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!

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 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. http://www.sheep101.info/breeds.html

Corriedale:
Medium to large in size, this breed originated in New Zealand from a Lincoln Ram and Leicester/Merino Ewe cross. They are a polled breed with high-quality, heavy fleeces.

Dorset:
This breed has a white face and can be polled, scurred, or horned. The ewes breed out of season, are good milkers, and often produce more than one lamb crop per year. They are medium-sized and originated in England.

Cheviot:
From Scotland, this polled breed has a small, blocky body with a white face and legs and black nostrils.

Suffolk:
Originating in England, this breed has black legs, and a black head and is polled. It is highly popular, having the greatest number of registrations in the U.S. Suffolks are meaty and have excellent carcass quality.

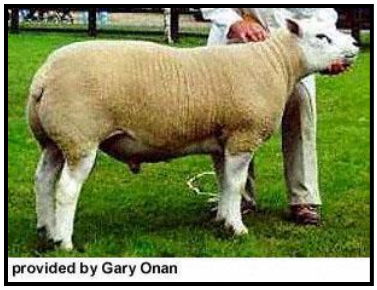

provided by Sally Anne Thompson

Southdown:
The oldest breed from England, Southdowns are small to medium in size with grey to mouse-brown faces. They have wool on their legs and are polled. Southdowns produce meaty carcasses.

Hampshire:
This is a popular, large, meaty-type breed with black faces, a wool cap, and wool on its legs. The lambs grow fast and the ewes are good milkers. This breed also originated in England.

Rambouillet:
Merinos imported from Spain to France formed the foundation of this breed known for superior, long, dense, fine wool. The Rams may be horned or polled. They are hardy, good foragers, excellent mothers, and have been used extensively in crossbreeding systems

Jacob:
A truly unique breed, both ewes, and rams are horned with 2, 4, or even 6 horns. The trademark white and black wool is favored by hand spinners and weavers. An unimproved breed with an obscure origin, Jacob sheep have a slight build and goat-like appearance.


provided by Gary Onan

Texel:
Noted for heavy muscling and minimal fat, this breed was first brought into the United States in 1990. The Texel is a white-faced, medium-wool breed with short ears and no wool on the face or legs. Research from Clay Center Nebraska indicates Texel lambs have a 6-10% loin eye area advantage over other black-faced breeds.

Selection: Visual Evaluation

Jr., Int. & Sr.

Many traits of economic importance can be evaluated by simply looking at the animal. Most livestock show judges rely totally on the way the animal looks, moves, or feels to make their decisions on class placings. Learn more about how to judge breeding sheep at: https://www.gov.mb.ca/agriculture/industry-leadership/4h/pubs/judge-sheep.pdf and practice judging some breeding classes at: https://afs.ca.uky.edu/livestock/judging/breeding-ewe-classes.

Feet and Leg Structure

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.

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. For wool breeds, consideration should be given to fleece as well.

Type	Most important → Less important				
Rams	Frame	Structure	Muscling	Pounds (Growth)	Volume
Ewes	Frame	Structure	Volume	Femininity	Muscle

Structure – correct; Frame = optimal; Volume = more is better; Muscling = more is better

