Reproductive Management of Beef Heifers

MISSISSIPPI STATE UNIVERSITY EXTENSION

Replacement heifers play a vital role in maintaining and improving any beef cow/calf operation. In a well-managed herd, first-calf heifers should represent the most valuable genetics in the herd and be an improvement on the previous generation of females. Heifer development requires a serious investment of time and capital, so to maximize returns on this investment, reproductive management is essential. Regardless of whether replacements are purchased or raised, proper management throughout the initial breeding and calving seasons is critical for the lifetime reproductive success of the female.

It is important for beef cattle producers to set realistic goals for their operations. Be mindful of available resources, marketing strategies, and future production and management strategies. Having a number of specific, achievable goals can help producers develop a roadmap to improving their operations. Furthermore, diligent and accurate record-keeping is crucial for monitoring progress toward goals, as well as for detecting and correcting potential problems in a timely manner—before they have a detrimental impact on productivity and profit.

Pre-Breeding Management

Just a few decades ago, breeding heifers before 2 years of age was nearly unheard of, but now it is common practice to breed heifers at 15 months old or even younger. A traditional approach to heifer development is centered on the concept of "target weights," in which heifers are fed to a target percentage of their projected mature body weight before breeding. Typically, producers who subscribe to this method are advised to grow heifers to 65–70 percent of their estimated mature weight before breeding.

Recently, however, this practice has been challenged, and several researchers suggest that it is both biologically and economically feasible to breed heifers at significantly younger ages and lighter weights. It has been demonstrated that breeding heifers at 53 percent of estimated mature body weight did not adversely affect reproduction or calf production traits. In addition, breeding heifers to this size decreases feed costs when compared to heifers fed to reach a prebreeding target of 60 percent of predicted mature weight (Funston and Deutscher, 2004).

Breeding heifers at younger ages and lighter weights yields a calf and a return on investment earlier than waiting to breed until the heifer is heavier and older, but this may also require additional costs and labor. Managers should carefully consider the time and resources they wish to invest when making decisions on when to first breed replacement heifers.

Heifers must have hit puberty and begun having estrous cycles in order to conceive. This typically happens around 1 year of age, although there are breed differences in average age at puberty, and some females may naturally undergo precocious puberty and begin cycling at or before 300 days of age. The ovulation after a heifer's third estrus is significantly more fertile than her pubertal estrus, so heifers that have begun cycling before the beginning of breeding season are more likely to conceive (Byerly et al., 1987). Heifers that give birth early in their initial calving season also have greater lifetime productivity (Lesmeister et al., 1973). The timing of the first estrus and first conception is highly influential on the reproductive efficiency of the female over the entirety of her productive life.

Selection

Numerous factors influence fertility and age at puberty in beef females, including genetics, nutritional status, and body weight. Although the producer does not have complete control of some of these, certain management practices can reduce average age at puberty in a group of replacement females. Heifer selection, including selection using genetic evaluation, is also an important aspect in improving herd fertility. By selecting for certain phenotypic, performance, and genotypic traits, producers can select the replacement females that are most likely to be productive and reproductively efficient for years to come. Sound management decisions and progressive female selection can significantly improve the overall profitability of the cowherd.

Selection considerations for heifers include:

- ***Phenotype characteristics***
  The most obvious factor that should be taken into consideration when selecting replacements is phenotype. Though phenotypic needs may vary slightly between herds, most producers should look for structurally sound females that display an adequate degree of muscling, as well as sufficient volume and depth of body. Heifers with poor structure, insufficient muscling, and a lack of depth and body volume are more likely to have decreased productivity and longevity.

- ***Performance***
  Another factor that should be taken into account when selecting replacements is individual performance. The majority of cow/calf producers sell calves shortly after weaning, so calf growth rate and weaning weights are economically important. Faster gaining heifers should ultimately produce calves that are heavier at weaning than calves whose dams were slow growing.

