A Matter of Priority

Prioritizing your cattle's production trait selection can put you one step closer to building a better beef operation — seedstock or commercial.

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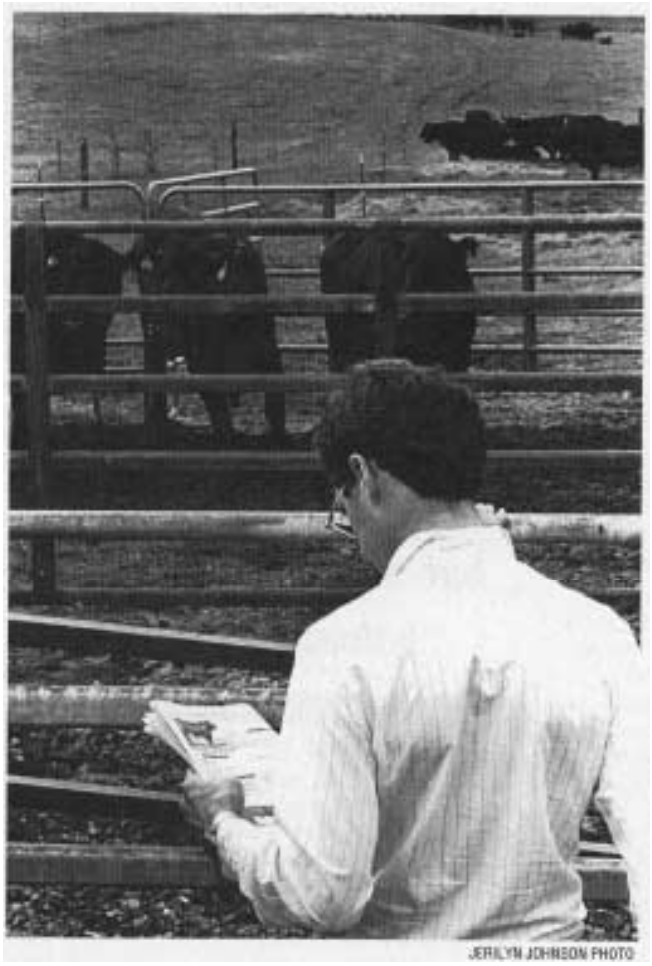
Perhaps the most enduring question asked by beef cattle breeders is, 'What traits should I select for, and how much emphasis should I put on each?"

There is no easy answer.

This is partly due to the large number of traits that are of importance in beef production, and partly due to the fact that the relative importance of traits depends on the natural enviromnent, management and economic conditions. And to make matters worse, some traits seem to work against each other; if you improve one, another one deteriorates.

This is what is meant by the term, 'genetic antagonism." Dealing with genetic antagonisms is difficult because it involves compromise, and as is so often the case in any endeavor, negotiating compromise is hard.

I would love to be able to supply truly objective advice, preferably in precise mathematical terms. And someday the state of computer simulation may be such that I can do that. But right now the best I can do is offer an approach for managing genetic antagonisms and addressing the larger issue of prioritizing traits. I call this approach a "thinking" model.



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A Thinking Model

The model I have in mind involves three basic steps:

1. Understand the basic nature of genetic antagonisms;
2. Become familiar with mitigating factors and breeding strategies that affect the seriousness of genetic antagonisms;
3. Reevaluate the severity of genetic antagonisms for specific situations relevant to your operation and make selection decisions accordingly.

And one more thing— be sure to do all of the above from the standpoint of a commercial producer. This may seem an odd approach to seedstock producers, but remember, the ultimate goal of seedstock production is (or ought to be) to meet the practical needs of the commercial beef industry. That can only be done if those needs are well understood.

So even if you're a seedstock producer who operates under conditions quite different from those of commercial production, address the question of trait selection from the perspective of a typical commercial customer.

Traits and Antagonisms Between Them

If we were to define the ideal beef cow, we would probably come up with something like the following

a. She conceives at an early age and breeds regularly thereafter;

b. She calves unassisted;

c. She produces healthy calves which gain fast and efficiently, resulting in high yielding, high quality carcasses of appropriate weight;

d. She eats very little.

This is not a complete list; I would be tempted to add statements relating to temperament, soundness and adaptability to specific environments. But if, for the purposes of this discussion, we limit ourselves to the above list, the following traits appear to be important: fertility, calving ease, milk production, growth rate and efficiency, carcass yield and quality, and maintenance efficiency.

