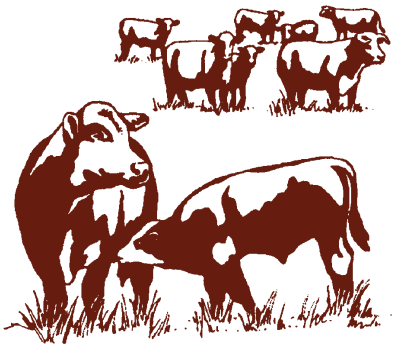

Beef Cattle Handbook

BCH-1100

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Selecting Replacement Heifers

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Raising vs Purchasing Replacements

Colorado State University researchers (Gutierrez and Dalsted) conducted an in-depth economic analysis of raising replacement heifers up to 31 months of age, the time at which their first calves were weaned. They calculated break-even values that were based upon all costs, minus the value of the first calf at weaning. Depending upon heifer retention rates and reproduction rates, heifer break-even values ranged from $601-$733 when production costs were normal (expected). If production costs were 15 percent higher than expected, the range was $692-$832. If production costs were 15 percent lower than expected, breakeven values ranged from $407-$634.

Depending upon the situation, heifer breakeven values may differ by as much as 100 percent ($832 vs $407). Therefore, it is worth the effort to estimate the cost of producing a replacement heifer in your operation. If you find the cost to be inordinately high, one of two things should be done: (1) examine the total heifer development program and make the changes needed; or (2) consider purchasing replacements, if they can be bought at a price, and level of quality, that makes it economically advantageous to do. Of course, when purchasing replacements, herd health implications must be given serious consideration.

Economically Important Traits

Consider the following list of traits when selecting replacement heifers.

1. Early growth (weaning and yearling weight)
2. Early puberty
3. Fertility
4. Ease of calving
5. Milking ability
6. Structural soundness
7. Temperament (disposition)
8. Fleshing ability
9. Muscle thickness
10. Frame size.

Early Growth—Weaning and Yearling Weight

Historically, many commercial producers have selected the heifers with heaviest actual weights at weaning time for two reasons: (1) larger heifers tend to be older, which means they are out of earlier calving cows; (2) the larger heifers tend to be out of the heavier milking cows. However, there is some risk in selecting extremely heavy heifers. If overfat, their milk production could be reduced because of fat deposits in the developing mammary tissue. Furthermore, extremely fast-gaining heifers may have a slight endocrine (hormone) imbalance which could lower their fertility. Many producers have said that their largest heifer often fails to rank high in productivity, as a mature cow. Nevertheless, weight is what a commercial cow-calf producer has to sell. Research shows that the weight of the calf is closely related to biological efficiency (pounds of calf produced per pound of TDN consumed by the cow-calf unit). However, keep in mind that as intense selection pressure on growth continues, three problems can occur: (1) higher birth weights, (2) larger mature cow size along with increased maintenance requirements that may be too high, and (3) steers that finish out at higher

than optimum slaughter weights (1,100-1,350 lb.).

Weaning weight and yearling weight are moderately to highly heritable traits (.25-.50) which means that selection for early growth is effective. As a rough guide, heifers that have within-herd weaning weight ratios below 90 (herd average 100) should be considered as candidates for culling in a commercial herd. In a purebred herd, the heifer's EPDs for weaning and yearling weight should be used when making selection decisions on growth.

Early Puberty

The younger a heifer begins to cycle, the better are her chances of conceiving at a date that will allow her to calve at 24 months of age. Early puberty is moderately to highly heritable and appears to be positively related to the heifer's future reproductive efficiency.

Research at the US Meat Animal Research Center shows that age at puberty ranges from 10-14 months across various breedtypes. There also was a tendency for the higher milk, lower lean breedtypes to reach puberty at a younger age than the lower milk, higher lean breedtypes.

Researchers at Colorado State University have developed a system of rectally palpating heifers one month prior to their first breeding season and assigning them a reproductive tract score (RTS), which is an estimate of puberty status. Scores range from 1-5, where one is infantile and five is a cycling heifer with a palpable corpus luteum. This trait was shown to be moderately heritable (.32). Heifers having scores of one and perhaps two could be considered potential candidates for culling.

Research also shows that bulls with a larger scrotal circumference (SC) tend to sire heifers that reach puberty at an earlier age than bulls with a smaller SC. In those breeds that have SC EPDs, breeders should use them to improve age at puberty.

Fertility

Heritability estimates of fertility (pregnancy rate) show fertility to be a lowly heritable trait (.00-.10). But, because reproductive rate is so important economically, do not ignore it in a selection program.

