A Comparison of Different Age of Dam Correction Factors for Weaning Weight in Beef Cattle

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Story in Brief

The present study was designed to evaluate the relative merit of two types of age dam correction factors for weaning weight: (1) the correction factors recommended by the U. S. Beef Cattle Records Committee (USDA), for general usage by the beef cattle industry; (2) the correction factors computed from an analysis of the herd data.

Records of 404 Hereford and 822 Angus calves during a five year period were analyzed. Age of dam correction factors were determined separately for each breed, and with the exception of 2-year-old Hereford cows, the correction factors computed from herd data were very similar to those recommended by the industry. These data suggested that a larger correction factor (1.23) was required for calves from 2-year-old Hereford dams, than that generally recommended for use by the beef cattle industry (1.15).

The herd correction factors and the industry correction factors were compared on the basis of their relative effects on a selection program. It was found that essentially the same group of individuals would have been selected on the basis of performance records adjusted by either set of correction factors, with the exception of Hereford calves selected for increased weaning weights, in which case a small loss in the accuracy of selections was observed when industry correction factors were used.

It was concluded that the industry correction factors for age of dam are adequate for a beef cattle herd managed under typical Oklahoma range conditions and, consequently, the extra cost of computing correction factors specific for the herd would not be justified in most cases.

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Introduction

The efficiency of selection for an economic trait in beef cattle depends upon the degree to which differences in performance among the animals are genetic. Therefore, it is highly desirable to reduce environmental sources of variation as much as possible. There are two methods of accomplishing this. The first is the physical control of the environment, by maintaining management and feeding practices as uniform as possible for all animals. The second is the use of correction factors to adjust for known sources of environmental differences among individuals.

A major non-genetic factor affecting weaning weights of calves is the age of the dam. In general, it has been observed that weaning weights increase with increasing age of dam until approximately 5 or 6 years and remain fairly constant thereafter. As long as dams of different ages are present in the cow herd, the only method available to the breeder for reducing the effect of age of dam on weaning weight is the use of proper adjustment or correction factors. In general, these correction factors adjust weaning weights to a mature dam basis.

The best correction factors that can be obtained are those developed from a statistical analysis of the records of the herd in which they will be applied. Theoretically, these correction factors are the most efficient in adjusting weaning weights for age of dam. In the course of this study, they will be referred to as *herd correction factors*. In 1965, the United States Beef Cattle Records Committee (USDA) recommended the following age of dam correction factors for weaning weight:

Age of Dam	Multiply 205-Day weaning weight by:
2 years	1.15
3 years	1.10
4 years	1.05
5-10 years	1.00 (no adjustment)

These recommendations were based upon the review of a large number of reports from a wide range of environmental conditions and are intended for general use by the beef cattle industry. Hereafter in this report, these adjustment factors will be referred to as *industry correction factors.*

The purpose of this study was to evaluate the relative merit of the correction factors recommended for general use by the beef cattle industry *(industry correction factors)* as compared to those computed from herd data *(herd correction factors)*.

Materials and Methods

The present study includes records of 404 Hereford and 822 Angus calves raised during a five year period at the Fort Reno Livestock Experiment Station. These calves are part of a beef cattle selection experiment already described in an earlier Feeder's Day Report (Okla. Agr. Exp. Sta. Misc. Publ. MP-80, pg. 111).

Calves were weaned at an average age of 205 days. Following weaning, the bulls were placed on a 160-day feedlot performance test and the heifers were wintered on wheat pasture and native range to gain approximately 0.75 to 1.0 lb. per day.

The Hereford calves belong to two lines selected for increased weaning weight (Line 5) and yearling weight (Line 6) respectively. The Angus calves were from four lines; in two of them (Lines 7 and 10) selection is for increased weaning weight and in the other two (Lines 8 and 9), for increased yearling weight. For the purpose of making selections, 205-day weaning weights were adjusted to a mature dam basis using the correction factors recommended for general usage by the beef cattle industry (*industry correction factors*). Yearling weights for the bulls were adjusted to 365 days. Long yearling weights adjusted to 425 days were determined for the heifers.

For purpose of comparison, a set of correction factors for age of dam were obtained from a statistical analysis of the herd data by the least squares method. The relative efficiency of the industry correction factors with respect to those calculated from herd data was evaluated by comparing the cumulative selection differential obtained when calves were selected on the basis of records corrected by the two methods. The selection differential is the average superiority of the animals selected to be parents, with respect to the population in which they were born. In other words, it is the difference between the average performance of the selected individuals and the mean performance of all animals born in the herd that year.

