serial number, if available.

The following questions are to make sure you fully understand health management for your swine projects.

1. What information should be recorded when an animal is given medication?
2. What is the difference between prescription and over-the-counter medications?
3. Where should you keep the Pork Quality Assurance Reference Charts?
4. What is a medication withdrawal time? Why is it important?
5. What is extra-label drug use? When is it allowed? Who can prescribe or order extra-label drug usage?
6. Explain what is meant by a Veterinarian-Client-Patient Relationship (VCPR).
7. After reading page 14, what is one change you are going to make to your operation?

Diseases and Their Control

This section includes descriptions of various diseases hogs can contract. This list does not include every disease hogs can be susceptible to, but it helps you gain a better understanding of some of the more common diseases.

Infectious Diseases

African Swine Fever

African swine fever (ASF) is caused by a virus with the same name (ASFV). This disease is considered one of the worst diseases for pigs, because it spreads rapidly and leads to a high mortality rate. Unlike most of the other infectious diseases discussed in this section, ASF can be transmitted to pigs through various forms. The most common transmission route is through direct contact among pigs, however, contact with infected wild boars and contaminated fomites are also notable forms of transmission. The ASF virus is very resistant in pork products, therefore, offering your pigs leftover food from your kitchen might put your pigs at risk of getting ASF.

ASF-affected pigs show loss of appetite, high fever, red discoloration of skin, and difficulty breathing. Their spleen and lymph nodes are frequently enlarged. In severe cases, hemorrhages can be

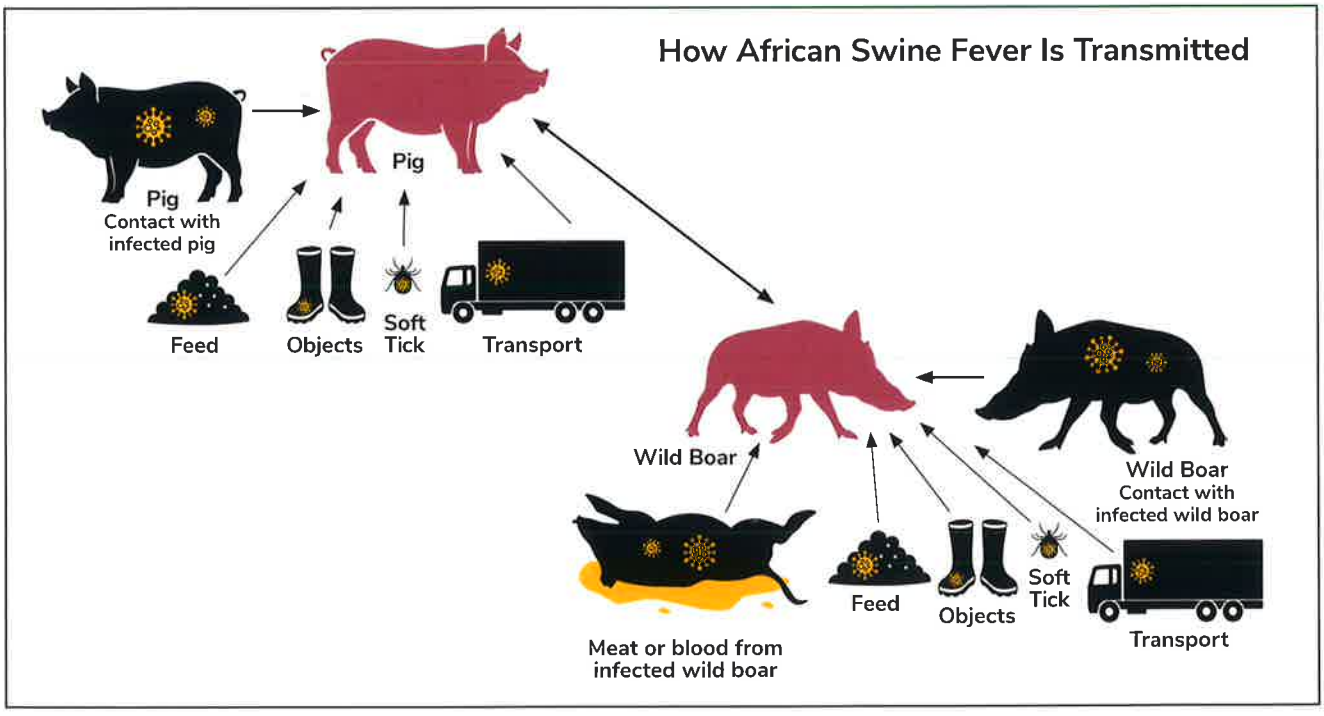


Figure 9.9. African Swine Fever can spread by various routes. Biosecurity measures are the key to keep pigs from becoming infected.

observed in many areas of the body. These clinical signs are not specific to ASF, and can also be observed in other diseases, such as Salmonellosis by *Salmonella Cholerasuis*, PCV2, and erysipelas. ASF is not a risk for human health; you cannot catch ASF from pigs.

Asian and East European countries have been fighting ASF since 2015, but ASF has never been present in the United States. Biosecurity measures are extremely important to avoid the virus' entrance into the United States, as well as to avoid disease spread should it ever get into the country.

Anemia

Anemia is a medical condition characterized by a low number of red blood cells or low concentration of blood hemoglobin. The most common cause of anemia in pigs is iron deficiency. Pigs are born with only enough iron reserves to survive for six to seven days. They require supplements to prevent anemia, particularly when reared in clean, modern, indoor facilities. Sows' milk contains very little iron. Because most pigs quadruple their birth weight in their first two to three weeks, they need more iron for hemoglobin to carry oxygen throughout their much larger bodies.

Signs of iron deficiency include pale skin and mucous membranes, such as the mouth lining; rough coats; rapid, labored breathing (thumps); and uneven growth. When nursing pigs are in contact with dirt, they ingest enough to receive enough iron. Managing anemia for pigs housed indoors is different from managing anemia for pigs raised in range (outdoor) growing conditions. To prevent anemia, piglets are routinely given injectable or oral iron supplements within the first three days after birth. See the "Breeding Management" chapter for an image of a piglet receiving iron.