Reproduction Overview

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

Gender Names and Terminology

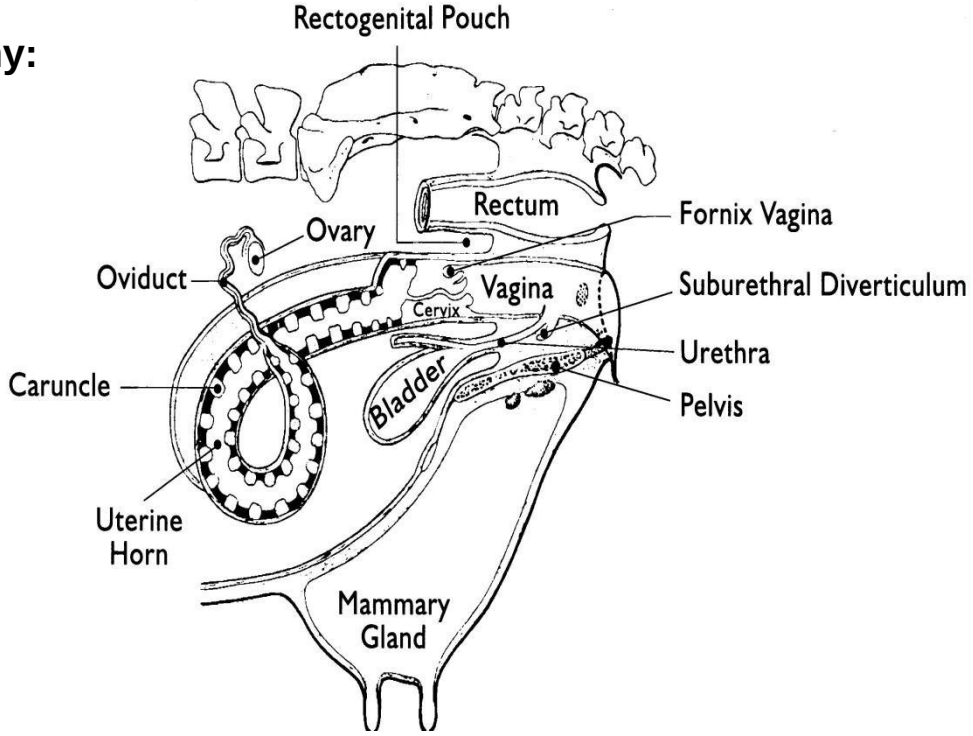
Young – Lamb	Mature male – Ram	Immature or mature female – Ewe
Castrated male - Wether	Parturition – Lambing	

Reproductive Anatomy

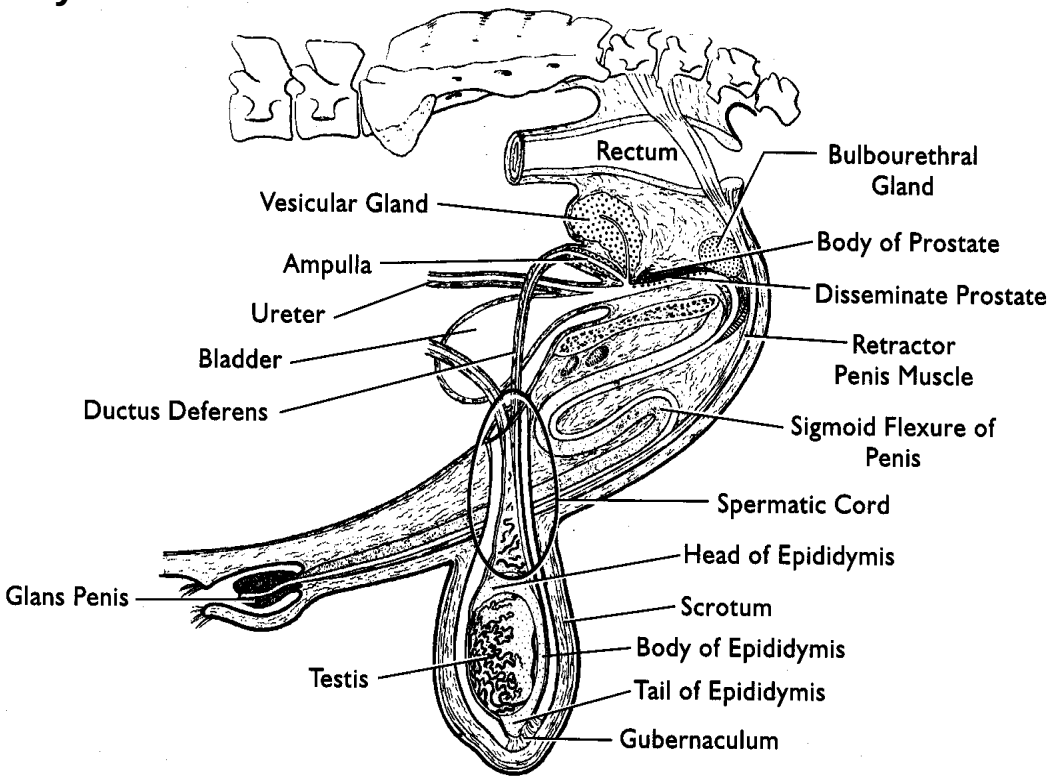
Int. & Sr.