- ***Temperament***
  Temperament is often an overlooked criterion when selecting breeding stock. Animals with an unruly disposition can be difficult to work with and may pose a danger to those responsible for handling them. Calmer animals are generally

much easier to handle, and less excitable animals have been shown to have increased average daily gains when compared to more easily agitated cattle (Voisenet et al., 1997). Temperament is a low- to moderately-heritable trait (Hoppe et al., 2010). By selecting replacements with calm dispositions, producers decrease the likelihood of stress and injury while handling and potentially increase daily gains.

- ***Age at Puberty***
  Though reproductive traits are not highly heritable, genetics do play a major role in heifer fertility, and it is possible to select for early maturing females. Breed composition is correlated to age at puberty. *Bos indicus* cattle undergo puberty significantly later than their *Bos taurus* counterparts, and British breeds such as Angus and Hereford generally reach puberty earlier than females of Continental breeds such as Charolais or Limousin. Commercial or crossbred cattle producers may also use complementary breeds and heterosis to their advantage when trying to increase reproductive efficiency. Heterosis, or hybrid vigor, is the increase in performance observed in crossbred animals compared to the purebred parents. Heterosis is of particular value in improving fertility. Traits that are lowly heritable, such as reproductive traits, tend to exhibit a high degree of improvement due to heterosis in crossbreeding scenarios. Consequently, crossbred females may reach puberty earlier than their purebred counterparts. Of course, there are also differences in fertility between individual animals within breeds. Heifers born to cows selected for early age at first estrus typically reach puberty earlier than the progeny of late maturing dams (Morris et al., 2000). Bulls with large scrotal circumferences tend to sire daughters that are younger at their first estrus and, as a result, have increased pregnancy rates compared to females sired by bulls with small scrotal circumferences (Martin et al., 1992).

In addition to considering phenotype, individual performance, disposition, and pedigree, there are a number of other attributes that may be used to select reproductively efficient individuals. Reproductive tract scoring via transrectal palpation or ultrasound is a useful tool in determining whether or not heifers have achieved puberty and are cycling normally by evaluating ovarian structures. A transrectal ultrasound evaluation can reveal reproductive tract abnormalities that may potentially interfere with the reproductive efficiency of a heifer. Another tool, the Rice pelvimeter can be used to evaluate the pelvic area of a heifer. This instrument measures both horizontal and vertical distances between the pelvic bones, and these measurements can be used to predict calving ease and the likelihood of dystocia due to small pelvis size. In-depth information regarding reproductive tract scoring and pelvic area measurement is available in MSU Extension Publication 2488 *Replacement Beef Heifer Development*.

Nutritional Management

Proper nutrition is extremely important in managing first-calf heifers. In order to initiate and sustain reproductive functions such as maintenance of pregnancy and lactation, first-calf heifers often require additional energy inputs because they are also still growing. It is important that heifers have adequate nutrition in order to raise healthy calves while still fulfilling their genetic growth potential.

It has been well established that feed intake and nutritional status play major roles in the attainment of puberty. In general, heifers with greater average daily gains (ADG) tend to reach puberty earlier than slow growing heifers. Target ADG will vary depending on the age at which the producer intends to breed. Studies have demonstrated that heifers receiving a concentrate diet are also more likely to achieve early puberty (Gasser et al., 2006), and overly conditioned heifers are neither economical nor ideal for reproduction.

Supplementing diets with an ionophore such as monensin may cause heifers to reach puberty at a younger age than those of comparable weight without monensin supplementation (Moseley et al., 1977). However, heifers on pasture may not see the same benefits, so the cost effectiveness of adding monensin must be analyzed. It is im-

portant that females stay on a positive nutritional plane the entire period from conception to parturition. Furthermore, it is critical for reproductive efficiency that all females in the beef herd be fed the proper balance of vitamins and minerals. MSU Extension Publications 2488 *Replacement Beef Heifer Development* and 2528 *Beef Cattle Nutrient Requirements* provide detailed information on the nutritional needs of beef heifers.

Preventive Medicine

In addition to sound selection and proper nutrition, a solid herd health program is necessary to optimize heifer development and productivity. This program should be developed using the recommendations of the herd veterinarian and should include vaccination protocols and parasite management strategies.