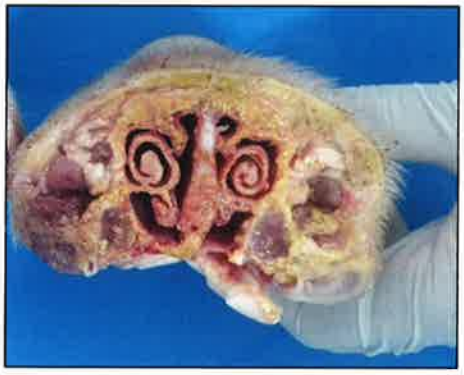
Atrophic Rhinitis

Rhinitis is a contagious disease caused by bacteria (*Pasteurella multocida* and *Bordetella bronchyseptica*), which results in an inflammation of the mucous membranes lining the pig's nose. In severe cases, this inflammation reaches the nasal bones, destroying them. When the bones are affected, the pig's nose gets atrophic, meaning that due to the bone destruction, the nose turbinates decrease and crook to the side. The turbinate bones are small, mucous membrane-covered structures in each nostril. They condition the air by warming, moistening, and filtering it as the pig breathes. The organisms that cause atrophic rhinitis also cause pigs to grow more slowly and to have poor feed conversion efficiency.

Common signs of this disease are sneezing, sniffling, snorting, and coughing. A moist, crescent-shaped area on the face below the eye caused by excessive tearing is usually present. Also, a clear-to-yellowish discharge from the nostrils is observed.

In advanced cases, the snout may be shortened and crooked as a result of the atrophy. Vaccines and antibiotics are used to control atrophic rhinitis although there has been a decreased reliance on antibiotics to control this disease after the damage has been done. Prevention is the key with atrophic rhinitis. The best way to avoid this disease is to purchase your pig from a disease-free herd, because pigs carrying the disease may have no obvious symptoms but still spread the disease.

Figure 9.10a This crooked snout was caused by atrophic rhinitis.



TALITA RESENDE

Figure 9.10b The nasal turbinates of a healthy pig have a butterfly shape when the nose is observed from inside. Note that the bottom "wings" are damaged, meaning that this pig had inflammation in the mucosa and in the underlying bones.

Colibacillosis

Colibacillosis is an infection of the intestinal tract by *Escherichia coli* (*E. coli*) bacteria, which causes diarrhea. In severe cases, death results from dehydration caused by fluid loss. Colibacillosis is most often seen in pigs less than five days old but may also occur about a week after weaning. The bacteria enter the mouth of the piglet, attach to the lining of the small intestine, and produce a toxin which causes diarrhea.

While *E. coli* bacteria can be found in the pig's environment, wet and dirty conditions cause the bacteria to grow in the large numbers necessary to cause disease. Proper husbandry, nutrition, and sanitation protocols must be followed to minimize onset of this disease. Some strains are more likely to cause disease, including F41, K88, K99, and 987P, which are common in nursing piglets. The most important source of contamination is from other pigs with diarrhea.

Piglets that become chilled are more susceptible to colibacillosis. Pigs that develop colibacillosis should be treated promptly with antibiotics and kept in a warm, dry environment. Even with proper treatment, death and performance losses make colibacillosis a very costly disease.

To control colibacillosis losses, good management practices include temperature control and sanitation protocols, because the organism can persist in the environment. Other important prevention techniques include vaccination of the sows pre-farrowing and adequate colostrum/milk intake by piglets.

Enteric Coronaviruses (PEDv, TGEv, PDCoV)

Porcine Epidemic Diarrhea Virus (PEDv), Transmissible Gastroenteritis Virus (TGEv), and Porcine Deltacoronavirus (PDCoV) are all part of the swine coronavirus family that affect the animals' enteric system. The largest effect on the industry has been seen in PEDv infections of neonatal piglets. In 2012, PDCoV emerged as an additional enteric coronavirus.

TGE is a highly contagious viral disease characterized by vomiting, diarrhea, and nearly 100% mortality in pigs less than two weeks old. This virus is stable in cold conditions and outbreaks are typically experienced during the winter. Birds are able to carry the infection between neighboring swine herds as they search for feed. The symptoms of vomiting and watery diarrhea lead to rapid dehydration, shock, and death. Older hogs and adults may stop eating and have diarrhea, but soon recover.

In another form, TGE can be a problem of post-weaning diarrhea. Vaccines are available but are of limited value. Treatment usually does not change the death rate. Control in an outbreak is aimed at exposing the entire herd at one time to shorten the length of the outbreak. Prevention is key with TGE. Maintain biosecurity protocols and closed herds, and obtain stock only from TGE-free herds.

PED is caused by a coronavirus similar to TGE. Pigs exhibit a similar set of slightly milder symptoms. The disease was present in Europe, and then a large outbreak occurred in the Midwestern United States in 2013. The outbreak caused tremendous economic loss due to close to 100% piglet mortality.

PED is transmitted by fecal-oral route, is extremely infectious, and has no known treatment. The disease spreads rapidly by way of feed trucks and personnel, so it is one of the major influences of the growing importance of herd and farm biosecurity.

Erysipelas

Erysipelas is a bacterial disease of swine that can cause sudden death, fever, diamond skin lesions, arthritis, heart valve lesions, anorexia, lameness, and abortion. The organism that causes erysipelas is a bacterium, *Erysipelothrix rhusiopathiae*, which can be found in the tonsils of many normal, healthy swine. The bacteria are passed in the feces of sick and carrier animals, persisting in the environment for a long period of time. The disease is more frequently seen in hogs raised outside as the soil becomes contaminated by the manure of infected animals. After a susceptible pig ingests the organisms, the infection starts in the tonsils, and the bacteria spread throughout the body, causing fever as they reach the skin, joints, and heart.

Signs of erysipelas include red skin blotches, purplish tails and ears, reluctance to get up and move around, and depression. Pregnant sows may abort from the fever, which is often 106–108 F. Feeding pork garbage to hogs can lead to erysipelas because the organism can remain in hams through the curing process.

Erysipelas is rare because most swine are vaccinated against it. Hogs with erysipelas can be treated with penicillin and antiserum. Prevention is also managed through the use of biosecurity protocols. Avoid purchasing an asymptomatic carrier of this disease.

Erysipelas is considered a zoonotic disease, which means that the causative microorganism can infect humans, causing the disease Erysipeloid. In people, clinical signs can include painful, swollen red and purple lesions on the hands and fingers. Severe cases can progress to systemic infection with endocarditis. The route of transmission for this zoonotic disease is direct contact. The microorganism usually enters through cuts in the skin. Recommended PPE includes rubber boots, gloves, and protective clothing.