Ewes give birth to single or twin lambs once or sometimes twice 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 understanding 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 deposition. 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 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.

Pregnancy and Parturition

It is important to know if an ewe 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 sheep, 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 an ewe was bred and the length of gestation, you can figure out when to expect her to give birth. The gestation period is about 152 days. Pregnancy ends with the process of parturition. There are several signs of approaching birth: udder fills with milk, teats appear full, ewe becomes restless, may go off by herself, vulva relaxes, stretches, and may appear moist.

As delivery begins, the ewe usually lays down and begins to push the lamb 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, ewes deliver their offspring without assistance. Sometimes things don’t go well, and the manager must help by carefully pulling along with the ewe’s contractions (pushes). Once the lamb is delivered, the placenta(s) (afterbirth) should be passed out as well. Difficult births (dystocia) and retained placenta usually lead to problems with the ewe breeding back. Visit http://www.sheep101.info/201/readylambing.html to learn about preparation for lambing.

Reproduction Equipment and Use

Int. & Sr.

It is important to know the different equipment that is used in breeding, aiding parturition, and caring for young. Below is a partial list of items you should be able to identify and tell what they are used for. There may be others that are not listed so know all the equipment that is used for practices which are explained in this manual. Livestock supply companies' catalogs are a good study reference.

- Colostrum
- Breeding gun
- Breeding sheath
- Breeding gloves
- Thermos
- Insemination pipette
- Implant gun
- Iodine/disinfectant
- Branding irons
- Burdizzo
- Elastrator
- Emasculators
- Dehorning irons
- Horn spoons, tubes, scoops
- Knife
- Feeding tube
- Thermometer
- Straw cutter or scissors
- Forceps
- Lubricant
- Speculum
- Ultrasound machine
- Artificial vagina
- Ear tagger
- Tattoo numbers &/or letters
- Notching clippers
- Nursing bottle with nipples
- Shearers
- Syringe and needle
- Heat detection devices
- Lamb puller
- Hanging scale

Processing Newborns

All lambs, whether born naturally or with assistance, need special care to remain healthy. Small lambs 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 ewe 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 lambs 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 lambing. http://www.sheep101.info/201/newborns.html

Docking

This is "stubbing" the tail. Lambs should be docked between 3 and 10 days of age. Docked lambs stay cleaner and are therefore less likely to get diseases and parasites. The tail is cut at the first or second joint, or about 1 to 1.5 inches from the body. Docking may be done with a knife, burdizzo, elastrator, emasculator, "all-in-one" electric docker, or hot docking iron. Follow good sanitation and dip all tools in a disinfectant before use. It is important to leave a tail stub to prevent rectal prolapses. http://www.sheep101.info/201/dockcastrate.html

Castration

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. Many producers dock and castrate lambs at the same time. Castration can be done with a knife, burdizzo, elastrator, "all-in-one", or emasculator. Proper sanitation methods must be followed. Visit http://www.sheep101.info/201/dockcastrate.html for more details on docking and castrating lambs.

Ear Mark

This should be done to lambs when they are docked and castrated to make it simpler to tell the wethers from the ewes. Different markings can be used each year to help identify ages easily. Plastic ear tags may also be used to identify the lambs.

