Selection of Cows for the Breeding Herd
I. Value of a Female's Own Growth Record

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Story in Brief

The records of 680 Angus cows and their 2,664 calves and 183 Hereford cows and their 634 calves were studied to determine the relative merit of different measures in predicting the average weaning weight of the calves that a cow produced. The measures were (1) the heifer's own 205-day weaning weight and (2) her yearling weight (about 14 months). The data came from fourteen years of records of two beef cattle breeding herds, one at the Fort Reno Livestock Research Station and one at the Lake Carl Blackwell range area west of Stillwater. All Weight records were corrected for age of calf at weaning, age of dam and sex and the average effects of years and herds were removed.

The value of a female's own record in predicting the record of her calves was evaluated in terms of a statistic called a regression coefficient. (This statistic indicates how the calves' records respond in relation to the cow's record. Example: If a regression coefficient is .2, this means that the calf's weaning weight tended to be about .2 pounds heavier than average for every pound that the cow's record was heavier than average. Also, if a cow's own weaning weight was lighter than average, her calf's weaning weight was .2 pounds lighter for every pound that the cow's record was below average.)

The analyses of these records indicated that if the heifer calves with heavier than average weights at weaning are saved as replacements they can be expected to produce heavier weaning calves than if the lighter heifers had been saved. The data further suggested that this difference would not be large, however. The regression coefficient was .23 for Herefords and .12 for Angus when comparing all calves produced to the weaning weight record made by the cow.

The study also evaluated the merit of the cow's yearling weight as a predictor of her ability to wean heavy calves. The data suggested that the cow's yearling weight may be a little better predictor. The values obtained suggested that for each pound that a Hereford heifer was heavier than her mates as a yearling, she would produce calves that were .29 lbs. heavier than their mates on the average throughout her life. The value for Angus was .14 again suggesting that these relationships are lower in Angus than in Hereford females.

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Introduction

There is a great amount of variation in the weight of different calves at weaning time. Further, it is easy to show that some cows consistently produce much heavier calves than others. It would be most fortunate if the cattlemen could know which heifers would become the producers of the heavier calves so that he could keep these for replacements.

There is presently some concern about the idea that if a young heifer becomes too fat her own milk producing ability may be damaged. If this is true, the heavier heifers at weaning (which would tend to be the fatter ones) might not themselves become the best cows in the next generation.

This study was undertaken to determine from typical Hereford and Angus cow production records (1) how valuable a cow's own growth performance as measured up to weaning and as a yearling is in predicting her producing ability as a cow and (2) whether there was a realistic problem regarding damage to a heifer whose mother gave enough milk to make her heavier at weaning.

Experimental Procedure

The weaning and yearling weights were collected from 1958 through 1971 as part of two beef cattle selection projects. These projects were located at the Lake Carl Blackwell Range west of Stillwater and the Fort Reno Livestock Research Station, El Reno. From these 14 calf crops, the weaning weights of 2,664 calves from 680 Angus and of 634 calves from 183 Hereford cows were studied. All cattle were purebred or straight-breds. The cows were born from 1956 through 1969. There were weaning weights available on 573 of the Angus and 162 of the Hereford cows when they were calves and yearling weights were present on 427 of the Angus and 144 of the Herefords. The averages of these various weights are reported for each breed in Table 1.

The cattle in this study are considered to be representative samples of the two breeds. Therefore, it is felt that the genetic base is broad enough in both breeds that the results of this study are characteristic of these breeds.

The cow herds were managed similar to local progressive beef herds under a native range, spring calving program. Wheat pasture was utilized by the cows after weaning when available. The cows were supplemented in the winter when on dormant range with up to 3 pounds daily of cottonseed cake. After calving, alfalfa and prairie hay were also fed. The amount of supplemental feed depended upon location, year and condition of the cattle. The calves were not creep-fed. Replacement heifers were fed their first winter to gain from 0.5 to 1.0 pounds per head daily.

Table 1. Number of Cattle and Averages by Breed for the Adjusted Weights[1]

Weight	Angus			Hereford		
	No.	Average (lbs.)	S.D.[2] (lbs.)	No.	Average (lbs.)	S.D.[2] (lbs.)
Cow:						
Weaning	573	434	39	162	450	37
Yearling	427	602	60	144	622	64
Calf:						
Weaning	2,664	426	42	634	435	49

[1] Weights were adjusted for age at weaning, age of dam, sex and year.
[2] Standard deviation.

Special effort was made to maintain uniform grazing conditions for all animals at each location.

The females in each herd were allotted to 15 to 30 cow, single sire breeding groups. The breeding season ran from May 1 to July 31. All calves were spring born with the majority coming in February and March. All cows were also spring born. Only calving records of cows 11-years-old and younger which calved first as 2-year-olds were included in this study.

All calves were identified at birth. Depending upon project and location, the male calves were left intact or castrated. About 35% of all males were castrated at about 3 months of age. The calves were weaned and weighed each year at an average of about 205 days, normally late September. The replacement heifers were weighed for long yearling weights just prior to being placed into breeding pastures at approximately 14 months of age. Cows were culled because of poor production, unsoundness, reproductive failures and age.

Measured differences in animal growth are due mainly to genetic or environmental causes. Genetic merit can be most accurately estimated when cattle are managed under similar environmental conditions and when their weights are corrected to a common basis for known environmental differences. The cow and calf weaning weights were corrected by statistical procedures for differences in age at weaning, age of dam, sex, year and herd. The weaning weights were corrected to a 205-day, mature dam and female basis.

The cow and calf traits studied were corrected to 205-day weaning weights of cows and calves and 425-day cow yearling weights.