Figure 9.11 Pig showing skin lesions of Erysipelas

Exudative Epidermitis

Exudative Epidermitis is commonly called "Greasy Pig Disease" because the infected pigs develop skin areas of brown debris starting on the head and neck. Many body parts become dark and greasy to the touch. This is a bacterial infection caused by Staphylococcus hyicus and is most often seen in nursery pigs. The condition spreads to other pigs in the group if the affected pigs are not removed and treated. Younger pigs may die of dehydration while older pigs survive but are stunted.

Treatment consists of antibiotics and spraying with diluted disinfectants. Prevention includes minimizing skin abrasions and wounds, which can be an entry point for the bacteria, reducing relative humidity, and ensuring adequate availability of drinking water. Treatment protocols can vary in effectiveness in this disease and should not be relied on to achieve control in all cases. The best method is prevention with a focus on husbandry, nutrition, hygiene, and proper sanitation.

TALITA RESENDE

Figure 9.12 Two greasy pigs can be observed in the center of this image. Their fur looks grayish with a greasy aspect, while the healthy pigs have cleaner hair and a pinkish skin coloration.

Gastrointestinal Infections

Gastrointestinal infections in pigs usually result in diarrhea. Depending on the pig's age, it can be more or less susceptible to infection and to show clinical signs due to a given pathogen. The most common agents of gastrointestinal infections in pigs are *E. coli*, as already discussed, *Clostridium perfringens*, Rotavirus, *Salmonella* serovar Typhimurium, *Lawsonia intracellularis* and *Brachyspira hyodysenteriae*. Other agents can also cause diarrhea in pigs, but are relatively less frequent: *Campylobacter* spp., *Yersinia enterocolitica*, *Cryptosporidium parvum*, and *Giardia intestinalis*.

TALITA RESENDE

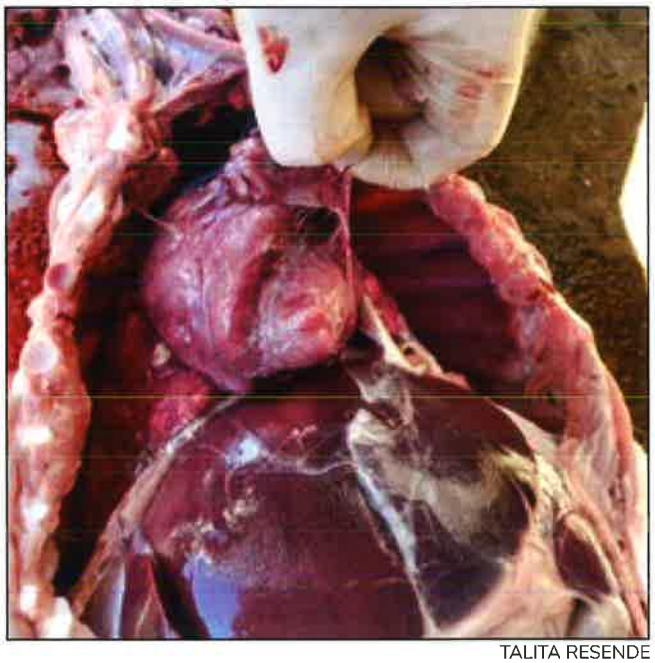
Figure 9.13 Fecal material in the perineal area indicates this pig has diarrhea. To determine what is causing this type of diarrhea, it is necessary to perform laboratory tests on fecal samples.

In swine, the only clinical sign of these infections is diarrhea. Some of these can be zoonotic. In people, symptoms of such infections may include nausea, vomiting, abdominal pain, and diarrhea. Because transmission is fecal-oral, the use of PPE is recommended including rubber boots, gloves, and protective clothing. Washing your hands properly is also a very effective way to avoid animal-to-human transmission.

Glaesserella parasuis (Glasser's Disease)

Glasser's Disease is caused by the *Glaesserella parasuis* (formerly *Haemophilus parasuis*) bacterium. This bacterial infection affects the chest and abdominal area including the organs and joints. The disease is most often seen in young pigs between two and sixteen weeks old following a period of stress, such as weaning or moving. High fevers accompany panting respirations and coughing. Because of swollen, painful joints, pigs may squeal when forced to move around. Some pigs may have tremors or convulsions.

Bacterial cultures may be needed to confirm the diagnosis. If one pig in a group is affected, all in the group should be treated with antibiotics immediately. Management of this disease emphasizes husbandry practices to minimize stress. Vaccines may be helpful, depending on the type of bacteria causing the illness. Research is being done on controlled exposure of piglets to the organism while still protected by maternal immunity to minimize infection.



TALITA RESENDE

Figure 9.14 Pig affected by Glasser's Disease. In this image it is possible to observe a whitish fibrinous material covering the organs. This material, fibrin, is characteristic of infection by *Glasserella parasuis*.

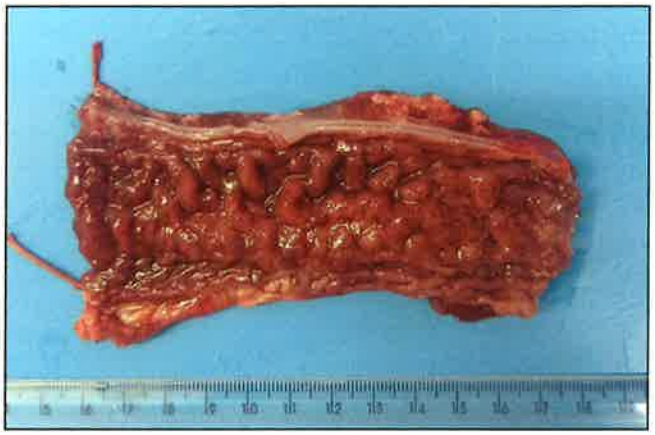
Hepatitis E

Hepatitis E is a zoonotic disease caused by the Hepatitis E virus. It is spread through fecal-oral transmission, which is why recommended PPE includes rubber boots, gloves, and protective clothing. Swine show no clinical signs; however, humans can have a mild fever, anorexia, nausea, and vomiting lasting for days. They may also have abdominal pain, itching (without skin lesions), skin rash, joint pain, jaundice with dark urine and pale stools, and ileitis.

