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...
Reproductive Functions
Male and Female Reproductive Anatomy
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!

Animal Breed Identification

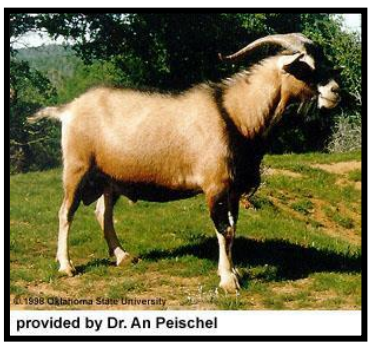
Jr., Int. & Sr.

Animals are selected for traits that are considered economically important. Though most of our livestock industries use crossbreeding systems, it is still important to consider the purebred animals that contributed genetics to the composite breeds and crossbred animals we see today. 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. Some crossbred animals are now listed as purebreds because they have a set of traits that are consistently passed on and a breed registry has been established. Several breeds of goats have been developed for meat production and their descriptions are listed below. http://www.ansi.okstate.edu/breeds/goats/

Spanish Meat Goat:
This breed, found primarily in Texas was kept mainly for clearing brush and undesirable plant species from pasture lands. Though most are feral, increased demand for goat meat has prompted some producers to intensify their selection for meat traits and improve the breed.

Boer Goat:
This breed originated in South Africa and is the only known goat breed routinely involved in a performance test for meat production. It is horned with lop ears and a variety of color patterns. Its most appealing traits are rapid growth rate, efficient gain, and high fertility.

Tennessee Meat Goat:
One of the few indigenous US goats, they suffer from hereditary myotonia and are sometimes called the “fainting goat”. When they are frightened, they experience extreme muscle stiffness in the hind limbs and can topple over. The trait is recessive, so it is not expressed in crossbred animals.



New Zealand Kiko:
A large population of feral goats introduced by Europeans during colonization underwent years of natural selection in the harsh environments of New Zealand. Feral does were crossed on Nubain, Toggenburg, and Saanen bucks for four generations then the breed was closed. The name was derived from the Maori word “kiko” meaning flesh or meat.

Pygmy:
The Pygmy originated in West Africa where it is known as the Cameroon Dwarf Goat. It came to America as a by-product of the slave trade in the 18th century. It is the dominant goat breed in West Africa and is used almost exclusively for meat. It has a full coat of straight, medium-long hair.

Anglo-Nubian:
This breed developed when English does were crossed with bucks from Africa and India. They have a strong convex facial profile and long, bell-shaped ears. Any color or pattern is acceptable. These goats have a long breeding cycle, and their milk is known for its high protein and butterfat content. They are considered a dual-purpose goat.

Angora:
This small-framed breed known for its fiber production originated in Asia Minor. The mention of mohair in the Bible makes this a very old breed. They are less prolific than other goat breeds and are more fragile in terms of parasites and extreme weather.

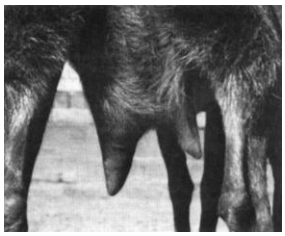
Selection: Visual Evaluation

Jr., Int. & Sr.

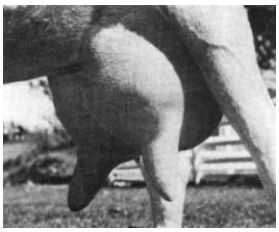
Many traits of economic importance can be evaluated by simply looking at the animal. In purebreds or registered animals, the "ideal" is usually described or illustrated by the breed registry. Goat judges evaluate animals on traits that are indicators of functional efficiency over a long productive lifetime including mouth structure, udder conformation and pigmentation, muscle conformation, and feet/legs.