Selection differentials are a suitable criterion for comparing the two sets of correction factors because if they differ significantly, the accuracy with which selections are made will be affected. Selections in each of the lines were based upon records adjusted by the industry correction factors and selection differentials were computed. All records were then readjusted using herd correction factors and individuals identified that would have been selected if these correction factors had been utilized. Selection differentials were also computed for this case.

Since herd correction factors are considered to be the most appropriate, the selections in the latter group were assumed to constitute the most accurate selections possible. Any discrepancies between the two

groups as to which animals were selected will be reflected in a difference in the selection differentials. On the other hand, similar selection differentials obtained for both methods indicates that the same animals were selected using herd and industry correction factors.

Results and Discussion

Table 1 shows the analysis of variance for 205-day weaning weights. As was expected, the effects of year, breed, sex and age of dam were highly significant ($P<0.01$). Of all possible two-way interactions between these effects, only year x breed and breed x age of dam were highly significant ($P<0.01$). The year x breed interaction indicates that the breed effects were not the same in all years, however, this has no effect on the age of dam correction factors.

The fact that breed x age of dam proved to be statistically significant indicates that the effect of age of dam on weaning weight is not the same in the Hereford breed and in the Angus breed. Therefore the computation of correction factors from herd data was carried out separately for each breed.

Table 1. Analysis of Variance of 205-Day Weaning Weights

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Squares	F Value
Total	1225	3564838.49		
Years	4	274004.69	68501.17	44.82*
Breed	1	21169.06	21169.06	13.85*
Sex	1	545273.53	545273.53	356.77*
Age of Dam	3	797766.93	265922.31	173.99*
Year X Breed	4	32950.03	8237.51	5.39*
Year X Sex	4	14254.52	3563.63	2.33
Year X Age of Dam	12	24048.58	2004.05	1.31
Breed X Sex	1	4918.33	4918.33	3.22
Breed X Age of Dam	3	25012.74	8337.58	5.45*
Sex X Age of Dam	3	8242.28	2747.43	1.80
Error	1189	1817197.80	1528.34	

*Differences were significant ($P<0.01$)

Table 2 shows the adjusted means for the age of dam groups and the additive correction factors obtained from a least-squares analysis. The major difference in the age of dam group means between the two breeds occurred for 2-year-old dams. The average weaning weight of calves from 2-year-old Herefords was 17 pounds less than the average weaning weight of calves from 2-year-old Angus cows. This is probably an indication of a difference in milking ability between Hereford and Angus heifers due to a difference in the rate of maturity.

Table 2. Adjusted Means and Additive Age of Dam Correction Factors Obtained from Herd Data

Age of Dam	Adjusted Means[1] (lbs.)		Additive Correction Factors[2]	
	Hereford	Angus	Hereford	Angus
2 years	368	385	84 ± 5	59 ± 3
3 years	415	411	37 ± 5	33 ± 3
4 years	447	435	5 ± 5	9 ± 3
+5 years	452	443	0 ± 3	0 ± 2

[1] The average weaning weight of each age of dam group, adjusted for differences in sex and years.
[2] Amount to be added to the 205-day weaning weight to adjust for the age of dam. Standard errors are also shown.

Since the adjustment factors recommended by the beef cattle industry are multiplicative, the additive factors obtained from herd data were transformed into multiplicative ones and are shown in Table 3.

The evaluation of the relative efficiency of the two types of correction factors was carrieed out by comparing the selection differential obtained in the following three situations:

1 Simulated selection (herd correction factors): The selection differential that would have been obtained if animals had been selected on the basis of performance records corrected for age of dam using *herd correction factors.*

2 Actual selection (herd correction factors): The selection differential obtained when selection was based upon performance records corrected by the *industry correction factors.* In this case, however, the selection differential was computed based on records corrected by herd correction factors.

3 Actual selection (industry correction factors): The selection differential obtained from selection based on performance records corrected by the *industry correction factors.*

Table 3. Multiplicative Age of Dam Correction Factors for Weaning Weight[1]

Age of Dam	Industry Correction Factors	Herd Data Correction Factors	
	Hereford and Angus	Hereford	Angus
2 years	1.15	1.23	1.15
3 years	1.10	1.09	1.08
4 years	1.05	1.01	1.02
5 years and older	1.00	1.00	1.00

[1] Age of dam is corrected for by multiplying the 205-day weaning weight by the appropriate correction factor.

Differences in the selection differentials when comparing (1) simulated selection (herd correction factors) with (2) actual selection (herd correction factors) are due to different animals being selected under the two methods. A measure of the relative efficiency of industry and herd correction factors is provided by this comparison. The selection differentials computed for (2) actual selection (herd correction factors) and (3) actual selection (industry correction factors) are based on the same group of selected animals. Consequently, their comparison provides a measure of the accuracy with which the selection differential has been determined in the actual selection experiment.

