

Reproductive Management

Control of Reproduction

The success of a cow-calf operation depends upon the number of calves raised, weaned, and marketed each year. The following are some of the most important factors influencing profits in the cow-calf business:

- Proper growth and development of replacement heifers
- The percentage of cows and heifers bred early in the breeding season
- Calving and weaning percentages

According to a recent survey, pregnancy and calving in the Southeastern part of the country is at 88 percent. In Alabama, however, pregnancy and calving are estimated to be 7 to 8 percent lower, or only 80 to 81 percent. We can improve these figures if we know and understand the factors affecting reproductive performance in a cowherd.

Table 1. General Reproductive Information

	Average	Range	Comments
Age at puberty	10 to 12 months	6 to 24 months	<ul style="list-style-type: none"> • Varies with breed. • Brahmans and continental breeds usually reach puberty later than British breeds.
Gestation	283 days	273 to 290 days	<ul style="list-style-type: none"> • Bull calves are often carried slightly longer. • Brahman type cattle often have longer gestations.
Length of estrous cycle	21 days	18 to 24 days	<ul style="list-style-type: none"> • Heifers often have slightly shorter cycles than cows.
Length of estrus (heat)	18 hours	6 to 30 hours	<ul style="list-style-type: none"> • Signs include restlessness, clear mucous vaginal discharge, and mounting other animals. The primary sign is "standing to be mounted."
Interval to first heat after calving	45 days	16 to 90+ days	<ul style="list-style-type: none"> • Retained afterbirth and uterine infection delay onset. • Adequate body condition is critical.
Reproductive life	10 years	Up to 15 years (rarely longer)	<ul style="list-style-type: none"> • Management, death loss, and culling play a large part in determining reproductive lifespan.

Normal Estrous Cycle

Estrus = standing heat

Estrous = the 21-day cycle from one estrus (heat) to the next

Drugs used for estrus synchronization programs often mimic what occurs during a cow or heifer's normal estrous cycle. Therefore, understanding the physiology of the normal estrous cycle is critical to understanding estrus synchronization programs.

The average estrous cycle, from one standing heat (estrus) to the next, is 21 days in the cow (Figure 1), with a range of 18 to 24 days. The cycle begins on day 1 when the egg is ovulated from a follicle on the ovary. The egg moves into the uterine tube where, if viable sperm from the bull are present, it is fertilized and moves into the uterus.

Regardless of whether the egg is fertilized, by approximately day 5, the site of ovulation on the ovary develops into a corpus luteum (CL), a gland that secretes the hormone progesterone into the cow's blood. While the CL is secreting progesterone, sometimes called the "hormone of pregnancy," the animal does not come into estrus.

Around day 17, if the animal is not pregnant, the uterus secretes the hormone prostaglandin F₂ alpha (PGF₂α) that causes the CL to regress in about 3 to 5 days. While the CL is regressing, a new egg-containing follicle is developing that secretes the hormone estrogen, causing the cow to come into standing heat on about day 20 or 21 of the estrous cycle. Cows should be inseminated near the end of standing heat to provide enough time for the sperm to undergo a process called *capacitation* before they encounter the egg. Capacitation gives sperm the ability to fertilize the egg. Cows ovulate approximately 4 to 16 hours after the end of standing heat. (See section on Timing of Artificial Insemination for Maximum Conception.)

If the cow becomes pregnant, the embryo in the uterus prevents the release of PGF₂α. When this happens, progesterone secretion by the CL continues, cycling ceases, and the pregnancy is maintained. If no problems occur during pregnancy, the embryo develops into a fetus which is born as a calf about 283 days after the egg was fertilized.