Clearly not all of these traits are compatible. There are genetic antagonisms between them, specifically:

1. Milk production and growth rate (size) vs. fertility;
2. Growth rate (size) vs. calving ease;
3. Lean yield vs. carcass quality;
4. Milk production and growth rate (size) vs. maintenance requirements.

A Matter of Priority cont.

We know that heavier milking cows and fast growing, larger cows often have a more difficult time rebreeding. It's not that these animals are inherently less fertile. In fact, there is reason to believe that more milk is associated with greater inherent fertility. It's just that these animals have greater demands placed upon them for lactation, growth and maintenance, and these demands compete for energy needed for good fertility.

Growth rate and calving ease are clearly antagonistic. This is largely due to the mathematically positive but unfavorable relationship between growth rate and birth weight. With some exceptions, the larger the mature size of a breed, the greater the degree of calving difficulty.

Lean yield and carcass quality are antagonistic because of the way they depend on carcass fat. Yield improves as fat content decreases, but quality improves as fat increases. It's hard to have it both ways.

We have long assumed that maintenance requirements were a simple function of body size. Thus larger cattle need more feed to maintain weight. Now we find out that maintenance requirements are a function not just of body weight, but of the relative weights of more metabolically active tissues like gut and liver or the vital organs. Faster growing and especially heavier milking animals (or just animals with genes for heavier milk production) have greater vital organ mass and therefore higher maintenance requirements.

Mitigating Factors

The antagonisms outlined above can be serious, or they can be relatively benign, depending on mitigating conditions or factors. In general, these factors fall under the categories of natural environment, particularly nutritional enbironment, management, mainly as it relates to nutrition, but not exclusively; and economics, namely the costs of feed and labor; and the prices of cattle. Let's examine how mitigating factors work for each antagonism.

Milk production and growth rate vs. fertility

Heavy milking and fast growing (more productive) animals need not be less fertile if they get enough to eat. So it's possible to feed our way out of this antagonism, provided that feed is abundant and cheap.

Some enviromnents provide a consistent supply of adequate quality forage. These environments are conducive to larger, heavier milking animals. Some environments provide good forage much of the time, but occasionally they fall short, especially in periods of drought. More productive animals may be optimal in these environments three years out of four, but they incur greater risk.

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Cattle with less milk and size are a safer bet. Some environments don't provide outstanding grazing, but supplemental feed, such as silage, is so cheap that more productive cattle make sense anyway.

The type of limit on feed intake imposed by the environment affects milk and size antagonisms in different ways. Feed quality limits forage intake; the lower the quality, the lower the intake. Larger animals can eat more low quality feed than smaller animals simply because they have larger vats to store it in and larger tubes to push it through. And although larger animals have greater requirements, their ability to consume low quality forage outstrips their increased requirements. This is why elephants thrive in the African savanna where coarse feed is plentiful. So when feed quality is limiting, larger cattle may actually have an advantage.

Feed intake can also be limited by feed availability. This will occur when a manager is reluctant to provide necessary levels of winter supplement. More typically it occurs when forage is so sparse, or the time animals spend traveling or staying in the shade or out of the weather is so great there simply isn't sufficient time in the day to eat enough forage.

Under these conditions, larger animals cannot eat much more than smaller animals, but they have greater requirements. So, when feed availability is limiting, smaller cattle have an advantage. Large cattle and desert environments do not go together.

Heavy milking cows may have a greater incentive to eat than light milking cows, but they have no particular physical capabilities for consuming more forage. As a result, heavier milking cows are at a disadvantage when feed intake is limited for whatever reason. Because of this, I think we need to look more critically at milk production and be very careful not to put too much milk into range cattle.

Another mitigating factor is strictly economic in nature. It involves the relative value of cull cows vs. replacement heifers and the relative costs of maintaining mature cows vs. raising replacements. When cull cows are relatively valuable and/or when replacements are cheap to raise or buy, fertility becomes less important. We can afford to breed more heifers and cull more cows.

Under these conditions, the tradeoffs between milk production and fertility or between size and fertility are less serious. This is not the case when cull cows are relatively less valuable and/or when replacement heifers are expensive to raise or buy.

Growth rate vs. calving ease

One of the reasons larger cattle have more calving difficulty as first-calf heifers is that they have not been allowed to reach a size at calving commensurate with the size of their calves. So, to some extent anyway, we can feed our way out of this antagonism too. Again, for this to

work, feed must be abundant and cheap.