Figure 1 shows the values of the cumulative selection differentials for a Hereford line selected for increased weaning weight. After 3 years of selection, the selection differentials for (1) simulated selection (herd correction factors) and for (2) actual selection (herd correction factors) differ by approximately 6 lbs. This difference was due to the fact that of the six bulls selected in this line, two would not have been selected had the herd correction factors being utilized, and of the 31 cows selected, three would not have been selected using herd correction factors. Some discrepancy was expected between the selection differentials computed on the basis of the two different sets of correction factors since the industry and the herd correction factors for the Hereford breed were different,

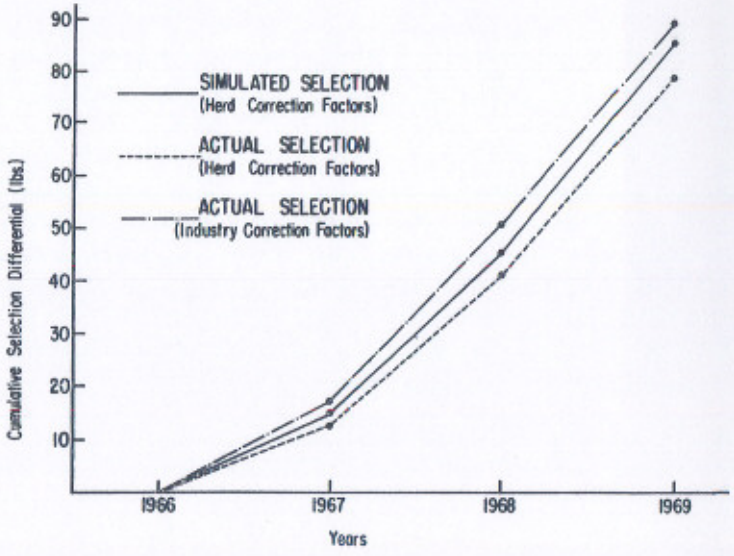

Figure 1. Cumulative selection differentials for a Hereford line selected for increased weaning weight (Line 5)

particularly for the 2-year-old group (Table 3). Since the heritability of weaning weight is approximately 0.30, the expected loss of performance due to inaccurate selections based on the industry correction factors in this particular selection line would be (0.30) X (6.0) = 1.8 pounds.

The comparison of (2) actual selection (herd correction factors) with (3) actual selection (industry correction factors) indicates that industry correction factors overestimated the cumulative selection differential by 10 pounds after three years of selection.

Figure 2 presents cumulative selection differentials for a Hereford line selected for increased yearling weight. There was no difference between the cumulative selection differential for (1) simulated selection (herd correction factors) and for (2) actual selection (herd correction factors), after 3 years of selection. This is a consequence of the fact that the same animals were selected when herd correction factors and industry correction factors were used. In general, selections based on yearling weight should be essentially the same regardless of which set of correction factors is utilized, since small differences in weaning weight will usually not be reflected in yearling weights. The comparison of (2) actual selection (herd correction factors) and (3) actual selection (industry correction factors) indicates that the industry correction factors over-

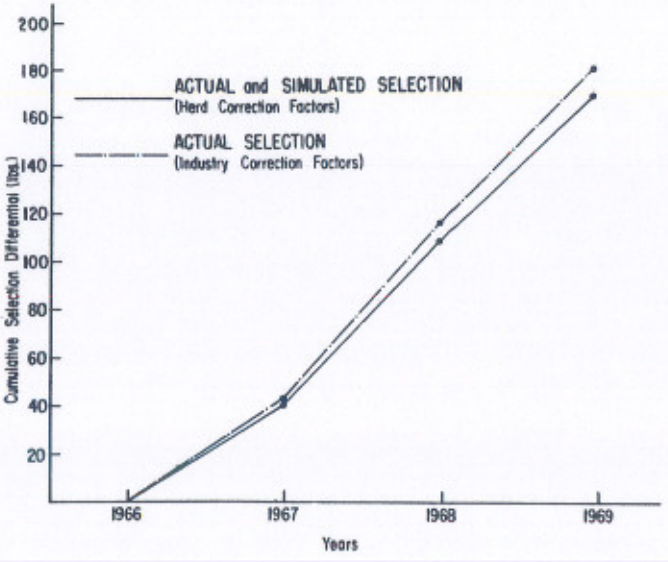

Figure 2. Cumulative selection differentials for a Hereford line selected for increased yearling weight (Line 6)

estimated the cumulative selection differential by 23 pounds after 3 years of selection.

