# 29 Development of Replacement Beef Heifers

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## Objectives

- **Discuss heifer development program goals.**
- **Explore heifer development nutritional strategies.**
- **Discuss various management decisions related to replacement heifers.**

When it comes to obtaining females to replace culled heifers or cows to maintain herd size or obtaining females to increase the herd numbers to expand the herd size, cow-calf producers have a choice of either retaining heifers raised within their own herd or purchasing open or pregnant heifers or cows. There are advantages and disadvantages with each of these approaches. Producers must take into account several factors such as market prices, production costs and tax implications when determining the optimal herd replacement strategy that will fit their breeding program (Clark et al., 2005; Shulz and Gunn, 2014). Many cow/calf operations will have the knowledge, expertise and resources conducive to a replacement heifer enterprise and will choose to retain, develop and breed heifers from their own herd for the purpose of replacing culled breeding females; while others operations may be better suited to purchase either open or bred replacement heifers or cows. The current-year replacement heifer selection will impact the genetic make-up and production traits of the beef herd for the next seven to 10 years. The implementation of proper selection criteria, growth and developmental strategies, health and nutritional programs and breeding strategies of replacement heifers are essential to meet both short-term and long-term objectives of the operation (Bridges, 2013).

## Importance of Early Calving at 2 Years of Age

The time period required for replacement heifers to pay for their development and maintenance is referred to as the payback period (Moorey and Biase, 2020). This payback period will fluctuate between different operations. Typically, six calves are necessary for the female to pay for her development and maintenance expenses. That is, a 7-year-old female producing her sixth calf is the break-even point. If the female does not produce a calf one year, the payback period is nine calves (Moorey and Biase, 2020). Research shows heifers becoming pregnant early in their first breeding season, whether through natural service or artificial insemination, remain in the herd longer and produce more cumulative calf weaning weight (Lesmeister et al., 1973; French et al., 2013). More specifically, Cushman et al., (2013) reported heifers that calved the first 21-day period of the calving season had increased herd retention compared with heifers that calved in the second 21-day period or later. Similarly, Funston et al. (2012) found heifers born in the first calving period had a higher first conception rate, a higher percentage calving in first 21 days, a greater first calf weaning weight and a higher second conception rate than heifers born in the second or third calving period. In a Canadian study, Damiran et al, (2018) reported an increased longevity in heifers that had their first calf during the first 21-day period of the calving season (7.2 years ± 0.3) compared with heifers that calved in the second (6.5 ± 0.4 years) and third 21-day periods (6.2 ± 0.4 year) with no differences in longevity between the group two and group three period heifers. Bridges (2013) suggested if a heifer conceives late during the breeding season compared to her herd mates and calves late during the calving season compared to her herd mates, that heifer is more likely not to be cycling at the beginning of the upcoming breeding season and will, more than likely, conceive late during the second breeding season. This recurring cycle of events is likely to carry on until eventually the female will turn up

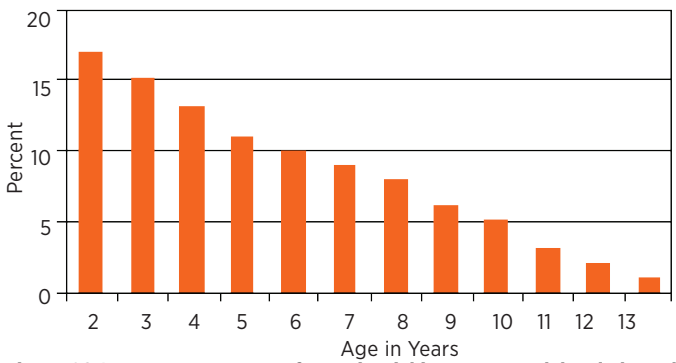


**Figure 29.1. Mean percentage of cows in Dickinson research herd plotted by age of cow.** Source: Ringwall.



**All Web addresses given in this chapter are subject to change. The links to these websites will be updated regularly at the Master Cattleman website at extension.okstate.edu/programs/master-cattleman.html**

open during the breeding season and will probably be culled. Therefore, the replacement heifer program, whether raised or purchased, should strive to achieve a high percentage of heifers calving early during the first calving season to maintain lifetime reproductive efficiency. This can be accomplished by retaining and exposing more heifers than needed to a short breeding season (30 days to 45 days) and retaining only the heifers that become pregnant during that time. Pregnancy status should be determined as soon as possible after the breeding season ends (approximately 30 days) and open heifers can be marketed as feeder heifers.

## Heifer Development from Birth to Weaning

In most beef cow-calf operations retaining heifers raised within their own herd, the early development of replacement heifers is entrusted entirely to the heifers' mothers. However, some producers use creep feeds to boost calf gains while the calves are still nursing. Occasionally, some purebred operations raising embryo transfer calves will utilize dairy cows as surrogate mothers and these calves are exposed to large quantities of milk while growing. Even though the cost effectiveness of these practices often is debated, there is little doubt they will increase calf gain.

A hidden expense, which might occur in a few instances, comes as a result of increased body condition in young heifer calves while still nursing their mothers. High-energy creep feeds or very heavy milking mothers that cause heifers to become extremely fat can unfavorably influence replacement heifer performance by depressing future milk production and lifetime productivity (Holloway and Totusek,1973; Martin et al., 198; Sexten, et al., 2004). Mammary development is in a critical stage from two months to three months of age until about nine months or just before puberty. If a calf is storing considerable amounts of extra fat during that time, excessive fat can be deposited in the mammary gland and inhibit its development. On the other hand, a certain minimum amount of fat is necessary for the gland to grow, so underfeeding can inhibit development as well.