Results and Discussion

Selection of replacement heifers is normally based primarily on their own weaning weight, condition and conformation and maybe secondarily on yearling traits. The observed or measured relationships between these weights of a cow when she was a heifer and the weaning weights of each of her calves and the average of all her calves was estimated by the statistical procedure of regression coefficients.[1] A larger coefficient indicates a larger influence, a value of zero indicates no influence and a negative value indicates a negative influence. (If the heaviest heifers at weaning were severly damaged as potential producers of milk, they would produce lighter than average calves and this regression coefficient would be negative.)

In Table 2 the relationships between a cow's own weaning weight and that of her calves is presented. The columns headed *b* present the estimates of the various regression coefficients for each breed. For instance, on the first line the value, .15, under Angus indicates the regression coefficient for the weaning weight of the calf born to a two year old

[1] A regression coefficient (symbolized by the letter, b) is a number which represents the average change in a second variable per unit change in the first variable. In this case the first variable is the weaning weight of the cow when she was a calf. If she was above average, how much do we expect her offspring to be above average? The regression coefficient tells how much.

Table 2. Estimates of the Regression Coefficients (b) for the Change in Calves' Weights per Pound Change in a Cow's Own Weaning Weight

Calf Weaning Records[1]	Angus			Hereford		
	No. of Pairs	b	Standard Error (lbs.)	No. of Pairs	b	Standard Error (lbs.)
	Cow Yearling Weight					
2	461	0.15**	0.05	140	0.26*	0.12
3	410	0.07	0.05	118	0.35**	0.13
4	326	0.09	0.06	93	0.15	0.13
5	240	0.16*	0.07	66	0.18	0.13
6	190	0.13	0.07	48	0.24	0.13
7	146	0.04	0.08	39	0.33	0.17
8	112	0.06	0.12	30	0.15	0.18
9	80	0.03	0.10	10	0.31	0.30
10	65	—.02	0.12	4	0.22	0.72
11	29	0.09	0.18			
Average	573	0.12**	0.04	162	0.23*	0.09

**P≤.01.
*P≤.05.
[1] The numbers in this column refer to age of cow when the calf was born. Average is the average of all calves of a cow.

heifer. If the cow weighed a pound more than the other heifers in her herd, her first calf is expected to weigh .15 lb. more than the other calves of the same sex and age. The other b values down the column are interpreted similarly relative to calves born to cows of the indicated age. Table 3 presents similar results relative to the cow's yearling weight and the weights of her various calves.

Of these regression coefficients, 39 percent of the Angus and 35 percent of the Hereford estimates were significantly larger than zero.[2] It was also encouraging that 86 percent of the Angus and 100 percent of the Hereford relationship estimates in Tables 2 and 3 were positive. The nonsignificant and negative estimates tended to be those involving older cows with comparatively low numbers of cow-calf pairs. A negative or very low relationship indicates that very little or no progress would be obtained from selection based on the cow trait involved. Thus, the relationship estimates in Tables 2 and 3 indicate that selection based on either or both of the cow weights should result in some increase in weaning weights of calves produced. However, the amount of increase is estimated by these data to be small, especially for Angus.

Tables 2 and 3 indicated no significant differences between corresponding relationship estimates involving cow weaning and yearling

[2] The word significant means that the evidence is strong that the real relationship being estimated is positve.

Table 3. Estimates of the Regression Coefficients (b) for the Change in Calves' Weights Per Pound Change in a Cow's Yearling Weight

Calf Weaning Records[1]	Angus			Hereford		
	No. of Pairs	b	Standard Error (lbs.)	No. of Pairs	b	Standard Error (lbs.)
	Cow Yearling Weight					
2	359	0.13**	0.04	129	0.32*	0.10
3	296	0.09	0.05	102	0.43**	0.13
4	221	0.08	0.06	82	0.13	0.13
5	162	0.20**	0.08	57	0.26*	0.13
6	128	0.15*	0.07	39	0.12	0.13
7	99	0.22*	0.09	28	0.36	0.20
8	65	—.01	0.13	20	0.20	0.27
9	46	0.05	0.12	7	0.48	0.26
10	34	—.01	0.15	4	0.07	0.47
11	8	0.12	0.07			
Average	427	0.14**	0.04	144	0.29**	0.08

**P<.01.
*P<.05.
[1] The numbers in this column refer to age of cow when the calf was born. Average is the average of all calves of a cow.

weights. However, there was a general trend for cow yearling weight estimates to be larger than corresponding ones involving cow weaning weight. This trend was most pronounced in Herefords where these relationships appeared to be larger than in Angus. These results suggested that a cow's yearling weight may be more closely related to the weaning weights of her calves than is her own weaning weight. Thus, selection of replacement heifers might best be accomplished by using their own yearling weights. Yearling weight has been shown to be a better indicator of an animal's inherited growth ability than is weaning weight.

Several researchers have suggested that mothering ability (basically milk production) provided by beef cows for their heifer calves may influence the heifer's own mothering ability. Some have suggested that there is a negative (undesirable) relationship between a cow's milk production and the genetic growth potential that she transmits to her calves. Either or both of these theories might be partial explanations for the low cow-calf weight relationships observed in this study.

Angus cows are generally considered to give more milk than Herefords. Therefore, the additional milk received by the Angus heifer calves could have harmed their cow productivity as compared to the Hereford heifers. Another factor which might have contributed to the observed breed differences in the cow-calf weight relationships is the tendency for Angus cows to allow more than one calf to nurse. This "community" nursing tendency would be expected to decrease the size of these weight relationships. This behavorial trait in Angus probably results in a heifer's pre-yearling growth not being a good indicator of her inherited mothering ability. And it might also result in the weaning weights of a cow's calves not being a good indicator of her true mothering ability.
