Introduction

This manual has been developed as a study guide for the Florida State Fair Skillathon which is part of the Champion Youth Program. The topic for this year's Skillathon is **reproductive management**. Animal reproduction has become a complex science that involves a series of physiological and psychological events that must be properly timed and managed. Reproduction has at least three purposes within the animal industry: 1) perpetuation of the species; 2) genetic improvement; and 3) to provide food.

The Florida State Fair recognizes that agricultural education instructors, 4-H agents, parents, and leaders provide the traditional and logical instructional link between youth, their livestock projects, and current trends in the animal agriculture industry. **PLEASE NOTE:** This manual is provided as a ***study guide*** for the Skillathon competition and should be used as an additional aid to ongoing educational programs.

Sections are labeled **Junior, Intermediate & Senior, Intermediate & Senior, or Senior** to help exhibitors and educators identify which materials are required for each age level.

The knowledge and skills vary by age group and may include:

Juniors (age 8-10 as of September 1, 2023)
Breed Identification
Selection: Visual Evaluation

Intermediates (age 11-13 as of September 1, 2023)
all of the above plus...
Male and Female Reproductive Anatomy
Reproductive Functions
Processing Newborns/Reproductive Equipment & Use

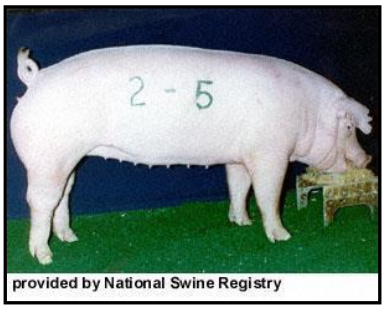
Seniors (age 14 and over as of September 1, 2023)
all of the above plus....
Breeding Management Practices
Selection: Pedigree/Performance Evaluation
Genomics

GOOD LUCK!

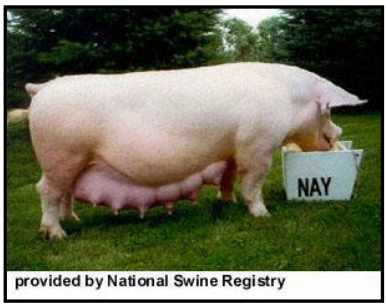
Swine Breed Identification

Jr., Int, & Sr.

Breeding sows and boars are selected for traits that are considered economically important. A *purebred* animal has the characteristics defined by the breed registry and purebreds are expected to pass those traits on to their offspring with a high degree of predictability. When animals of different breeds are mated, we call it *crossbreeding*. The resulting offspring often outperform the parents due to a phenomenon called *hybrid vigor*. Though most of the swine industry uses crossbreeding systems, it is still important to consider the purebred animals that contributed genetics to the composite crosses we see today. Some breeds of swine and their descriptions are listed below. In general, white breeds are considered strong in maternal traits, and colored breeds are considered strong in carcass traits.

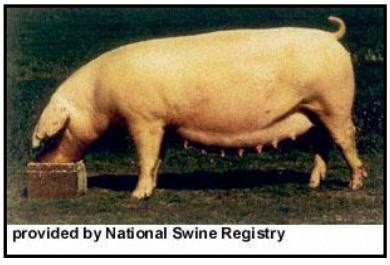


Chester White:
These animals have white bodies and medium-sized, droopy ears. They were developed in Pennsylvania and are very good mothers.

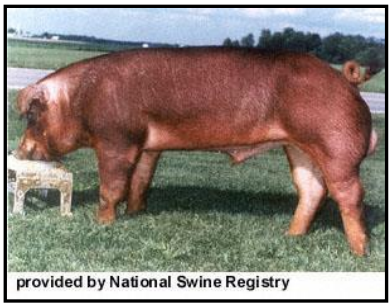


Yorkshire:
This breed has long, large-framed, white bodies with erect ears. They produce large litters and are good mothers. This breed is known as the “mother” breed.

Berkshire:
Coming from England, these animals have black bodies with white feet, tails, and faces. They have dish snouts and short, erect ears.



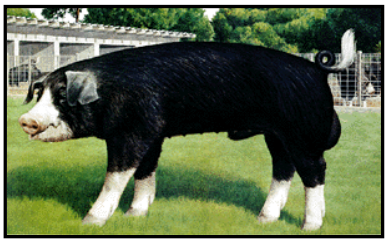
Landrace:
Coming from Denmark, this breed has very long, white bodies and very large, floppy ears. They are also good mothers.



