Making Great Cows - Strategic Replacement Female Selection

Bob Weaber, Ph.D., Professor and Extension Cow-calf Specialist,

Department of Animal Science and Industry, Kansas State University

Introduction

Although the recent slip in calf prices may require cow-calf producers to sell more heifer calves than planned and forgo herd expansion, many producers will still keep a significant percentage of replacement females in order to maintain herd inventory. Producers retaining heifers this fall should consider several key strategies to select the best replacement candidates from their weaning pens.

The first step in any selection decision is knowing what it is that you desire. In animal breeding terms, that's your breeding objective. In the case of replacement heifers, your breeding objective should include a listing of the traits and attributes that you believe make a heifer a good candidate for selection as a replacement female for your herd. The traits included in this list should be focused on maternal traits that will aid a cow in being reproductively successful in your environment for a long time. Traits to consider include fertility, longevity, calving ease, milk, docility, mature weight, growth to weaning or yearling endpoints. Other attributes may include coat color, polledness, and breed or breed combinations to generate maternal heterosis. Recognize that many commercial heifers won't have EPDs for any of these traits, so they will largely be influenced by the sire selection that occurs in a herd over time.

In many cases, limiting environmental conditions will dictate that moderate or optimal levels of growth and milk or lactation potential be selected for rather than maximization of these traits. American Angus Association provides an effective tool for evaluating nutrient availability and selecting optimal ranges of Milk EPDs for sires of replacement heifers: http://www.angus.org/Performance/OptimalMilk/OptimalMilkMain.aspx . Cows with high growth and mature weights and lactation potential may outstrip nutrient availability on native range and require substantial supplementation. Use of selection indexes that heavily weight terminal traits are strongly discouraged for use as selection tools for sires of replacement heifers.

Additional factors that help identify replacement females that have a leg up to be great cows include:1) produced from a planned crossbreeding system; 2) produced by a proven sire; 3) born to a proven dam; 4) born early in the calving season; and 5) have moderate adjusted 205-day weaning weights. These factors will be discussed in more detail below.

Produced from a planned crossbreeding system

Heifers that represent optimal combinations of breeds known for superior maternal performance generally are a better alternative to straightbred heifers of otherwise equal quality. Maternal heterosis, or the heterosis the heifer will exhibit as a cow, has been shown in numerous studies to be very beneficial to commercial cow-calf production. About two-thirds of the economic benefit of crossbreeding comes from having crossbred cows; one-third from having crossbred calves. A bulk of the maternal heterosis benefit is driven by the improved maternal calving ease, fertility and longevity of crossbred females. First cross (F1) crossbred cows typically last about 1.5 years

longer in herd and have a 23-30% improvement in weaning weight per cow exposed thus improving production efficiency dramatically.

The use of crossbreeding offers two distinct and important advantages over the use of a single breed. First, crossbred animals have heterosis or hybrid vigor. Second, crossbred animals combine the strengths of the parent breeds. The term 'breed complementarity' is often used to describe breed combinations that produce highly desirable progeny for a broad range of traits. With useful across breed EPDs and adjustment factors, we can effectively select for improvement in a wide range of traits including carcass traits, while seeking to build environmentally adapted cows that leverage the power and value of heterosis.

Commercial producers continue to receive market signals to increase growth rate, performance and carcass value by downstream value chain participants while simultaneously facing increased production costs. Resulting in selection of less fit replacement heifers produced by bulls with diminished emphasis on maternal traits or appropriate biological type for the production environment. It is becoming progressively more difficult to find bulls for use in commercial production that meet all the goals of being a suitable sire for both terminal calves and desirable replacement females due to the growing antagonisms in the value chain between traits in the terminal and maternal objectives. The desire to produce environmentally adapted replacement females that are appropriate for mature weight and lactation potential (both of which establish maintenance requirement) in a given forage environment and management system, that may be trying to reduce the use of harvested feedstuffs, while simultaneously producing high value market targeted feeder cattle, has challenged the thinking of many producers.

One potential solution that may help optimize the selection of sires that produce desirable maternal attributes and market targeted calves is to separate this into two distinct breeding decisions. Doing so increases the selection intensity of both sire groups as they are no longer bounded by the demands of balancing the trait groups. Within both the maternal or paternal groups, breeders are able to make breed/line and individual selections that produce ideal combinations of breed and heterotic effects (i.e. selection for additive and non-additive genetic merit) that maximizes the value or profit in the system. An example would be British crossbred female mated to a Continental or terminal trait sire.

