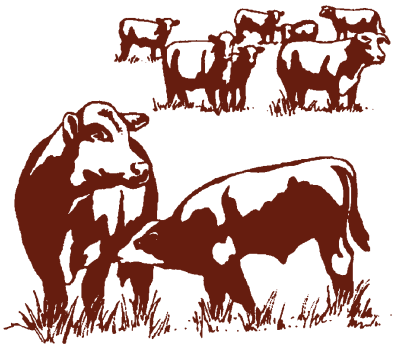

Beef Cattle Handbook

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Replacement Heifer Development

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Effective replacement heifer development is a critical segment of the integrated management program in an efficient beef cow production system. The main objective should be to develop an adequate number of heifers to a point where they reach puberty and are cycling regularly at the start of the breeding season. In addition, they should have adequate pelvic area to deliver a reasonable size calf unassisted. Because of her increased nutritional needs, one might also consider the first-calf heifer as part of the replacement heifer development program until she breeds back and weans her first calf.

The replacement heifer represents the future profitability and genetic improvement of the cow herd. Assuming a restricted breeding season and a somewhat static weaning date each year, the age of calf at weaning has a large impact on pounds of calf weaned. This is particularly important if calves are sold at weaning. Therefore, it is important to the production unit that heifers conceive early in the first breeding season. Researchers at Montana State University concluded that heifers that conceived the earliest, immediately indicated their greater productive efficiency and lifetime production potential.

Development of a replacement heifer is costly. The fact that she is growing and developing means that she must be managed and fed separately from the remainder of the herd. However, since she will not produce any economic return until she is approximately two and a half years of age (when she weans her first calf), this long period makes her an easy target for mismanagement. Because of the expense of the development phase, it makes weaning a calf in subsequent years from that properly managed and developed first calf heifer all the more critical. It is more economical to spread the development costs over several calves, rather than one if she is open after her first calf.

The selection and development of replacement heifers can be divided into five phases:

- Sire selection
- Preweaning management
- Heifer selection at weaning
- Weaning to breeding
- Gestation through parturition and rebreeding

Sire Selection

Genetic improvement through the replacement heifer starts with sire selection. When a cow/calf unit generates its own replacement females, more than 85 percent of the genetic make-up of the cow herd is contributed by the sires selected for the program. It is extremely critical that traits of economic importance be prioritized in the sire selection program and be matched to the environment and nutritional resources available. It is essential that growth and maternal data be analyzed for potential sires. Tools available for genetic evaluation, Expected Progeny Differences (EPDs) in particular, are invaluable in progressing toward the goals of your genetic improvement program.

Scrotal circumference should be evaluated on potential sires. Considerable information has been generated on the relationship between scrotal circumference and puberty in offspring. A genetic correlation of -.71 has been reported between scrotal circumference and age of

puberty in half-sib heifers.[1] This high estimated genetic correlation indicates that sires of above average scrotal circumference should produce progeny that reach puberty at a younger age than those produced from sires of below average scrotal circumference.

Preweaning Management

During the phase prior to weaning, we largely depend on the dam to nurture and care for the replacement heifer. However, the influence of several management practices should be discussed as they relate to the total management system. Producers are encouraged to identify all calves at birth so that birth dates are known, records can be kept so that replacements can be selected and subsequent culling of the cow herd can be more efficient. In addition, producers should work with a local veterinarian to develop a specific vaccination program that offers protection against disease problems for that particular locale.

Since puberty is influenced by age, weight and breed, it is important to consider available nutritional resources and the environment when determining what maternal breeds to include in the breeding program. Can the selected breeds be reproductively efficient utilizing the resources available (Table 1)?

Selecting early born replacement heifers that weigh at least 450-600 pounds at weaning, depending upon breed and frame size, is the first step. However, it is important that this weight be true muscle growth without a substantial amount of fat. Research has shown that feeding a high energy creep feed to suckling heifers of British breeding may hinder their subsequent milking ability because of fat deposition in the developing udder[2]. However, a summary of similar data collected on large-frame heifers containing European breeding, showed no effect of creep feeding on subsequent maternal performance[3]. Thus, creep feeding of replacement heifers, when economically feasible, should depend on the breeding and growth potential of the calves.