The problem is also less severe when cheap labor is available. Calving difficulty is not so costly if calf losses are kept to a minimum by helping heifers and cows in trouble. Size of operation can be a factor in this. Faster growing cattle may be more appropriate on small farms or ranches where the cattle are watched carefully at calving.

In contrast to antagonisms involving fertility, antagonisms involving calving difficulty are essentially unaffected by the relative value of different classes of cattle. A dead calf represents a clear loss; unlike an open cow, it has no trade-in value.

Lean yield vs. carcass quality

The antagonism between lean yield and carcass quality can be managed to some degree by controlling age and time on feed. For every biological type, there is probably some optimum set of feeding periods and slaughter weights and ages for which this antagonism is minimized.

Consumer preferences and grading systems have a strong effect. If Americans were to adopt European tastes and grading standards tomorrow, the conflict between yield and quality would disappear; quality would be of little importance.

Milk production and growth rate vs. maintenance requirements

Maintenance requirements are important because such a large proportion of total feed is used just to maintain the cow herd. Increased maintenance is not such a problem if enough feed is available. So again, more productive, higher maintenance cattle can be justified if feed is abundant and cheap.

Term of ownership is also a factor. If calves are not sold at weaning, but owned to slaughter, there will be more product sold per cow maintained— more product to offset the overhead of maintenance. Maintenance costs then assume less importance.

Breeding Strategies

The seriousness of genetic antagonisms is affected by breeding strategy. In this context I conceive of two basic strategies. The first is to find a happy medium by choosing appropriate breeds, breed combinations and individuals within breeds. Some breeds or breed combinations are simply better with respect to a particular antagonism.

For example, some breeds are sufficiently fertile that they can tolerate more milk and size before fertility becomes limiting. Some breeds and breed combinations represent better compromises. British x continental crosses, for example, generally do better at producing carcasses with both quality and cutability.

The same is true of individuals within breeds. There are needles in the haystack out there — individuals which seem to defy the rules. There are bulls which have easy-calving daughters, yet sire fast growing calves. And there are bulls whose daughters produce lots of milk, yet maintain body condition and rebreed well. These individuals are rare and hard to identify, but they are truly valuable. If they show up in sire summaries, it makes good sense to use them or their sons.

There are also individuals which don't defy the rules, but rather represent a reasonable compromise. They are not outstanding in any particular respect, but they have no great faults either. These animals can work too.

The second breeding strategy is to avoid genetic antagonisms by using terminal sires and light birth weight bulls. With terminal sires, we can have fast growing, efficient calves and still have a maternal cow herd that is fertile and easy to maintain. Moreover, we can probably get carcass yield and quality, as well. By using light birth weight or "heifer" bulls, we can largely avoid calving difficulty in first-calf heifers (which are the biggest problem anyway), and still get fast growing calves from the older cows.

Prioritizing Traits

Let's return to the "thinking' model outlined at the beginning of this article. The first two steps were to study genetic antagonisms and mitigating factors and breeding strategies which affect them. The third step is to relate this information to the specifics of your own operation, determine how serious the genetic antagonisms are in your case, and prioritize traits accordingly.

This is not an easy step. It will be a rare situation where the choices to be made are perfectly clear. And in the midst of this procedure you may find that management and/or breeding strategies need changing. If so, this third step will have to be repeated.

Few decisions can be made with perfect objectivity, and that is certainly the case in this last step of the trait selection process. If there is art in cattle breeding, it probably enters here. But at least this art will not be free-form; it will have a method.

lessons for Seedstock Producers

One of the most important things for a seedstock producer to know is how his/her cattle fit in a commercial program. Are they general purpose cattle? Or are they specialized cattle— calving ease, calving ease/maternal or terminal types? Many seedstock producers raise more than one kind.

If the cattle are general purpose, then the breeder should evaluate the seriousness of antagonisms for his/her customers. This is complicated because for every seedstock breeder there are many commercial customers, and no two commercial situations are exactly alike. The breeder needs to define the situation of a typical customer or of several categories of customers. The next step is to select for appropriate compromises in terms of growth rate (size), milk and composition. And always search for needles -the animals which defy the rules.

If the cattle are special purpose, and the breeder is honest enough to admit it, then prioritizing traits is easier. Select for only those traits that are important to the specialization and forget the rest.

Editor's note: *This article is reprinted from the 1992 Beef Improvement Federation Meeting proceedings.*

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