The use of creep-feeding should be evaluated by the producer to determine if it will provide production and economic benefits to the operation. Nursing pressure on the cow has rarely been shown to be reduced with creep feeding as research indicates milk intake by creep and non-creep fed calves is similar. Faulkner et al., (1994) showed forage DM intake decreased linearly with increasing levels of creep feed, whereas milk DM intake was not affected by level of creep feed. Lusby (1989) reported calves prefer milk first, highly palatable creep second and forage third and suggested when milk and forage are available, creep feed may become a substitute for forage. Thus, creep feed may be advantageous only when forage supplies need to be extended. However, conflicting data can be found in the literature regarding the effect of creep feeding on forage intake as Loy et al., (2002) reported no difference in forage consumption by calves fed creep feed.

Beef producers need to observe heifer body condition if they are using high-energy creep feeds or dairy-based recipient cows. Because of the differences in birth weight and frame size, it is impossible to recommend a common average daily gain appropriate for all young heifers. Therefore, monitoring the body condition (fatness) of the heifer calf through visual appraisal may be the most practical way to evaluate the potential likelihood of excess fatness (chapter 15). Creep-feeding calves with a self-limited amount of high protein feed, such as soybean meal, can allow most heifer calves to grow adequately without concern for extreme fatness. One such creep-feeding program has been described by OSU beef nutritionists as the Oklahoma Silver program (chapters 21 and 22).

## Implant or No Implant

Research has clearly shown the timing of implanting and the number of implants given can impact fertility in heifers. However, there is little, if any, detrimental effects on reproductive performance of heifers that will potentially be retained as replacement animals when administered growth-promoting implants at the time of branding (2 months to 4 months of age) or at the time of weaning. In fact, in research trials where one implant was administered to heifer calves between 30 days of age and weaning, calving difficulty was not influenced and fertility was only slightly reduced; a 1% to 3% reduction in pregnancy rate (Selk, 1997). In two recent studies (Rosasco et al., 2018; 2019) implants administered at branding time (3 months of age) or at weaning did not influence subsequent reproductive performance of retained females. On the other hand, weight gain is consistently improved when heifers are implanted at branding or at weaning (Selk, 1997; Rosasco et al., 2018; 2019).

Heifers implanted at birth and close to puberty, generally around 9 months to 14 months of age, had substantially reduced fertility that ranged from a 7% to 39% reduction in pregnancy rate compared to nonimplanted heifers (Selk, 1997). Similarly, heifers implanted more than once had substantially reduced fertility. Therefore, heifers potentially be kept as replacement females should either not be implanted at all, or they should be implanted only one time between 30 days of age and weaning age. Replacement heifers should not be implanted prior to 30 days of age or after about 7 months of age, and they should never be implanted more than once.

## Immunizations from Birth through Weaning

Early immunization for blackleg and malignant edema at approximately 2 months of age will be appropriate in most areas for all calves including those becoming replacements. If heifers are to be vaccinated for brucellosis, be certain to do this between 4 months and 10 months of age in Oklahoma. It is advisable to vaccinate heifers nearer the younger age if

possible. Other immunizations should be done three weeks to four weeks prior to weaning. Booster injections can be given at weaning time (Caldwell, 2019).

Visit with a local veterinarian about the need to vaccinate replacement heifers for:

- Infectious Bovine Rhinotracheitis (IBR).
- Bovine Virus Diarrhea (BVD 1 and 2).
- Parainfluenza–3 (PI3).
- Clostridial vaccines also known as 7–way or 8–way blackleg vaccines.
- Hemophilus.
- Leptospirosis.
- Camplyobacter (sometimes called Vibriosis).
- Pinkeye vaccines in relationship to the high-risk period of disease such as late spring and early summer.
- Internal and external parasite control (chapters 38 and 39).

Fortunately, many of the above immunizations are now included in combination vaccinations. Use the one most appropriate for the herd health history and local disease situation.

Weaning stress can result in serious health problems, especially respiratory disease. Heifers affected with respiratory disease and pneumonia often have significant lung damage, do not grow and develop properly and must be culled prior to breeding.

## Influence of Modified Live Vaccines on Reproductive Performance

Infectious reproductive diseases are a continual threat to the beef herd as reproductive performance can be negatively affected throughout the reproductive cycle of the female. Bovine Viral Diarrhea and Infectious Bovine Rhinotracheitis (bovine herpesvirus) are two diseases often vaccinated for in the beef herd. Affected reproductive performances from infectious reproductive diseases that have been reported in the literature include decreased ovulation rates, fertilization rates, embryonic survival rates and fetal survival rates (Chiang et al., 1990; Perry et al., 2013). Commercial vaccines are a readily available and beneficial tool in the prevention of these diseases; however, vaccination does not always mean immunization, as each individual animal's response to the vaccine will vary (Perry et al., 2017; Caldwell, 2019).

Veterinarians regularly recommend female beef cattle be vaccinated with either a modified-live virus (MLV) or inactivated virus vaccine (IVV) to reduce the risk of reproductive failure. However, there is evidence MLV versions of some vaccines can have negative effects on reproductive performance in well-managed herds (Perry et al., 2018). MLV vaccines can possess an unacceptable risk of causing undue harm if administered to previously unvaccinated pregnant heifers or cows, or if administered as the initial dose of MLV vaccine to heifers or cows within a minimum of 30 days of breeding (Givens and Newcomer, 2017). The choice of the type of pre-breeding vaccine to use and the timing of its administration is a choice the producer needs to carefully consider. The producer should always strive to determine the best balance between appropriate disease protection and minimal harmful effects from the vaccines themselves. This balance will be different for each cattle operation across the country, making it imperative that cattle producers consult their local veterinarian to discuss the most current information on all products available when making decisions about pre-breeding vaccinations in their herds (Daly, 2016; Perry et al., 2017). This balance to achieve appropriate disease protection also includes other management practices besides vaccinations. As the gestating fetus is the most susceptible individual within a cow–calf operation (Caldwell, 2019), the producer should always be cognizant of the fact the purchase of a pregnant cow, where the disease status of the fetus is unknown, is considered by many to be the number one method of bringing BVD into the herd (Walz, 2020).