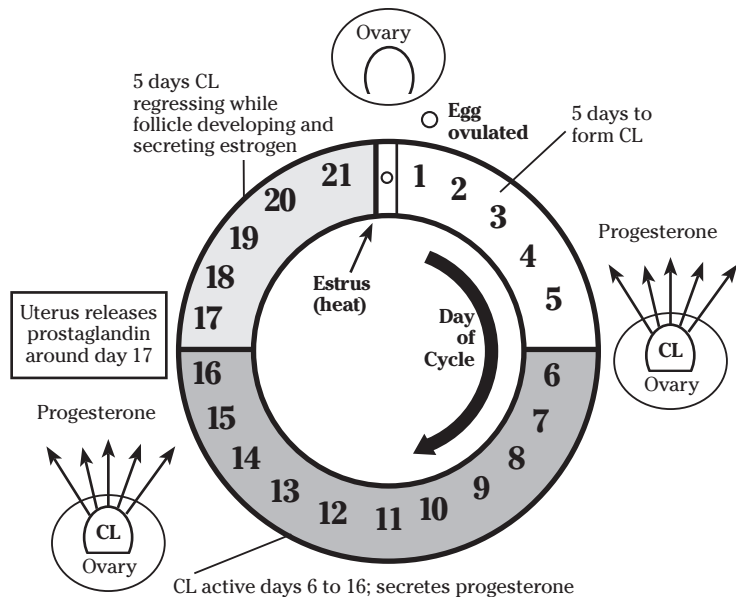


Figure 1. Cyclicity—the normal 21-day cycle

Developing Replacement Heifers From Weaning to Breeding

- Determine your target weight at breeding.
- Sort replacement heifers by size, giving the most feed to heifers that need it the most.

Note: Start of puberty is affected by age, weight, and breed. Of these three factors, weight is the one that producers can change.

The following is an example worksheet for calculating your required heifer gains before the start of the first breeding season.

	Alabama Example	Your Herd
Mature cow size	1100 pounds	
Target weight at breeding (65 percent of mature weight) ¹	715 pounds	
Current weight	550 pounds	
Current date	August 1	
Start of breeding season	December 1	
Development period	120 days	
Total gain needed	165 pounds	
ADG needed	1.37 pounds/day	

¹Calculate target weight based on your mature adult cow weight in the herd. Avoid underestimating the target weights for heifers.

Table 2. Recommended Height and Body Weight of Breeding Females (Different Frame Sizes)

Frame Score	205 Days		426 Days		Maturity	
	Height ¹	Weight ²	Height ¹	Weight ²	Height ¹	Weight ²
1	35	356	41	580	44	880
2	37	375	43	618	46	953
3	39	396	45	653	48	1,027
4	41	418	47	693	50	1,100
5	43	438	49	728	52	1,172
6	45	458	51	766	54	1,247
7	47	480	53	803	56	1,320
8	49	499	55	838	58	1,393
9	51	521	57	880	60	1,467

Source: Adapted from D.G. Fox, C. J. Sniffen, and J. D. O'Connor, "Adjusting Nutrient Requirements of Beef Cattle for Animal and Environmental Variations," *Journal of Animal Science* 66 (1988):1475.

¹Hip height (inches) based on Beef Improvement Federation standards.

²Weights (pounds) are expected averages for flesh condition (body condition score 5).

Estrus Synchronization Programs

The majority of estrus (heat) synchronization programs use one or a combination of two basic methods that work with the physiology of the cow's normal estrous cycle.

- Prostaglandin (PGF₂α) injections cause CL regression (see section on Normal Estrous Cycle) and standing heat in 1 to 5 days, unless the cow or heifer is in the first 5 to 7 days of her estrous cycle when her CL is not responsive PGF₂α.
- Progesterone or progestins, released from Controlled Internal Drug Release (CIDR) inserts or ingested in feed (MGA), respectively, mimic the effects of the cow's natural progesterone by preventing heat from occurring as long as they are present in the body. Once removed, the cow or heifer typically comes into heat in 1 to 3 days. These products are often used in conjunction with a PGF₂α injection.

Federal law restricts the majority of reproductive hormones to use by or on the order of a licensed veterinarian. Contact your veterinarian to learn about specific recommendations and products for an estrus synchronization program.