Duroc:
These animals have light-red to dark-red bodies and droopy ears. They came from crosses between red hogs in New York and red hogs in New Jersey. They grow quickly and efficiently.

Hampshire:
Developed in England, these animals have black bodies with a white belt around the shoulders and both front legs. They also have erect ears and heavy muscles.

Spotted:
This breed has black and white spotted bodies and droopy ears. They gain weight easily and are aggressive breeders.



Poland China:
The members of this Ohio breed have black bodies with six white points. The white points are their four legs, tail, and nose. They have droopy ears and are lean with heavy muscles.

Hereford:
Developed in the early 1900s in Missouri, Iowa, and Nebraska, Herefords are a relatively new breed. Animals must have a white face with at least two white feet. They must be red in color. The shade of red may vary from light to dark, but a deep red color is preferred. The face is medium length with a slight dish, ears are medium size, and droop.

Adapted from Swine Learning Laboratory Kit, The Ohio State Univ. Agric. Education Curriculum.
http://www.ansi.okstate.edu/breeds/swine/

Selection: Visual Evaluation


Jr., Int, & Sr.

Many traits of economic importance can be evaluated by simply looking at the animal. In purebreds or registered animals, the "ideal" is usually described or illustrated by the breed registry. Most livestock show judges rely totally on the way the animal looks, moves, or feels to make their decisions on class placings. Be prepared to visually evaluate a class of pigs. To learn more about visually evaluating swine, visit:
https://livestockjudging101.weebly.com/breeding-gilts.html

Feet and Leg Structure

How well a pig can stand and move around will have a major impact on its ability to find food, mate, and care for its young. Often, a pig that stands correctly will move freely while a crooked-legged pig may have trouble getting around and may become sore or lame. Feet and leg structure as well as movement are important evaluation criteria for breeding animals. Explore selecting for feet and leg soundness at:

https://www.usporkcenter.org/wp-content/uploads/2016/05/Evaluation-of-Body-Condition-and-Feed-and-Leg-Soundness.pdf

and https://texas4-h.tamu.edu/wp-content/uploads/Replacement-Gilt-Evaluation.pdf.

Criteria for Selection Using Visual Appraisal

The criteria listed below are commonly considered most important in visual evaluation. The priority or emphasis placed on each may change with market demand, breed, age, management scenario, and performance data.

Type	More important → Lesser importance				
Boars	Pounds (growth)	Structure	Volume (width)	Muscling	Fat
Gilts	Structure	Volume	Pounds	Muscling	Fat

Structure = correct Fat = less is better Volume = more is better Muscling = more is better

Practice judging a class of breeding gilts: https://www.youtube.com/watch?v=fkqtCaikGis
http://www.livestockjudging.com/classes.aspx?Breeding+Gilts=on

Reproduction Overview


Int, & Sr.

Sexual reproduction begins with the boar and sow mating, called *copulation*. This occurs during the time period (*estrus* or heat) when the sow will accept the boar for copulation or breeding. The boar deposits *sperm* in the reproductive tract of the sow. *Ovulation* is the release of the egg cells from the ovaries of the sow. *Fertilization* is the union of the sperm and the egg cells. The number of young a sow gives birth to at one time is an indication of the number of egg cells released and fertilized by sperm. The *gestation* period is the time during which the sow is pregnant, and *parturition* is the process of giving birth and is called *farrowing*.

Gender Names and Terminology

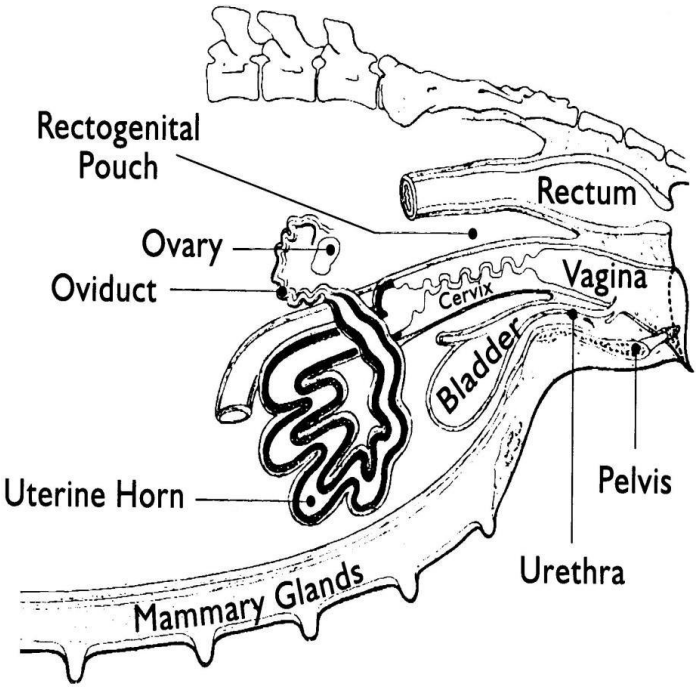
Young: piglet, young female: gilt, Mature female: sow, Male: Boar, Castrated male: barrow