The use of growth promoting implants in suckling calves is a highly profitable practice used by cow/calf operators to increase weaning weights. Implants currently approved for use in suckling heifers are zeranol (Ralgro: Brac/Mallinckrod T Vet., Inc.) and progesterone/estradiol benzoate (Synovex C: Fort Dodge Animal Health; Calif-oid: Pharmacia and Upjohn, Inc.). All are approved for use in potential replacement females but should not be used in calves less than 45 days of age. Some studies have shown that implanted heifers have larger pelvic areas at one year of age. However, when heifers were followed to calving, no reduction in calving difficulty was noted. Therefore, with the data presently available it appears that the advantage in pelvic area may be lost by the time the heifer reaches calving age.

Table 1. Breed Comparisons: Heifer Age at Puberty

Breed Cross	Days at Puberty
Gelbvieh	341 ± 9
Brown Swiss	347 ± 8
Red Poll	352 ± 8
Angus	372 ± 12
Simmental	372 ± 6
Hereford	390 ± 13
Charolais	398 ± 7
Limousin	398 ± 6
Average	368 ± 3 (SE)

Heifer Selection At Weaning

Selecting early born replacement heifers that weigh at least 450-600 pounds at weaning, depending on breed and frame size, is the initial step. In selecting potential replacements, it is normally advisable to keep a number in excess of those actually needed as replacements to allow for further culling as yearlings and after breeding. The number in excess of need should be determined by available feed and associated costs. An excess from 10-50 percent may be feasible, depending on these associated factors. The nutrition program should be built around feedstuffs raised on the farm or ranch with a minimal of purchased supplemental feed, unless economically justified alternatives are available. The nearer this can come to being accomplished, the closer the female is matched to her environment and the more economical heifer development will become.

The key to a successful heifer development program is to select heifers at weaning that are adequate in weight, and when coupled with a good nutrition program, can reach a target weight that is 60-65 percent of the mature cows' of similar genetics, prior to the breeding season. Depending on weaning weight and the time available prior to breeding, heifers may have to gain 1-1.5 pound per day from weaning to breeding. Usually, this means the average British breed of heifer will need to gain about 200 pounds in order to reach a target weight of approximately 650-700 pounds which is necessary to begin cycling. With the larger-frame European breeds and crosses, a target breeding weight of 750-800 pounds is usually necessary. Although an adjusted 205-day weight might allow us a more valid genetic comparison, in reality, the relationship between weight and puberty suggests the actual weaning weight must be in a range that allows the heifer to reach the pre-breeding target weight with the available nutrition in the existing time period.

If a product wants to minimize the impact of increased weaning weight on mature cow size, they might want to select heifers for replacement that have 205-day weight ratios within a certain percentage of the herd average (i.e. 18%; a breeder should determine this level on an individual basis). In addition, heifers with extremely large birth weights should not be selected as pentential replacement heifers.

Weaning to Breeding

By determining the date one wants to start breeding heifers and knowing their actual weaning weight, one can calculate the rate of gain necessary to reach the target weight in the existing time period. A balanced ration can then be developed utilizing available nutrient resources, to achieve this objective. If considerable variation exists in heifer weight, nutrients can more accurately be targeted to need by dividing the heifers into a light half and a heavy half, and meetng their respective nutrient requirements.

As was indicated previously, puberty in heifers is a function of breed, age and weight. *Table 1* illustrates differences in age of puberty for some reference breeds. Recent research has illustrated that the degree of development from weaning to breeding influences not only when heifers cycle as yearlings, but also their subsequent productivity and rebreeding rate after they calve as two-year-olds. Research at Purdue and Kansas State (Tables 2 and 3, respectively), indicates the impact of inadequate growth and development during this development phase on subsequent calving ease, rebreeding and calf growth. Poor rebreeding efficiency under economical nutrition programs might suggest that another breed cross should be considered that more effectively matches the environment. Increasing size and milk production will have a pronounced effect on the heifer's nutritional requirement.

Ionophorcs, such as Rumensin and Bovatec, may have a place in heifer development programs. Miles City researchers reported that heifers receiving 200 milligrams of Rumensin daily gained more weight than controls fed high roughage diets, even though the Rumensin-fed heifers received 10 percent less energy. Age of puberty was decreased slightly in the Rumensin-fed group, with the difference being greater in heavier heifers[4]. In addition, other research has shown ionophores to decrease the interval to first postpartum estrus[2].

Producers are encouraged to breed their replacement heifers starting three to four weeks prior to the time they start breeding the rest of the cow herd. Researchers at the Fort Keogh Livestock and Range Research Station at Miles City, Montana have reported reduced fertility on the initial behavioral estrus. This would indicate an additional benefit from having the heifers cycling at 12-14 months of age, prior to the start of the breeding season. Since first-calf heifers typically have a two to three week longer postpartum period than older females, this allows them one extra estrous period to start cycling and, therefore, be in synchrony with the rest of the cow herd for their second parturition. The three to four weeks additional age on calves at weaning adds pounds and "adjusts" for the age of dam.

