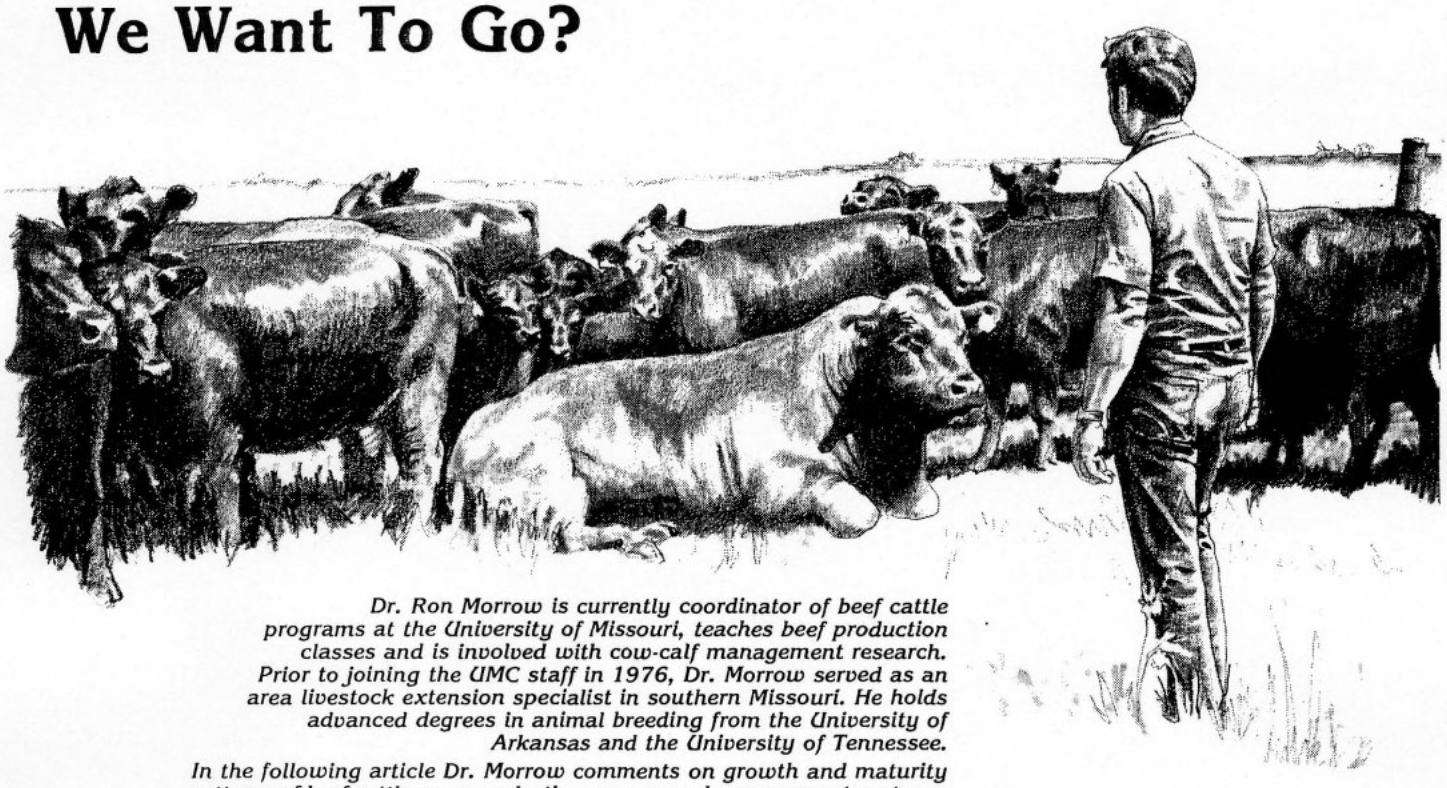
Maturity Patterns

Is Selection Taking Us Where We Want To Go?



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In the following article Dr. Morrow comments on growth and maturity patterns of beef cattle vs. our selection process and management systems.

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Whenever cattlemen get together these days, cattle selection is usually a popular point of discussion. Changing cattle types, availability of new breeds and economy of production have stimulated discussion. The decade of the 70s saw us make great strides in changing our cattle to a different type from the small frame, early maturing cattle of the 50s and 60s to the present large frame, late maturing animal. Very few people argue against increasing the size of our cattle over the early maturing cattle. The question in the early 80s should be, "Where to now?" Are we presently discussing the selection and evaluation process using the right terminology and with the proper goals in mind?