Reproductive Anatomy

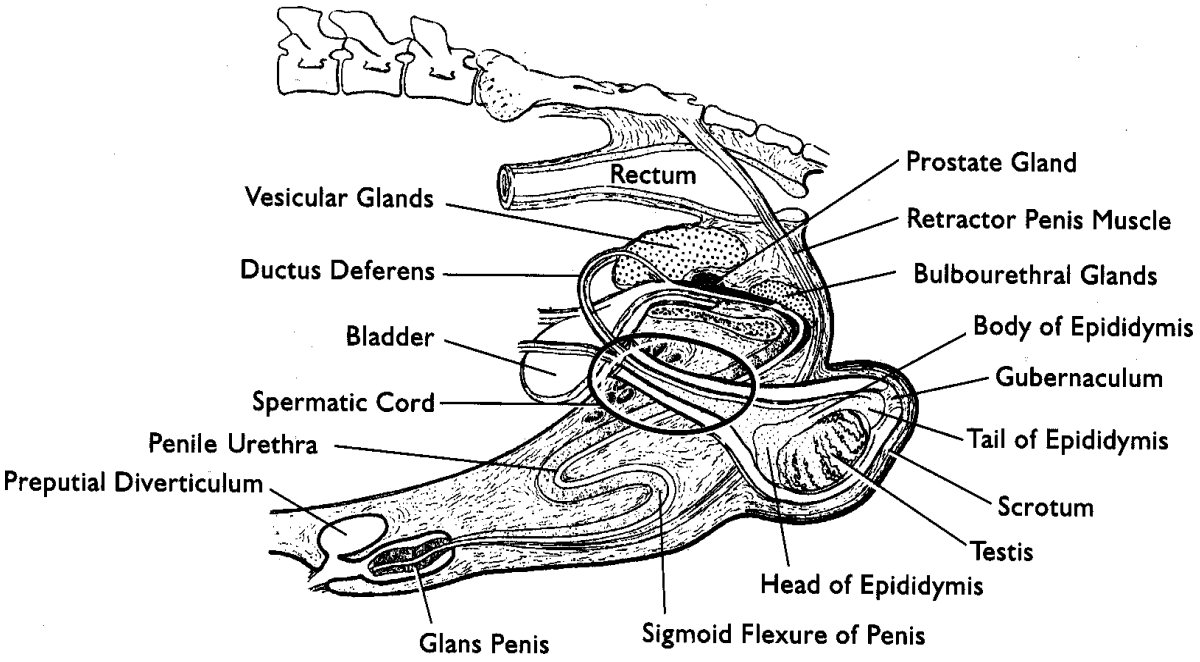
Int, & Sr.

Swine give birth to litters of piglets (more than one at each birthing) and may have more than one litter each year. The way an animal reproduces determines the type of reproductive tract it has. Understanding reproductive anatomy is basic to managing reproduction.

Female Anatomy:



Male Anatomy:



Reproductive Functions

 Int, & Sr.

Once you know the names of all of the reproductive structures, the next step is to understand the role of each part. Understanding normal functional anatomy allows the manager to apply reproductive management tools.

Female Functional Anatomy

Ovaries The paired female gonads that produce eggs and hormones. Follicles are blister-like structures that grow on the ovary which produce estrogen (causing heat or estrus) and release the egg at ovulation (rupture of the follicle). Following ovulation, the remaining cells change and form the corpus luteum which produces progesterone (maintains pregnancy).

Oviducts Two tubes that connect the ovaries to the uterine horns. The oviduct (also called the Fallopian Tube) transports eggs and sperm cells is the site of fertilization, and moves the fertilized ova (egg) into the uterus. The infundibulum is the funnel-shaped opening at the end of each oviduct that surrounds the ovary and "catches" the egg at ovulation.

