
Roy Beeby, owner of Beeby Red Angus Prairie City Farms, Marshall, Okla., presented the following information at the recent International Stockman's School in San Antonio. Reprinted here courtesy of Winrock International, his presentations appear in their entirety in "Emerging Technology and Management for Ruminants."

Maternal Selection

by Roy G. Beeby

The history of breeds of cattle in the United States reveals that the commercial industry has intermittently turned to the breed that could solve periodic economic problems. In the beginning, the Longhorn was used because it could survive in West Texas and walk to a market in Kansas. The first English breed used by U.S. cattlemen was the Shorthorn, which had fleshing ability. Then the Hereford breed was used extensively because of its wide adaptability. Angus cattle were introduced for their maternal traits and carcass qualities. Brahman cattle became popular in southern areas because of their hybrid vigor contribution and their unique resistance to heat and insects. In recent years, a number of European breeds have been introduced for increased size, growth rate, and leanness. The popularity of the European imports, because of their size and gain, caused many of the British breeds to move rapidly toward size, performance, and terminal-sire production. This article will deal with some of the effects this move toward performance has had on the maternal traits of U.S. beef cattle.

Can one beef cow herd produce terminal-sire herd bulls and functionally efficient, maternal females? Negative genetic relationships among traits make this an extremely hard approach for beef improvement. Intense breeding for size can create problems in maternal trait selection. A more realistic procedure is a breeding program designed to produce a specialized maternal herd. The primary objective of the program at Prairie City Farms in Marshall, Okla., is maternal female and maternal sire production. The motivation for this maternal program is the belief that it



would be beneficial if all feeder calves had a maternal dam and a terminal sire. To accomplish this would create a tremendous demand for maternal cows that are more effectively produced from maternal bulls. Both maternal cows and maternal bulls come in a wide variety of sizes. This is good because the beef producing ecology of this world is very diverse.

Harmony with nature

The maternal-herd concept of Prairie City Farms has been influenced by a long family tradition of sound economics. The family operation, older than the state, began 18 years before statehood, on April 23, 1889, when my grandparents made the run into Oklahoma and staked their claim. Their first dwelling was a dugout, partly underground, partly walled up with sod, with an earthen floor and a roof of overlapping sod. Range riders from nearby ranches would stop by the homestead, but some of the most interesting visitors were bands of Cheyenne Indians from the west and Ponca Indians from the east. Even before statehood, our family had started in the cattle business. Since the homestead was only a mile from the "Cherokee Strip," open range was rented from the Indians to

graze cattle in the summer.

The year of the "Run," in 1889, marked the beginning of one of the worst drought cycles Oklahoma has

**Maternal reliability
combines regularity of
calving, short calving
interval, trouble-free calving,
and the ability to raise a
calf to weaning.**

ever known, and a disastrous nationwide financial depression. To the settlers, it brought actual hunger. For more than three years, they worked their land without raising anything but kafir corn and one very light crop of \$.40 wheat. For those who stayed, cattle and native grass brought them through. Reviewing hard times in the cattle business 100 years ago should help us evaluate our priorities for survival today.

The unique character of the early cattle breeding program at Prairie City Farms was its harmony with nature.

The natural resources were fully utilized and little outside supplementation was required. The cattle that developed were adapted to their environment. Any cow that was fat in the fall was sold for cash flow. Cows that gave plenty of milk and calved regularly never got fat. Cows that did not raise a calf or were poor milkers got fat and went to town. Although this practice was not designed as selection criterion for regularity of calving and milking ability, it served that purpose.

There were other beliefs, true or false, that were strongly held by the pioneers at Prairie City Farms. One was that the registered bulls purchased for the herd often introduced more problems than benefits. The second was that cattle shows provided breeders with a forum to exaggerate extremes in type and were often counterproductive to beef production. The third was that "blue sky" promotion of breeding stock had little relationship to the real world of cattle breeding. There is some truth in these traditional beliefs. We still try to avoid any problems or activity that compromises reproduction.

The commercial cattle industry through the years has used the breeds that promised to solve current econom-

ic problems. There have always been genuine seed stock producers striving to breed animals of value for the commercial industry. Also, promoters of popularity trends have always been available to carry new directions to extremes.

Problems that surface in the beef industry stimulate changes in direction. This could be referred to as the change cycle in beef cattle. Economics force a change until promotion of the change forces economics to force a change.

The most valuable cows may be the ones that can beat their competition in conceiving and raising calves on forage for a profit.