Dehorning

The practice of dehorning or disbudding lambs is not as common as for calves or goats. Many sheep are polled (genetically hornless), in some breeds only the males are horned, and because many sheep are kept in more open situations, the presence of horns does not cause as much damage as in animals kept in close quarters. If lambs are to be dehorned, it should be done when they are less than twelve weeks of age using cautery (heat only) or by physical removal of the horn bud, using a scraper blade or dehorning shears.

Breeding Management Practices

Seniors

Natural Mating

This type of mating is the easiest for the rancher and the most commonly practiced in the sheep industry. If rams are allowed to be with the ewes, they can find the ones ready to breed and they know what to do. Sheep are short-day, seasonal breeders, meaning ewes will begin to have heat cycles when the days begin to get shorter. The breeding season begins when the rams are placed with the cycling ewes and ends when the rams are removed and/or the ewes stop cycling. For an excellent reference on modern sheep breeding practices visit:
http://www.sheep101.info/201/ewerepro.html

Heat (Estrus) Detection

In flocks 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 flock. A good record-keeping system provides important information for breeding and parturition.

Ewes do not demonstrate any signs of estrus when separated from the ram. Therefore, it is necessary to use an altered ram to detect estrus in ewes if AI or pen mating are to be used. The vasectomized (surgically altered) ram has been used most frequently, but rams with redirected prepuce are preferred because of the reduced possibility of disease transmission. Paint on the brisket or a harness on the ram can be used to identify ewes that have been mounted.

Timing of Reproductive events:

Age at puberty – 6-8 mos. Weight at puberty – 60-75 lbs.

Estrus – 24-36 hrs. Estrous cycle length – 17 days Gestation length – 145-151 days