Uterus Supports, nourishes, and protects the embryos as they develop and expels the fetuses at parturition. Walls are soft and spongy in non-pregnant animals. It is made up of the uterine body which divides into two uterine horns.

Cervix A thick-walled tube with an irregular passageway that serves as a valve between the outside organs and the delicate inner organs. It contains tough cartilage making it firm and dense to the touch. The cervix prevents microbial contamination of the uterus. It serves as the reservoir for and transport of sperm. It is the site of semen deposit.

Vagina The passageway from the vulva to the cervix that serves as the organ of copulation and birth canal during parturition. The rear of the vagina conducts urine to the outside of the animal.

Urethra Tube connecting the bladder to the vagina that serves as a passageway for urine excretion.

Vulva External opening of the female reproductive tract.

Male Functional Anatomy

Scrotum External sac; contains, supports, protects, and provides temperature control for the testes.

Testicles or Testes Paired male gonads produce sperm cells and the male sex hormone, testosterone.

Epididymis Long coiled tube that sperm enter upon leaving the testicles. It is the site of sperm storage, concentration, maturation, and transport.

Vas deferens Long tube that connects the epididymis to the urethra near the bladder and transports sperm. The ampulla is the section that dumps into the urethra.

Seminal Vesicles Paired glands that secrete seminal fluid into the urethra which serves as a transportation medium and provides protection for sperm.

Prostate Found near the urethra and the bladder. It adds fluid to the semen.

Bulbourethral Gland (Also referred to as the Cowper gland.) Secretes a fluid similar to that of the seminal fluid that flushes urine residue from the urethra.

Urethra The tube that passes through the penis and is the common passageway for semen and urine.

Penis Organ used for copulation that deposits sperm into the female reproductive tract. An S-shaped bend called the sigmoid flexure allows the penis to be retracted into the body by the retractor penis muscles.

Glans Penis The free end of the penis contains sensory nerves and the opening of the urethra. The boar has a corkscrew-shaped glans penis.

Prepuce Fold of skin serving to protect the penis by enclosing the free end when retracted.

Pregnancy and Parturition

It is important to know if a sow is pregnant to feed her properly and to prepare for delivery. After breeding, failure to return to estrus is the first sign of pregnancy. In swine, an ultrasound machine can be used to tell if the female is pregnant. This machine sends out sound waves that bounce back and register as a picture on a monitor or a light and a beep.

If you know when a sow was bred and the length of gestation, you can figure out when to expect her to farrow. The gestation period is about 114 days (or 3 months, 3 weeks, and 3 days). Pregnancy ends with the process of parturition. There are several signs of approaching birth: teats fill with milk, vulva relaxes, stretches, and may appear moist, sow becomes restless, may go off by herself, and will usually try to build a nest.

As delivery begins, the sow usually lays down and begins to push the piglets out with her abdominal and uterine muscles. The first thing to appear from the vulva is the “water bag” followed by two front feet and a nose or the rear end. It is normal for piglets to come out rear or front first.

When everything is normal, sows deliver their offspring without assistance. Sometimes things don’t go well, and the manager must help by carefully pulling along with the sow’s contractions (pushes). Once the piglets are delivered, the placenta(s) (afterbirth) should be passed out as well. Difficult births (dystocia) and retained placenta usually lead to problems with the female breeding back. http://www.thepigsite.com/pighealth/article/220/parturition-farrowing

Reproduction Equipment and Use

It is important to know different reproductive equipment that is used in breeding and aiding parturition as well as for processing and caring for young. The following are some ideas of things to be able to identify and tell what they are used for. There may be others that are not listed so know about equipment that is used for practices which are explained in this manual. Livestock supply companies' catalogs are a good study reference.

