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Reproductive Management of Beef Cattle Herds

For a cow-calf operation, good reproductive rates are critical to operational success and profitability. It is generally expected that each breeding-age female in the herd produces a healthy calf each year and successfully raises each calf until a planned weaning time.

Cows that do not produce calves on at least an annual basis use resources that could be better used to support more productive cattle. Closely monitor cattle reproductive efficiency to identify and address reproductive problems quickly. This helps protect and improve operational profitability.

Assessing Reproduction

It is first important to develop goals for reproductive rates in the herd. Base these goals on the economic needs of the operation. Consider both the revenues needed from each calf crop and the costs associated with producing each calf crop. Several key indicators of reproductive success can be evaluated. Measures of reproductive efficiency include conception rate, pregnancy rate, live calving rate, weaning rate, and calving interval. See Table 1 for measures of reproductive efficiency in cattle.

Reproductive Management

Reproductive management begins well in advance of breeding with proper selection and development of breeding herd replacements. Follow development programs with good management of mature breeding cattle and effective culling criteria to meet reproductive goals. Establish and maintain appropriate herd health and nutrition programs for all cattle in the herd. Evaluate reproduction from both the male and female side. One or both may contribute to reproductive failure.

Cow and Heifer Management

Focus selection of replacement beef heifers on genetic improvement and phenotype. Also consider indicators of reproductive performance when selecting replacements. It is important to have heifers cycling before the first breeding season to ensure the highest possible fertility at first service. This means heifers should reach puberty as soon as is reasonably possible. To first calve at 2 years of age, heifers must conceive at 14 to 15 months of age.

Make sure heifers are developed properly and reach puberty before breeding. Reproductive tract scores can be used to indicate reproductive maturity in heifers. Pelvic measurements can be used to cull heifers with extremely small birth canals that may lead to calving difficulty. Extension Publication 2488 Replacement Beef Heifer Development provides detailed information on heifer development.

Heifers should weigh approximately 60 to 65 percent of their expected mature weight at first breeding and then 85 to 90 percent of their expected mature weight at first calving. This usually means they will need to gain 1 pound per day during gestation. After a heifer calves at 2 years of age, she is still growing and now must devote some nutrition to lactation. This is a highly demanding time for first-calf heifers, and they may require supplemental nutrition to ensure that they re-breed on time in the next breeding season.

Consider breeding replacements 20 to 30 days ahead of the mature cows. This gives them more time to recover nutritionally and increases pregnancy rates as first-calf heifers.

Manage nutritional programs to produce heifers that first calve in a body condition score of 6. Target a body condition score at calving of 5 for mature cows. Cows with body condition scores below 5 require more services per conception. Pregnancy rates are lower in groups of cows with an average body condition score of 4 or lower at calving, during the breeding season, or at pregnancy testing compared to cows averaging body condition score 5 or higher. In-depth information on body condition scoring of beef cattle is available in Extension Publication 2508 Body Condition Scoring Beef Cattle.

Decide on the most appropriate breeding and calving seasons. Extension Publication 2501 Calving Season Selection Considerations discusses advantages and disadvantages to breeding and calving during various times throughout the year. It also addresses the rationale behind implementing a controlled breeding and calving season and details how to develop a controlled breeding program over time. A controlled breeding and calving season involves exposing the breeding herd to artificial insemination (AI) or natural service for a defined period of time.

Table 1. Measure of reproductive efficiency in cattle.

Reproductive Efficiency Measure	Calculation	Management Considerations
Conception rate	Number of females conceiving / number of females exposed to breeding x 100	Percent conceived. Typically not measured because of the difficulty in determining if conception has taken place. Cattle may conceive and then suffer early embryonic death and may not be distinguishable from cattle that never conceived.
Pregnancy rate	Number of females diagnosed pregnant / number females eligible for pregnancy x 100	Percent pregnant. Measure of breeding season success.
Live calving rate	Number of live calves born / (number of females exposed to breeding – number of breeding herd females sold or died + number of pregnant females purchased) x 100	Percent birth calf crop. Measure of collective results of breeding and calving seasons. Cattle must not only conceive, but they must also give birth to live, healthy calves. Reproductive losses between breeding and calving may be due to reproductive disease.
Weaning rate	(Number of calves weaned + number of calves sold preweaning) / (number of females exposed to breeding – number of females sold or died + number of pregnant females purchased) x 100	Percent calf crop weaned. Single most descriptive measure of herd reproductive performance. Evaluates conception, pregnancy, calving, and preweaning success or failure.
Calving interval	(Age in days at first calving - age in days at last calving) / number of calvings	Number of days between successive calvings. Measures reproductive success over the last year. Ideally 365 days or less and not average more than 365 days over multiple years to maintain the desired calving season and produce a marketable calf on an annual basis.