Heterosis Effects

Improvements in cow-calf production due to heterosis are attributable to having both a crossbred cow and a crossbred calf. Tables 1 and 2 below detail the individual (crossbred calf) and maternal (crossbred cow) heterosis observed for various important production traits for *Bos taurus* crosses. These heterosis estimates are adapted from a report by Cundiff and Gregory, 1999. They summarize crossbreeding experiments conducted in the Mid-west area of the US. Heterosis generates the largest improvement in lowly heritable traits. Traits such as reproduction and longevity, essential for cow-calf profitability, have low heritability. These traits respond very slowly to selection but heterosis generated through crossbreeding can significantly improve an animal's performance. The largest economic benefit (roughly 66%) of crossbreeding to commercial producers comes from having crossbred cows (Table 2.) Crossbreeding has been

shown to be an efficient method to improve reproductive efficiency and productivity in beef cattle.

Table 1. Units and percentage of heterosis by trait for *Bos taurus* crossbred calves.

Trait	Heterosis Units	Percentage (%)
Calving Rate, %	3.2	4.4
Survival to Weaning, %	1.4	1.9
Birth Weight, lb.	1.7	2.4
Weaning Weight, lb.	16.3	3.9
Yearling Weight, lb.	29.1	3.8
Average Daily Gain, lb./d	0.08	2.6

Table 2. Units and percentage of heterosis by trait for *Bos taurus* crossbred dams.

Trait	Heterosis Units	Percentage (%)
Calving Rate, %	3.5	3.7
Survival to Weaning, %	0.8	1.5
Birth Weight, lb.	1.6	1.8
Weaning Weight, lb.	18.0	3.9
Longevity, years	1.36	16.2
Lifetime Productivity		
Number of Calves	.97	17.0
Cumulative Weaning Wt., lb.	600	25.3

Crossbreeding's impact on profit

Enhanced profit is likely one of the strongest motivators for producers to implement effective structured crossbreeding systems. The substantial improvements in production efficiency measured as weaning weight per cow exposed supports improved profit and operational sustainability. Improved profit potential is realized through the simultaneous improvement in gross revenue stream to the ranch while decreasing costs of production through reduced replacement female requirements. Enhanced reproductive efficiency, especially in harsh environments, favorably decreases breakeven unit cost of production. Getting more calves to market endpoint, marketing heavier calves and selling a larger percentage of the calf crop through the benefits of individual and maternal heterosis, enhances gross revenue. Increasing revenue while decreasing or maintaining costs improves profit assuming constant inventories.

A variety of crossbreeding systems yield 20-30% improvements in weaning weight per cow exposed not including the additional value generated through sire selection within breed. This

represents a substantial change in output given relatively constant input. Simple examples of a 23% increase in weaning weight per cow exposed using a terminal sire/F1 (two cross) cow can generate $150-250 additional revenue per cow per year. I'm not aware of any set of calves that have generated carcass premiums of $150 premium per cow exposed regardless of breed or grid. In today's calf prices the value of heterosis for a herd of 100 cows is $15,000 to $25,000 per year and represents a decrease in breakeven costs of more than $30/cwt on 600 lb calves.

A well-constructed crossbreeding system can have positive effects on a ranch's bottom line by not only increasing the quality and gross pay weight of calves produced but also by increasing the durability and productivity of the cow factory. As you make your decision to straight-breed or cross-breed make sure you don't give away a couple hundred dollars per cow to make a $20-60 premium per calf sold at market or on the rail when **you can go for both**!

Produced by proven sire

Replacement female selection should start with selection of sires. Sires should be selected to produce heifers that meet the replacement female breeding objective outlined above. Use of fixed time AI to proven sires with high accuracy EPDs for maternal traits makes for an effective breeding/selection system. Select sires that optimize traits of cows so they fit your production environment.

Born to a proven dam

Replacement heifers that are born to cows that have been reproductively successful under your management for a long period of time are natural candidates as replacements. These cows are fertile and have demonstrated they are of appropriate mature size and lactation potential for your environment. Although selecting replacements from older cows increases your generation interval, it also buffers rapid changes in the genetic trend in your herd for other traits under selection that may be antagonistic to longevity and fertility. Note: if you desire rapid change in traits, selection of replacements from younger cows will speed up change by shortening generation interval.

Born early in calving season

Heifers born early in the calving season will be older at the initiation of their first breeding season than calves born later in calving season. They have a better chance of having reached puberty by start of breeding season and have a higher likelihood of breeding early in the season. These heifers are also likely from dams that conceived early in the breeding season and 'fit' in your management system and environment.

