

Breeding Systems Take Planning

The profitability of any cattle operation depends upon designing and using an appropriate breeding system.

Story by
BRAD PARKER

No one would build a factory, then decide what it will produce. Likewise, cattlemen shouldn't just buy breeding stock, then decide their production targets.

"Often we think of genetics as the first step rather than the last," says Dan Moser, assistant professor of beef cattle genetics in the department of animal sciences and industry at Kansas State University in Manhattan. But, he says, beef producers must identify their marketing opportunities, desired carcass characteristics, and growth and reproductive requirements before choosing herd sires or replacement females.

Commercial cattlemen must approach genetic selections much like an industrial engineer approaches planning a new production process or facility. While the engineer must consider things like human resources, raw materials and energy sources, the beef producer must keep in mind herd size, marketing outlets and feedstuffs, among other factors.

Moser says that efficiently turning available resources into a desired product requires designing a breeding system, deciding what breed or breeds will be used, and choosing the individual animals.

The system

Designing a breeding system involves deciding how many breeds to include and when to include them.

For most commercial cattlemen, a key component in their breeding systems is providing heterosis, or "hybrid vigor," which refers to the tendency of a crossbred animal to outperform the average of the breeds in its pedigree (see "Heterosis can boost performance in commercial herds" on page 90.). The system also has to be manageable and has to produce a uniform calf crop.

Maximum heterosis results from crossing two different pure breeds, such as breeding a purebred Angus bull to a purebred Simmental cow. However, such crossbreeding systems are not the norm.

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The most common method of capitalizing on heterosis through a planned program is a rotational crossbreeding system, says Dan Moser, Kansas State University. This refers to systems of crossing two or more breeds where the breed of sire is systematically rotated. [PHOTO BY SHAUNA HERMEL]

breed of sire is systematically rotated. Replacement heifers are generally retained. In a conventional rotation, sire breeds are rotated each generation so that females are mated to sires of the breed least represented in their own genotypes.

While including more breeds in this type of rotation will maintain a higher percentage of that maximum heterosis, it also increases the management and land-resource requirements, Moser says. Different breed compositions require specific management to maintain uniform carcass end points; and to accurately keep track of breed composition, each breed of bull will need its own breeding pasture.

To illustrate how complex this issue may be, consider that in a three-breed rotation using purebred bulls, three different genetic groups will eventually exist within a calf crop after a couple of times through the rotation.

"Different breed combinations are produced in the system, increasing overall variation," he says. "If calves can be sorted into groups by sire breed for marketing or feeding, variation in performance of each group should be no greater than purebred calves."

Beef quality and consistency at the consumer level relies on uniform cattle at the cow-calf producer's level. However,

that should not deter commercial producers from considering a crossbreeding program, Moser says.

"Certainly, crossbreeding can increase the amount of variation that we have in our cattle," he explains. "I'd argue that, if we have a good system, we can certainly keep that under control."

Moser maintains that cattle of similar crossed genetics will be just as uniform as purebred cattle if they're managed the same. The trick in rotational breeding systems, he says, is that the genetic makeup of the calves must be tracked.

The American Angus Association soon will be offering the Angus Beef Record Service (BRS) through its Commercial Relations Department to assist with this type of genetic tracking. (See "The Angus Link" on page 21 of the January 2000 *Angus Beef Bulletin*.)

The important thing is to establish a system and to stick with it, emphasizes John Crouch, director of performance programs for the Association. "Most crossbreeding systems are determined at the sale barn without any thought given to the discipline needed to carry out an effective program," he says.

While there are advantages from heterosis in a commercial setting, Crouch cautions producers about the increased

management requirements. He says straight-bred programs are simpler to manage and can take better advantage of high-accuracy expected progeny differences (EPDs), which can lead to market premiums that may compensate for the forfeited hybrid vigor.

The breeds

Once a breeding system is designed, the correct breeds must be chosen. Every breed has its strengths and weaknesses, and in every breed there are individuals strong or weak in any particular trait. Optimum systems capitalize on breed complementarity, Moser says, by matching breeds whose strengths make up for the others' weaknesses.

Moser, who earned both a master's degree and a doctorate in beef cattle genetics at the University of Georgia in Athens, suggests there are six points to remember when fitting breeds together: calving ease, growth, milking ability, carcass quality, carcass yield and cow size.

"Lots of antagonisms there; where you go for one, you may lose another," he explains. "Hopefully, you're developing a system that gets somewhere in the middle on all of these."

To add efficiency to a commercial breeding system, Moser suggests considering the use of a terminal sire. Terminal sires are those from which a producer doesn't keep any daughters as replacements. All the bull's offspring will go to market.

This is most common in a three-breed rotation, where the first two breeds are selected to provide heterosis in maternal traits and maintenance requirements. The third breed is used to add growth efficiency and carcass traits to the market-bound progeny.

Of course, this approach requires the producer to buy replacement heifers of the desired maternal breed cross or to maintain a separate breeding herd that will produce them.

Crouch explains that within a straight-bred system, individuals of the selected breed can be identified to fill both roles. "It should be noted that sufficient variation exists within the Angus breed wherein sires excelling in both growth and end-product merit can be selected," he says.