Two Main Reasons Estrus Synchronization Programs Fail

- The animals were not cycling.
 - Cows must be in sufficient body condition at calving and have adequate nutrition available to return to cyclicity postpartum.
 - Heifers must be at approximately 65 percent of their mature body weight to initiate cycling.
- The animals were cycling, but heat was not detected after injection of PGF 2α or removal of progesterone/progestin.
 - The signs of heat may have been present but just not detected. Cows are usually in estrus for only 12 to 24 hours and may only show signs of standing heat a few times. Observe for standing heat at least 30 minutes twice a day. Early morning and late afternoon are the best times for heat detection.
 - The cow or heifer did not respond to the PGF 2α injection because she was in the first 5 to 7 days of her estrous cycle when her CL was not responsive to PGF 2α .

Things to Remember

- Always be careful when handling reproductive hormones because they can be absorbed through the skin and affect humans.
- Women of childbearing age, asthmatics, and persons with bronchial or other respiratory problems should exercise extreme caution when handling reproductive hormones.
- Always follow label directions and adhere to all other BQA guidelines.

Timing of Artificial Insemination for Maximum Conception

Figure 2 offers general guidelines for timing of artificial insemination based on observed “standing heat” (estrus). Actual times will vary depending on the length of standing heat, but the goal is to inseminate near the end of a heat period. Cows ovulate approximately 4 to 16 hours after the end of standing heat. Inseminating near the end of heat provides time for the sperm to undergo capacitation before they encounter the egg. The process of capacitation gives sperm the ability to fertilize the egg. In general, it is better to have the sperm waiting on the egg, rather than the egg waiting on the sperm, because the egg has a shorter lifespan.

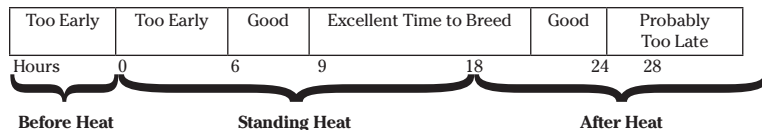


Figure 2. Timing of artificial insemination for maximum conception

Things to Consider

- Good heat detection is critical for successful artificial insemination. Observe for standing heat at least 30 minutes twice a day. Early morning and late afternoon are the best times for heat detection.
- Maximum conception rates for artificial insemination occur if animals are bred near the end of standing heat. Traditional artificial insemination has therefore followed the a.m.-p.m. rule. An animal first observed in heat in the a.m. should be inseminated that p.m.. An animal first observed in heat in the p.m. should be inseminated the next a.m..
- An alternative to the traditional a.m.-p.m. rule is to inseminate animals on a once-a-day schedule in the morning. Animals in heat in the a.m. are bred that morning. Animals in heat in the p.m. are bred the next morning. Breeding animals once per day may be a more efficient use of labor and can be a reliable method for artificially inseminating cattle. However, if you use this method, you must continue to monitor heat activity a minimum of twice each day (a.m. and p.m.).

- Some producers may consider the use of timed artificial insemination in which insemination occurs at a predetermined time following an appropriate synchronization program. Timed artificial insemination allows for a more regimented schedule, but often results in poorer conception rates.

Parturition (Calving)

Observation of cows and heifers before and during the calving season is necessary to ensure a good calf crop percentage. Observe cows at least daily during the calving season, and observe heifers more frequently (perhaps several times a day). It is important that you are familiar with the signs of impending parturition, as well as the sequence of events associated with normal labor and delivery to determine when assistance is necessary.

Signs of Impending Parturition

- The udder and vulva will often enlarge 1 to 3 weeks prior to parturition.
- Cows and heifers often become nervous (restless) and will isolate themselves from the rest of the herd just prior to parturition.
- Cows and heifers may show signs of abdominal discomfort by kicking at their belly. They may also glance to the rear nervously.

Normal parturition is divided into three stages:

Table 3. Three Stages of Parturition

Stage	Duration	Comments
Stage I Preparatory	cows (4 to 8 hours) heifers (6 to 12 hours)	<ul style="list-style-type: none"> • Cow or heifer may become nervous and isolate herself from the rest of the herd. • Uterine contractions begin. • “Dropping” of colostrum into the teats. • Water bag appears toward the end of this stage. Stage II begins when the water bag breaks.
Stage II Delivery of the calf	cows (< 1 hour) heifers (1 to 4 hours)	<ul style="list-style-type: none"> • Cow or heifer is now actively straining. • In normal parturition, the calf’s forelegs and head protrude first about 70 percent of the time, and the hind legs and tail come first about 30 percent of the time. • The calf is delivered.
Stage III Expulsion of the placenta (afterbirth)	cows (1 to 12 hours) heifers (1 to 12 hours) This usually occurs within the first few hours.	<ul style="list-style-type: none"> • Cow or heifer straining decreases. • Uterine contractions continue, and the placenta is expelled. • If the placenta is not expelled soon after birth, do not manually remove the placenta by pulling it out. (See section on Retained Placenta.)