How well an animal can stand and move around will have a major impact on its ability to find food, mate, and care for its young. Often, an animal that stands correctly will move freely while a crooked-legged animal 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. Practice evaluating the conformation and structure of the goats you encounter. Study what the judge is looking for in a meat goat and learn how you can select the best breeding animals.
http://www.agecon.okstate.edu/meatgoat/files/Chapter%203.pdf
http://www.youtube.com/watch?v=YT4idUBLJIQ

Undesirable udder
Teats too large



Unbalanced
due to mastitis



Good Udder

Reproduction Overview

Int. & Sr.

Reproductive Process

Sexual reproduction begins with the buck and doe mating, called *copulation*. This occurs during the time period (*estrus* or heat) when the doe will accept the buck for copulation or breeding. The buck deposits *sperm* in the reproductive tract of the doe. *Ovulation* is the release of the egg from the ovary. *Fertilization* is the union of the sperm and the egg cells. The number of young a doe gives birth to at one time is an indication of the number of egg cells released and fertilized by sperm. G*estation* is the time during which the doe is pregnant and *parturition* is the process of giving birth. Visit the extension website below to learn more.
https://goats.extension.org/goat-reproduction-puberty-and-sexual-maturity/

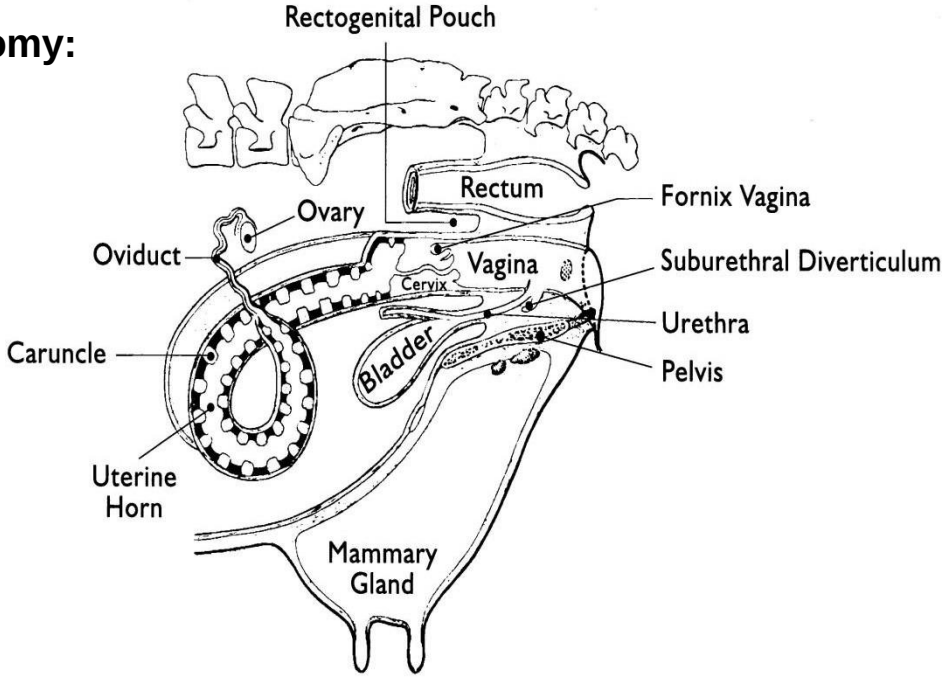
Gender Names and Terminology

Young – Kid	Male – Buck	Castrated male – wether
Immature Female – Doeling	Mature Female – Doe	Parturition – Kidding