If it is impossible for a producer to breed his replacements earlier than the rest of the cow herd, then he should limit the heifers' breeding season to 35-45 days. This emphasizes reproductive efficiency and assures the keeping of fertile replacement females that conceive promptly. It will also force the heifers into a short calving season so management can give them more attention.

Table 2. Effect of First Winter Nutrition on Subsequent Performance of Heifers [6]

	Pound of Grain Per Head Fed Daily in Addition to Low-Quality Fescue Hay Fed ad libitum		
Item	0.0	3.0	6.0
Number of heifers	112	113	112
Initial fall weight, lb.	496	502	493
Daily gain - winter, lb.	0.07	0.50	0.80
Breeding weight, lb.	506	577	613
Percent conceiving as yearlings	69.2	73.9	83.5
Subsequent production:			
Percent rebreeding after first calf	67.3	75.4	87.1
Weaning weight (first calf, lb.)	405	433	443

Pelvic measurements of potential replacements taken either prior to breeding or at pregnancy checking time, is another potential tool to assist in the reduction of dystocia.

Nebraska researchers report that a PA/birth weight (BW) ratio is highly related to calving difficulty. Their work suggests the following to predict results with 75-80 percent accuracy:

Calving difficulty	PA/BW ratio
1 - no assistance	2.2
2 - hand pull	2.1
3 - puller needed	1.9
4 - hard pull with puller	1.8
5 - Caesarean	1.6

G.H. Deutscher, Proceedings, 1989 BIF Annual Convention

For example, it might be predicted that a heifer with a 365-day adjusted PA of 180 cm2, could deliver an 81 pound calf unassisted (180 cm2 â 2.2 cm2/lb). However, one must realize we still can't accurately predict birth weight in an absolute sense. Producers should utilize BW and calving ease EPDs to help reduce dystocia.

Another method of using pelvic area in the heifer selection process is to rank the PA of your bred heifers and eliminate the smallest five percent (or whatever percentage you have the luxury of culling). Over time, this should have a positive impact on reducing dystocia.

If a producer reaches pregnancy checking time with an excess number of heifers, additional selection pressure might be put on conception date. Keeping only heifers that conceive in a short, 45-day breeding season will have a positive impact on cow herd fertility and will

Table 3. Effect of Heifer Nutritional Development on Subsequent Performance[7]

Percent of Mature Weight Pregnancy at Breeding as Yearling	Number	Pre-Breeding Weight	Calving Weight	Calf Birth Weight	Percent Calving Difficulty	Calf Death Loss Percent	Fall Rate Percent
55	60	600	834	70.9	52.3	6.2	85.0
65	61	683	897	73.3	28.8	4.5	93.4

more effectively allow the heifers to fit into the calving sequence of the cow herd in subsequent years. If palpated prior to 100 days of gestation, your veterinarian may be able to assist you by identifying those heifers that have bred early in the breeding season.

Gestation Through Parturition and Rebreeding

The next step in the profitable management of the replacement heifer is to assure adequate growth and development from breeding until she calves as a two-year-old at about 85 percent of her mature weight. During this time, the bred heifer should gain three quarters to one pound per day, or approximately 250-300 pounds. Thus, British breeds and British breed crosses should go into the calving season weighing 850-950 pounds, with larger frame breeds and crosses weighing approximately 950-1050 pounds. It is important to remember that the majority (approximately 70 percent) of fetal growth occurs during the last one-third of gestation. Therefore, adequate nutrition, especially energy and protein, is essential for proper development of the fetus and preparation of the heifer for calving, lactation and rebreeding.

Research has consistently shown that inadequate nutrition prior to parturition results in lighter, weaker calves at birth without any decrease in calving difficulty. In addition, it has resulted in increased calf sickness and mortality, lower milk production, a longer postpartum interval to first estrus and poorer overall reproductive performance.

Suckling management may be considered to reduce the postpartum interval if first-calf heifers are either in poor body condition or limited on nutritional resources. Due to the tremendous demand put on these young lactating, spring calving females, a producer may consider weaning first calves somewhat earlier than normal in order to allow the first calf heifer the opportunity to improve her body condition going into the last half of gestation. This could benefit her reproductive efficiency as a three-year-old.

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