Figure 3 shows the cumulative selection differentials for an Angus line selected for increased weaning weight. The selection differentials obtained in (1) simulated selection (herd correction factors) and in (2) actual selection (herd correction factors) are similar and, therefore, represented by the same line (Figure 3). This is a consequence of the same animals being selected based upon their performance records adjusted by both herd correction factors and industry correction factors. These results agree with the fact that the herd correction factors for the Angus breed and the industry correction factors are very similar (Table 3).

The comparison of the cumulative selection differential for actual and simulated selection (herd correction factors) with that obtained for actual selection (industry correction factors) indicates that the cumulative selection differential in the actual selection experiment had been underestimated by 8 pounds.

Figure 4 presents cumulative selection differentials for an Angus line selected for increased yearling weight. The selection differentials for (1) simulated selection (herd correction factors) and (2) actual selection (herd correction factors) are similar and, thus, represented by the same line. This indicates that the same animals were selected using herd

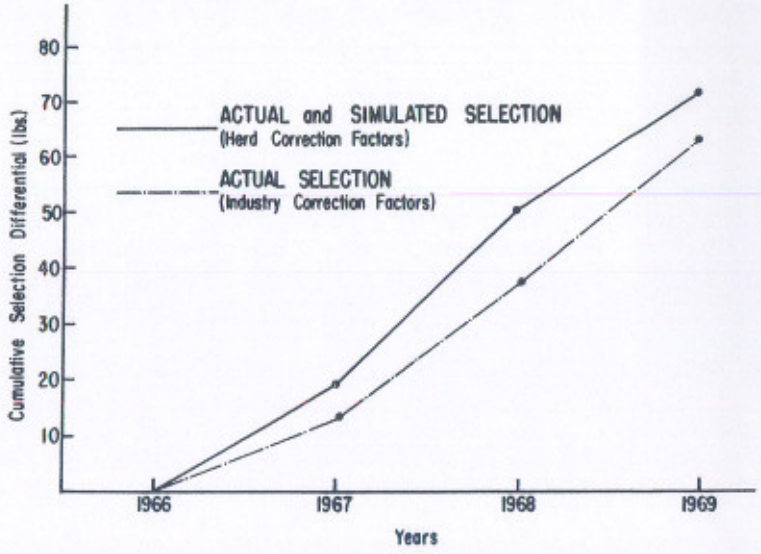

Figure 3. Cumulative selection differentials for an Angus line selected for increased weaning weight (Line 7)

and industry correction factors, which agrees with the fact that the herd correction factors for Angus and the industry correction factors are very similar (Table 3).

The comparison of actual and simulated selection (herd correction factors) with actual selection (indutsry correction factors) shows a difference of 4 pounds in the cumulative selection differential after 3 years of selection. This difference in yearling weight can be considered negligible.

It can be concluded from the results obtained in the present study that for a beef cattle herd managed under typical Oklahoma range conditions, the age of dam correction factors for weaning weight recommended for general usage by the beef cattle industry are adequate, with the possible exception of Hereford calves being selected on the basis of weaning weight. In this case, the results indicated that a larger correction factor than the 1.15 value provided by the industry correction factors was needed for properly correcting the weaning weights of calves from 2-year-old Hereford dams. Even in the case of Hereford cattle being selected on the basis of weaning weight performance, the gain in accuracy from selections based on herd correction factors was not large. Consequently, the extra cost of computing correction factors specific for the herd would not be justified in most cases.

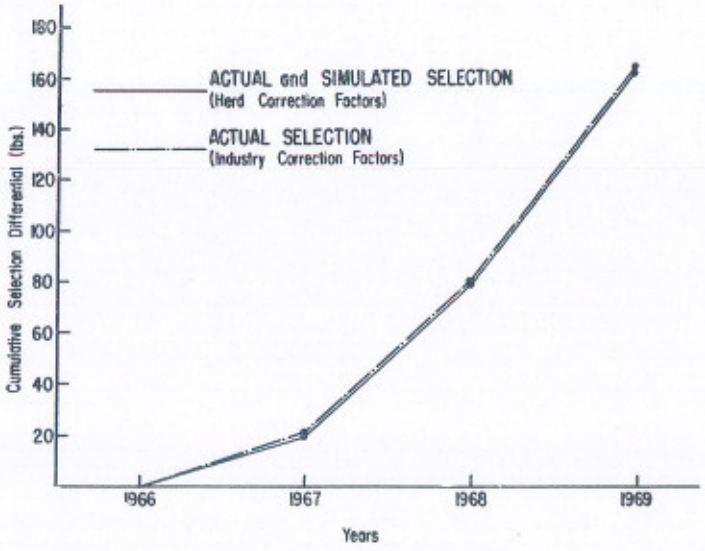

Figure 4. Cumulative selection differentials for an Angus line selected for increased yearling weight (Line 8)