Ileitis

Porcine Proliferative Enteritis (PPE) is also referred to as ileitis. *Lawsonia intracellularis* bacteria infect the cells of the wall of the intestinal tract and cause it to thicken. Many different sites in the small and large intestine can be affected. The primary symptom is diarrhea from weaning to market weight. Some heavier hogs may die suddenly when the infection causes massive hemorrhage (bleeding) into the intestinal tract. Most pigs experience chronic diarrhea and weight loss. Porcine Proliferative Enteritis (PPE) usually starts with a new pig arriving to the herd, but other animals, such as horses and rodents (including mice and rats), can serve as a source of infection.

Therefore, biosecurity protocols are critical. Transmission of ileitis is fecal-oral. In-feed and intramuscular antibiotics are available to treat ileitis, but vaccination is the best way to prevent this disease.



TALITA RESENDE

Figure 9.15 Section of the small intestine of a pig with ileitis. The intestinal wall is thickened and corrugated.

Influenza A virus (Flu)

Influenza A virus causes a brief and severe respiratory illness. The virus is common and widespread. Outbreaks of flu often occur after pigs have been moved or have comingled, such as at a show and sale. The disease spreads rapidly, causing the entire group to get sick within a few days. Clinical signs can include fever, depression, coughing (barking), discharge from nose or eyes, sneezing, difficulty breathing, and anorexia. Breathing becomes labored and opened-mouthed. There are episodes of barking coughs.

While nearly all the pigs get too sick to move around or eat for a couple of days, only rarely does one die. Recovery is almost as quick as the disease onset. Antibiotics are of limited use as they serve only to control secondary bacterial infections, but vaccines are now available to help prevent such outbreaks. Prevention is best, with closed herds and biosecurity protocols. There is no specific treatment in pigs, just as with humans who contract flu. Keep pigs with influenza warm and dry, provide fresh feed and water, and treat any secondary infections.

As a zoonotic disease, humans can contract influenza from pigs through direct contact as well as through aerosol and fomites. However, it is more likely pigs will get infected from humans than humans from pigs. Therefore, use rubber boots, gloves, protective clothing, and face masks when working with sick animals. Washing hands is very effective. Symptoms in humans are similar to those in swine. People with influenza often have a fever, muscle or body aches, fatigue (tiredness), lack of appetite, coughing, and, more commonly in children, vomiting and diarrhea.

TALITA RESENDE

Figure 9.16 This sow was suffering from Influenza A infection associated with a secondary bacterial infection, which results in a nasal discharge of a viscous, whitish-to-yellowish material.

Leptospirosis

Signs of leptospirosis are usually found in gestating sows, where it causes abortions, stillbirths, mummified fetuses, weak pigs, and decreased litter size. Other clinical signs include decreased weight gain, anorexia, fever, diarrhea, and generalized neurological signs. The disease is caused by the *Leptospira* bacteria and is spread by contact with the urine of sick and carrier animals.

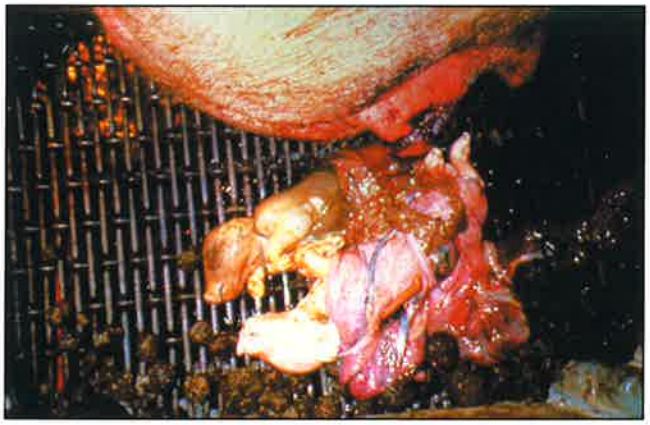


Figure 9.17 Leptospirosis—aborted fetuses

Leptospira bacteria live much longer in wet conditions. Eliminating standing water and wet areas in housing may reduce disease spread. Many species of animals, both domesticated and wild, can carry leptospirosis, including rats. Because

exposure is so difficult to control, vaccination is routinely done prior to each breeding using a vaccine containing multiple bacteria strains.

Leptospirosis is a zoonotic disease that affects all mammalian species, including humans. Clinical symptoms in people include fever, chills, headaches, muscle aches, and vomiting, and can progress to liver and kidney failure. Leptospirosis can be transmitted by direct contact, aerosol, fomites, or ingestion (spread of urine). Suggested PPE for people working around possibly infected swine includes rubber boots, gloves, protective clothing, and face masks.

Mycoplasmal Pneumonia (Enzootic Pneumonia)

Mycoplasmal pneumonia affects pigs of all ages, starting with those as young as 10 to 16 days of age. It is caused by a bacterium, *Mycoplasma hyopneumoniae*. Signs of the disease are often not noticed until after three months of age. Pigs have a dry, nonproductive cough, most noticeable after exercise. This cough then develops into pneumonia in some pigs. Generally, while they continue to eat, some do not grow at a normal rate if lesions are extensive. Up to 90% or more of the swine herds in the Midwestern United States are infected with Mycoplasmal pneumonia.

Mycoplasmal pneumonia is a chronic, or long-lasting, disease. A high percentage of pigs are affected, but the death loss is low. Antibiotics and vaccinations may be useful in the control of Mycoplasmal pneumonia, but results have been inconsistent. Good nutrition and a warm, dry, dust-free and draft-free environment, along with lungworm control programs, are useful in controlling it. Biosecurity should be emphasized, paying strict attention to allowing only disease-free stock into the herd.

Porcine Parvovirus (PPV)

Parvovirus infections cause swine reproductive failure, primarily in gilts and first-litter sows. The virus remains stable in the environment and practically all herds are considered infected. Parvovirus is a common, endemic disease, which means it is found in a particular location and is ongoing. Generally, there are no noticeable symptoms.

When young females first become exposed, at the time of breeding or early in gestation, the virus infects their fetuses, causing the death of the fetuses. Depending on the stage of gestation when the infection occurs, results may include infertility, mummified fetuses, or stillborn pigs. Abortions are unusual with parvovirus infections. The best way to control PPV is through preventive methods, such as vaccines, which are effective. There is no effective treatment. The virus is shed in secretions and excretions and can remain in the environment for a long time.