It might be necessary for you to assist when parturition does not proceed as described, and early intervention is the key. Waiting too long to provide assistance unnecessarily risks the life of the cow or heifer and her calf. Seek the help of a veterinarian as needed.

Supplies Needed to Assist With Calf Delivery

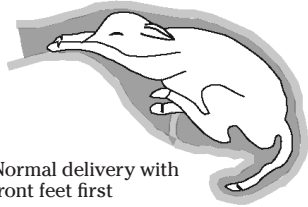
- Obstetrical (OB) chains or ropes. (Chains are preferred because they can be easily disinfected after use.) OB chains and ropes are used for pulling on the legs. Never attach OB chains or ropes to the jaw and then pull on a calf; the jaw will almost always fracture.
- OB handles for pulling on the chains or ropes.
- Mechanical calf puller, also known as a “calf jack.” **USE WITH CAUTION, AND DO NOT APPLY EXCESSIVE FORCE.** Calf pullers can exert substantial force on the cow or heifer and the calf. When used improperly the cow, heifer, and calf can be injured or killed. Never attempt to deliver a calf with any type of vehicle.
- OB lubricants
- Plastic gloves
- Buckets
- Towels and paper towels
- Tincture of iodine for disinfecting calf’s navel

Providing Assistance During Parturition

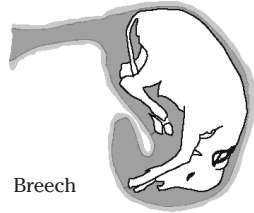
The first step in providing assistance during parturition is assessing the problem. Several common situations encountered when delivering a calf are described below and illustrated in figure 3.

- Normal delivery
 - The calf’s forelegs and head protrude first about 70 percent of the time.
 - The hind legs and tail come first about 30 percent of the time. Always make sure the tail is protruding with the hind legs in this situation.
- Calf too big (not illustrated)
 - Most frequently encountered in heifers, but it can also occur in cows.
 - Applying excessive force to attempt delivery of a calf that is too big is detrimental to the health of the heifer and the calf and wastes precious time.
 - Call a veterinarian as soon as you determine that the calf is too big. The calf can be saved if assistance is provided promptly. Even if the calf cannot be saved, a veterinarian can dismember the calf or perform a C-section to save the heifer.

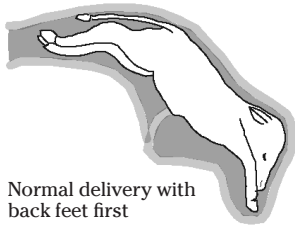
- Breech (hindquarters first with both hind legs retained)
 - o Both hind legs and the tail must be straightened out and placed correctly within the birth canal for delivery to proceed.



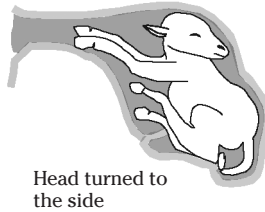
Normal delivery with front feet first



Breech

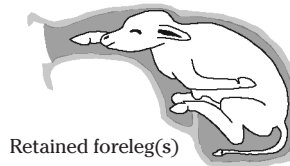


Normal delivery with back feet first

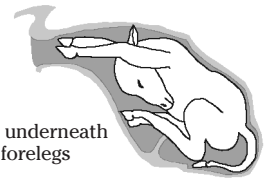


Head turned to the side

- Head turned to the side
 - o The neck must be straightened out and the head placed on top of the forelegs for delivery to proceed.
- Retained foreleg(s)
 - o Occasionally one or both forelegs are retained. If both forelegs are retained, then only the head will be in the birth canal.
 - o The forelegs must be straightened out and delivered simultaneously with the head resting on top of the forelegs.
- Head underneath both forelegs
 - o The head must be placed on top of the forelegs, and then delivery can proceed.



