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Michigan State University Extension Service
Harlan D. Ritchie, Davis R. Hawkins, Department of Animal Science
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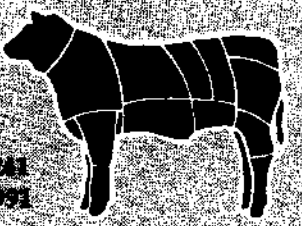

Selecting Beef Replacement Heifers

Harlan D. Ritchie and David R. Hawkins
Department of Animal Science

Cost of Raising 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 their first calves were weaned. Depending upon heifer retention rates and reproduction rates, heifer breakeven values ranged from $601 to $733 when production costs were normal (expected). If production costs were 15% higher than expected, the range was $692 to $832. If production costs were 15% lower than expected, breakeven values ranged from $407 to $634.

Depending upon the situation, heifer breakeven values may differ by as much as 100% ($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 those needed changes; or (2) consider purchasing replacements if they can be bought at a price and level of quality that makes it economically advantageous to do so. 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 wt)
2. Early puberty
3. Fertility
4. Ease of calving
5. Milking ability
6. Structural soundness
7. Disposition (temperament)
8. Fleshing ability
9. Muscle thickness
10. Frame size.

Early Growth (Weaning and Yearling Wt)

Selecting those heifers that have the heaviest actual weights at weaning time has two advantages: (1) the 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. There is some risk in selecting extremely heavy heifers. If overfat, their milk production could be lower 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 (lb of calf produced per lb 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) calves that finish out at higher-than-optimum slaughter weights (1,100 to 1,300 lb).

Weaning weight and yearling weight are moderately to highly heritable traits (.25 to .50) which means that selection for early growth is effective. As a rough guide, heifers that have weight ratios below 90 (herd average = 100) should be considered as candidates for culling.

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 fertility.

Research at the U.S. Meat Animal Research Center (MARC)

shows that age at puberty ranges from 10 to 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 1 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 to 5, where 1 is infantile and 5 is a cycling heifer with a palpable corpus luteum. This trait was shown to be moderately heritable (.32).

Research also shows that bulls with a larger scrotal circumference tend to sire heifers that reach puberty at an earlier age than bulls with a smaller scrotal circumference.

Fertility

Heritability estimates of fertility (conception rate) show it to be a lowly heritable trait (.00 to .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 coarse, 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 herd 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 a 60 to 65% first-service conception rate and a 95% pregnancy rate after no more than 60 days of breeding.

Ease of Calving

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

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 PA's 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).

If using A.I., use highly proven sires with low birth weight EPD's (expected progeny difference) to mate to yearling heifers. For those using natural service, seek out a bull that is a son of a low birth weight EPD sire and has a low birth weight himself.

Because PA is a highly heritable trait (0.5), you should be able to make progress in your cow herd by using bulls with large PA's and retaining their heifers. In comparing PA's among yearling bulls, they should be adjusted to a constant age or weight. The adjustment factor for age is .25 sq cm per day of age. The adjustment factor for weight is .09 sq cm per lb. A word of caution: select for PA within a size category because allowing size and PA to increase together will likely allow 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. Conversely, lower milk levels are better suited to limited feed conditions such as those in the arid southwest.

Many herds in the North Central region can still benefit from increased milk production. Within a breed, the most effective way to improve milk is to use sires or sons of sires that have high EPD's for maternal milk and then save their daughters. Retaining heifers out of the heaviest milking cows in the herd is also recommended. However, if a prepubertal heifer is overly fat from nursing her heavy milking dam, her own milking ability may be reduced.

Milking ability is not as highly heritable as the growth traits. Heritability estimates range from .15 to .30. Consequently, progress from selection for milk within a breed will be slower than when selecting for growth. For the commercial producer, the easiest way to increase milk is to crossbreed with a heavy milking breed of sire.

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 acceptance 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 to .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 European heifers whose teats are barely visible and appear to be embedded in a nest of long hair and fatty tissue. Conversely, 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.

Disposition

Research shows disposition to be a transmittable trait, ranging from approximately .15 to .40 in heritability. Cattle with extremely bad dispositions are difficult to handle and dangerous. Furthermore, extremely nervous females exhibit a lower A.I. conception rate than quiet females. Cull heifers with extremely bad dispositions.

Fleshing Ability

Heifers that flesh (fatten) easily are generally easy-keepers in the cow herd. They can subsist on lower-quality feeds and less total feed energy. They are more apt to breed back on schedule year after year. In addition, overly-lean heifers are apt to transmit less marbling to their slaughter progeny. 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 extremely fat.

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 maternal 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, somewhat approaching double muscled cattle in their appearance.

Frame Size

Frame size, as measured by hip height, is a highly heritable trait that responds to selection. Evidence suggests that over the past 20 years, frame size has been increasing at an average rate of 0.1 frame score per year. In many purebred herds in recent years, the rate has been faster (.15 to .20 frame score per year). The average frame size of the commercial cattle population is somewhere around 5.0. Most of the population ranges from 3.0 to 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 generally discriminates against carcasses that fall outside the weight range of 550 to 850 lbs. 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. Because some commercial herds are still too small and need improvement, purebred breeders can probably justify a frame score range of 5 to 8.

Replacement Rates and When to Make Decisions

Assuming a cow herd attrition rate of 15 to 20%, an average weaning percentage of 80 to 85%, and a pregnancy rate of 90 to 100% on heifers, it is necessary to retain a minimum of 35 to 55% of the heifer calf crop to maintain a constant herd size. To allow some room for selecting traits other than fertility, this makes it necessary to retain about 1/2 to 2/3 of the heifer crop at weaning time. These heifers should be fed a growing ration from weaning to puberty (12-14 months) and then another cut made at that time.

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

Summary

The following table lists selection guidelines for two breedtypes of cattle in differing environments. These are only a guide and vary with each operation.

Trait	Mod. size, mod. milk breedtype; limited feed resources	Lrg. size, high milk breedtype; abundant feed resources
Minimum weaning wt, lb	475	550
Minimum weaning wt ratio	90	90
Minimum yearling wt, lb	650	800
Minimum yearling wt ratio	90	90
Minimum age at puberty, mo	12	12
Minimum pelvic area at breeding, sq cm	150	180
Minimum condition score at breeding	6	6
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	8
Disposition	Calm	Calm
Structural soundness	Adequate	Adequate
Average daily milk production, lb	12	18
Mature cow wt, lb	1,050	1,350

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