Figure 9.18 Parvovirus—Mummies of various sizes

Porcine Reproductive and Respiratory Syndrome (PRRS)

PRRS is a syndrome caused by a virus that can infect pregnant sows and growing pigs. It is considered the most important infectious disease of pigs in the United States and in many other countries and causes significant economic losses. PRRS causes premature farrowing, stillborn pigs, and mummified fetuses in pregnant sows. The sows usually have poor conception rates at the next breeding. In growing pigs, PRRS leads to respiratory problems as the virus attacks the lungs' defenses. Pigs with PRRS often have additional diseases and do not respond to normal treatments.

PRRS is usually brought into a herd by infected animals that can shed the organism for several months. Transmission is usually through close contact, but can also occur through fomites, insects, and aerosol. Laboratory testing is often needed to confirm the diagnosis of PRRS.

When investing in herd additions, only consider PRRS-negative pigs from PRRS-negative herds.

There is no single successful strategy for preventing PRRS because of its variable nature, but biosecurity protocols and sanitation protocols are crucial to prevent the spread of the virus. There is no PRRS treatment, but vaccination can be used to reduce PRRS losses.

Porcine Circovirus 2 (PCV2)

Porcine Circovirus Associated Diseases (PCVAD) are caused by one of the smallest viruses. Although there are more than one type of Porcine Circovirus, type 2 is proven to cause many different syndromes of disease in pigs. Nearly all pigs have been exposed to this virus, but in certain cases and often in conjunction with another viral disease, pigs develop signs such as anorexia, ill thrift (failure to grow), wasting, diarrhea, skin lesions, reproductive failures, and respiratory signs.

Some pigs in a herd may show evidence of PCV2 while others show no signs. Disease outbreaks are often associated with other viruses being present or environmental stress. There is no treatment other than supportive therapy, and pigs often die from this disease. Vaccines are the best way to prevent pigs from getting sick with a PCV2 infection.

Pseudorabies (Aujeszky's Disease)

Pseudorabies (PRV) is an acute, frequently fatal disease affecting most species of animals, except humans. The disease is caused by a virus and involves the nervous and respiratory systems. The virus may be isolated in the spleen, lungs, liver, or brain, and diagnosis should be confirmed by lab tests. It can affect pigs of all ages.

PRV is spread mainly by direct contact between swine. The nose and mouth are the main entry points of the virus. Pigs that recover may be virus carriers and can later infect other pigs and most domestic animals including cattle, sheep, goats, cats, and dogs.

You can reduce the risk of this virus infecting your animals by controlling the movement of people, animals, and objects into swine premises. Always wear clean clothes and regularly clean and disinfect instruments, boots, and other objects used with your swine. While pseudorabies was eradicated in commercial operations in 2004, it is still present in the growing feral pig population.

Ringworm

Ringworm is a highly contagious fungus caused by dermatophytosis and can affect humans and animals. This zoonotic disease is either transmitted by direct contact or via fomites. Clinical signs of ringworm in swine include crusty, dark, hairless patches on the skin. These patches can be seen around the head and neck, thorax, flank, behind the ears, and on the legs.

When seen in humans, signs include local itching, reddish skin, and hairlessness at the point of contact. To prevent infection and transmission, wear PPE including rubber boots, gloves, and protective clothing.

COURTESY DR. KAREN A. MORIELLO

Figure 9.19a Skin lesion with ring format in the skin of a pig. In this case, a dark crust line, which resembles the shape of a ring, has formed around the lesion. This type of lesion is observed in more severe cases.

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Figure 9.19b Typical ringworm lesions in a sow. Two crusty, dark, hairless skin patches are located in the thoracic region and flank.

ISTOCKPHOTO.COM BY GETTY IMAGES

Figure 9.19c Ringworm in a person. In humans, the ringworm lesion is usually red, not dark as is common in pigs.

Salmonellosis

Salmonellosis is a bacterial infection by *Salmonella enterica*. In pigs, *Salmonella enterica* serovar cholerasuis leads to septicemia and pneumonia, and affected pigs have red skin discoloration and difficulty breathing. The serovar Typhimurium usually causes diarrhea. Pigs that seem healthy can be bacteria carriers and are the usual source of infection. The microorganism is shed in the feces, and it can survive in water for 24 days, in a mixture of water and swine manure sludge for 78 days, or in pasture dirt for over a year. Ingestion of contaminated material is the main route of infection. Outbreaks are often associated with stress, such as transportation, commingling, and overcrowding. Control is based on sanitation, minimizing stress, treatment with antibiotics, and vaccination.

TALITA RESENDE

Figure 9.20 This pig has several areas of red skin discoloration. This sign is frequently associated with *Salmonella enterica* serovar cholerasuis, but it can also be observed in cases of PCV2 infection and African Swine Fever.

Streptococcus suis

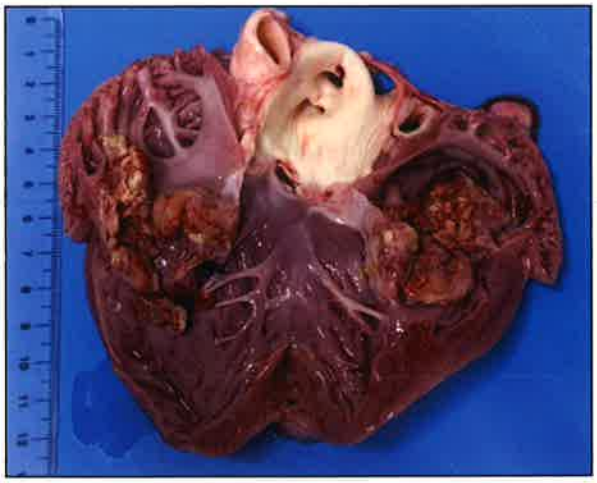
Streptococcus suis is a bacterium carried in the nose and tonsils of many swine and is often acquired by piglets during farrowing. Currently, it is considered to be the most important streptococcal disease of swine. Other species of *Streptococcus* rarely cause diseases in pigs, while *Streptococcus suis* can cause meningitis, pneumonia, arthritis, endocarditis, and other conditions. The infection can also be transmitted by a pig to its penmates through nose-to-nose contact, as well as through feces or other secretions.

After a period of stress for the pig, the organism spreads from the tonsils to other body parts including body cavities, joints, heart, lungs, and brain. Infections can also occur with skin wounds. Tail biting, tail docking, and abrasions, such as those caused by knees on rough floors, may lead to infections.