Retained foreleg(s)



Head underneath both forelegs

Figure 3. Common situations encountered when delivering a calf

Reproductive Tract Prolapses

- Vaginal prolapse
- Cervical prolapse
- Uterine prolapse

Vaginal and Cervical Prolapses

- Usually occur prepartum (before calving) during the last half of pregnancy; occasionally occur postpartum (after calving).
- Usually occur in cows; occasionally occur in heifers.
- Vaginal and cervical prolapses are classified as follows:
 - **1st degree**—intermittent protrusion of the floor of the vagina. This type of prolapse occurs when the cow is lying down, and it corrects itself when the cow stands up.
 - **2nd degree**—continuous protrusion of the vagina.
 - **3rd degree**—continuous protrusion of the vagina and cervix (*cervical prolapse*).
 - **4th degree**—a 2nd or 3rd degree prolapse that has been prolapsed so long the tissue is becoming necrotic (dead).

- Vaginal and cervical prolapses reoccur and are heritable; therefore, it is probably best to have your veterinarian temporarily fix the prolapse with the intent of eventually culling the cow and her heifer offspring.

Uterine Prolapse

- **EMERGENCY!** Cows with a uterine prolapse will die without prompt medical attention.
- Contact your veterinarian immediately.
- Do not overly stress a cow with a uterine prolapse, and do not attempt to move her very far. A cow with a prolapsed uterus is often in shock and at great risk for fatal hemorrhaging.
- Always occurs postpartum.
- It is best to treat the cow on the farm if possible. If transport is necessary, be extremely cautious.
- If the cow survives treatment, she will likely develop a temporary uterine infection and be slower to breed back. She is not at any greater risk for uterine prolapse in subsequent years.
- This is not a heritable condition, and it is not likely to reoccur. Therefore, there is no need to cull the cow as long as she breeds back.

Differentiating Between Vaginal/Cervical and Uterine Prolapses

- If a reproductive tract prolapse occurs prepartum, it is a vaginal/cervical prolapse.
- If a reproductive tract prolapse occurs postpartum, it can either be a vaginal/cervical prolapse or a uterine prolapse, but it is most likely a uterine prolapse.
- If caruncles are present on the prolapsed tissue, the cow has a uterine prolapse. The caruncles are darker than the surrounding tissue, circular to oval in shape, and approximately 2 to 4 inches in diameter.

Retained Placenta

The bovine placenta, or afterbirth, is normally expelled within a few hours after calving. A “retained placenta” occurs if the afterbirth is not expelled within 12 hours. Retained placentas normally occur in 3 to 12 percent of all calvings. Closely evaluate your herd’s nutrition if you are experiencing a more frequent occurrence of retained placentas. Cows with retained placentas will often be slower to breed back.

Predisposing Factors for Retained Placenta

- Inducing parturition (calving) prematurely greatly increases the incidence of retained placentas. Fortunately, there is rarely a need to induce parturition in cattle.
- Abortions or premature births
 - No retained placenta before 120 days of gestation
 - 15 percent if 121 to 150 days of gestation
 - > 50 percent if 240 to 270 days of gestation
- Dystocia (difficult births)
- Nutritional deficiencies, especially hypocalcemia (low blood calcium). Poor nutrition results in weak uterine contractions that are necessary to expel the placenta.

Treatment

- Do not forcefully pull out the placenta as this will often leave pieces of the placenta in the uterus that will further delay the cow from rebreeding.
- Time. The recommended treatment for a retained placenta is to “let mother nature take its course,” and eventually the placenta

will fall out. This may take up to a week (and will smell bad), but be patient. If the placenta is hanging extremely low, it may be advisable to twist the placenta into a knot around the cow's hocks to prevent her from stepping on it or catching it on some object. Watch the cow closely to ensure that she is eating, drinking, and feeling healthy.