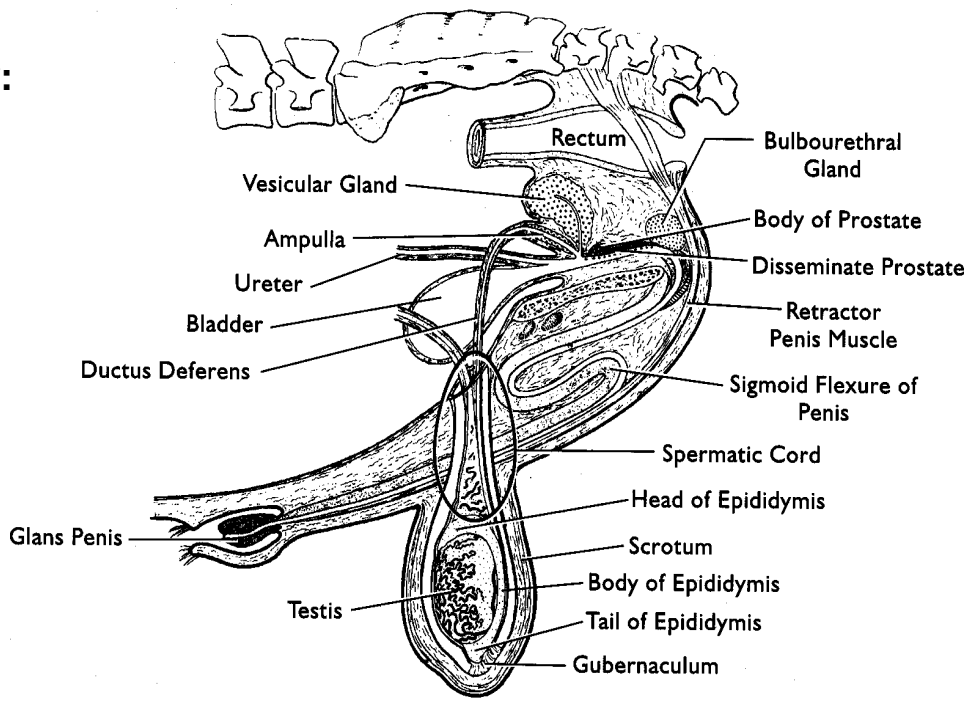
Reproductive Anatomy

Does give birth to one to three kids once or sometimes twice in a year. The way an animal reproduces will determine 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 egg 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 partially surrounds the ovary and “catches” the egg at ovulation.

Uterus Supports, nourishes, and protects the embryo as it develops and expels the fetus at parturition. Walls are soft and spongy for 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 tougher 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.

Vagina The passageway from the vulva to the cervix that serves as the organ of copulation and birth canal during parturition. This is the site of semen deposit. 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 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 The organ used for copulation that deposits sperm into the female reproductive tract. Has an S-shaped bend called the sigmoid flexure which 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.

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

Reproduction Equipment and Use

It is important to know different equipment that is used in breeding, aiding parturition, and for processing and caring for young. Below are items you should be able to identify and tell the use of. 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 catalogs are a good study reference.

- Semen tank
- Breeding gun
- Breeding sheath
- Breeding gloves
- Thermos
- Insemination pipette
- Marking harness
- Kid puller
- Ear tagger
- Burdizzo
- Emasculators
- Elastrator
- Dehorning paste (chemicals), irons
- Thermometer
- Paint stick
- Forceps
- Lubricant
- Speculum
- Ultrasound machine
- Knife
- Tattoo numbers &/or letters
- Iodine/disinfectant
- Syringe and needle
- Notching clippers
- Nursing bottle
- Horn spoons, tubes, scoops

Processing Newborns

Int. & Sr.

All kids, whether born naturally or with assistance, need special care to remain healthy. Small kids will be especially susceptible to starvation and/or hypothermia. The placental membranes should be removed from the head and fluid removed from the nostrils and mouth if the doe is unable to attend to this. The umbilicus should be dipped with a good disinfectant. Povidone iodine is an adequate solution for this purpose. A partially filled plastic film canister works well for this. Normal kids will start trying to stand up immediately and should be on their feet and nursing in a short period of time. Nursing within the first few hours after birth is critical to absorb antibodies to fight disease. The first milk, called *colostrum*, contains antibodies, is thick and yellow, and is only produced for a short time following kidding. For a good discussion of the process of kidding with pictures visit: https://extension.okstate.edu/programs/meat-goat-production/site-files/docs/chapter-8-kidding.pdf

Neutering

Bucks that will not be used for breeding should be castrated (testicles removed). Kids should be castrated as young as possible to avoid disruptions in growth performance and other possible complications. Tetanus antitoxin injections are recommended in conjunction with castration procedures to avoid tetanus or lockjaw. Castration may be performed by one of three methods: https://morningchores.com/castrating-goats/

Knife Method

1. Begin by washing your hands and instruments (knife or scalpel) thoroughly with soap and water and then disinfectant. Next, wash the scrotum and disinfect it.