Over time, culling heifers that fail to conceive within a set breeding season should enhance cow herd fertility. When visually evaluating heifers, avoid extremely masculine appearing females; they could be marginal in fertility.

Overly-refined, frail appearing heifers should also be discriminated against. However, the real test of fertility in a group of heifers is a high first-service conception rate, and a high pregnancy rate at the end of the breeding season.

Good goals would be 60-70 percent first-service conception rate and 90-95 percent pregnancy rate after no more than 65 days of breeding.

Ease of Calving

Nationally, the incidence of dystocia (calving difficulty) in first-calf heifers averages somewhere around 30 percent, resulting in about a 10 percent calf mortality rate. In some herds, heifer dystocia can run well over 50 percent. In addition to increased calf losses, heifers that require assistance are more difficult to breed back because of the additional trauma that occurs during an assisted birth.

Recent research shows that the birth weight of the calf relative to the dam's pelvic area (PA) is the primary determinant of calving difficulty. Therefore, dystocia could theoretically be reduced by culling heifers with small PAs and mating the remainder to sires whose calves will not be disproportionately large at birth.

Some producers are measuring PA in their heifers before breeding season and culling those below a specific threshold level. Dividing PA by a factor of 2.1 can serve as a rough guide to the size of the calf the heifer may deliver without assistance. For example, a heifer with a PA of 180 sq. cm., should be able to give birth to an 85 lb. calf (180 sq. cm. divided by 2.1 = 85 lb.).

When making decisions on bulls to be mated to yearling heifers, select those with low birth weight EPDs. As a rule of thumb, bulls having birth weight EPDs within the 15th percentile of their breed can usually be considered calving ease sires. When selecting young, unproven bulls, use the birth weight EPD rather than the bull's actual birth weight.

Because PA is a highly heritable trait (.60), you should be able to make progress in your cow herd by using bulls of acceptable frame size with large PAs, and retaining their heifers. Selection for large PA alone will likely result in larger, higher maintenance cow size. In comparing PAs among yearling bulls, they should be adjusted to a constant age or weight. As with heifers, eliminate bulls from consideration if the PA is below a specific minimum standard. This should be done within a body size category. Allowing size and PA to increase together will likely permit birth weight and PA to increase in a parallel fashion.

Milking ability

Research clearly shows an optimum range in milk production for a given environment. For example, abundant feed resources will accommodate a relatively high level of milk (16-20 lb./day). Conversely, lower milk levels (10-12 lb./day) suited to limited feed conditions such as those in the arid Southwest.

Within a breed, the most effective way to improve milk is to use sires, or sons of sires, that have high EPDs for maternal milk and then save their daughters. Retaining heifers out of the heaviest milking cows in the herd should result in an increase in milk production. However, if a prepubertal heifer is overly fat from nursing her heavy milking dam, her own milking ability may be reduced because some of the secretory tissue in the mammary gland may have been replaced by fat. Milking ability is not as highly heritable as growth traits. Heritability estimates range from .15-.30. Consequently, progress from selection for milk within a breed will be slower than selecting for growth. For the commercial producer, the easiest way to increase milk is to cross-

breed with a sire from a heavy milking breed.

Structural Soundness

Structural soundness contributes to longevity, a trait research shows to be related to cow herd efficiency. However, there appears to be a relatively wide range of acceptability in the physical traits that are involved in structural soundness.

The Skeleton. Common foot problems are excessive growth, curled claws, small feet, weak pasterns, shallow heels, and steep pasterns. Common hind limb problems are post-legged, sickle-hocked, cow-hocked, and bow-legged. Common front limb problems are steep-shouldered, buck-kneed, knock-kneed, bow-legged, splayed-footed, pigeon-toed, and coarse open shoulders. Some of these conditions are interrelated. For example, some cattle are too straight throughout their skeleton: post-legged, steep shouldered, buck-kneed, and steep-pasterned. When this condition (inadequate joint angulation) is severe, it can reduce a heifer's longevity in the herd.

The Eyes. Pigmentation of the eyelid and skin around the eye is a positive trait because cattle with no pigment are more predisposed to cancer eye. Pigmentation is a moderately heritable trait (.30-.40). In areas where there is a great deal of bright sunlight and a high incidence of cancer eye, producers prefer the eyeball to be "hooded" or "shaded" by a heavy eyebrow. Thus, discriminate against cattle with prominent eyes (pop-eyed).