- When in doubt, call your veterinarian. Veterinarians will occasionally prescribe hormonal treatment if indicated. Your veterinarian will also prescribe antibiotics if the cow becomes systemically ill.

Reproductive Measurements

You can only manage what you measure. The most important measures of reproductive efficiency are listed below.

- Pregnancy percent (PP) is a measure of the success of the breeding season. Make your calculations based on the number of cows exposed to breeding. To produce a marketable product, each cow must conceive and give birth each year.

$$PP = (\text{Number palpated pregnant} \div \text{Number of cows exposed}) \times 100$$
- Percent birth calf crop (PBCP) measures the collective results of the breeding and calving seasons. Not only must cows conceive,

but they must also give birth to live, healthy calves. If cows are losing calves between breeding and calving, there could be a problem with reproductive disease.

$$PBCP = (\text{Number of live calves} \div \text{Number of cows exposed to breeding}) \times 100$$

- Weaning percent (WP), also called “percent calf crop weaned,” is the single most descriptive measure of reproductive performance of a cowherd.

$$WP = (\text{Number of live calves weaned} \div \text{Number of cows exposed to bulls}) \times 100$$

- Calving interval (CI) is the number of days between successive calving. CI is one measure of a cow's reproductive performance for the past year. Ideally, calving interval should be 365 days or less. A late-breeder cow with a long CI may sooner or later fail to rebreed during a controlled breeding season.

$$CI = [\text{Age (in days) at first calving} - \text{Age at last calving} + 365] \div \text{Number of calvings}$$

General Causes of Poor Reproductive Performance

There are many causes of poor reproductive performance in cows and heifers, but in general, all causes can be categorized as infectious or noninfectious.

Infectious Causes of Infertility or Abortion

- Anaplasmosis
- Bovine Viral Diarrhea Virus
- Brucellosis
- Infectious Bovine Rhinotracheitis (IBR)
- Leptospirosis
- Neosporosis
- Trichomoniasis
- Vibriosis (*Campylobacter*)
- Others

Noninfectious Causes of Infertility or Abortion

- Nutrition
 - Poor body condition score
 - Improper mineral supplementation
- Heat stress
- Improper handling of frozen semen for artificial insemination (Improper handling can occur during the thawing and insemination process, or while the semen is stored in the liquid nitrogen tank.)
- Improper artificial insemination technique
- Unobserved standing heats (estrus) due to poor heat detection, leading to poor artificial insemination results
- Insufficient bull power (i.e., not enough bulls) or subfertile bulls
- Nonpuberty in replacement heifers
- Toxins
- Fetal genetic defects

With so many causes of poor reproductive performance, it is often advisable to contact your herd health veterinarian or extension agent for help. A herd check, including various diagnostic tests, may be necessary to determine the exact cause of poor reproductive performance.

If an Abortion Occurs

- Contact your veterinarian.
- Keep other cattle away from the aborted tissues and the animal that aborted in case the cause of the abortion is infectious.
- Keep scavengers away from the aborted tissues so your veterinarian can examine them for the cause of the abortion. Your veterinarian may also want to submit the aborted tissues to one of the Alabama Department of Agriculture Veterinary Diagnostic Laboratories.
- Be careful if handling the aborted tissues because some causes of abortion in cattle are also infectious to humans.

Consequences of Nutritional Mismanagement on Reproduction

- Increased age at puberty
- Lower conception rates
- Greater degree of calving difficulty
- Increased calf morbidity and mortality
- Calves born later in calving season

- Lighter weaning weights
- First calf heifers with poor reproductive performance during rebreeding
- Later rebreeding of first calf heifers
- Reductions in lifetime productivity
- Increased rate of culling

Fundamental Ingredients for Improving the Reproductive Performance of Your Beef Herd

- Permanently identify cows and calves.
- Avoid strung-out calves. Establish a controlled breeding and calving season.
- Ensure that every bred female weans a calf with acceptable weaning weight every year.
- Match breeding/calving seasons to nutritional resources based on what forages are available before and after breeding.
- Monitor body condition scores for rebreeding.