2. Push the testes up out of the way and cut off the lower 1/3 of the scrotum with a cut parallel to the ground. The testes should now be visible.

3. Using your fingers, grasp one of the testes and pull downward. The testes are slick and difficult to hold onto, so grasp firmly. Do not allow the testis or spermatic cord to go back up into the scrotum once you have touched it as this will increase the chances of infection. In young kids (less than 4 or 5 weeks) pull down firmly, but steadily until the cord breaks. In older kids or adults, instead of pulling the cord, use a knife or scalpel to sever the cord. Do not cut the cord cleanly, instead scrape it until it abrades through. Because the spermatic cord contains many blood vessels, a clean cut could cause excessive blood loss.

4. If a segment of the spermatic cord is protruding below the cut scrotum, it must be removed. If left exposed, it will act as a wick to pull bacteria into the body cavity and cause infection. Pull it free or abrade it with the knife.

5. Apply antiseptic to the castration site and administer an injection of tetanus antitoxin.

Emasculatome Method

The emasculatome or Burdizzo method involves an instrument (emasculatome) that crushes the spermatic cord, thus destroying the blood supply for the testes. Without this blood supply, the tissues eventually atrophy even though the scrotum (cod) will be visible for the animal's lifetime. This method is known as a "bloodless" method since no cutting is done and when done properly the skin is not even broken. Care must be taken to be sure that both cords have been properly crushed. http://fiascofarm.com/goats/buck-wether-info.htm

1. Since the emasculatome can break the skin, it doesn't hurt to wash and disinfect it.
2. Have an assistant hold the kid. Wash the upper portion of the scrotum (near to where it attaches to the body) and disinfect.
3. Grasp the scrotum in one hand and manipulate until you have the testes down into the scrotum and the spermatic cord between your fingers. Place the jaws of the emasculatome onto the upper scrotum, just below the rudimentary teats. Position the jaws so that about two-thirds of the scrotum is crushed when the jaws are closed. Leave the instrument closed for 15 to 20 seconds. Open the jaws and move the instrument about 1/2 inch lower and crush the other side of the scrotum.

Elastrator Method

This method involves cutting off the blood supply to the testes with a heavy rubber band or ring. In 10 to 14 days, the scrotum and testes will slough off. This method is most effective for young animals whose scrotal tissues have not yet become well-developed. Materials needed include an elastrator (an instrument used to apply the bands) and castrating bands or rings (Purchase these from a livestock supply company. Do not use household rubber bands!). It is not necessary to disinfect the elastrator or rings since this method is bloodless.

1. Restrain the animal as described previously.
2. Place a rubber ring on the prongs of the elastrator. Turn the elastrator so that the prongs face the kid's body. Expand the ring by squeezing the elastrator and placing it over the scrotum and testes. Position it as close to the kid's body as possible without interfering with the rudimentary teats.
3. Manipulate the scrotum until you are certain that both testes are descended below the ring.
4. Press the trigger lever, displacing the ring from the prongs, thereby positioning the ring. Note: Be sure that both testes are below the ring! If they are not, cut the ring and start over.
5. Administer an injection of tetanus antitoxin. Even though this is a bloodless procedure, the tetanus organism can gain entry through the irritated tissue around the rubber ring.