## Development from Weaning through First Breeding Season

### Target Weight for First Breeding Season

A major decision related to the post-weaning development strategy revolves around the idea of a targeted weight for heifers to reach by the beginning of the first breeding season. This target weight is generally defined as body weight expressed as a percent of expected mature weight. Thus, to be able to define and execute a target weight goal, one must first have an accurate estimate of average mature cow weight. Mature cow weight should be determined using cows that range from 4 years to 7 years old, weights recorded at or around the time of weaning and adjusted to a body condition score of 5 (see chapter 20). Sale weights of culled mature cows can be used if collecting weight data from cows in the current inventory is not practical.

Target weight strategies in the heifer development program basically fall into two categories:

a) Approximately 55% of expected mature weight achieved by the beginning of the first breeding season. This strategy is sometimes characterized as lower input or a more extensive heifer development system.
b) Approximately 65% of expected mature weight achieved by the beginning of the first breeding season. This strategy is sometimes characterized as higher input or more intensive because more nutritional inputs are required.

Factors affecting the timing of puberty and early pregnancy at 14 months to 15 months of age include genetics, photoperiod, level of nutrition and growth rate (Wiltbank et al., 1966; Schillo et al., 1992; Martin et al., 1992; Hall, 2013). In general, it has been well documented that an inverse relationship exists between post-weaning level of nutrition

and age at puberty (Short and Bellows, 1971; Beverly and Spitzer, 1979). Similarly, early pregnancy is related to the number of heifers achieving puberty and first estrous cycle prior to or soon after the beginning of the first breeding season (Short and Bellows, 1971; Byerley et al., 1987). This early research provided the foundation for the guideline to develop heifers to a target weight of 65% of expected mature weight by the beginning of the first breeding season.

The 65% rule of thumb has been effective over a wide range of environments and breed types (Patterson et al., 1992). While this guideline is still sound and effective, more recent work has questioned the economic feasibility of this level of nutritional input (Hall, 2017).

Recent studies have investigated reproductive performance and subsequent productivity of heifers developed with lower nutritional inputs (and lower cost) to achieve around 50% to 55% of expected mature weight by the beginning of the first breeding season. Critical in the lower-input strategy is the concept of timing the beginning of the breeding season with availability of high-quality forage in order to take advantage of compensatory weight gain during the breeding season. Continued nutritional restriction through breeding and gestation results in reduced pregnancy, lower body condition at first calving and lower rebreeding success for the second calf.

In three studies (Funston, 2004; Roberts et al., 2009; Larson et al., 2009), the lower input system resulted in no reduction in the percentage of heifers becoming pregnant during the first 21 days of the breeding season. However, other work reported reduced early pregnancy percent (15%; Eborn et al., 2013) or early calving percent (11%; Martin et al., 2008) when heifers were developed to lighter weights. Hall (2017) summarized overall pregnancy rates in eight studies and reported only a slight numerical advantage (2%) for the 65% target-weight system (Table 29.1).

The lower-target weight system did result in lower development costs per heifer and per pregnancy. In one experiment, heifers developed to 55% of expected mature weight had more calving difficulty (Patterson et al., 1992). Hall (2017) cautioned that conception to synchronization and timed AI systems may be lower in the lower-input development system.

**Table 29.1. Impact of target weight on overall pregnancy rates in replacement beef heifers[1].**

| Study | No. of heifers | Target weight[2] (% of mature weight) 55 | 65 |
|---|---|---|---|
| Patterson et al., 1992 (*Bos Taurus*) | 137 | 84 % | 89 % |
| Funston and Deutscher, 2004 | 240 | 92 % | 88 % |
| Martin et al., 2008[3] | 261 | 87 % | 90 % |
| Roberts et al., 2009 | 397 | 87 % | 92 % |
| Eborn et al., 2013 | 360 | 77 % | 83 % |
| Mulliniks et al., 2013 | 191 | 91 % | 84 % |
| Lardner et al., 2014 | 176 | 86 % | 88 % |
| Bailey et al., 2014 | 203 | 74 % | 77 % |

1 Adapted from Hall, 2017
2 65% - Range 58% to 65%; 55% - Range 48% to 56%
3 In this study, 55 = 50% and 65 = 56%

**Table 29.2. Puberty weight of heifers and mature weights by breed through time.**

| Breed | Puberty weight Year 1975 | Puberty weight Year 2000 | Mature weight 1975 | Mature weight 2000 |
|---|---|---|---|---|
| Angus | 585 | 753 | 1,103 | 1,410 |
| Hereford | 588 | 768 | 1,073 | 1,409 |
| Simmental | 631 | 742 | 1,190 | 1,404 |
| Gelbvieh | 600 | 700 | 1,121 | 1,323 |
| Limousin | 643 | 779 | 1,201 | 1,391 |
| Charolais | 667 | 728 | 1,246 | 1,371 |
| Brahman | 731 | 754 | 1,272 | 1,322 |

Source: MARC GPE Progress Reports

Breed effects play a major role on age at puberty and therefore the number of heifers cycling and becoming pregnant in a controlled breeding season. In general, breeds with *bos indicus* influence reach puberty later and breeds with greater genetic potential for milk production reach puberty earlier (Table 27.2). Therefore, the lower target weight system is not recommended for cattle with significant *bos indicus* influence (Patterson et al., 1992). Additionally, Hall (2017) cautions that most studies comparing the 65% and 55% target weight systems have been conducted using *bos taurus* breed types with either crossbred or composite cattle. Composite and crossbred cattle are expected to achieve puberty at an earlier age, compared to purebred cattle because of heterosis. Therefore, the lower target-weight system may not work as well for purebred heifers.