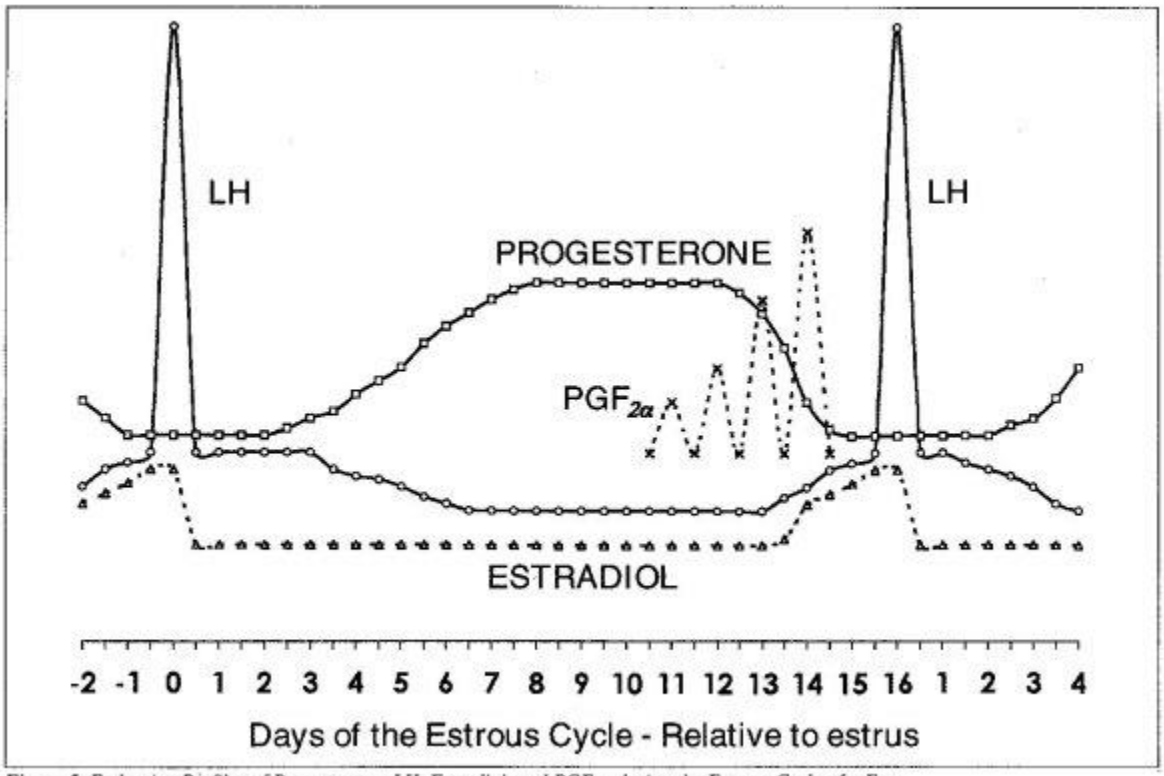


Figure 5. Endocrine Profiles of Progesterone, LH, Estradiol, and $PGF_{2\alpha}$ during the Estrous Cycle of a Ewe.

Estrous Manipulation

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. Progesterone from CIDR™ (controlled internal drug release) can be used in cycling or non-cycling ewes. It keeps the ewe out of heat for the duration of the therapy and when it is removed after 9-19 days, a high percentage of the ewes will be in heat within 24 to 48 hours. Prostaglandin can be used in cycling ewes to regress the CLs, causing them to return to heat in a very predictable time frame (30 – 48 hours). Two shots given 11 days apart is the most common approach.

Most sheep in the United States experience a period of seasonal anestrous (not cycling). Since ewes are SHORT day breeders, artificial lighting programs may be used to cause them to breed out of season. If sheep 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 sheep to be bred out of season. If your facilities do not allow you to put the ewes in darkness, it is possible to use the hormone melatonin to make the ewes begin to cycle out of season. Melatonin is the hormone that the ewe produces when days are short.

Artificial Insemination

If you do not own a ram, or if you want to breed an animal 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 rams to breed more ewes than they could with natural mating. Key components of artificial insemination are selected matings, heat detection, semen collection, proper handling and storage of semen, proper insemination technique, and accurate record keeping. Unlike cattle and goats, sheep are not easy to inseminate. Most sheep are inseminated surgically.

AI procedures

Due to the difficulty detecting heat, poor conception rates, and relatively minimal financial incentive, AI is not routinely used in ewes. Because of their small body size, the method used in cattle is not possible. AI is performed in one of 4 ways in sheep. Vaginal AI is the easiest but has the lowest success rate and is not suitable for frozen semen. Cervical AI involves using a speculum (clear glass or plastic tube) to locate the cervix and place semen into the first ring. It has reasonable success rates with cooled and fresh semen but not with frozen semen. Trans-cervical method involves grasping the cervix with a pair of forceps and retracting it into the vagina so the insemination instrument can be introduced. Laparoscopic AI involves making a small incision and using an endoscope to bypass the vagina and cervix, placing the semen directly into the uterus.

Selection


Seniors

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 lambing rate, growth rate, carcass merit, or fleece quality 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 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 sheep. 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 rams and ewes to be mated using the available data, producers can improve the genetics, and thus the performance of their offspring.

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 American Sheep Industry Association is dedicated to making sheep production efficient and profitable through research and education. http://www.sheepusa.org/

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. The desirability of a high or low value for the trait is dependent on the scenario.

Sheep
50-day gain
100-day gain
Number born per lambing
Number weaned per lambing

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 ram with a 1.0 60-day weaning weight EPD should sire lambs with 1 pound heavier 60-day weaning weight than a ram with 0.0 60-day weaning weight 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. Visit the following website to learn more about sheep EPDs: http://livestocktrail.illinois.edu/sheepnet/eventDisplay.cfm?ContentID=1230

https://animalrangeextension.montana.edu/sheep/selection.html

http://afs.ca.uky.edu/livestock/sheep/epd

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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