Disbudding:

Ideally, goats should be dehorned when they are very young. It is advisable to wait until they are 1-2 weeks of age and in good flesh to be sure they are healthy and not coming down with neonatal diarrhea. If discolored skin is fixed to the skull in two rosettes, horn buds are present. Moveable skin indicates a naturally hornless condition. https://fiascofarm.com/goats/disbudding.htm

Breeding Management Practices

Seniors

Natural Mating

This type of mating is the easiest for the farmer and the one most commonly practiced with goats. If bucks are allowed to be with the does, they can find the ones ready to breed and they know what to do. Goats are short-day, seasonal breeders, meaning does will begin to have heat cycles when the days begin to get shorter. The breeding season begins when the bucks are placed with the cycling does and ends when the bucks are removed and/or the does stop cycling.

Heat (Estrus) Detection

In herds where artificial insemination is to be practiced, one of the most important management practices is detecting *estrus* so that insemination can be performed at the proper time. The key to heat detection is frequent and careful observation of the herd. A good record-keeping system provides important information for breeding and parturition.

Does seldom show strong symptoms of estrus in the absence of the buck. Does occasionally mount each other, but not often. Altered bucks (vasectomized) can be used to check does for estrus by fitting them with a harness containing a crayon that will mark the doe when they are mounted. Bucks have also been placed in secure pens adjacent to the doe paddock. Estrous does will congregate around the pen, and other symptoms can be used to verify estrus. These include tail wagging, bleating, frequent urination, swelling of the vulva, and discharge of mucus. https://content.ces.ncsu.edu/heat-detection-and-breeding-in-meat-goats

Timing of Reproductive events:

Age at puberty – 4-7 mos. Weight at puberty – 25-65 lbs.

Estrous cycle length – 18-21 days Estrus – 12-36 hrs Gestation length – 148-153 days

Estrus Manipulation

Synchronization is the altering of the normal estrous cycle using hormones to cause females to come into heat during a specific time period. Synchronized breeding reduces the time required for heat detection and breeding. New products are being developed for synchronization that could be used in goats but most of the products are not yet labeled for use in goats. Progesterone and prostaglandins are the primary hormonal synchronization tools. Prostaglandin works on cycling does to regress a corpus luteum. Progestins keep the does from coming into heat and ovulating for the duration of the progestin treatment.

Most goats in the United States experience a period of seasonal anestrous (doe is not cycling). Since does are SHORT day breeders, artificial lighting programs may be used to cause them to breed out of season. If goats are kept under artificial lights for 14 to 18 hours per day for 3 months and then gradually cut back to 6 hours of light per day, more than 50% will come into estrus and conceive. This allows goats to be bred out of season. If your facilities do not allow you to put the does in darkness, it is possible to use the hormone melatonin to make the does begin to cycle out of season. Melatonin is the hormone that the doe produces when days are short.

Artificial Insemination

Artificial insemination in goats is becoming a popular breeding tool for some producers. Initial equipment purchases can be expensive, and it is highly recommended that you have someone experienced in goat AI show you the correct method before attempting it yourself. Once the equipment is purchased and the process understood, the breeder will have access to many of the most outstanding bucks in the nation. AI allows breeders to bring the genetics of proven animals into their herd at a fraction of the cost of buying and maintaining a quality herd sire. As in other animal species, success depends on many factors including proper handling and storage of semen, proper insemination technique, and the correct timing of insemination. A full discussion of artificial insemination can be found at: https://pubs.nmsu.edu/_d/D704/

Procedures
Restrain doe with a breeding stand or other method (holder). Thaw semen in a thawing box at 95˚ F for 30 seconds or according to the processor's directions. Dry the straw thoroughly with a paper towel. Pull the plunger back 4-6 inches on the insemination gun and place the straw into the gun with the cotton plug toward the plunger. Cut the sealed tip of the straw squarely. Cover the straw and gun with a sheath and secure it with an O ring. Lubricate the speculum with a sterile, non-spermicidal lubricant. Clean the vulva with a dry paper towel and insert a lubricated speculum at a slight upward angle. Visually locate the cervix and center the speculum over it. Insert the insemination gun into the speculum and thread it into the cervical opening. Work the insemination gun through the rings of the cervix no more than 1.5 inches. Deposit the semen slowly by pushing the plunger.
Remove the gun slowly and remove the speculum. Record all important information in the record system.