## Number of Heifers to Retain

The sustainability and profitability of a cow-calf operation is dependent on the longevity of each breeding female and the production of a live calf every year (Mousel et al., 2014). Cow culling rates can vary greatly from year to year due to pregnancy status, health issues or drought. The 2007-08 National Animal Health Monitoring System (NAHMS) reported approximately one-third of the cows culled are removed because they do not become pregnant during the breeding season. Furthermore, 15.6% of all culled cows leave the herd before 5 years of age and an additional 31.8% leave the herd between 5 and 9 years of age (NAHMS).

Culling rates can vary substantially between operations based on the amount of selection pressure placed on one or more specific traits. Some operations may choose to market excess bred heifers or bred mature cows at a younger age. These scenarios contribute to the number of heifers needed to be retained each year. According to a survey of U.S. cow/calf operations (NAHMS, 2017), on average, 16.3% of calves weaned or expected to be weaned were classified as replacement females. Culling and replacement data collected from 1990-2012 from the North Dakota State University Cow Herd Appraisal Performance Software (CHAPS) showed the typical culling rate was 14.1%, while the typical replacement rate was 17.8%. The production benchmark values from the CHAPS program is 14.9% for

replacement rate and a 13.2% cull rate. This data provides a starting point in choosing how many heifers to retain as replacements each year. Even in the very best scenarios, some heifers will be difficult or impossible to breed, some bred heifers will lose their pregnancy and some will lose their calves at or shortly after calving. For these reasons, most Extension specialists and researchers recommend exposing at least 10% more heifers than needed.

As mentioned previously, an alternative is to treat the heifer development enterprise essentially as a stocker enterprise, retaining a much greater percentage (if not all) of the heifer calves. In this program, generally, the 55% target weight would be employed for the purpose of keeping nutritional costs down through the first part of the breeding season. Subsequently, the cattle are turned out on high-quality forage to ensure compensatory, rapid growth during the breeding season and exposing the heifers to fertile bulls for a short breeding season (usually 30 days). The heifers that become pregnant are retained and the opens are marketed as feeder heifers. In this system, adequate nutrition/development through first calving is critical so the heifers have had time to achieve body condition score of 6 and 85% to 90% of their expected mature weight by the time they calve.

## Use of Reproductive Tract Soring

Reproductive Tract Scoring (RTS) is a subjective measurement which involves the rectal palpation of the heifer reproductive tract (uterine horns and ovarian structures) and the subsequent assignment of a reproductive tract score, ranging from 1 to 5 (1 = immature; 5 = presence of a corpus luteum), to assist the producer in making replacement heifer decisions. Since age at puberty is difficult to measure directly, RTS can estimate pubertal status and, if performed before the onset of the breeding season, can be a predictor of heifer reproductive performance allowing for heifers with a poor breeding potential to be removed from the breeding group before any further costs are incurred. The RTS system has been shown to a repeatable measure between and within practitioners and to be moderately heritable (.32 + 0.17).

A RTS of 1 is refers to a prepubertal heifer, a RTS of 2 or 3 is refers to a peripubertal heifer (transitional stage), and a RTS of 4 or 5 is refers to a pubertal (cycling) heifer. The reproductive performance of heifers with an RTS of 1 or 2 is less than that of heifers with an RTS of 3 or greater. Heifers with a RTS of 1 or 2 are less likely to be cycling at the beginning of the breeding season and therefore are less likely to become pregnant. If they do become pregnant, they do so later in the breeding season, suggesting heifers with a RTS of 1 should possibly be eliminated from the breeding group. It is worth mentioning that some heifers do not exactly fit a particular RTS score and it is up to the producer and/or practitioner to decide on which of the measures are to be given the most emphasis.

RTS should be done about one month or less prior to breeding if the score is to be used as a culling tool as an indicator of a heifer's ability to conceive early during the first breeding season. If RTS is to be used as a selection tool to place pressure on age at puberty, the best time to evaluate the heifers is when approximately 50% of the heifers are thought to be cycling based on age, weight and occasional observations for estrus.

Another possible application of the RTS system is to assess the nutritional program being utilized by the producer. If RTS is taken within a sufficient time before the start of the breeding season (approximately 30 days to 60 days); based on the results of the tract scores, the producer can adjust the ration to help the heifers reach developmental goals prior to the beginning of the breeding season or the beginning of the breeding season can be adjusted.

The uterine and ovarian dimensions for each of the reproductive tract scores are described in Table 29.3. The reproductive tract score is based on the degree of uterine horn development and ovarian status (size of dominant follicle and presence or absence of a CL).

## Timing of Weight Gain from Weaning to Breeding

In the 65% target weight system, a major objective is to achieve a high percentage of heifers experiencing their first estrous cycle before the beginning of the breeding season. Until recently, very little was known regarding the importance of the timing of this weight gain. Would it be desirable to have the heifers gain at an even pace at

**Table 29.3. Description of uterine and ovarian measurements for different Reproductive Tract Scores (RTS).**

| *Reproductive Tract Score* | *Uterine horns (diameter, mm)* | *Ovarian length (mm)* | *Ovarian height (mm)* | *Ovarian width (mm)* | *Ovarian structures* |
|---|---|---|---|---|---|
| 1 | Immature, < 20 mm, no tone | 15 | 10 | 8 | No palpable follicles |
| 2 | 20-25 mm, no tone | 18 | 12 | 10 | 8 mm follicles |
| 3 | 20-25 mm, slight tone | 22 | 15 | 10 | 8-10 mm follicles |
| 4 | 30 mm, good tone | 30 | 16 | 12 | > 10 mm follicles, CL possible |
| 5 | > 30 mm | >32 | 20 | 15 | CL present |

approximately 1.33 pounds per day? Or, could growing the heifers slowly through most of the winter, then putting them on a very high plane of nutrition for the last two months prior to breeding gain some biological and economical efficiency?

