

RANGE BEEF HERD GROWTH SELECTION

*D.E. Ray,¹ A.M. Lane,²
C.B. Roubicek,³ and R.W. Rice⁴*

A major economic goal of the cattle producer and others in the beef industry is the genetic improvement of growth traits in range cattle. Superior genetic growth potential is reflected in improved feedlot efficiency and carcass desirability. These factors make it imperative that the cattle producer use accurate objective measurements and selection methods to identify the superior genotypes in his herd.

The growth performance of range beef cattle in areas of year-long grazing reflects forage availability as well as climatic stress conditions. Because annual rainfall and temperature patterns in an area directly influence quantity and quality of range forage, all range stock are subjected to varying periods of feed or nutrient restriction. Live weight and body measurement data show that with only range feed available, growth in weight is strictly seasonal from weaning to maturity.

A successful selection program for improvement of performance traits in beef cattle depends on selection for a specific trait and understanding how selection for one trait may influence other traits. The major purpose of the study to be described was to obtain information on genetic parameters of growth of range beef cattle under a practical management system. This information should be directly applicable to a performance testing program for the range cattle producer.

MATERIALS AND METHODS

Data were obtained from the registered Hereford herd owned and maintained by the Apache Indian Tribe at San Carlos, Arizona. With the initiation of the study, individual breeding pastures were developed for the registered herd. Each pasture carries 30 to 35 cows and averages about 600 acres in size. Cows were allotted to the breeding pastures in January for calving during the following three months and remained in the individual pastures through the breeding periods, May 1 to July 30.

The general range area is at an altitude of 5,000 feet, with range forage consisting primarily of desert grassland vegetation. Annual rainfall averages about 14 inches with most of it occurring during the summer months of July and August. Temperatures may range from -20°F in January to 95°F in July.

Individual data recorded at birth included identification, birth date and weight. The calves were ear tattooed with individual identification numbers. During the nursing period pertinent comments concerning unusual maternal or calf information that could affect performance were noted.

In the fall all cows and calves were brought to corrals for weaning. The calves were weighed and individually scored by three judges for conformation and condition.

Bulls and heifers were maintained separately after weaning. Subsequent weights and scores were obtained in the early spring (about March 1) before the appearance of new range forage, again in the fall at weaning time and the following spring. Thus, four stages of development were represented, with an average mean age at each stage of 8, 11, 20 and 23 months. Records from more than 1,500 calves were utilized in this 10-year study.

None of the bull calves were castrated during this period. The herd was maintained on a year-long grazing program with little, if any, supplementation. It should be noted that during the more severe winters of the test period snow cover remained on the ground for several days at a time.

Sires used in the herd during the years of this study came from many different sources. They included purebred herds from Arizona and surrounding states, the Arizona Agricultural Experiment Station, United States Department of Agriculture performance tested lines, and bull progeny produced in the herd.

RESULTS

Average weights and the heritabilities of the weight at each age are summarized in Table 1. Only the bull calves are included in this report, although similar results were obtained with heifers. The average weaning weight of 480 lbs. at an average age of eight months translates into a daily gain from birth to weaning of 1.7 lb. This emphasizes the importance of having cows calve early in the season, as one month's difference in birth date resulted in an average difference of 50 lb. for the calf at weaning.

Table 1. Average Weights and Heritabilities

Age	Weight (lbs.)	Heritability Percent
Birth	76	50
Weaning	480	15
340 days	440	30
600 days	825	50
710 days	700	50

The weight losses that occurred over the two winter periods (weaning to 11 months and 20 to 23 months of age) should be very typical of unsupplemented range cattle in Arizona

and many other parts of the world. It is not uncommon for animals to lose 10% or more of their weight from fall to spring under these conditions.

The highest values for heritability (50%) were for birth weight, long yearling weight (20 months) and weight as coming two-year olds.

The lowest heritability was for weaning weight (15%), with short yearling weight having a heritability of 30%. Many times the meaning of heritability is misunderstood. Probably one of the best ways to use a heritability value is in predicting how much improvement can be made when selecting for a particular trait. As an example, assume we selected replacement bulls and heifers in this herd that averaged 50 lb. above the weaning weight for the herd. We call this value (50 lb.) the selection differential. If we mate these replacements together, then we would expect their calves to have an average weaning weight 15% (heritability) of the selection differential (50 lbs.) above the herd average (480 lb.). In this case, that would be $15\% \times 50 \text{ lb.} + 480 = 487.5 \text{ lbs.}$ Obviously, the higher the heritability value for a trait, the more improvement we will make in the process of selection.

The major questions posed in this study were (1) what effect does selection for a specific trait have on other traits, and (2) when would be the "best" time to select replacement animals. To help understand Table 2, let's consider the information on the first line. In this case, we are selecting only for heavier birth weights (which we probably would not do). If this were the actual situation, birth weight would be increased by 5 lb. per generation. Due to what we call the correlated response, the other weights would also increase. In this example, selection for birth weight would also result in weaning weight increasing by 4 lb., yearling weight by 5 lb., and 20 and 23 month weights by 10 lb. each.

Table 2. Direct and Correlated Response to Selection

Trait Selected For	Change in Weight (lb.) At:				
	Birth	Weaning	11 months	20 months	23 months
Birth weight	5	4	5	10	10
Weaning weight	1	6	7	9	8
11 month weight	1	7	12	13	15
20 month weight	2	7	11	25	22
23 month weight	2	6	12	22	25

If we are primarily concerned with weaning weight, we would expect to improve it by 6 lb. per generation if we selected directly for it. However, we can make just as much (or more) improvement in weaning weight if we select for weights measured later in life. This may not seem reasonable, but it is due to three factors: 1) the heritability of weaning weight is low; 2) the heritability of yearling or two-year old weights is higher; and 3) the correlation between the latter traits and weaning weight is high. The weight taken at long-yearling age (20 months) appears to be "best" when we consider both preweaning and post-weaning gain performance, as it is the youngest age which results in a near-maximum improvement of all traits. One possible disadvantage of

selecting for this weight is a greater increase in birth weight than we would expect by selecting at weaning time. To overcome this problem, we could use an index which selects against heavier birth weights and at the same time selects for heavy long-yearling weights. One index that has been suggested is $I = Y - 3.2B$, when I = index value, Y = yearling weight, and B = birth weight. As compared to selection on yearling weight alone, this index would reduce the expected increase in birth weight by 55% while reducing the improvement in yearling weight by only 10%. Thus, near maximum improvement can be made in growth rate while minimizing the usually undesirable increase in birth weight.

*Research Scientist*¹
*Extension Specialist*²
*Research Scientist (Deceased)*³
*Professor, Department of Animal Sciences*⁴
Cooperative Extension
College of Agriculture
The University of Arizona
Tucson, Arizona 85721

FROM:

Arizona Ranchers' Management Guide
Russell Gum, George Ruyle, and Richard Rice, Editors.
Arizona Cooperative Extension

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