Clinical signs in swine with *Streptococcus suis* can include depression, tremors, incoordination, blindness, paralysis, and convulsions or paddling of the legs. Besides infection in the nervous system, one of the most common forms of the infection, infected pigs can also have inflammation in the joints (arthritis), endocarditis, and inflammation in body cavities, including the abdomen. *Strep suis* infection is a common cause of convulsions one to two weeks post-weaning.

If one or more pigs in a group are diagnosed with *Strep suis*, all pigs in the group should be treated with antibiotics immediately to prevent further losses in the group. Asymptomatic pigs can start showing clinical signs after they get an influenza A infection or after they pass through severe temperature drops. Vaccines are available to prevent future outbreaks, but there are so many types of *Strep suis* it is becoming more difficult to control the disease with vaccination. Rely on good husbandry, sanitation, and ventilation. **All-in, all-out (AIAO)** protocols may be effective.

This is a zoonotic disease. Symptoms in people include meningitis, sepsis, endocarditis, arthritis, hearing loss, and skin lesions. *Strep suis* is transmitted via direct contact, and therefore PPE should include rubber boots, gloves, and protective clothing.



TALITA RESENDE

Figure 9.21 Heart of a pig with endocarditis caused by *Streptococcus suis*. In the heart's center, there is an accumulation of a yellowish material, composed of inflammatory cells, bacteria and debris.

Swine Dysentery

Swine dysentery is caused by the *Brachyspira hyodysenteriae* bacterium. It occurs most commonly in pigs eight to fourteen weeks old, although all ages are susceptible. The affected pigs pass loose stools containing blood and mucus, which contain the organism and can then contaminate nearby water and soil. When swine dysentery occurs in young, weaned pigs, 90–100% may be affected and 20–30% may die without effective treatment. The disease is usually milder in older pigs. To prevent further outbreaks of swine dysentery, the affected groups must be treated, the pens must be cleaned and disinfected, and rodents must be eliminated. Mice have been shown to transmit the organism for up to six months after the initial outbreak.

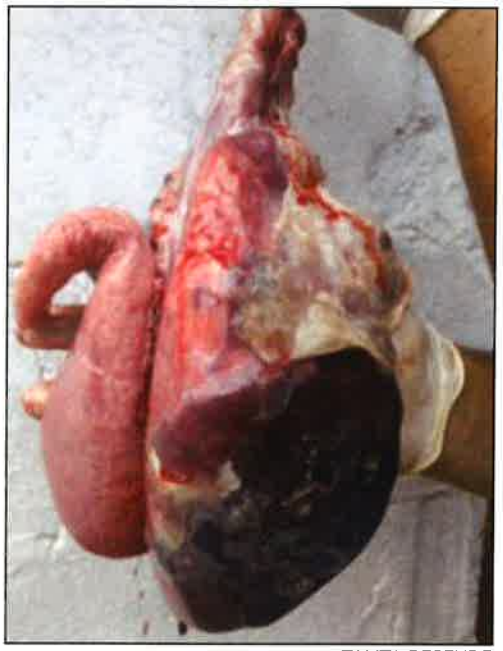
Economic losses in most herds result from poor rate of gain, poor feed efficiency, and prolonged medication costs.

Swine Pleuropneumonia

Swine pleuropneumonia is caused by the *Actinobacillus pleuropneumoniae* (APP) bacterium. This is a severe, often fatal, pneumonia of growing-finishing swine. This disease is distributed worldwide and causes significant economic losses in swine industries in many countries.

Pigs of all ages are susceptible, but the most commonly affected are growing pigs 40 pounds to market weight. Sudden death of apparently healthy pigs may be the first sign the disease is present in a herd. Death losses often follow a stressful period, such as relocation, weather change, and mixing.

Infected pigs may have labored breathing, a high fever (104–109 F), depression, and reluctance to move. Pigs that do survive may have severely damaged lungs. Because the organisms are spread through the air, as well as present in the secretions on the animals, their handlers, and/or equipment, the number of swine affected in a group can quickly reach 100%. Herd loss from death can reach 20% to 80% or more if treatment is delayed.



TALITA RESENDE

Figure 9.22 Lung affected by swine pleuropneumonia. This image depicts a lung infected with *Actinobacillus pleuropneumoniae*. An extensive area of the right lung is dark red and covered by a whitish material. These lesions are very common in pigs with pleuropneumonia.

Pigs held in overcrowded, poorly ventilated buildings are more likely to have problems. Sudden weather changes and drafts can also increase the chances for an APP outbreak. Once APP is in the herd, environmental quality must be improved and maintained at optimum levels. Efforts to reduce overcrowding and maintain good ventilation are important. Antibiotics and vaccines are used in treatment and control. Survivors of this disease can become carriers. Use good biosecurity protocols and only purchase animals from APP-free herds.

Parasites

Internal Parasites

Parasites are organisms that live in or on a larger animal, called the host. Internal parasites live in the body of an animal; external parasites are found on (or in) the skin. Infections by parasites in swine cause economic loss for producers.

Pigs often get internal parasites by (accidentally) eating the parasite's eggs. Some of the more common internal parasites that infect pigs are roundworms, whipworms, nodular worms, stomach worms, lungworms, threadworms, and kidney worms.

There are numerous deworming agents, or anthelmintics, on the market for controlling and eliminating internal parasite infections. The method of administration varies with the deworming product and includes feed, drinking water, and injection. Your choice of product depends on the types of parasites you need to control. You can also choose the method of administration. Other considerations include the stage of production of your animals, the dewormer cost, and the withdrawal time.

In addition to using the right dewormer at the right time, sanitation is an important part of a parasite control program.

Deworming pigs without cleaning the pen or moving them to an uncontaminated area is like inflating a flat tire without fixing the hole—the results do not last long.

Dirt lots, especially those used for raising swine in the past, are generally contaminated with parasite eggs and are impossible to completely clean. The eggs of some parasites remain in the soil for more than five years! Pens with cement floors are easier to clean but still may be a source of contamination. The trend of raising swine indoors using all-in, all-out and biosecurity protocols has greatly reduced infections from many internal parasites. Providing your pigs with optimal nutrition and maintaining good body scores is another way to decrease the negative effects of internal parasites.

To determine the best deworming medication, your veterinarian needs to identify the types of parasites in your pigs. Your veterinarian will examine fresh fecal samples under a microscope and look for the parasite eggs to make the diagnosis. Using only a visual observation of parasites for diagnosis is not reliable. Once the types of parasites are known, your veterinarian can recommend the best medications to use. Additional information about the treatment and control of swine parasites is available at the Pork Information Gateway at **porkgateway.org/resources**.