Kansas State University and OSU researchers (Smith et al., 1995; Lynch et al. 1996; Marston et al., 1992) have independently studied the timing of gain. KSU workers noted that heifers gaining at 0.55 pounds per day until the last two months and then grown at 2.5 pounds per day were equal in reproductive performance to heifers grown at 1.31 pounds per day from November to May. The heifers that were pushed in the last two months were more efficient, consuming 12% less DM than the conventionally grown heifers. At OSU, heifers that were wintered to achieve 0.6 pound per day gain, then fed in a dry lot, gained 1.92 pounds per day and reached puberty 20 days to 30 days younger than their counterparts fed to gain at more uniform rates. This indicated that growing programs allowing heifers low to moderate rates of gain during most of the growing phase and then accelerate their growth leading into the breeding season may be cost effective and result in more heifers cycling early. This could be critical to the success of an AI and estrous synchronization program.

## Cost Comparisons with Different Feed Cost Scenarios

To help make decisions about heifer growing strategies, Table 29.4 contains total cost comparisons of feed for heifers from weaning on Nov. 1 to start of breeding season on May 1. The SLOW-FAST program is designed to rough heifers through the winter as inexpensively as possible. The assumed SLOW diet is 2 pounds per head per day of a high- protein supplement such as soybean meal. The remainder of the diet is prairie hay (5.8% crude protein) fed free choice. Average daily gain on this diet for medium-framed 500-pound heifers is only 0.35 pound per head per day (1996 NRC). The FAST gain portion is a self-fed ration programmed to achieve the required 3.16 pounds per day gain and reach the 65% of mature weight target the last 60 days.

This ration is as follows:

| | |
|---|---|
| 10% | cottonseed hulls |
| 5% | alfalfa pellets |
| 49.5% | corn |
| 30% | corn distillers grain |
| 4.5% | molasses |
| 1% | vitamin A, Rumensin® 80, limestone, salt, zinc sulfate |

**Table 29.4. Price comparisons of EVEN GAIN and SLOW-FAST growing programs with different feed price situations.**

| | | | |
|---|---|---|---|
| Corn | $3/bu | $4.50/bu | $5.00/bu |
| CSM | $250/ton | $300/ton | $400/ton |
| Hay | $80/ton | $85/ton | $90/ton |
| EVEN GAIN | $155.71 | $193.10 | $223.13 |
| SLOW-FAST GAIN | $155.64 | $176.83 | $194.19 |

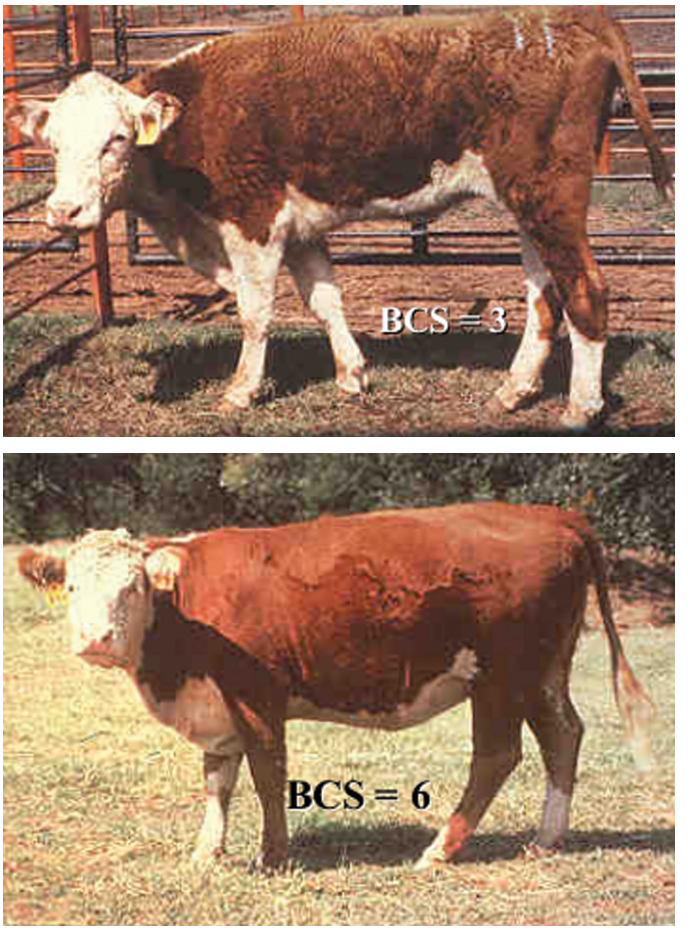


**Figure 29.2. A very thin heifer BCS 3 (top) and a correctly developed heifer BCS 6 (bottom).**

During this FAST growing phase, the heifers will average 620 pounds and consume 20.4 pounds per day on an as-fed basis.

The diet formulated to achieve the EVEN GAIN from November to May was chosen to achieve 1.33 pounds gain per day. Average weight of the heifers during this growing program would be 595 pounds and they would need to consume 15.4 pounds of the following ration daily to reach the desired target weight:

| | |
|---|---|
| 47% | prairie hay |
| 35% | corn |
| 14% | cottonseed meal |
| 3% | molasses |
| 1% | vitamin A, salt, Rumensin® 80, zinc oxide |

A second alternative, if alfalfa hay is available, would be:

| | |
|---|---|
| 66% | alfalfa hay (18%) |
| 33% | corn |
| 1% | vitamin A, salt, Rumensin® 80, zinc oxide |

The total feed ingredient costs for these heifer-growing programs were compared with four different corn price scenarios (Table 29.4). Because most other feeds are affected by the corn price, it was used as the basic feedstuff. Hay prices and cottonseed meal prices are listed as estimates of what they might be as the corn price changed.

