Balancing Angus Genetics and Hybrid Vigor in Breeding Black Cattle

Jim Gosey, Beef Specialist
University of Nebraska, Lincoln

Angus cattle are black. Many black cattle are Angus. Many Angus cattle have excellent marbling. Thus, the perception that all black cattle have excellent marbling and excellent carcasses. Although this connect-the-dot logic is faulty, this perception has become reality, particularly when cattle are sold live as weaned calves or feeder cattle. Color has become the most common descriptor used to market cattle sold live.

MARBLING, MARKETING & COLOR

Marbling is not the only factor driving carcass pricing as there are numerous market targets that reward other factors (retail product, leanness tenderness, optimum weight). However marbling is the swing factor in most markets, assuming Y4's and other "out" cattle are avoided.

Proof of this reality is found in the weekly Choice-Select price spread for box beef which has ranged from $4 to $12 for the most recent 5-year average. The wider Choice-Select price spreads exist because the market is undersupplied with Choice cattle and is trying to pull more Choice cattle into the beef supply.

The long-term goal of beef producers may be to breed superior carcass cattle for a color blind market but the short-term reality (at least for many markets) is that black cattle are generally sold for a higher price per pound.

REPLACE CROSSBREDS WITH COMMERCIAL PUREBREDS?

The extrapolation of logic regarding color has led many beef producers to first make their cattle black, then to work on making their cattle genetically superior in regard to production, carcass merit and reproduction. Producers should not be criticized for this decision, they are simply responding to a market reality. By this response many commercial herds have been drained of nearly all of the hybrid vigor that was once there in their crossbred cows and calves. Three generations of Angus bulls on F1 Angus-Hereford cows results in 15/16 Angus cows and loss of 87% of the hybrid vigor, particularly in important reproduction & production traits. Hardest hit are the lowly heritable traits (such as conception, survival, fitness) which do not respond well to selection for the more highly heritable carcass and growth traits.

Why did this happen?

1. Crossbreeding systems were mismanaged
2. Certified Angus Beef is a successful branded beef program
3. The Angus data base became large & powerful
4. Angus bulls & semen became the calving ease choice for breeding commercial heifers

5. The dominant black gene solves color inconsistency.

The widely criticized "so called" mongrelized and rainbow colored cow herds of the 70's and 80's led many producers and industry pundits to conclude there were just too many breeds to choose from. Thus, born out of frustration, one proposed solution was to return to the days of two or three breeds and purebred commercial cattle.

A purebred commercial beef industry based on only a small handful of breeds would probably increase uniformity, but at what cost? Can a single beef breed produce cows adapted to a wide range of environments and also produce high quality carcasses with excellent lean yield? Furthermore, could the above be accomplished without the coping mechanism of hybrid vigor? Not likely, unless the environment was consistently low stress and the beef market was narrowly defined. Given the powerful sire selection tools found in National Sire Evaluation programs there are certainly individual purebred commercial programs that are as productive as crossbred commercial programs because in low stress environments the advantages of hybrid vigor in that circumstance are small enough that purebreds can successfully compete. Thus, it would only take one drought year to blow the purebred commercial approach out of the water should it be used on an industry-wide basis.

The advantages of hybrid vigor for the economically important trait of calf crop weaned is well documented to average about 4% for crossbred calves and an additional 5% for crossbred cows. Research at the US Meat Animal Research Center at Clay Center, Nebraska estimates lifetime productivity of crossbred cows exceeds that of purebred cows by at least 20%. Hybrid vigor for crosses involving Brahma breeds would be even larger.

BREED DIFFERENCE OPPORTUNITIES

In the last three decades about 20 breeds have contributed significantly to the U.S. beef cattle gene pool. Table 1. lists these breeds in alphabetical order.

Table 1. Contributing Beef Breeds in the United States

Angus	Chianina	Maine-Anjou	Salers
Brahma	Gelbvieh	Pinzgauer	Shorthorn
Brangus	Hereford	Piedmontese	Simmental
Braunvieh	Limousin	Red Angus	South Devon
Charolais	Longhorn	Red Poll	Tarentaise

However, only eight of these breeds (Angus, Brahma, Charolais, Gelbvieh, Hereford, Limousin, Red Angus and Simmental) are currently major contributors to the breed composition of the commercial beef industry. Lest these eight breeds become complacent, there are other breeds that are waiting in the wings and given the right market conditions could become major contributors in the future. Not by accident, the eight major breeds have

larger populations and viable genetic databases, both necessary prerequisites to effect genetic improvement.