Beef cattle selection necessitates evaluating the growth pattern of the animal. We realize one weight on an animal at a particular age tells us very little about that animal. More information is needed to properly delineate growth. A series of weights at critical ages would more accurately show the growth pattern. For example, the superiority of adjusted 365-day weight is recognized since weaning weight and gain on test make up the figure. By adding a statistic on skeletal size (frame score) or an estimate of body composition with any particular weight in the series one can more accurately predict growth potential as well as appraise previous growth.

Any discussion on growth needs to begin with a review of the work of Samuel Brody at the University of Missouri and published in "Bioenergetics and Growth" in 1945. Brody worked with a mathematical equation to analyze weights of an animal and describe growth with two parameters. One estimates mature weight of the animal and the other is an estimate of the rate at which an animal matures. This can be illustrated in figure 1. The jagged line represents the actual weight of the animal; the smooth line the growth curve as estimated with Brody's equation.

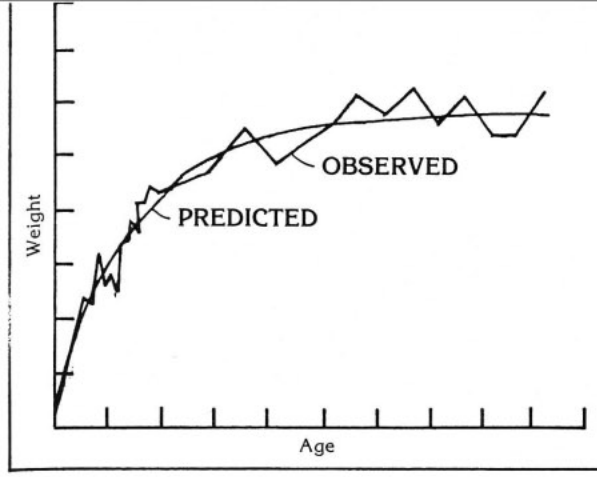

Figure 1

Studying the total growth of an animal more accurately describes growth patterns and relationships than does single weights or measures at a particular age.

Considerable research has been performed at the University of Arkansas, University of Tennessee and Texas A&M University using Brody's equation to study growth of beef cattle. C.J. Brown at the University of Arkansas has illustrated four types of growth curves (figure 2). The type of growth characterized by cattle of the early 60s is the early maturing animal to a low mature weight (I). The other extreme would be a slow maturing animal to a high mature weight (II). The two other types are slow maturing animals to low weight (III) and fast maturing to a high mature weight (IV).

A negative correlation normally exists between rate of maturing and mature size. In other words, cattle with heavier mature weights will take longer to mature. For this reason we have been selecting for late maturing cattle (and ultimately heavier mature weights) the last few years to move away from early maturing, lightweight cattle. A lot of commercial beef producers in the country still need to work toward that goal but as the purebred producer focuses in on the 80s and possibly the 90s we need to reevaluate this procedure. Better commercial producers are already asking the question and may even have some of the answers on evaluation and selection of cattle.

Two negative points in selection for late maturing, large mature weight cattle are (1) larger animals will need more feed to maintain their weight and (2) later maturing heifers will take longer to reach puberty or require a higher energy ration to reach puberty at the same chronological age. Both relate to the onset of fattening, which must occur at some point in the growth cycle.

The first is important to the beef producer because of his feed availability. Beef cattle are, and need to be, forage utilizers. They must be able to maintain body weight and function (reproductively) on high forage diets. The commercial producer is very concerned with form and function, both as it relates to reproduction and to efficiency of production (growth). His cattle must have the volume and capacity to produce on forages, yet produce calves of high growth potential. Consequently, we now hear a lot of discussion on "easy keepers" and "hard keepers". Is this something we can include in our selection programs?

The second point also relates to reproductive ability. Brody showed us an animal reaches puberty at the point of inflection on the growth curve. This is the point where growth is the most rapid and most efficient—the point at which the increase in growth velocity ceases. This relates to the physiological maturity of cattle. An Angus heifer that is a four frame may reach puberty at 650 pounds and a six frame heifer at 750. The age is dependent upon management.

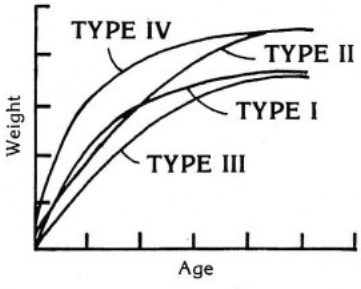

Figure 2

Growth patterns and maturing rates can vary with management as well as genetics. Selection programs need to emphasize types to fit specific management systems.

A producer with both types of heifers has two options: 1) Keep the same management program to allow both types of animals to gain the same and thus breed the late maturing to calve at 2½ or 3 years of age, or 2) Change the feeding program to allow the later maturing heifer to reach the needed weight to be bred to calve at 2, which increases cost of heifer development.