Pregnancy and Parturition


Seniors

It is important to know if a doe 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 goats, an ultrasound machine can be used to tell if the female is pregnant. This machine sends out sound waves which bounce back and register as a picture on a monitor.

If you know when a doe was bred and the length of gestation, you can figure out when to expect her to give birth. Pregnancy ends with the process of parturition. There are several signs of approaching birth: udder fills with milk, teats appear full, doe becomes restless, may go off by herself, vulva relaxes, stretches, and may appear moist.

As delivery begins, the doe usually lays down and begins to push the kid 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. When everything is normal, does deliver their offspring without assistance. Sometimes things don’t go well, and the manager must help by carefully pulling along with the doe’s contractions (pushes). Once the kid is delivered, the placenta(s) (afterbirth) should be passed out as well. Difficult births (dystocia) and retained placenta usually lead to problems with the doe breeding back. https://extension.okstate.edu/programs/meat-goat-production/oklahoma-basic-meat-goat-manual.html

Selection: Pedigree/Performance 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 species. That is the animal that expresses, to the highest degree, traits that are of economic importance like milking ability, kidding rate, pounds weaned, and growth rate is the type selected. https://goats.extension.org/genetic-selection/

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 genotype 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*.
https://extension.okstate.edu/programs/meat-goat-production/site-files/docs/chapter-3-meat-goat-selection.pdf

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 bucks and does to be mated using the available data, producers can improve the genetics, and thus the performance of their offspring.

Pedigree evaluation

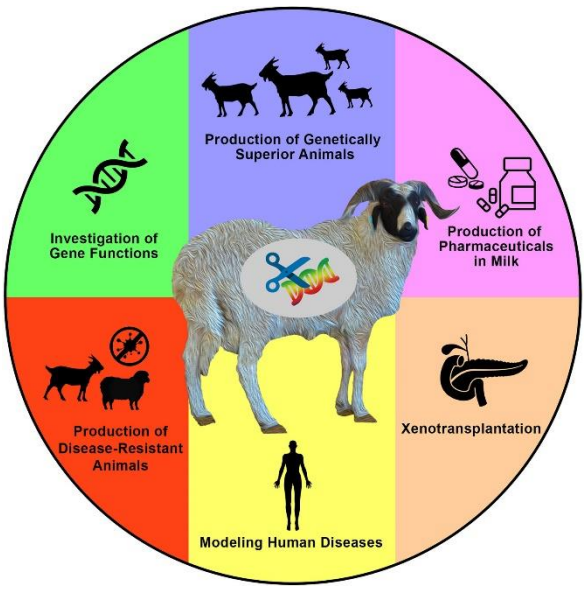
Basically, a pedigree provides genetic and performance information on the individual animal and its ancestors. Genetic information is provided for each male relative on the pedigree. Estimates of his ability to transmit superior production and type traits to his daughters are printed. These genetic estimates are based upon the performance of the buck's daughters as compared to other does in the same herd. The classification score and production records for each female ancestor are shown on a pedigree. The doe's genetic estimates for production and type traits also are included. The genetic value for an individual animal with no performance or progeny information is predicted from its ancestor's information and shown on the pedigree. For a mature animal, the pedigree contains genetic values for production and type traits based on the animal's own performance, performance of the animal's offspring, and ancestor information. Traits of importance to dairy goat farmers are birth weight, 90-day weaning weight, carcass, milk, reproduction, and productive life. https://goats.extension.org/goat-reproduction-selection-genetic-animal-evaluation-epds/#:~:text=An%20EPD%20is%20a%20numerical,1.

Predicted Transmitting Abilities (PTAs)

PTAs are assigned to different traits of goats. PTAs are genetically equivalent to EPDs and are similarly derived by a complex process. Like the accuracy values of EPDs, PTAs have reliability estimates that increase as more information is available on an animal. Animals can be ranked based on the PTA values listed on their pedigrees.

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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