Vaccinations help minimize the incidence of disease and subsequent production and death losses in the herd. If properly vaccinated as calves before weaning, all heifers should be vaccinated against campylobacter fetus, leptospirosis, and other reproductive diseases (including infectious bovine rhinotracheitis and bovine viral diarrhea at least 1 month before the start of the breeding season). Vaccination or revaccination against respiratory diseases such as bovine respiratory syncytial virus and parainfluenza type 3 should also be done at this time. It is generally recommended that a modified live vaccine be used on non-pregnant females in order to provide maximum protection.

Testing for persistently infected bovine viral diarrhea (BVD-PI) cases is advisable for all heifers, especially if heifers are purchased from an unknown source. This test requires a skin sample (usually from the ear) and must be sent to a laboratory for analysis. Though BVD-PI testing requires some initial investment, eliminating persistently infected cattle from the herd can help prevent long-term losses and disease costs. Though Mississippi is a brucellosis-free state, proof of brucellosis (bangs) vaccination may be required if cattle are transported across state lines. Producers should consult their veterinarian to determine whether brucellosis vaccination is necessary for their herd.

Both internal and external parasites can cause significant problems for beef producers in the Southeast, in particular. Parasite infestation negatively impacts an animal's nutritional status, growth potential, and immunity status. Increased transmission rates of some insect-borne diseases can occur, as can production losses from decreased growth and performance. Fortunately, numerous options are readily available for the control of parasites in the beef herd. A veterinarian can advise the most effective products and route of administration for parasite management depending on the individual needs of the herd.

Breeding Decisions

Many producers elect to breed heifers 2–3 weeks before the mature brood cows. This allows producers to more closely monitor heifers for calving difficulties and gives calves born to first-calf heifers a slight advantage in age and performance. Most importantly, calving early in the calving season allows first-calf heifers more time to recover after calving before the next breeding season. Primiparous (first calf) females have a longer period of postpartum anestrus and uterine involution. Therefore, heifers set to calve earlier than the rest of the herd will be more likely to have reinitiated estrous cycles before the next breeding season than if they were bred to calve with the mature cows.

Reproductive technologies like estrus synchronization and artificial insemination (AI) are underutilized in beef herds in the United States. According to the National Animal Health Monitoring System beef cow-calf survey, less than 5 percent of beef operations in the Southeast used AI in 2007, and less than 7 percent used estrus synchronization. Though many producers perceive these technologies as cost prohibitive, estrus synchronization and AI can be cost effective ways to improve genetics and enhance performance. MSU Extension Publication 2486 *Economic Comparisons of Artificial Insemination vs. Natural Mating for Beef Cattle Herds* provides a comprehensive analysis of the economic feasibility of estrus synchronization and AI for use in beef herds.

Artificial Insemination

Because replacement heifers should have the most advanced genetics in the herd, breeding them with the best quality bull available will speed up the rate of genetic improvement in the herd. Often, little consideration goes into

heifer mating decisions (particularly when artificial insemination is *not* used), and producers miss the opportunity to capitalize on their investments in cowherd genetics until the females are older.

It is strongly recommended that heifers be bred to proven "calving ease" sires. This type of bull has a record of producing calves with low birth weights that arrive with minimal calving difficulties. These predictions can most reliably be obtained using expected progeny differences (EPD) from registered bulls. MSU Extension Publication 2491 *Expected Progeny Differences and Selection Indices for Beef Cattle Selection* contains more information about interpreting and using EPDs.

One problem with calving ease bulls is that calf birth weight is positively correlated with growth and performance traits. In other words, calves with low birth weights tend to be lighter at weaning. Fortunately, there are bulls that sire low birth weight calves that have exceptional genetic potential for growth and performance. These bulls are typically the result of several generations of intensive selection on exceptionally high-quality animals, and it may be too expensive for an individual producer to purchase one of these bulls outright.

Without AI, it would be nearly impossible for most producers to gain access to these genetically superior bulls. Producers who use AI in their herds can breed their females to bulls with higher quality genetics in a more economical manner—purchasing semen instead of the bull. A straw of semen from a bull that is valued at tens of thousands of dollars may be available for purchase for $20 or less. Of course, other factors such as facilities, AI equipment, and labor costs must be considered. With AI, producers have the opportunity to improve the performance and quality of animals in their herds more economically and more rapidly than if they had to purchase live animals.