- Implement a breeding system that utilizes heterosis.
- Select and use superior bulls for traits important to you.
- Use bulls with appropriate calving ease or birth weight EPDs.
- Conduct breeding soundness exams for your bulls before breeding season.
- Select early born replacement heifers.
- Select replacement females based on performance.
- Develop replacement heifers to reach target weight to breed as yearlings.
- Breed replacement heifers 2 weeks before mature cows.
- Calve heifers at 2 years of age.
- Calculate average calving date, calving interval.
- Calculate pregnancy rate and weaning rate.
- Cull cows based on performance.
- Cull cows with significant structural, eye, tooth, or udder problems.
- Cull open cows and those with late calves or extended postpartum intervals.
- Develop an effective health program.

How to Optimize the Breeding Performance of Your Bulls

- Select bulls that will complement the genetics of your herd in terms of growth, carcass, and maternal ability.
- Cull all bulls with structural problems, an inability to breed, an inadequate scrotal circumference, and poor semen quality.
- Sort bulls by age into breeding pastures to minimize the effect of the dominant bull hurting or crippling a younger less dominant bull in the pasture.
- Observe bulls at the start of the breeding season to determine that each bull has the ability to breed. Observe pastures for cows that have been bred earlier and are returning to heat.
- Check bulls to determine if and why they are not settling cows.
- Use only bulls that pass an annual breeding soundness evaluation (BSE) 60 days prior to the start of the breeding season. Retest bulls that previously failed the examination. Cull bulls that fail the BSE. (See section on Breeding Soundness Evaluation.)
- Ensure that an appropriate herd health program is in place.

Breeding Soundness Evaluation (BSE)

Failure to properly evaluate your bulls can result in huge economic losses. Yet, performing bull BSEs prior to the breeding season is one of the most neglected reproductive management practices in cattle operations. A bull's fertility can be considered fertile, subfertile, or sterile. Subfertile bulls may eventually get cows pregnant if left together for sufficient time, but they will take much longer to get cows pregnant than fertile bulls. As a result, calves will be born later and will therefore be younger and lighter at weaning. Subfertile bulls also produce fewer calves during a breeding season, leading to fewer pounds at weaning. Fewer pounds at weaning equals fewer pounds to market, which translates to fewer dollars in your pocket.

A bull BSE is a uniform method of assessing a bull's likelihood of accomplishing pregnancy in an appropriate number of open, healthy, cycling cows or heifers in a defined breeding season. The minimum requirements for scrotal circumference, sperm motility, and sperm morphology are outlined by the Society for Theriogenology. Additional factors influencing the number of cows a bull can breed in a season include pasture size and terrain, physical soundness, age of the bull, libido, and number of bulls in the group.

A bull BSE includes the following components:

Physical exam. Evaluates the physical characteristics of the bull necessary for mobility and athleticism in the pasture, including structural soundness and overall internal and external reproductive development.

Scrotal circumference. Evaluates testicular size and health and estimates the bull's sperm producing capacity. See table 4 for the minimum recommended scrotal circumference as outlined by the Society for Theriogenology. Bulls must meet minimum scrotal circumference measurements based on age in order to pass a BSE.

Sperm motility. Ensures that the bull is producing sufficient numbers of live sperm. Bulls must have at least 30 percent motility to pass a BSE.

Sperm morphology. Ensures that the bull is producing sperm that are properly shaped and capable of fertilization. Bulls must produce at least 70 percent normal sperm to pass a BSE.

Based on the results of the BSE, the bull is then assigned to one of three classifications:

Satisfactory potential breeder (fertile). This classification indicates that the bull:

- passed a physical exam
- met the minimum requirements for scrotal circumference
- has at least 30 percent sperm motility
- produces at least 70 percent normal sperm

Unsatisfactory potential breeder (subfertile or sterile). This classification indicates that the bull did not pass at least one of the four components of the BSE.

Deferred. This classification indicates that the bull did not pass at least one of the four components of the BSE due to a condition that may resolve with time. A “deferred” bull should be rechecked at a later date.