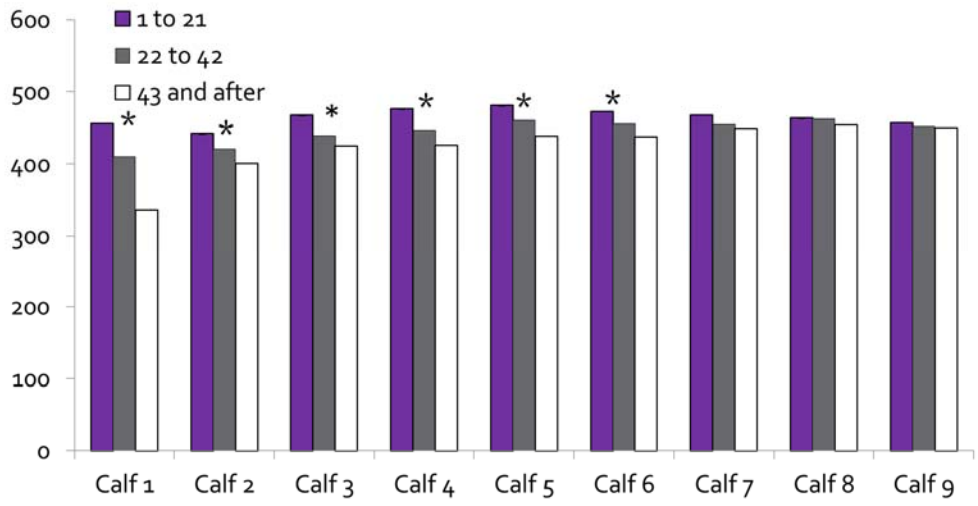
If your herd has a well-defined breeding season, selection of heifers born in the first 21 - 30 days of the calving season offer a significant improvement in longevity and breeding success over the long haul. In many ways, this trait of heifers trumps all other attributes. Data from Funston (2012), table 3, demonstrated that heifers born in the first 21 days of the calving season had 31% improvement in heifers cycling at the initiation of their first breeding season, a 12% higher pregnancy rate for their first calf, had 16% higher calving rate in the first 21 days of their first calving season, and weaned off 16 lb heavier calves.

Table 3. Production performance of heifers born in three consecutive 21 day calving periods.

	1st 21 d	**2nd 21 d**	**3rd 21 d**	**p-value**
n (%)	651 (64)	304 (30)	64 (6)	
Birth date	77[a]	93[b]	113[c]	<0.01
Weaning Weight	482[a]	469[b]	433[c]	<0.03
Prebreeding Weight	651[a]	642[b]	607[c]	0.01
Cycling @ breeding, %	70[a]	58[b]	39[c]	<0.01
Pregnancy rate, %	90[a]	86[b]	78[c]	0.02
Pre-calving weight	944	946	920	0.06
Calved in 1st 21 days, %	81[a]	69[b]	65[b]	0.01
Calf weaning weight	425	416	409	0.10

Heifers that produce their first calf in the first 21 d period as a first calf heifer have improved longevity in the herd. These first period calvers out last the females calving after day 42 by over a year (Cushman et al., 2013). Moreover, these females that conceived in the first 21 days of the breeding season as first calving heifers, produced more cumulative weaning weight through their sixth calving (see figure 1).

Figure 1. Effect of time of conception at first breeding on average weaning weight



Cushman et al., 2013

From middle group of adjusted 205-day weaning weights

If your cows are bigger than you would like to fit your environment, consider selecting replacement heifers from the middle part of the weaning weight distribution. Keeping the biggest, fleshiest heifers from your herd over time contributes to increases in mature cow weights and increased nutrient demand as cows. You should use age-of-dam adjusted 205-day weaning weights to classify your heifers' potential for growth. The adjustment procedures remove bias due to age of calf and age of dam at weaning. Heifers of similar genetic potential born at the beginning or the middle of a 90 calving season can have a difference in weaning weights of more than 100 lb so correcting for age is very important. Selection of heifers born early in calving season (see above) and selection for moderation of mature size/growth need not be independent events. For instance, one could compute adjusted 205-day weaning weights for all calves, select the middle half of the heifers as candidates, then choose the oldest heifers among these as replacements. This approach would optimize selection for moderate size and calved early.

A handy K-State Beef worksheet to compute adjusted performance measure for beef cattle is available here: http://goo.gl/Leq5Jc.

More information of beef cattle selection can be found in the NBCEC Beef Sire Selection Manual here (from KSUbeef.org): http://goo.gl/Zrc9pL.