SEARCHING FOR CONSISTENCY

Following the rapid explosion of breed introductions in the 70's, it was inevitable that the beef industry would narrow its focus to a smaller number of breeds, however any further effort to develop the one perfect breed would be pointless and actually counter-productive. We must learn to use the breed differences that have been so carefully researched to build adaptable cows and target progeny to evolving market desires.

The fascination with high percentage or purebred commercial cattle has been partially prompted by a desire for greater consistency. However, lack of consistency was not caused by too many breeds or multi-colored crossbred cattle, it was caused by producing extreme biological types that weren't adapted to their environment as cows nor targeted to a specific beef market as finished steers.

CROSSBREEDING 899

Failure to stabilize breed composition has led to many failed crossbreeding programs, because the continual swing in breed composition became difficult to manage as some crosses had too much of a particular biological type thus the output became difficult to market.

Rotational crossbreeding systems using purebred bulls will work well if the breeds are similar in biological type. A two-breed rotation maintains 67% of maximum F1 hybrid vigor and a three-breed rotation maintains 87% of maximum F1 hybrid vigor. The difficulty of using rotational systems with purebred bulls is the resulting swing in breed composition which is multiplied when breeds used are not similar in biological type.

Potentially diverse pure breeds can be crossed to produce F1's of similar biological type. Such bulls can then be used in a rotation and can actually help solve inconsistency and ease management problems (fewer breeding pastures, etc). Thus more diverse breeds can be used which allows large breed complimentary effects and avoids big swings in breed composition. Two-breed F1 cattle and three-breed crosses with no back-crossing yields maximum hybrid vigor.

Another option is the use of composite bulls which generally are a blend of two or three breeds. Composites will yield less hybrid vigor, but are desirable since they can be managed similar to purebreds in terms of breeding pastures, identification of replacements, tracking matings, etc. and they offer constant breed composition.

The management ease advantage of composites comes from their flexibility in small and large herds and their "one-pasture" use which greatly simplifies grazing management. It is worth noting that the crossbreeding decisions made with composites are in the hands of the seedstock segment of the industry building composites and not in the hands of the

commercial users of composites. This might help avoid some of the extremes in biological type that have been observed in some crosses of the past.

Table 2. Example Crossbreeding Systems

System	Min. Breed A	Max. Breed A	Percent F1 Hybrid Vigor
Rotate Purebred A & B bulls	33	67	67
Rotate Purebred A, B & C bulls	14	57	86
Rotate F1 AxB and F1 CxD bulls	17	33	83
Composite AxBxCxD bulls	25	25	75
Composite AxB bulls	50	50	50
Composite A x (BxC) bulls	50	50	63
Rotate F1 AxB and F1 AxC bulls	50	50	67

The examples of crossbreeding systems in Table 2. show how composites can be used to reduce the swing in breed composition. The systems shown in the bottom half of the table indicate how the breed contribution of a specific breed, such as Angus (Breed A), could be fixed at a given percentage, say 50%. These examples show how a fairly large proportion of the crossbred cow could be a single breed, yet still yield 50 to 67% of maximum F1 hybrid vigor. It should be noted there is no self-contained crossbreeding system using purebred bulls that can maintain constant breed contribution and hybrid vigor.

Terminal sires (either purebred or composite) make the most sense when there is a clear conflict between cow adaptability and carcass merit. A highly adapted cow that is below average in carcass merit can be mated to a specialized terminal sire to produce optimal slaughter steer and heifer progeny.

IMPLICATIONS

Most commercial cows of the future will have at least 50% of maximum F1 hybrid vigor as a result of crossing only two or three mostly British breeds. This cow will likely be at least ½ Angus or Red Angus and will have no more than ¼ Continental breeding if in a program that produces yearlings for grazing but may have up to ½ Continental breeding if her progeny are placed directly on feed post-weaning. Feeder cattle will be the product of at least two generations of known genetics (including carcass merit) and sired by bulls with linkage to comprehensive databases. The stone-age practice of allowing the price of cattle to be influenced by coat color will continue only until such generic cattle are replaced by genetically sourced cattle that will be priced on factors that relate to their true profit potential.