Producers may also choose to use sex-sorted semen. Female calves are usually lighter at birth and cause fewer incidences of dystocia. Therefore, production systems that value female calves, in particular, may benefit from this technology for multiple reasons. Although the sexing technology has now been available for several years, it is becoming more mainstream, and some producers are considering it for the first time. As prices for sexed semen continue to decrease, it may become a more viable option. Producers should take a look at the economics and decide if the use of sexed semen would benefit their operations. More information on AI is available in MSU Extension Publication 2628 *Artificial Insemination Programs for Cattle*.

Estrus Synchronization

Estrus synchronization protocols may be used in conjunction with AI to optimize the reproductive efficiency and performance of beef females. Advantages of using estrus synchronization protocols include improved conception rates, a shorter calving season, and a more uniform calf crop. In addition, using estrus synchronization protocols that include progestins may induce cyclicity in prepubertal heifers. Producers can choose from different methods of estrus synchronization depending on the amount of time and money they wish to invest. MSU Extension Publication 2614 *Estrus Synchronization in Cattle* provides a thorough overview of the various estrus synchronization programs that are available to producers.

Using estrus synchronization to facilitate AI allows producers to capitalize on heifer investment by potentially allowing heifers to conceive earlier to bulls of exceptional quality. Complementing an AI program with synchronization can help produce a more uniform group of calves, yielding better performance. In many situations, AI and estrus synchronization are especially useful in helping to minimize producer stress associated with the reproductive management of primiparous females. However, producers should educate themselves on the costs and benefits of these reproductive technologies in their beef cattle operations and make informed decisions on the best course of action for their herds.

Post-Breeding Management

After the breeding season, it is important to evaluate the pregnancy status of all females in the herd. Heifers that are not pregnant should be culled from the herd. Culling open heifers allows resources to be allocated for more productive and profitable animals, thereby decreasing the total cost of replacement heifer development. It is recommended that all females be pregnancy diagnosed by an experienced veterinarian within 60 days of the end of the breeding season.

Maintaining proper nutrition throughout gestation is critical. Contrary to popular belief, restricting feed in late gestation does little to minimize the incidence of dystocia. In fact, it may detrimentally affect the health and growth of the female while decreasing the quality and availability of colostrum, which is critical for neonatal health and immune function. On the other hand, heifers that are too heavy at calving can have increased dystocia rates due to fat accumulation in the pelvis. Females should have a body condition score of 5 to 6 (scale: 1 = thin and 9 = obese) at calving in order to remain healthy and minimize the interval between parturition and rebreeding.

As the start of calving season approaches, heifers should be monitored closely as they are far more likely than mature cows to experience dystocia. After parturition, a period of uterine involution and anestrus will occur. During this time, continue to monitor BCS and make dietary adjustments as necessary. Ideally, heifers will lose less than one BCS after calving.

Rebreeding

In order for a female to have her second calf 1 year after the birth of her first one (12-month calving interval), she should be rebred no later than 90 days postpartum. It is more difficult for heifers to rebreed after their first calving season than it was for them to conceive initially, so decreased conception rates should be expected when attempting to breed the first-calf heifer for her second calf. However, proper management can improve the pregnancy outcome of the 2-year-old female.

Culling decisions should be made again after the second breeding season. Producers should consider culling females that do not successfully wean a calf and rebreed within 90 days. Cows that generate profit wean healthy, heavy calves every year and rebreed in a timely manner while maintaining body condition on forages and minimal supplementation. It is generally not cost efficient to overwinter open or poor producing cows, and it is not advisable to allow these genetics to perpetuate in the herd as they may detrimentally affect progress.

In well-managed beef herds, replacement heifers represent the highest quality genetics. Any heifer development venture requires a significant input of time, capital, and risk. With a well-developed plan and proper management strategies, it is possible to be successful in developing highly productive, reproductively sound, and economically efficient replacement females that have the potential to be profitable brood cows for years to come. For more information on the reproductive management of replacement beef heifers, contact your local MSU Extension office.

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