The change cycle in seed stock production repeats itself periodically. Today in seed stock production, we could be at the beginning of another change cycle. Breeds or families within breeds that have the ability to solve economic problems in the industry will be used. In the future, cattle that fill some special need in the beef industry will have their day.

At the time we founded our Red Angus herd almost 30 years ago, the industry used the terminology "beef cattle production testing." This phraseology soon gave way to the term "performance testing." This change in name may describe a transition in philosophy from total herd production testing to the performance evaluation of sires. Performance testing began to mean postweaning feed tests that increased adult size, growth, and gain in beef sires. Standards of perfection in the show ring also emphasized the theme that "bigger-is-better." The annual selection for maximum weaning weights was also biased for unlimited milk and growth. Female production in the performance movement has been almost a by-product of sire selection motivated by priorities for unlimited size.

Antagonisms between size and maternal selection

Maternal selection is more than milk production reflected in weaning weights. All of the things that make up motherhood in a cow and calf program are included: regular reproduction, gestation length, trouble-free calving,

mothering ability, survival of progeny, foraging ability, maximum intake of forage, adaptation to adversity, and weaning a desirable calf without heavy supplementation. These are all a part of the total influence of a maternal beef cow.

It is no secret that antagonistic genetic relationships among traits exist in beef production. Increased size in bulls can increase calving difficulties. Increased size and milk production in cows does increase maintenance requirements, which require the producers' greatest expense. Increased frame size can delay sexual maturity and may limit regular reproduction.

It should not be surprising that a change in one trait can cause changes in other traits. Sir Isaac Newton's third law of motion states: "For every action, there is an equal and opposite reaction." This law of physics may not be completely applicable to animal breeding. However, it can remind us that a change in a selection criterion should be evaluated for the total effect of all traits of economic importance. We may be on the threshold of a real need for specialization in trait selection in herds and breeds in beef cattle. It will be hard for individual animals to make signifi-

cant genetic contributions in all of the economic traits of efficient beef production. There is a real need in the industry today for specialized maternal breeds and maternal families to support the terminal-sire herds.

Maternal selection program

The maternal selection program at Prairie City Farms has been in progress for over a quarter of a century. The objective of the "maternal" approach has been to produce the optimum cow whose nutritional requirement does not interfere with regular reproduction in unpampered range conditions. This is accomplished by using as many sons as possible out of the regular-calving, top-producing cows of the herd. A direct route to genetic balance is provided by identifying those cows that can produce the maximum amount of calf on a regular basis in a natural environment and intensify their desirability in the herd through their sons.

Selection for fault-free cattle is the first priority in building a maternal herd, i.e., functional and structural soundness that includes trouble-free udders, feet, legs, eyes, reproductive systems, and disposition. These traits may not be the most important but you

do not want to propagate them in your program. Correct the faults in your herd by selection. You should never have to trim a hoof or treat an udder. Breed your herd until it is structurally and functionally correct. Your progress in developing a sound herd will be apparent when you do not make an excuse for any animal you own.

An April 1976 Prairie City Farms advertisement described an ideal maternal cow as follows:

- Be fast maturing and sound
- Be able to conceive on exposure
- Be able to calve trouble-free
- Raise an outstanding calf every year
- Wean calves over 50 percent of her body weight

There may be a better description of an ideal maternal cow, but there is little doubt that a cow that fits this description is maternal. A new procedure is now being tested at Prairie City Farms for the selection of maternal cows that have optimum productivity in their environment. It is called MATE (maternal analyses = total efficiency).

An observation was made in our advertisement concerning the selection of a maternal herd sire: "When you select a herd sire for maternal traits, you do not have to make great sacrifices in weaning weights, postweaning rate of gain, or mature weight. But you cannot select on these traits alone and obtain a bull that will produce maternal females." Bulls produced in our program have convinced me that there is truth in this statement. A maternal bull is one that produces maternal females.

Another Prairie City Farms advertisement described what was felt to be the frontier for cattle breeders—maternal reliability. The virgin territory in cattle breeding today is maternal reliability. It cannot be measured in the show ring, on the scales, or in the cooler. Selection by current procedures, feed test gains, or adjusted yearling weight will not improve it. Few sire progeny tests include it. Yet maternal reliability adds more net profit to commercial cow herds than any other trait. Maternal reliability combines regularity of calving, short calving interval, trouble-free calving, and the ability to raise a calf to weaning. The cattle industry today does not have enough interest or emphasis aimed at improving the regularity of production in beef cows. This is why maternal reliability is a frontier in cattle breeding.