The Jaw. Jaw defects are uncommon. However, "parrot mouth" (overshot) is seen occasionally. This condition could impair the heifer's foraging ability.

The Mammary System. It is difficult to assess the mammary system on virgin heifers. However, it is wise to avoid heifers whose teats are barely visible and appear to be embedded in a nest of long hair and fatty tissue. Avoid *Bos indicus* heifers whose teats are too long and too thick. Furthermore, discriminate against daughters of "balloon-teated", "pendulous-uddered", and "goat-uddered" cows.

Temperament (Disposition)

Research shows temperament to be a transmissable trait, ranging from approximately .15-.40 in heritability. Cattle with extremely bad temperaments are difficult to handle and dangerous. Furthermore, extremely nervous females have a lower A.I. conception rate than quiet females. Therefore, it is wise to cull heifers having bad dispositions because they are apt to create problems in overall herd management.

Fleshing Ability

Heifers that flesh (fatten) easily are generally easy-keepers in the cow herd. They can maintain body condition on lower-quality feeds and less total feed energy. They are more apt to breed back on schedule year after year. Beyond a certain point, however, fleshing ability is a liability because it runs contrary to the consumer's desire for leaner cuts of beef. Fertility is apt to be reduced in overfat heifers. The goal is to avoid the extremes: (1) heifers that are obviously too lean and "hard-doing" in their appearance; and (2) heifers that are predisposed to becoming overly fat. When purchasing replacement heifers, it is important to determine how they were fed before making decisions on their condition or fleshing ability. If they have received an adequate diet, their condition score should be a minimum of 5 (on a 1 to 9 scale).

Muscle Thickness

In recent years, there has been an emphasis on greater muscle thickness, which is related to muscle-to-bone ratio in the carcass. Some research results suggest that long-term extreme selection pressure for muscling could have a negative impact on reproduction traits (puberty, fertility, and calving ease). Here again, the key is to avoid the extremes: (1) heifers that are obviously too narrow, flat, and light muscled; and (2) heifers that are extremely thick, coarse and highly defined in their musculature. However, heifers in the so-called double-muscled breeds are expected to be extreme in their muscle definition.

Frame Size

Frame size, as measured by hip height, is a highly heritable (.50-.60) trait that responds to selection. The average frame size of the commercial cattle population is estimated to be somewhere around 5.0 on a 1 to 9 scale. Most of the population ranges from 3.0-7.0.

Frame size can be used to estimate the weight at which young cattle will reach a given market endpoint such as Choice grade. Today the beef industry tends to discriminate against carcasses that fall much outside the weight range of 600-900 lb. Carcasses that grade Choice within this range likely come from slaughter cattle with frame scores that range between 4^{+} and 7^{-}.

In commercial herds, it makes sense to cull heifers that are smaller-framed than 4 and larger-framed than 7. In purebred herds, an acceptable frame score range will depend somewhat on the breed involved.

Replacement Rates and When to Make Decisions

Assuming a cow herd attrition rate of 14-20 percent , an average weaning percentage 80-90 percent , and a pregnancy rate of 90-95 percent on heifers, it is necessary to retain a minimum of 35-55 percent of the heifer calf crop to maintain a constant herd size. To allow some room for selecting on traits other than fertility, this makes it necessary to retain about ½-⅔ of the heifer calves at weaning time. These heifers should be fed a growing diet so as to gain an average of 1.25-1.50 lbs./day from weaning to puberty (12-14 months) and then a second culling decision can be made at that time.

Make another cut after a pregnancy exam of the heifers once the breeding season is complete. Make a final culling decision after the remaining heifers have weaned their first calves.

Summary

The following table lists selection guidelines for two

Trait	Moderate size, moderate milk breedtype	Large size, high milk breedtype
Minimum weaning wt., lb.	425	500
Minimum weaning wt. ratio	90	90
Minimum yearling wt., lb.	600	750
Maximum age at puberty, mo.	14	14
Minimum pelvic area at breeding, sq. cm.	160	190
Minimum condition score at breeding	5	5
Minimum wt. at breeding (65% of mature wt), lb.	700	875
Maximum age at conception, mo.	14.5	14.5
Maximum services per conception	2.0	2.0
Minimum wt. at calving (85% of mature wt), lb.	900	1,150
Minimum conformation score (17-point scale)	13	13
Minimum frame score	4	5
Maximum frame score	6	7
Temperament	Calm	Calm
Average daily 205-day milk production, lb.	12	17
Mature cow wt. (at condition score 5), lb.	1,050	1,350

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