TALITA RESENDE

Figure 9.23 Pig expelling a roundworm parasite

Figure 9.24 Nodular worms

Figure 9.25 Lungworms

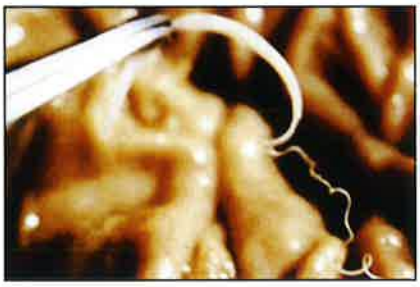


Figure 9.26 Whipworms

Figure 9.27 Pigs with uneven growth on dirt lots due to internal parasites

Table 9.1 Internal Parasites

Parasite	Most Commonly Affected Stage of Life	Specific Ways Parasites Damage the Host*
Coccidiosis (*Cystoisospora suis*) (*Eimeria*)	Suckling pigs	Coccidiosis results in diarrhea and poor digestion.
Kidney Worm (*Stephanurus* spp.)	Any age, uncommon	Lesions are commonly found in the liver. The kidneys, ureters, and the tissue around the kidneys (perirenal tissue) can also be damaged.
Large Roundworm (*Ascaris suum*)	Weanlings, Feeder pigs, 40–75 lb	Migrating large roundworm larvae damage the liver, intestines, and lungs; create conditions favorable for development of bacterial and viral pneumonia; cause diarrhea; and block the intestine.
Lungworm (*Metastrongylus* spp.)	Generally, Feeder pigs and older, 60–150 lb pigs	Lungworms irritate the fine air passages, rupture tissues, cause bleeding, and allow the development of pneumonia.
Nodular Worm (*Oesophagostomum* spp.)	All ages, 60–350 lb (increase with age)	The host response results in nodule formation in the intestines, which decrease digestive efficiency, and outright illness occasionally results.
Stomach Worm (*Hyostrongylus rubidus*)	All ages, 60–350 lb	A stomach worm irritates the stomach lining, or tunnels beneath it, and causes inflammation and ulceration. The end result can be diarrhea.
Threadworm (*Strongyloides*)	10–20 day old pigs; Breeding stock	Threadworms cause moderate to severe to bloody diarrhea in very young pigs, which can result in death.
Whipworm (*Trichuris suis*)	40–85 lb	Accumulations of whipworms ulcerate the cecum and anterior large intestine. They cause bloody diarrhea.

*In terms of economics, parasites affect their hosts by interfering with digestion, feed conversion, and weight gain, so production is more expensive.

External Parasites

The most common external parasites of swine are lice and mange. External parasites cause millions of dollars in economic losses each year. If you see your pigs constantly rubbing on feeders, gates, and buildings, they likely have external parasites. The hog louse has a dark body and is big enough to be seen on the skin when closely examining the flank and abdomen. The lice suck blood through the skin causing irritation and itching. Lice on growing and finishing pigs cause decreased feed intake and slow growth because the pigs spend more time rubbing and less time eating. In younger pigs, the blood loss caused by hog lice can lead to anemia.

Mange, the result of *Sarcoptes scabiei* mite infestation, may appear as raised areas of skin covered with brown scabs around the ears and neck. If untreated, the skin becomes thickened and rough over more of the body. The activity of the microscopic mites increases as the skin temperature rises causing increased itching.

Ticks are external parasites uncommonly found in confinement operations where pigs are housed indoors, but ticks may be present with pasture-raised pigs. Ticks are important vectors in transmitting diseases to pigs as well as other livestock, humans, and companion animals, such as dogs and cats.

Lice, ticks, and mange mites most commonly transmit diseases through pig-to-pig contact. Control of these pests includes sanitation and the use of agents to kill them. Treatment products are available as topical sprays and powders, pour-ons, injections, and feed additives. These can be used in conjunction with spraying the environment. Consult your veterinarian for advice to establish an effective treatment plan. Additional information about treatment and control of swine parasites is available from the Pork Information Gateway at **porkgateway.org/resources**.

ADOBE STOCK

Figure 9.28 Hog Lice

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Figure 9.29 *Sarcoptes scabiei* mite viewed under microscope

NORTH CAROLINA STATE UNIVERSITY

Figure 9.30 Mange

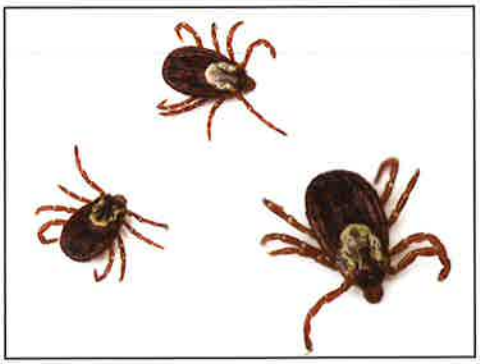

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Figure 9.31 American dog ticks.

Abnormalities

Structural defects, also called anatomical abnormalities, occur in at least 1% of newborn pigs. These defects may be caused by genetics or the environment. Although the frequency of these defects is usually low, structural defects may cause economic loss.

In the past, swine producers assumed all abnormalities were genetic, because the defects are often dramatic and congenital (visible at birth). A **congenital defect** does not necessarily have a genetic cause.

Many environmental factors may cause problems with the piglet's normal prenatal development. During pregnancy, viral infections and nutritional deficiencies, as well as the consumption of certain drugs, chemicals, and pesticides, may cause birth defects. In some cases, an abnormality may result from genetic factors, while other cases of the same defect may have been caused by environmental factors.

Umbilical Hernia

A weakened supportive muscle in the navel area results in an umbilical hernia, in which the intestines stick out through the stomach wall. This condition is also called "belly bust." It is primarily caused by infection in the navel area. Research studies have shown no genetic cause for umbilical hernias.

Figure 9.32 Umbilical hernia

Porcine Stress Syndrome (PSS)

Can lead to sudden death and possible production of pale, soft, and exudative (PSE) meat. (Refer to the "Pork Products and Their Values" chapter.)

Rendement Napole Gene (RN)

Can result in carcass change. (Refer to the "Pork Products and Their Values" chapter.)

Scrotal Hernia

Results from a weakness of the muscles in the lower abdomen, which causes the intestines to drop into the scrotum.