Calving management is another critical control point in managing breeding herds for reproductive success. A common misconception is that restricting feed before calving will reduce calving difficulties. The fetus continues to grow at a rapid rate toward the end of gestation, and restricting nutrition decreases a heifer's chance of rebreeding in the subsequent season. Restricting nutrition before calving can also result in a weak heifer that tires easily during calving. Refer to Extension Publication 2558 Beef Cattle Calving Management for a thorough discussion of this topic.

Always keep detailed, accurate breeding and calving records. Watch for returns to heat. Determine pregnancy status in exposed females within a reasonable time after breeding, preferably within 60 days or less after breeding exposure to allow for early decisions on marketing non-pregnant cattle. Rectal palpation, ultrasound pregnancy diagnostics, and blood pregnancy tests are available for pregnancy checking. Ultrasound is effective at diagnosing pregnancy as early as 30 days after breeding or insemination. Calculate reproductive efficiency measures as soon as data become available. Culling open (nonpregnant) heifers early reduces the overall cost of developing a group of heifers by reducing feed cost. Using ultrasound at the appropriate time can also differentiate between AI and natural service pregnancies. This allows producers to keep AI pregnancies first and, if enough replacements are pregnant, market the bull-bred heifers.

Breeding Bull Management

Breeding soundness evaluations (BSEs) are a management tool to assess whether or not a bull is a satisfactory potential breeder. The evaluation is based on a physical examination, scrotal circumference measurement, and semen evaluation for morphology (sperm shape) and motility (sperm movement). Breeding soundness evaluations do not rate the libido (sexual drive) of bulls, so even bulls that pass a BSE may not be good breeders. Injuries or illnesses during the breeding season can also impact bull breeding effectiveness. The BSE should be performed before every breeding season, because sperm production can be negatively impacted for 60 days after illness or injury.

Bulls should be adequately developed to meet nutritional and growth targets before selection and use as herd sires. Extension Publication 2564 Beef Bull Development provides detailed information on bull development.

Evaluate the bull's body condition score. Thin bulls generally have a reduced libido and serving capacity. Bulls should begin the breeding season in a body condition score of 6 and should be managed to not become overly thin. Bulls should not be overly fat and should be allowed ample room to exercise before being turned out for breeding.

Consider the age of each bull among other factors when determining how many females to place him with during a breeding season. Bull-to-cow ratios are often referred to as "bull power." Following are rules of thumb for bull-to-cow ratio:

1:15-20 for a yearling to 18-month-old bull

1:25-30 for a mature (2-year-old and older) bull

Adjust this if the cows are synchronized or if the cows are spread over a large pasture area. The fertility of an overused yearling bull can be permanently compromised. Reduce the length of the breeding season, lower the number of females placed with each bull, and provide adequate nutrition to the breeding herd during the breeding season to prevent excessive body condition losses in herd sires.

Causes of Reproductive Failure

Infectious Causes of Infertility

Many factors affect reproductive success. Knowing some of the more common reproductive problems and the timing during which they typically occur can help narrow down the source of a particular problem. Infectious causes of infertility or abortion include anaplasmosis, bovine viral diarrhea virus (BVDV), brucellosis (Bangs), infectious bovine rhinotracheitis (IBR), leptospirosis, neospirosis, trichomoniasis, and vibriosis (Camplyobacterosis).

Consult a local veterinarian to determine the best herd health program for the operation. It is extremely important to build immunity to diseases that commonly affect cattle. Consider vaccinating and boostering breeding age cattle for vibriosis and leptospirosis before each breeding season. These common bacterial diseases lower fertility and stimulate early abortions.

Bovine campylobacteriosis is often called vibriosis or vibrio because the bacterial agent was previously named *Vibrio fetus*. It is a venereal disease characterized primarily by early embryonic death, infertility, repeat breeders, a long calving season, and rare mid- to late-term abortion. It is one of two sexually transmitted diseases in cattle, the other one being trichimoniasis. Campylobacteriosis is caused by *Campylobacter fetus venerealis* or *Campylobacter fetus fetus*, both gram-negative bacteria.

Campylobacteriosis can be prevented by using virgin bulls or by testing older herd sires. Strict use of AI also eliminates exposure but is often not feasible. Vaccinating all mature breeding animals can also control the disease. Vibrio vaccinations are often administered as part of "prebreeding" vaccinations. National Animal Health Monitoring System 2007 data show an incidence rate of Campylobacter on cow-calf operations of 32.5 percent in the southeast U.S. and 44.5 percent nationally.

Leptospirosis is an infectious bacterial disease that can be contagious between livestock and many wildlife species. The source of infection is most often urine from infected animals that contaminates pasture, drinking water, or feed. There are more than 100 serotypes of the bacterial agent, but only 7 serotypes have been recognized in U.S. cattle. One of the more disruptive serotypes in cattle is *hardjo bovis*.