With lower grain price situations, the SLOW-FAST gain approach appears to be slightly less expensive. As feed prices change, the comparisons should be re-evaluated. The added advantage of more heifers cycling earlier could make these growing programs the method of choice on ranches that synchronize and breed artificially.

## Using Wheat Pasture

Years of research and experience with stocker cattle wintered on small grain pasture prove SLOW-FAST is a good choice for a heifer growing ration. Heifers weaned in October are old enough to make good use of wheat pasture that becomes available in late November. In years when good wheat pasture is available, grazing the heifers on wheat will allow 1.5 pounds per day gain throughout the winter growing period. Heifers wintered on good wheat pasture will be heavy enough to enter the breeding season in April or early May in excellent body condition and at the target weight. Some caution must be taken to avoid severe weight and condition loss if heifers are wintered on wheat pasture, removed from wheat, then placed on lower-quality pasture such as native or Bermudagrass until the breeding season begins. Setting aside a few acres of small grain pasture for graze-out allows the replacement heifers to graze high-quality pasture well into May. Some producers have reported disappointing conception rates on heifers grazing lush wheat pasture. Other producers indicated they have excellent results from using wheat pasture for replacement heifer growing programs. No definitive research data is available to directly address this unanswered question. When comparing the price of renting wheat pasture with those programs listed above, it should be noted the price per pound of gain of the least expensive scenario in Table 29.2 is $0.41. The most expensive program costs $0.81 per pound of gain. Wheat pasture, if available, will compete well with those costs.

## Using Ionophores in Replacement Heifer Diets

In an effort to ensure more replacement heifers are bred to calve early in their first calving season, producers should consider using a supplement containing an ionophore in the growing diet of the heifers. Ionophore is the generalized name for the feed additives monensin (Rumensin®) and lasalocid (Bovatec®). Both are presently approved for use with growing programs for replacement heifers. Research has shown growing heifers fed 200 milligram monensin per head per day reached puberty at an earlier age than did similar heifers fed similar diets containing no monensin (Moseley et al., 1977, 1982; McCartor etal.1979; Sprott, 1981). Similar data is available for lasalocid. Most stocker cattle research indicates the addition of 100 milligrams to 200 milligrams of an ionophore increases average daily gain by 0.1 pound to 0.2 pound per day. During a 150-day growing period of a replacement heifer, this means an additional 15 pounds to 30 pounds in average weight improvement of the heifers by breeding time.

## Yearling Immunizations (four to six weeks prior to breeding)

Replacement heifers should be given booster immunizations at one year of age. Often, this will include a modified live form of the respiratory disease vaccinations (BVD 1 and 2, BRSV, IBR, PI3) and the clostridial vaccines also known as 7–way or 8–way blackleg vaccines. The modified live vaccines must be given at least 30 days prior to the start of the breeding season. The annual vaccinations for the bacterial reproductive vaccines including 5-way Leptospira and Campylobacter (Vibrio) fetus could be given at this time as well. See a veterinarian for additional information.

## After the First Breeding Season

Many Oklahoma ranchers breed the replacement heifers about a month ahead of the mature cows in the herd. In addition, they use a shortened 45- to 60-day breeding season for the replacement heifers. The next logical step is to determine which of these heifers failed to conceive in their first breeding season.

As the bulls are removed from the replacement heifers, arrange with a local veterinarian to have those heifers evaluated for pregnancy in about 60 days. In two months, experienced palpation technicians should have no difficulty identifying which heifers are pregnant and which are not pregnant (open). Heifers that are open after this breeding season should be strong candidates for culling. Culling these heifers immediately after pregnancy checking serves three very useful purposes:

1. Identifying and culling open heifers early will remove subfertile females from the herd. Lifetime cow studies from Montana indicated properly developed heifers exposed to fertile bulls that did not become pregnant were often subfertile compared to the heifers and did conceive (Bellows). In fact, when the heifers that failed to breed in the first breeding season were followed throughout their lifetimes, they averaged a 55% yearly calf crop. Despite the fact that reproduction is not a highly heritable trait, it makes sense to remove this genetic material from the herd so as to not proliferate females that are difficult to get bred.
2. Culling open heifers early will reduce winter costs. If the rancher waits until the next calving season to find out which heifers do not calve, the winter feed expense will be lost and there will be no calf to help pay the bills. Money can be better spent in properly feeding pregnant cows, which will be producing a saleable product the following fall.
3. Identifying the open heifers shortly after the breeding season (60 days) will allow for marketing the heifers while still young enough to go to a feedlot and be fed for the choice beef market. The grading change of several years ago has a great impact on the merchandising of culled replacement heifers. B maturity carcasses, those estimated to be 30 months of age or older, are no longer allowed to be graded choice, and may be discounted because of new Bovine Spongiform Encephalopathy

export rules. Therefore, it is imperative to send heifers to the feedlot while young enough to be fed for four to five months and not be near the B maturity age group. Auction barn order buyers will be especially leery of heifers that may be near 18 months to 20 months of age because B maturity beef receives a considerable discount when harvested at the packing plant.

The percentage of open heifers will vary from ranch to ranch. Do not be concerned if after a good heifer development program and adequate breeding season it is found that 10% of the heifers still are not bred. These are the very heifers to identify early and remove from the herd. It makes good business sense to identify and cull nonpregnant replacement heifers as soon as possible.