Another effect of maternal reliability is longevity. A cow decreases her

chances of being culled if she is structurally and functionally sound. To have optimum producers, breed cows with the following ideals:

- High-producing cows that will not quit
- Cows that can stand the stress of producing more milk on grass and forage and still breed back in time to calve during the same month the next year
- Cows that produce heavier-than-average calves for the herd every year and still remain sound without developing udder or feet problems
- Cows that do not develop health problems or die due to the stress that milk production and regular calving places on them
- Cows that continue to perform on a regular basis and lead the herd on weaning weights during the drought years when feed is short but still breed back
- Cows that don't foul up when they are entitled to—cows that just won't quit!
- Cows that are bred with these ideals in mind are optimum regular producers, not quitters.

Table 1 describes some selection techniques used by Prairie City Farms for producing and maintaining a maternal herd.

Table 1. Six essentials for producing and maintaining a maternal herd.

1. Each year, eliminate any cow that fails to calve trouble free or wean a calf.
2. Select replacement heifer calves from cows that breed early in the calving season and calve unassisted.
3. Keep the bred heifers that breed early in the breeding season and calve unassisted.
4. Select herd sires with acceptable birth weights from the highest-producing females in number 1 and number 3 above.
5. Breed the bulls in number 4 above to the females in number 2 and number 3, and continue to practice number 1.
6. Do not engage your cattle in any activity or program that interferes or compromises rules number 1 through number 5.

This formula for producing and maintaining a maternal herd is certainly not for everyone, and is easier to establish in a functionally sound herd.

It is not compatible with a show program. Current sire-evaluation programs are not presently being utilized successfully to produce maternal bulls. The performance of a sire's daughters should receive primary consideration in maternal sire selection.

In the past, maternal bulls could only be discovered through the function and production of their daughters. Successful maternal bull selection can be enhanced when prospects are picked from the higher performing, regularly producing females in the herd. The dams that have the ability to function regularly and efficiently within the herd fit the environment for the herd.

Cows that are not regular in their production within the herd may have one of the following adaptation problems: cow size too large; too much milk production; lack of appetite; poor foraging ability; timid disposition. Any one or a combination of these traits, or others that cause a cow to be irregular in her production, should not be transmitted to the herd through her son.

Females by sires whose dams are functionally efficient within herd should be more compatible to the program than those sired by outcross bulls from different environments.

The beef industry should have programs specifically designed to produce specialized strains of seed stock. The industry needs to give a higher priority to the production of maternal strains of beef cows.

Producing Cows with Optimum Productivity for Their Environment

Criteria for selection

Maternal selection for optimum productivity in diverse environments is a formidable challenge for beef-cattle seed stock producers today. Before outlining this challenge, perhaps I should first define the way I am using the words "optimum productivity." "Optimum" is used as the best results obtainable under specific conditions and "productivity" as the creation of something of economic value. Thus optimum productivity in a cow can be defined as consistent efficient production of a product of economic value.

Cow productivity combines all of the

things that make up motherhood in a cow and calf program and can be defined as optimum production with maximum reproduction in a cow's natural environment. The selection criteria should not be guided by anything that interferes with reproduction. The role that cattle will play in commercial production should determine the choice of priorities, and the selection objectives should be in harmony with the environment in which the cattle will be raised.

Past trends

Since the 1950s, the "performance movement" has directed much effort to improving growth and carcass characteristics, and because these traits are intermediate and high in heritability, they have responded to selection very well.

Seed stock producers may be required to show some restraint in keeping performance trait improvement at a level that is compatible with the operations of customers.

In addition, breeders have derived some "glamour" and promotional benefits from these traits through feed tests, carcass contests, and the show ring. Ideally animals would be evaluated on the basis of physiological maturity rather than chronological age as occurs in the previous events.

In contrast, heritability is relatively low for reproduction. The selection emphasis for increased frame size has been negative for total reproduction efficiency. Moreover, maternal selection has not been glamorous. You may feel as lonesome as the proverbial Maytag repairman if you have had a maternal selection program for the past 25 years.

The economic pressures to increase outputs, including weight at weaning and yearling weights, have been very compelling in the beef industry. Performance breeders have produced successive generations of cattle with each generation heavier at maturity than its parents. This has increased the maintenance cost of the herd. However, once optimum levels of size and milk production are achieved, additional selection for size can be counterproductive to the reproductive traits and can only be justified in the production of terminal sires.

Future needs

Crossbreeding systems in the commercial industry correctly use terminal sires on maternal cow herds. In the future, the need for terminal sires could be met with a relatively small part of the seed stock population, while there is a much greater need for maternal cow production. Many of the traditional maternal female seed stock sources that were available at the beginning of the performance movement have been incorporated into terminal-sire upgrading and crossbreeding programs.