Paint stick	Thermometer
AI saddle	Straw cutter or scissors
Semen bottle	Forceps
Breeding gloves	Lubricant
Thermos	Speculum
Insemination catheter	Ultrasound (preg-tone)
Cheesecloth	Artificial vagina
Extender	Pig puller
Teeth cutter	Knife/scalpel
Iodine/disinfectant	Nail clippers
Nursing bottle	Tail clippers
Syringe and needle	Notching clippers

Processing Piglets

The newborn piglet is fragile and requires special care. They must nurse within the first few hours after birth to get antibodies to fight disease. The first milk, called *colostrum*, contains antibodies, is thick and yellow, and is only produced for a short time. To help prevent infection, the navel stump is dipped in a disinfectant like iodine. Males that will not be used for breeding should be castrated (testicles removed) as early as possible to reduce stress, minimize bleeding, and prevent the development of secondary sex characteristics. Other management practices carried out for identification or safety should be done as early as possible for similar reasons. http://www.youtube.com/watch?v=RFpgJPuSBNI

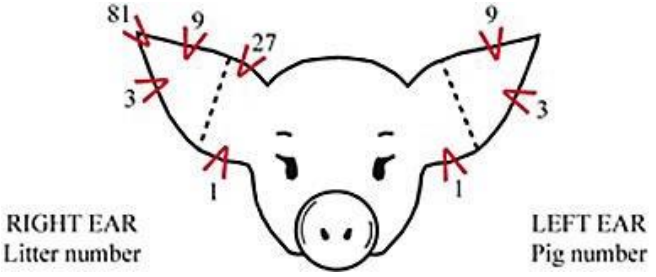
https://extension.oregonstate.edu/sites/default/files/documents/12281/careofnewbornpigs-estill.pdf

Needle Teeth

Needle teeth of baby pigs are removed to prevent injury to the sow during nursing. The teeth of pigs that are less than two days old should be clipped off at the gum line, making sure not to cut the gum. One-half to one-third of the tooth should be cut off in pigs that are more than two days old.

Castration

Male piglets are typically castrated at 3 days of age. Two incisions are made in the scrotal sac and the testicles are pulled out. At this age, there is very little bleeding or stress.



Ear Notching

Ear notching is done as a method of identification. Many different systems can be used. Ear notching is required for the registration of purebred pigs. Purebred associations state which system they require. This is usually carried out at the same time the needle teeth are cut.

Iron Injection

Sow's milk is naturally low in iron so pigs raised indoors must be given an iron injection by 3 days of age. This is typically given in the neck.

Tail Docking

To discourage tail biting or cannibalism, tails are docked within about 24 hours after birth. Some producers wait to dock the males until castration to make them easier to identify. Sterilized side cutters are most commonly used. The tail should be about 1 inch long (width of your thumb) from the place where the tail joins the body.

Breeding Management Practices

Natural Mating

The easiest way to breed animals is to let nature take its course. If boars are allowed to be with the sows, they can find the ones ready to breed. Typically, when the sow or gilt is in heat, she is driven to the boar's pen and he breeds her there. Then she is taken out and returned to her group. This is called pen mating. Pigs breed year-round.

Heat (Estrus) Detection

In herds where pen mating (gilt brought to the boar) or artificial insemination is to be practiced, one of the key elements is detecting *estrus* so that breeding can be accomplished at the proper time. Sows usually demonstrate symptoms that help us to detect estrus. The vulva of the estrous gilt swells noticeably. They walk up and down the fence line and make a lot of noise. Sows show estrus more plainly when boars are kept within hearing and smelling range. Sows respond to odors and the visual presence of, as well as noise made by the boar. Sows can be checked for standing estrus by pressing down on the rump area. If she is in standing estrus, she will assume the mating stance. The final sign of standing estrus is the "ear popping response" where the sow's ears will repeatedly jump to an erect position as she assumes the mating stance. A key to heat detection is frequent and careful observation of the herd. A good record-keeping system is essential and provides important information for planning management strategies surrounding breeding and parturition.
https://digitalcommons.usu.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=2393&context=extension_curall

Timing of Reproductive events:

Age at Puberty – 5-7 mos. Weight at Puberty – 150-200 lbs.

Estrus (heat) – 48-72 hours Estrous cycle length – 21 days Gestation length – 114 days