## Growing Bred Replacement Heifers

Bred replacement heifers that will calve in several months need to continue to grow and maintain body condition. Ideally, 2-year-old heifers should be a BCS 6 (Figure 29.2) at the time their first calf is born. This allows them the best opportunity to provide adequate colostrum to their calf, repair their reproductive tract, return to heat cycles, rebreed on time for next year and continue normal body growth. From breeding until calving time, heifers need to gain 1 pound to 1.5 pounds per head per day, assuming they are in good body condition after the breeding season. Heifers will need supplemental protein if the major source of forage in the diet is Bermudagrass, native pasture or grass hay. If the forage source is adequate in quantity and average in quality (6% to 9% CP), heifers will need about 2 pounds of a high-protein (38% to 44% CP) supplement each day. This will probably need to be increased using higher-quality hay such as alfalfa or additional energy feed (20% range cubes) as winter weather adds additional nutrient requirements. Soybean hulls or wheat middlings also may be used to ensure adequate energy intake of pregnant heifers.

## Wheat Pasture for Bred Heifers

Although wheat pasture can be used more efficiently to add gain on stocker cattle or weaned replacement heifers, wheat pasture, if adequate rainfall produces growth, also can be used as a supplement for pregnant replacement heifers. Using wheat pasture judiciously makes sense for pregnant heifers for two reasons. Pregnant heifers consuming full feed of wheat pasture will gain about 3 pounds per head per day. If they are on the wheat too long, the heifers can become very fat and possibly cause dystocia (calving difficulty). If wheat pasture is used for bred heifers, use it as a protein supplement by allowing the heifers access to the wheat pasture on at least alternate days. Some producers report that one day on wheat pasture and two days on native or Bermudagrass works better. This encourages heifers to rustle in the warm season pasture for the second day, rather than just stand by the gate waiting to be turned back into the wheat. Whatever method is used to grow the pregnant replacement heifers, plan to have them in good body condition by calving so they will grow into fully-developed, productive cows.

## Body Condition Score at Calving is Critical

One of the major constraints in the improvement of reproductive efficiency of beef cows is the duration of the post-calving anestrous period. If cows are to maintain a calving interval of one year, they must conceive within 80 days to 85 days after calving. Body condition at calving time determines to a great extent the rebreeding performance of beef cows in the subsequent breeding season. Based on research of mature and young cows from several studies, cows that maintained body weight and ample energy reserves before parturition, exhibited estrus sooner than cows that lost considerable body weight and, consequently, had poor energy reserves.

Body weight change during pregnancy is confounded with embryo and placenta growth. Therefore, the estimation of body fat by use of body condition scores is more useful in quantifying the energy status of beef cows. The numeric system of body condition scoring is an excellent estimator of percentage body fat in beef cows. BCS accounted for 85% to 91% of the variation in stored body energy in cows. Examples of different body condition scores are shown in Figure 29.2.

The processes of fetal development, delivering a calf, milk production and repair of the reproductive tract are all physiological stresses. These stresses require the availability and utilization of large quantities of energy to enable cows to be rebred in the required 85 days. Add to these physiological stresses the environmental stresses of cold, wet weather on spring calving cows, and often energy intake of range beef cows, is below body maintenance needs. As the intake falls short of the energy utilized, then the cow compensates by mobilizing stored energy or adipose tissue and during a period of several weeks, a noticeable change in the outward appearance of the cow takes place. This is a change in the body condition and can be monitored by assigning body condition scores to cows and quantifying the degree of change. Cows in a thin body condition at calving slowly return to estrus. Postpartum increases in energy intake can modify the length of the postpartum interval. However, increases in the quality and quantity of feed to increase postpartum body condition can be very expensive. The producer must ask - does the improvement in reproductive performance achieved by expensive postpartum feeding to thin cows be in adequate body condition justify the cost of the additional nutrients?

## Heifers Thin at Calving

Oklahoma researchers used 81 Hereford and Angus x Hereford heifers to study the effects of BCS at calving and post-calving nutrition on rebreeding rates at 90 days and 120 days after calving (Bell et al.). Heifers were divided into two groups in November and allowed to lose body condition or maintain body condition until calving in February and March. Each of those two groups was then redivided to either gain weight and body condition postpartum or to maintain body condition postpartum. Figure 29.3 illustrates the change in body weight of heifers that calved in a BCS 5 or greater or those that calved with a BCS less than or equal to 4.9. The same pattern that has been illustrated in the other

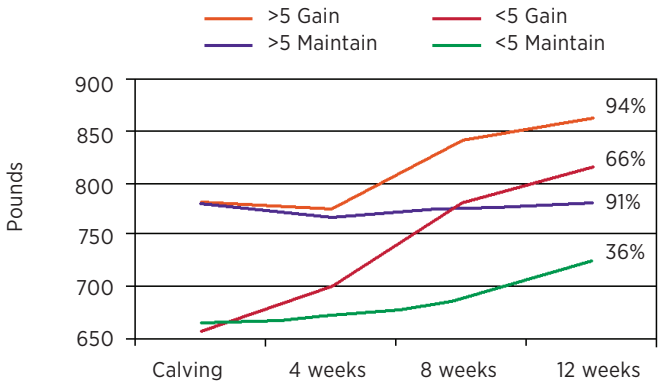


**Figure 29.3. Postpartum body weight of heifers with body condition greater than 5 or less than 5 at calving and fed to gain or maintain weight. Pregnancy rates are indicated on the right side of the graph.** Source: Bell et al.

experiments is manifest clearly with these heifers.

Thin heifers that were given ample opportunity to regain weight and body condition after calving actually weighed more with a greater body condition by eight weeks than heifers that had good body condition at calving and maintained their weight through the breeding season. However, the rebreeding performance (on the right side of the legend of the graph) was significantly lower for those that were thin (66 percent) at parturition compared to heifers that were in adequate body condition at calving and maintained condition through the breeding season (91 percent).