Currently, economic conditions suggest future changes in beef production in the United States. Such changes may include more beef produced on grass and roughage. The most valuable cows may be the ones that can beat their competition in conceiving and raising calves on forage for a profit. Cows that are superb grazers should play an important role in food production in the future.

Although all cows will eat forage, some cows eat more forage per unit of cow weight and many utilize it more efficiently than others. A production test for a cow could be described in the following terms:

- Produces a calf every 12 months
- Gives enough milk to raise the calf
- Provides enough inherent growth to the calf for a profit
- Performs the above on grass and forage with a minimum amount of supplementation

Weight is a good description of size. Frame size is a popular substitute today. A long-legged 1,200-lb. cow has been considered larger than a short-legged 1,200-lb. cow. Breeders often refer to frame size rather than weight size. The other dimensions in animal size are length and thickness; both contribute to an animal's weight. Although an animal's height can be measured in inches, its "largeness" must be determined on the scales. Weight records the accumulation of all dimensions of size. (I have observed that weight size is not as negative a factor as is frame size in maternal selection.)

Many producers have made significant improvements in weaning weights, thinking there was no limit to progress, when suddenly they could advance no further or the cows showed irregular reproduction. Such findings could be a sign that the genetic ability of their cattle has outgrown their available energy. The environment can place a ceiling on milk production, and (or) cow size, and (or) reproduction. When this happens,

one option is to improve the environment, but this is seldom profitable for the operation or desirable for the commercial customer. The alternative is to select females that have the ability to produce calves regularly and effectively in their environment.

Seed stock producers may be required to show some restraint in keeping performance trait improvement at a level that is compatible with the operations of customers. Competition among seed stock producers for maximums in performance trait development can be counterproductive to commercial customers. Increased birth weights resulting in calving problems and increased size, and milk production resulting in increased maintenance and decreased regularity of calving, is

Commercial beef herds can progress without registered cattle; it is up to registered breeders to see that the commercial beef herd can continue progressing with registered seed stock.

"progress" that most commercial customers cannot afford.

My experience through the years suggests that the selection for heavier weaning weights and postweaning gain has made it more difficult to maintain appropriate birth weights. In our herd sire selection, we should not pick prospects with maximum gain if they have an unacceptable birth weight. A seed stock producer must not rationalize that increased birth weights might be justified, even if his herd shows no associated difficulties. The calving difficulties experienced by his commercial customers must govern his tolerance for increased birth weights.

When outcross sires are from areas that are dissimilar to those where they will be used, there may be negative efforts for selection for environmental adaptation. Artificial insemination provides an extensive choice of sires. Sire selection within-herd from outstanding, regularly producing females is a more positive approach to producing females adapted to the operation.

Beef cattle shows may also have a negative influence on selection for a specific environment; show animals are raised in a near-perfect environment and many areas where they will be used

are not so ideal.

Registered seed stock producers should not lose touch with the problems of the commercial beef industry. A lesson can be learned from the poultry industry. Registered chicken breeders once supplied seed stock for commercial chicken producers. Today, 100 percent of the breeding stock for broiler and egg production is produced by the commercial industry. Registered chicken breeders are no longer in the real world of food production. Many of the associations for poultry breeding still exist and their breeders still produce, exhibit, and sell breeding stock to each other, but they are in a world apart from the commercial broiler and egg producers.

Promotion of registered breeding stock will be a necessary part of the cattle business until such promotion leaves the real world of profitable beef production. Commercial beef herds can progress without registered cattle; it is up to registered breeders to see that the commercial beef herd can continue progressing with registered seed stock.

Some specific goals

How successful has the beef industry been in developing a beef-improvement program for all environments and breeding objectives? Performance testing took the correct direction 30 years ago; today there are indications that some modifications should be made. Some signs of beef improvement limitations in beef cow herds are:

- Birth weight increases, resulting in increased calving problems
- Cows failing to breed back, resulting in irregular calving
- Cows harder to maintain while nursing, requiring increased supplementation
- More stress, resulting in increased health problems
- Shorter average longevity in the herd
- Heifers breeding later, resulting in fewer calves weaned during lifetime
- Bull calves reaching sexual maturity later
- Mature bulls too large for heifers in natural service

The goal of beef improvement has been to help seed stock producers develop maximum potential for growth—which results in an increase in size without an upper limit. Maternal selection for functional efficiency requires an upper limit on growth dictated by ecology, management, and breeding objectives.

AJ