Estrous Cycle

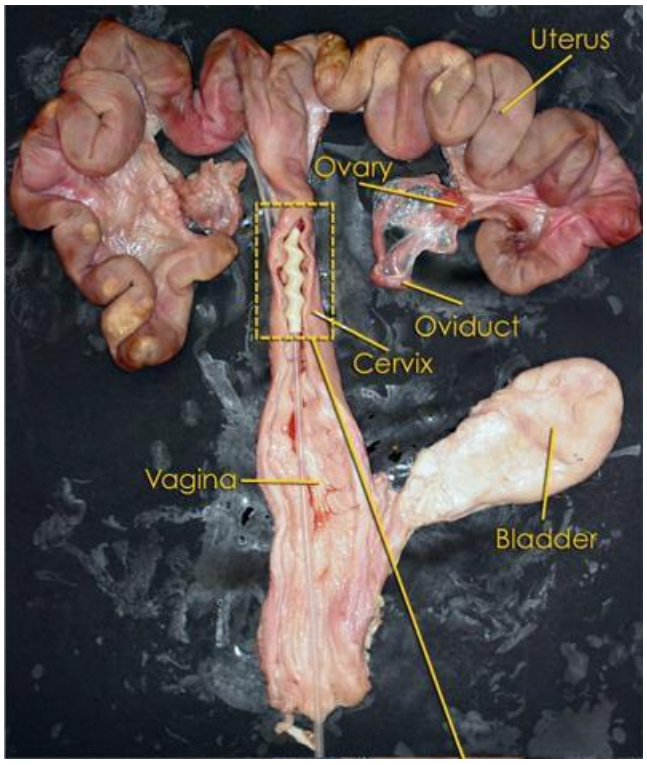
An understanding of the estrous cycles is critical for efficient management and informed decision-making. Since the sow is a litter bearer, she ovulates many follicles over a period of time. Breeding the sow more than one time per heat cycle will increase litter size. A nursing sow will return to estrus in 3-7 days after her piglets are weaned. If not pregnant a gilt or sow will cycle every 21 days and will be in heat for about 2 days. Exposing the females to a boar (smell and touch) will help gilts reach puberty and encourage sows to return to estrus after weaning. http://porkgateway.org/resource/estrus-or-heat-detection/

Seniors

Artificial Insemination

If you do not own a male, or if you want to breed to a boar that is too expensive for you to own, it is possible to buy semen and breed artificially. Artificial insemination (AI) accelerates genetic progress by allowing outstanding boars to breed more females than they could with natural mating. Even if you own a boar, AI will help you get more sows covered without overworking him.

Key elements of artificial insemination are selected matings, heat detection, semen collection, proper handling and storage of semen, proper insemination technique, and accurate record keeping. Success (high conception rate) depends on all of the factors listed above.
http://extension.usu.edu/files/publications/publication/AG_Swine_04pr.pdf



AI Procedures:

Since estrous sows will stand for rump pressure, minimal restraint is necessary. The cervix is easily penetrated by passing a catheter with a tip that is shaped like the boar's penis. This specially designed inseminating tube enters the cervix much like the locking of the boar's penis. A squeeze bottle or syringe filled with 80-90ml of extended semen is attached and the semen is expelled.

https://www.aces.edu/blog/topics/farming/artificial-insemination-in-swine-breeding-the-female/

https://www.youtube.com/watch?v=vpgORQWEkno

Estrus Synchronization

Synchronization is the altering of the normal estrous cycle through the use of hormones to cause females to come into heat during a specific time period. Synchronized breeding reduces the time required for heat detection and breeding.

Altrenogest, an oral progestin, when fed for 14 to 18 days will bring 90% to 95% of sows into estrus within 6 days of withdrawal. Conception rates for sows bred in this manner are the same as those bred naturally.

Weaning is a natural synchronizer. Sows usually return to heat 3 to 10 days after weaning. Boar exposure will help weaned sows show estrus.

Selection: Performance/Pedigree Evaluation

Proper selection is a critical factor in establishing a good breeding program. The goal of animal selection is to produce an animal that will yield/produce high-quality products at a low cost to the farmer and the consumer. This goal is the foundation of the standard "ideal animal" in the various breeds. That is the animal that expresses, to the highest degree, traits that are of economic importance like mothering ability, litter size, weight gain, carcass merit, or even longevity is the type selected.
The expression of observable or measurable traits is called the animal's *phenotype*. Phenotype is affected by both heredity and environment. The inherited portion of a trait is referred to as a *genotype*. How well an animal expresses its genetic potential is affected by the environment in which it is raised. Therefore, when making selected matings, the use and management of the offspring should be considered.

We use both visual appraisal and performance records when selecting breeding stock. The following section outlines various traits and methods used to evaluate breeding animals. Use and management are expressed as *scenarios*.