Figure 9.33 Scrotal hernia

Atresia Ani

This is the name for pigs born without a rectal opening. Boar pigs die within a few weeks unless an opening is made surgically to allow them to defecate. Females with no anal opening can defecate through the vulva and grow normally.

Cryptorchidism

Male pigs with one or more testicles retained up in the body cavity have cryptorchidism.

Hermaphrodites

Pigs born with both male and female sex organs are called hermaphrodites. An example of a hermaphrodite is a pig with both vulva and testicles present.

Tremors

Pigs display a rhythmic twitching of the neck and legs within a few hours of birth.

Other Genetic Abnormalities

Swirls (hair whorls), screw tail, blood warts, brain hernias, cleft palate, humpback, hydrocephalus, spraddle (splay) legs, polydactyly (extra toes), and syndactyly (mule foot) are other abnormalities described in pigs but are considered uncommon. Additional information about genetic abnormalities in swine is available from the Pork Information Gateway at **porkgateway.org/resources**.

Figure 9.34 The hematoma on this pig's right ear was caused by environmental conditions.

Figure 9.35 This pig has spraddle (splay) legs, a genetic defect.

Figure 9.36 Masking tape is used to aid the piglet in movement and to strengthen the legs

Herd Health Management Tips

These recommendations should be followed after you have established a good veterinary-client-patient relationship (VCPR). The health status of your herd can vary greatly from another herd. You must establish a health program for your herd with your own veterinarian.

Gilts (5–6 months of age)

Purchased gilts added to your herd should be isolated for 30 days, followed by an additional 30-day acclimation period. During the isolation and acclimation periods, the gilt should be tested (or retested) for diseases. Home-raised gilts need a 30-day acclimation period before breeding begins. In order to maintain strict biosecurity protocols during acclimation, cull sows can be mixed in with gilts or put into fence-line contact with the gilts as long as the sows are confirmed to be healthy.

- **Parasite Control**. Treat for internal and external parasites. Dewormers are available in injectable and oral formulations. External parasites (lice and mange) can be controlled by injectable, oral, and topical medications (spray, powder, or pour-on). Repeat as necessary according to the directions on the product's label or your veterinarian's recommendations.
- **Vaccinations**. Give Parvovirus-Erysipelas-Leptospirosis (6-way, including Bratislava) vaccine and repeat three weeks later. The use of other vaccines may be recommended, such as circovirus, PRRSv, and swine influenza, depending on the herd's disease exposure and status.

Sows Before Breeding

Boost immunity for the sows by re-vaccinating against parvovirus, leptospirosis (6-way), and erysipelas. The vaccine may be given in the farrowing facility two to three weeks post-farrowing if the sow is to be re-bred immediately following weaning. The use of other vaccines may be recommended by your veterinarian depending on the herd's disease exposure and status.

Sows/Gilts Prior to Farrowing

Vaccinate breeding females to protect piglets from *E. coli*, *Clostridium*, and other bacterial diarrhea at approximately six weeks and two weeks pre-farrowing. You should consider the use of other vaccines, such as influenza and PRRS, depending on the herd's disease exposure and status. Follow directions on the label and your veterinarian's recommendations.

Treat sows and gilts for parasites 10 days prior to entering the farrowing house. Producers can assist with farrowing by drying piglets immediately after birth and making sure piglets get colostrum. Assisted farrowing increases piglet survival. Getting colostrum in the first few hours after birth helps piglets' survival and long-term health.

Boars

New boars should be handled in the same way as new females added to your herd. They should be isolated for 30 days, and then receive a 30-day acclimation period. During this time, they should be tested for diseases, treated for parasites, and vaccinated using your biosecurity protocols. Re-vaccinate at least annually.

Piglets

Within hours of birth, navel cords should be trimmed and disinfected, if needed. Disinfection can be performed by dipping the navel cord into a 5% iodine solution. Ensure all piglets are nursing and have received colostrum in the first eight hours or less following birth. This is their chance to get maternal immunity. Make sure the environment for the baby piglets is warm, clean, and dry. Baby pigs need more heat than a mature sow.

Processing piglets at one to two days of age may include iron injection and clipping needle teeth. Processing piglets at one to ten days of age may also include tail docking, ear notching, and castration. Wean at 17 to 28 days of age. Erysipelas vaccine should be given at six to eight weeks of age. Depending on your herd's experience and status, your veterinarian may recommend other vaccines. For example, vaccination for circovirus is often recommended, as well as for Mycoplasmal pneumonia, caused by *mycoplasma hyopneumoniae*. Follow label directions along with your veterinarian's recommendations. Treatment for parasites depends on conditions on the farm. Frequency of treatment and choice of product should be based on the results of tests for parasites.

Growing Pigs/Hogs

You may choose to use vaccines based on your herd's disease experience and current status. Follow your veterinarian's recommendations and the directions on the labels. If you need to treat for parasites, base your decisions on test results and follow your veterinarian's recommendations. Be sure to observe withdrawal times for medications, including medicated feeds, which are only available with a veterinarian's prescription. Use slaughter checks to monitor herd health status and effectiveness of disease control programs.

Other Vaccines to Consider

- *Actinobacillus pleuropneumoniae* (APP)
- Atrophic rhinitis (*Bordetella bronchyseptica* and *Pasteurella multiocida*)
- *Clostridium perfringens*
- *Glaesserella parasuis*
- *Mycoplasma hyopneumoniae*
- Porcine reproductive and respiratory syndrome (PRRS)
- Rotavirus
- *Salmonella* choleraesuis/typhimurium
- *Streptococcus suis*
- Swine influenza
- Transmissible gastroenteritis (TGE)
- Porcine proliferative enteritis (Ileitis)
- Porcine circovirus 2 (PCV2)

Death

Your investment in a market animal or breeding project eventually leads to witnessing and understanding death in the food chain. People react in many different ways when an animal dies. Their reactions may depend on the cause of death and their emotional attachment to the animal. Death is a part of the life process. All living organisms die.

The loss of an animal can be stressful both emotionally and financially. Discuss how you feel with your parents, advisor, or other trusted adult. In commercial swine production, pigs are produced for human consumption, and you should understand that before you purchase an animal to raise. Unless the animal dies of disease or natural causes, the animal will be harvested for food.

Animals that die due to causes other than the harvesting process should be necropsied (autopsied) by a veterinarian. Why? Swine are susceptible to many diseases. You can help prevent additional losses if you know the cause of an unplanned or unexpected death. You can take steps to protect the rest of your herd.