Producers using this type of system must choose bulls with high-accuracy maternal-trait EPDs to produce replacement females and bulls with high-accuracy carcass EPDs as their "terminal" sires, Crouch notes.

"It should always be remembered that the immense size and depth of the Angus database lends itself to very predictable

Table 1: Expected results of various rotational crossbreeding systems

Rotational System (using purebred bulls)	Proportion of maximum heterosis	Increase in wt. weaned per cow exposed	Breed combination of calves
Two-breed	67%	16%	67% breed A, 33% breed B 67% breed B, 33% breed A
Three-breed	86%	20%	57% breed A, 29% B, 14% C 57% breed B, 29% C, 14% A 57% breed C, 29% A, 14% B
Four-breed	93%	22%	53% breed A, 27% B, 13% C, 7% D 53% breed B, 27% C, 13% D, 7% A 53% breed C, 27% D, 13% A, 7% B 53% breed D, 27% A, 13% B, 7% C

Source: Gregory, K.E., L.V. Cundiff, and R.M. Koch. 1999. Composite breeds to use heterosis and breed differences to improve efficiency of beef production. USDA Technical Bulletin No. 1875.

performance within straight-bred Angus programs," he says.

The individuals

Selecting individuals is the producer's chance to fine-tune the breeding system. "If you've got a system in place and it works pretty well, ... but you need a little bit more of this or that, now is the time to really study the EPDs," Moser says.

Remember, there can be great variation within any breed just as there is variation between breeds. "Just because you plugged in the right breeds, if you didn't plug in the right bulls in those breeds, you can sure have problems," he admits.

By analyzing the herd's current carcass, performance and production records, a producer can decide the importance of a particular trait. Not every EPD available is going to have a significant effect on selections. Look for individuals that overcome the herd's weaknesses.

"It's hard to figure out what changes you need to make if you don't know where you're starting," Moser explains. He suggests comparing herd records to Standardized Performance Analysis (SPA) data.

The Angus BRS data, when it becomes available, will be another useful tool in this regard. County or area Extension personnel can help locate local averages that may be used as a barometer for change.

Moser also says EPDs should be weighted in light of the decisions made when selecting breeds. "Remember why you use that breed in the first place," he says. "If you use it to add milk, you probably don't want to buy the lowest-milk-EPD bull."

Establish a desired range of EPDs for each economically important trait based on the breed's average, remembering the average value for a particular trait is rarely zero. Also realize that EPDs can't be compared across breeds. "Hopefully

we've each devised a system and we know what breeds we want, so we can't really interchange bulls of different breeds anyway," Moser emphasizes.

He says experience is the best guide in establishing acceptable ranges and adjusting selection criteria. For example, if a producer hasn't had to pull many calves, there's no need to get more strict on birth weight EPDs.

Optimize growth, milk and cow size with genetic selections, Moser advises. "We can have too much or too little of about anything. Somewhere in the middle, depending on your operation, is probably where you need to be."

The emphasis placed on carcass traits depends on the end use of the progeny. "If you've got good carcass genetics and you've got somebody who'll pay for it, then it's worth putting into your system," Moser says. "Carcass traits aren't going to get less important."

He also reminds producers that a bull's actual performance is incorporated into the calculation of EPDs, so if the actual performance disagrees with the EPDs, there must be strong evidence in the animal's pedigree that the actual performance could be more the result of environment than genetics. Even selection based on low-accuracy EPDs will be more successful than selection on actual measurements or ratios, Moser says.

That's not to mean that environment should be ignored. In fact, the opposite is true. Select bulls raised under conditions similar to your own, Moser adds. He also encourages producers to select on mature size, fertility tests and structural soundness.

"Those genetics in terms of structural soundness go into the cow herd," he explains. "Longevity has a lot of value in the beef cattle business."

Most importantly, don't be afraid to spend a little extra money on good breeding stock. Cattle-Fax data show the most

profitable operations are those that spend more on bulls.

Putting it all together

By choosing balanced-trait bulls to use in a well-designed breeding system and sorting progeny based on sire breed to increase uniformity, producers can increase their returns.

But realize that one system won't work for everyone. "The guy across the fence might be doing something totally different, and you might both be right," Moser says.

Most importantly, stay with the plan. Producers who frequently change mating

systems greatly increase variation within the herd and often fail to realize the benefits desired.

"If you need to adjust, you can adjust individuals within the breed," Moser says. "But if you're scrapping the system too often, you're probably doing more harm than good."

Crouch agrees with that sentiment. "A successful crossbreeding program cannot be based on the 'Breed of the Month' or the fad of the year," he says.

Both Crouch and Moser encourage producers to use records collected before and after implementing the system to analyze its effectiveness and to select indi-

viduals that fit the environment and marketing opportunities.

"Cattle breeding is a long-term process, so don't short-change yourself by making short-term decisions," Moser concludes.



Editor's Note: For more information on designing a crossbred or straight-bred program using Angus genetics, contact John Crouch at (816) 383-5100. For more information on the Angus Beef Records Service, call Bill Bowman, director of commercial relations, at the same number.