Performance Evaluation

How an animal looks may be important in the show ring but how that animal performs is more important to the farmer. With advancements in the understanding of heredity and the increased use of computers for keeping records, the use of genetic information in selected matings has become easier. By keeping records on desirable traits and then carefully selecting males and females to be mated using the available data, producers can improve the genetics, and thus the performance of their offspring. To become familiar with terms used in performance and data evaluation visit: https://mail.nationalswine.com:8443/newstages/glossary.aspx

Performance Data

There are several types of performance data that, when used properly, are important tools in the selection and genetic improvement of animals. Many breed associations and commodity groups provide information, assistance, and technical support to producers wishing to collect and use performance data. The National Swine Registry and the National Swine Improvement Federation are two such organizations.

Adjusted Performance

Adjusted performance consists of an animal's actual performance record with an adjustment for age or other factors. For example, instead of weighing animals on the same day of age, they are weighed on the same day and the weights are adjusted for age. Below are examples of the most common data used in swine. The desirability of a high or low value for the trait is dependent on the scenario.

pigs per litter Days to 250# 250# backfat
Pounds of lean-weight litter

Expected Progeny Differences (EPDs)

EPDs estimate how the future progeny of an animal will compare to the progeny of other animals within a breed and are computed in the units of the trait being measured. They are accompanied by an accuracy value between 0 and 1 which represents the reliability of the prediction. For example, a boar with a -0.14 (.96 accuracy value) backfat EPD should sire pigs with .10 inch less backfat than a boar with a -0.04 (.96 accuracy value) backfat EPD. EPDs are based on an animal's performance along with measures of the performance of an animal's relatives, including ancestors, siblings, and progeny. When comparing EPDs for selections, always keep in mind the situation or scenario in which the animals are to be used. Desirable EPDs may be positive or negative. For example, positive EPDs are more desirable for the number born alive, 21-day litter weight, and pounds of lean. Negative EPDs are more desirable for days/250 and backfat.

To learn more about swine EPDs visit: http://www2.ca.uky.edu/agcomm/pubs/asc/asc153/asc153.htm

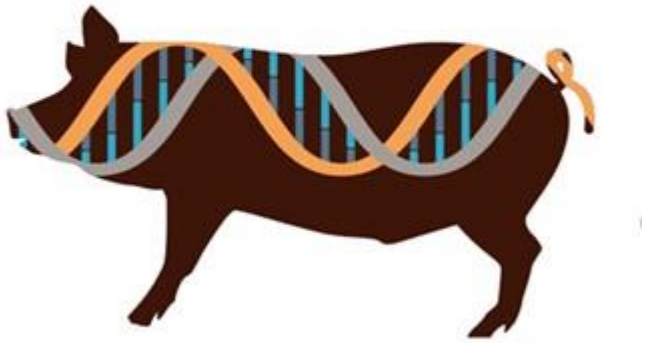
To help you understand how to use performance data in judging swine visit:

https://porkgateway.org/resource/understanding-and-using-performance-data-in-judging-classes/ and

https://swine.extension.org/understanding-and-using-performance-data-in-swine-judging-classes/

Genomics

Genomics is the study and mapping of a species or individual animal's genome, or all of the animal's genes and their interactions with one another. The expression of the genome is what one sees in the animal's phenotype or performance/appearance. In short, genomics is the study of an animal's DNA. DNA, or deoxyribonucleic acid is composed of two polynucleotide chains that coil around each other to form a double helix. The chain contains the genetic instructions for the development, function, growth, and reproduction of an organism. For animal agriculture, the genome also influences (along with nutrition, health, environment, etc.) the animal's quality and quantity of meat, milk, reproductive life, growth rate, heat tolerance, and about any other trait one can imagine. Understanding the blueprint of a particular animal at the genetic level by studying the animal's genetic code has immense ramifications for animal agriculture. Livestock genomics is an emerging field in which breeding sires and dams with specific genes that directly influence specific traits is possible (muscling, marbling, milk fat, milk production, sexual maturity, etc.). Over the past 20 years, the use of genomics has emerged in livestock and poultry production. Unlike simple genetics, genomics studies the entire genetic makeup including all of the interactions of each gene with all the other genes in an animal. Producers can utilize genomic testing to predict future profitability. To this point, the genome of just about every major livestock species has been mapped, including cattle, goats, sheep, swine, rabbits, and poultry. Genomics is currently primarily used as a tool to make decisions on selected breedings to result in offspring with targeted genetics. The potential for editing genes to produce offspring with targeted traits exists but is not currently utilized because the regulatory frameworks are still being developed. Still, genomics is among the latest cutting-edge technologies in animal agriculture and animal reproduction management.



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