We recognize that large mature size cattle are not fitted to all management situations (forage systems). A commercial producer needs to evaluate his program and match type of cattle and management system.

Purebred producers recognize the need for growth and that skeletal size (frame) is indicative of growth (mature weight) potential. Linear skeletal growth increases faster and matures earlier than thickness growth. Therefore, weight is later maturing than height. For example, cannon length is 85 to 90 percent mature at birth. This partially explains the popularity of the numerical frame score of cattle developed by John Massey at the University of Missouri. First, height is a fast maturing measurement and secondly, large frame cattle are late maturing to a large mature weight. The Chianina breed is a classic example. Selection using frame score has certainly been beneficial in increasing the size of our cattle. The question to ask is, "What next?"

If we analyze the maturity pattern of weight we recognize considerably more variation in rate of maturing than mature weight. A recent analysis of growth curves of Angus cattle at 11 Southeastern universities showed a 20 percent variation in mature weight and a 37 percent variation in rate of maturing, indicating a large amount of difference in growth of cattle going to the same mature weight. Keep in mind if two animals have the same mature weight and one is late maturing and one fast maturing, the one with the best rate of gain is the fast maturing one. He is also the more efficient. Therefore, the shape of the growth curve rather than its magnitude is related to efficiency and this is where we should focus our attention.

What we do not know in purebred production is how the growth curve parameters are changed through management. Commercial beef cattle feeders can change the end point at which a steer should be slaughtered by the feeding program. Most agree a small frame steer can be backgrounded (grown) for a time before going on full feed and he will finish heavier. On the other hand, a large frame steer put on feed directly after weaning would finish lighter than if he were backgrounded. Thus we are changing the shape of the growth curve more than the mature weight.

For several years now we have been selecting for increased linear growth. This will probably increase mature size and will decrease rate of maturing as shown by look-

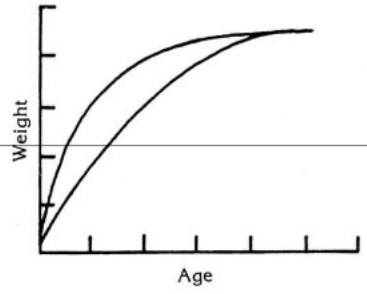

Figure 3

When two animals have the same mature weight, the later maturing animal is the slower gaining, and the faster maturing is the faster gaining.

ing at the diagram of two curves with both animals reaching the same mature weight (figure 3). Our preference has been to choose the animal that appears to have the most growth left (later maturing), sometimes without a great deal of regard to what his previous growth has been. Are we sure this is genetic, or even more important, desirable?

Two examples can be used giving different perspectives. First, let's look at two bulls handled after weaning in two ways. One bull is put on a 160-day feed test and gains 4.0 pounds per day. The other bull is "grown" at the rate of 2.5 pounds per day. Height would not be appreciably affected by the two feeding systems; therefore, if the two bulls have the same mature weight potential, one appears to be fast maturing and the other late maturing because the management system we imposed on them does not allow the one bull to fully express his genetic potential for weight gain. Visual appraisal would favor the late maturing or slow growing bull because of maturity pattern.

On the other hand let's look at two bulls weaned and put on test together. One bull gains 4.0 pounds per day and the other 3.0. Both bulls are gaining according to their genetic potential. If they have the same height with the same mature weight potential the slow growing bull will keep growing longer than the fast gaining bull. Body composition is not necessarily the answer as research at Ohio has shown animals gaining faster are also putting down more fat. Based on maturity pattern, we are selecting against genetic potential for growth and selecting for slow, prolonged growth if we take the late maturing animal. Why is the late maturing animal growing slower?

People working with feed efficiency feel the ability to gain is reflected in appetite and ability to eat a lot of feed. If this is true we can be selecting for inefficient cattle or animals without capacity for feed when we select late maturing cattle over fast maturing cattle, if they have the same mature weight potential.

We see a lot of information on frame score of cattle and we have discussed its merits. We also have alluded to problems of using only height and some people are emphasizing several body measurements to increase functional efficiency. The people using several body measurements and weight are probably selecting for fast maturing cattle (not to be confused with early maturing cattle). In our example of bulls on test, the use of several body measurements would favor the fast maturing bull. This is shown in work at Tennessee where basing selection upon several body measurements increased mature weight and rate of maturing.

We probably have enough variation in our cattle now (within breeds) to select for cattle that are fast maturing and large; whereas, 10 years ago we did not. The breeds that are to continue to be strong in maternal traits need to face the issue of maturity pattern. The producer wanting to increase efficiency needs to be aware of how maturity patterns and management systems interact. There is no such thing as the ideal animal—only the optimum management system for each type. AJ