A BSE does not evaluate a bull’s libido, nor does it ensure that a bull will remain a satisfactory potential breeder the entire breeding season. If a bull suffers injuries to his feet, legs, or reproductive tract, such an injury may render him incapable of breeding your

cows. Therefore, it is still extremely important to observe your bulls regularly to ensure they are doing their job. A BSE also does not guarantee that bulls are free of infectious diseases, so consult with your veterinarian on what diagnostic tests may be appropriate for your bull. The extra pounds of beef per exposed cow will more than pay for the BSE, so contact your veterinarian for a bull BSE prior to next breeding season.

Table 4. Minimum Recommended Scrotal Circumference (SC)

Age (months)	SC (cm)
< 15 months	30
> 15 ≤ 18 months	31
> 18 ≤ 21 months	32
> 21 ≤ 24 months	33
> 24 months	34

Source: Adapted from “Breeding Soundness Evaluation Form” (Hastings, NE: Society for Theriogenology).

Measuring Scrotal Circumference

- Testicles must be descended into the scrotum. Hold testicles to the bottom of the scrotal sack by placing your fingers on the side of the scrotum and above the testicles (Figure 4). Do not place fingers between the testicles.
- Slip loop formed by the scrotal tape over the scrotum around the widest point.
- Pull tape up snugly.
- Take circumference reading, in centimeters, at the index formed by the small stainless steel crossbar on the scrotal circumference tape thumb piece.

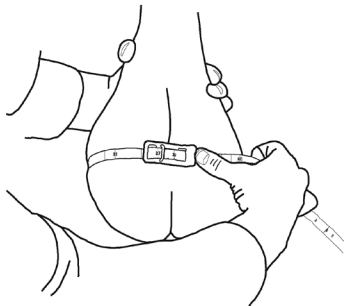


Figure 4. Proper method for measuring scrotal circumference

Note: Any irregular shape or swelling may indicate abnormal structure, illness, or injury.

Table 5. Ratio of Heifers or Cows per Bull

Age of Bull	Ratio of Heifers or Cows per Bull
12 to 18 months	1:10 to 15
2 years	1:15 to 20
3 to 7 years	1:25 to 30
Aged (7 plus)	1:20 to 40

Table 6. How Reproductive Performance Affects Breakeven Prices per Pound of Calf at Fifteen Production Levels and Four Annual Calf Production Costs

Percent Calf Crop Weaned/Average Market Weight	Pounds of Calf per Cow	Annual Calf Production Cost ¹				
		\$250	\$300	\$400	\$500	Yours ²
90/600	540	\$0.46	\$0.56	\$0.74	\$0.93	
90/550	495	\$0.51	\$0.61	\$0.81	\$1.01	
90/500	450	\$0.56	\$0.67	\$0.89	\$1.11	
90/450	405	\$0.62	\$0.74	\$0.99	\$1.23	
90/400	360	\$0.69	\$0.83	\$1.11	\$1.39	
80/600	480	\$0.52	\$0.62	\$0.83	\$1.04	
80/550	440	\$0.57	\$0.68	\$0.91	\$1.14	
80/500	400	\$0.63	\$0.75	\$1.00	\$1.25	
80/450	360	\$0.69	\$0.83	\$1.11	\$1.39	
80/400	320	\$0.78	\$0.94	\$1.25	\$1.56	

Percent Calf Crop Weaned/Average Market Weight	Pounds of Calf per Cow	Annual Calf Production Cost ¹				
		\$250	\$300	\$400	\$500	Yours ²
70/600	420	\$0.60	\$0.71	\$0.95	\$1.19	
70/550	385	\$0.65	\$0.78	\$1.03	\$1.30	
70/500	350	\$0.71	\$0.86	\$1.14	\$1.43	
70/450	315	\$0.79	\$0.95	\$1.27	\$1.59	
70/400	280	\$0.89	\$1.07	\$1.43	\$1.79	

Source: Adapted from L.R. Sprott, "Break-even Costs for Cow/Calf Producers," Pub L-5220 (College Station, Texas: Texas Cooperative Extension, 1998).

¹ Annual calf production cost per cow is the total cow-calf production cost, less cull cow and bull revenue, divided by the total number of brood cows.

² Your breakeven cost per pound of calf produced =

$$\frac{\text{Your annual calf production cost}}{\text{Pounds of calf per cow}}$$