Post-calving increases in energy and, therefore, weight and body condition gave a modest improvement in rebreeding performance, but the increased expense was not adequately rewarded. The groups that were fed to maintain postpartum condition and weight received 4 pounds of cottonseed meal supplement (41% CP; $0.13 per pound) per day. The supplement cost for the 69-day-feeding period was approximately $36 per cow. The cows in the gain groups were fed 28 pounds of a grain mix (12% CP; $0.073 per pound) at a total supplement cost of $141 per cow. Both groups had free choice access to grass hay (Wettemann). The improvement in reproductive performance (66% pregnant vs. 36% pregnant) of the thin 2-year-old heifers was not enough to offset the large investment in feed costs.

Other data sets have shown conclusively cows that calve in thin body condition, but regain weight and condition going into the breeding season, rebreed at a slower rate than those that calve in good condition and maintain that condition into the breeding season. Table 29.3 from Missouri researchers illustrates the number of days between calving to the return to heat cycles, depending on body condition at calving and body condition change after calving.

This data clearly shows young cows that calve in thin body condition (BCS 3 or BCS 4) cannot gain enough body condition after calving to achieve the same rebreeding performance as cows that calve in moderate body condition (BCS 5.5) and maintain or lose only a slight amount of condition. Cows must rebreed 85 days after calving to calve again at the same time next year. Notice that none of the averages for cows that calved in thin body condition were recycling in time to maintain a 12-month calving interval. The body condition score target for 2-year-old heifers at calving should be 6. This condition score will give the heifer the best opportunity to calve with no additional threat of dystocia and the very best opportunity to rebreed in 85 days.

**Table 29.5. Predicted number of days from calving to first heat as affected by body condition score (BCS scale 1 = emaciated; 9 = obese).**

| *BCS at calving* | *Condition score change after calving to day 90* | | | | | | |
|---|---|---|---|---|---|---|---|
| | *-1* | *-0.5* | *0* | *0.5* | *1* | *1.5* | *2* |
| 3 | 189 | 173 | 160 | 150 | 143 | 139 | 139 |
| 4 | 161 | 145 | 131 | 121 | 115 | 111 | 111 |
| 5 | 133 | 116 | 103 | 93 | 86 | 83 | 82 |
| 5.5 | 118 | 102 | 89 | 79 | 72 | 69 | 66 |

Source: Lalman et al.

## Sort Young Cows from Mature Cows

First-calf heifers have historically been the most difficult females on the ranch to get rebred. They are being asked to continue to grow, produce milk, repair the reproductive tract and have enough stored body energy (fat) to return to heat cycles in a short time frame following parturition. Two-year-old cows must fill all of these energy demands at a time when their mouth is going through the transition from baby teeth to adult teeth. If these young cows are pastured with the larger, older cows in the herd, they very likely will be pushed aside when the supplements are being fed in the bunk or on the ground. The result of these adverse conditions for young cows very often is a lack of feed intake and lowered body condition. Of course, lowered body condition results in delayed return to heat cycles and a later and smaller calf crop the following year.

North Dakota State University data of commercial cow herds recorded during a 21-year period illustrates the differences in size of very young cows and the very mature (11 years and older) cows (Figure 29.4). Very young cows and very old cows cannot compete with middle age cows weighing 200 pounds to 250 pounds more.

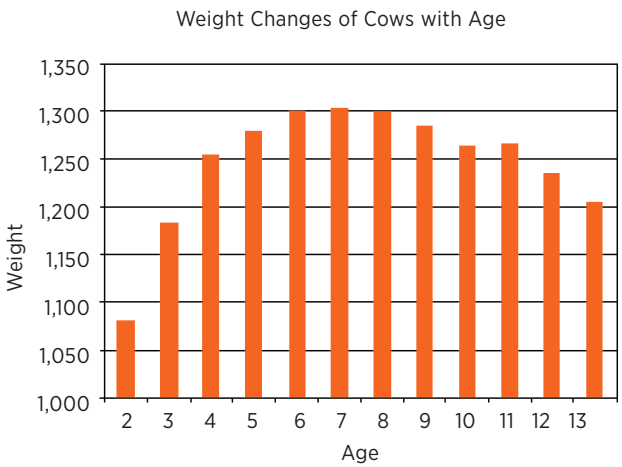


**Figure 29.4. The average weight of commercial beef cows in North Dakota SPA data by age. Source: Ringwall.**

## Cost of Replacement Heifer Development

Shulz and Gunn (2014) provide further details and a convenient enterprise analysis spreadsheet related to raising heifers versus buying heifers for beef cow replacement. This publication and decision tool enables producers to address the question of buying versus raising replacement heifers from an economic perspective. It does not address biosecurity risk related to potentially introducing diseased cattle into the herd when replacements are purchased with unknown background.

# Conclusion

Properly immunize heifers at two months, weaning and at one year of age according to a veterinarian's recommendation. Depending on the ranches long- and short-term goals and available resources, development systems from weaning through breeding targeting 55% to 65% of expected mature weight can be successful. The most economical growing program for replacement heifers utilizes standing or harvested forages as a major portion of the diet. Heifers may be grown slowly then given higher energy feed or grazed forage to accelerate the rate of gain to achieve acceptable target weight by the start of the breeding season.

Utilize the highest-quality hays and/or the best pastures because young cattle cannot utilize low-quality roughage as well as mature cows. Use an ionophore to improve feed utilization and hasten the onset of puberty.

Breed replacement heifers three weeks to four weeks ahead of the adult cows. Cull all open heifers after the first breeding season. Grow bred heifers adequately so they have a BCS 6 at calving time. Sort young cows, 2- and 3-year-olds, from older, larger cows to ensure adequate feed intake for young, growing, but smaller cows.

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