Leptospirosis can produce an abortion rate of up to 30 percent when it occurs in the final trimester of pregnancy in cattle. Several management practices help limit infection by leptospirosis. Eliminate cattle access to surface water or streams other livestock or wildlife use. Make sure urine does not drain into water sources. Reduce contact between cattle, other livestock, rodents, dogs, and wildlife as much as possible. Vaccinate susceptible animals for relevant serotypes. "Lepto" vaccinations are often administered as part of "prebreeding" vaccinations.

Trichomoniasis ("trich") is a venereal disease in cattle caused by the protozoan *Tritrichomonas foetus*. It causes infertility, early abortions, and uterine infections, resulting in "repeat breeder" cows and an extended calving season. Bulls become infected with trichomoniasis by breeding an infected cow and then spread the disease to other cows. The bull harbors the protozoa in his sheath. Most cows clear themselves of the infection within 3 months. Bulls more than 4 years old become infected permanently. Using virgin bulls or testing older herd sires can prevent trichomoniasis. Strict use of AI also eliminates exposure but is often not feasible.

Noninfectious Causes of Infertility

In addition, there are many different noninfectious causes of reproductive failure. Poor nutrition, toxins, heat stress, anestrous heifers and cows, insufficient bull power (cow-to-bull ratios too high), subfertile bulls, and fetal genetic defects can lead to reproductive problems. Poor AI results can be because of poor heat detection, improper semen storage and handling, and improper AI technique.

Excellent recordkeeping is critical when trying to determine which factors might be causing a problem with reproduction. Using a controlled breeding and calving season helps in monitoring herd reproductive efficiency. Besides monitoring measures of reproductive efficiency, producers can look for signs of reproductive failure, such as failure to show estrus, lack of conception, early embryonic death, fetal mortality, stillbirth, premature birth, and weak or dying calves. Vaginal and uterine prolapses can also make it difficult to rebreed cattle in a timely manner.

Potential causes of failure to show detectable estrus (heat) include transportation, overcrowding, heat stress, ovarian cysts, anatomical abnormalities, hormonal abnormalities, genetics, low body condition, deficient dietary energy, low dietary phosphorus, low dietary vitamin A, poor heat detection, and uterine infection. Lack of conception can occur due to low body condition, nutritional competition, weight loss during breeding season, low postpartum dietary energy, genetics, prolonged calving season, subfertile bulls, insufficient bull power, poor AI management, uterine infection, leptospirosis, or BVDV infection.

Embryonic death occurs less than 45 days after conception. It can be caused by genetic abnormalities, poor nutrition, heat stress, neospirosis, trichomoniasis, or vibriosis. Many cases of early embryonic death (less than 24 days after conception) go unnoticed and are falsely assumed to be lack of fertilization. In studies, the fertilization rate in suckled beef cows averaged 75 percent, while the average in beef heifers was 88 percent. Some embryonic mortality is unavoidable, but when the incidence is frequent, a cause needs to be determined.

Fetal death is considered to occur between 45 and 260 days of gestation. Fetal mortality can be the result of genetics, poor nutrition, insufficient dietary vitamin A, or high nitrate intake. Early fetal mortality can be caused by trichomoniasis, and mid-gestation fetal losses can be caused by vibriosis. Late gestation fetal mortality can be due to IBR, brucellosis, anaplasmosis, or sporadic bacterial and mycotic causes. Both BVDV and IBR can cause fetal losses anytime between 45 and 260 days of gestation.

Stillbirth happens from 260 days gestation to term. Potential factors leading to stillbirth include dystocia, genetics, leptospirosis, brucellosis, foothill abortion, and pine needle consumption. Premature birth occurs from 260 gestation days to term and can be the result of genetics, IBR, BVDV, brucellosis, foothill abortion, or neospora. Weak or dying calves may be caused by stress in late gestation, dystocia, low dietary phosphorus intake, low dietary vitamin A intake, low dietary protein intake, or aflatoxin consumption. Infectious causes of weak or dying calves include IBR, BVDV, brucellosis, leptospirosis, late gestation infection, foothill abortion, and neospora.

Summary

Reproductive rates greatly influence cow-calf operation productivity and profitability. In addition to the management aspects described previously, a variety of assisted reproductive technologies are available to improve reproductive function, decrease the generation interval, and/or improve the availability and influence of superior genetics. These technologies include AI, estrous synchronization, embryo transfer, sex-sorted semen, in-vitro fertilization, cloning, and transgenics.

Plan breeding and calving programs for reproductive success. Constantly look for signs of potential reproductive problems, and then investigate likely causes. A veterinarian can assist with managing infectious causes of infertility. Proper nutrition, animal handling, and genetic management are essential to establishing and maintaining high reproductive rates in the herd. For more information about beef cattle reproduction, contact an office of the Mississippi State University Extension Service.

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Publication 2615 (POD-05-20)

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MISSISSIPPI STATE UNIVERSITY EXTENSION

Extension Service of Mississippi State University, cooperating with U.S. Department of Agriculture. Published in furtherance of Acts of Congress, May 8 and June 30, 1914. GARY B. JACKSON, Director