

A Comparison of Different Age-of-Dam and Sex Correction Factors for Birth, Weaning and Yearling Weights in Beef Cattle

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Story in Brief

Prewaning performance records of 2747 Angus and 1267 Hereford calves and postweaning performance records of 2591 Angus and 1178 Hereford calves were analyzed to obtain age-of-dam and sex correction factors for birth, weaning and yearling weights. Calves were born from 1964 through 1979 as part of the beef cattle selection study.

Additive age-of-dam adjustments for Hereford birth weights were +8, +3 and +2 lb and for Angus birth weights, +11, +4 and +1 lb for 2-, 3- and 4-year-old cows, respectively. Age-of-dam correction factors for 205-day weaning weight were different for each sex and breed. Additive age-of-dam correction factors for 205-day weight of bull calves were +100, +48 and +12 lb for Hereford and +70, +40 and +19 lb for Angus from 2-, 3- and 4-year-old cows, respectively. Age-of-dam correction factors for 205-day weight of heifer calves were +70, +33 and +10 lb for Hereford and +55, +32 and +12 lb for Angus from 2-, 3- and 4-year-old cows, respectively. In the case of bull calves on full feed postweaning, age-of-dam effects were not significant on postweaning gain. Thus, the effect of age of dam on yearling weight was of the same magnitude as on weaning weight. Consequently, adjusted yearling weight for bulls can be calculated by adding 160 times postweaning ADG to the 205-day weaning weight, adjusted for age of dam. In the case of heifer calves maintained on a lower plane of nutrition, age-of-dam effects on 425-day weight were different from those obtained at weaning. Thus, age-of-dam effects should be made directly on heifer yearling weights adjusted to 425 days of age. The additive age-of-dam correction factors obtained in this study for heifer 425-day weight were +44, +24 and +5 lb for Hereford and +34, +21 and +7 lb for Angus from 2-, 3- and 4-year-old cows, respectively.

When it is necessary to compare birth and weaning weights of calves of different sexes, a multiplicative correction factor is more appropriate. The appropriate procedure to correct heifer birth weights to a bull basis from these data was to multiply heifer birth weights by 1.06 for both Hereford and Angus calves. To correct heifer 205-day weaning weights to a bull basis, Hereford heifer weights should be multiplied by 1.06 and Angus heifer weights by 1.07.

Introduction

The genetic improvement obtained from selection of replacement stock is largely dependent upon the extent to which true genetic differences are expressed in performance among calves. Since environmental differences tend to reduce the effect of selection, it is desirable to minimize as many environmental sources of variation as

possible. There are many environmental factors which breeders have little control over; however, the use of correction factors to adjust for nongenetic differences among calves for age of dam and sex of calf will reduce the total effect of environmental factors and thus permit more accurate comparisons of genetic merit. The use of such factors is recommended by the Beef Improvement Federation (BIF) as well as many breed associations.

The purpose of this study was to develop correction factors for differences in age of dam and sex of calf from a large number of Hereford and Angus records and to compare these correction factors with recommendations of the Beef Improvement Federation.

Materials and Methods

The data used in this study were collected from 1964 to 1979 as part of the beef cattle selection study at the Southwestern Livestock and Forage Research Station at El Reno. Table 1 presents the number of calf records that were analyzed to obtain age-of-dam and sex correction factors for birth, weaning and yearling weights. The selection lines were established in the early 1960's to measure direct and correlated responses to selection for weaning and yearling weights in Hereford and Angus cattle. One line of Hereford cattle was selected for increased weaning weight and another for increased yearling weight. The Angus herd was divided into four lines: two selected for increased weaning weights, one for increased yearling weight and an unselected control line.

Calves were born from early February through April of each year, and actual calf weights were recorded within 24 hr of birth. Calves were maintained with their dams on native and bermudagrass pastures without creep feed until weaning at an average age of 205 days. Following a 2-week warm-up period after weaning, all bull calves were placed on full feed for a 160-day gain test through 1971 and a 140-day test in subsequent years. Heifers were grazed out on wheat pasture, supplemented with prairie hay, alfalfa and concentrate to gain from .75 to 1.00 lb/day, and long yearling weights were taken at an average age of 425 days.

Calf records were analyzed by least squares procedures with year, sex, age of dam and all two-factor interactions in the full model to obtain age-of-dam and sex correction factors. Calf records from dams over 10 years of age were eliminated from the analysis.

Results and Discussion

Additive vs. multiplicative correction factors

Both additive and multiplicative correction factors have been used to adjust calf weights for differences due to environmental factors such as age of dam and sex. Additive factors are derived by choosing a standard such as average calf weaning weight from mature dams and using the difference between the standard and another particular sub-class average such as average weaning weight from calves raised by 2-year-old cows as the correction. The appropriate sub-class difference is added to a particular calf's birth, weaning or yearling weight to make adjustment to the standard basis. With multiplicative factors, calf weight is multiplied by the ratio of standard (i.e.

Table 1. Number of observations for each trait by breed and sex of calf

Trait	Angus			Hereford		
	Bulls	Heifers	Overall	Bulls	Heifers	Overall
Birth weight	1417	1330	2747	635	632	1267
Weaning weight	1417	1330	2747	635	632	1267
Yearling weight	1332	1259	2591	567	611	1178

average calf weaning weight from mature cows) to the particular sub-class average (i.e. average weaning weight from calves raised by 2-year-old cows).

Additive correction factors are the same regardless of calf weight while multiplicative adjustments increase or decrease weight proportional to the existing weight of the calf. Both types of corrections are approximately the same for calves that have average or near-average weights but are different for animals at extreme heavy or light weights. The type of factor also affects variation within adjusted groups in different ways. Additive corrections do not alter variance within adjusted groups while multiplicative factors raise or lower variance depending on whether factors are larger or smaller than 1.00. Ideally, correction factors should equalize both the averages between adjusted groups and variances within adjusted groups.

BIF recommendations for age-of-dam corrections are additive factors. The data from this study also indicate additive factors are most appropriate when variances between age-of-dam subclasses for a particular breed are approximately equal for each trait considered. Multiplicative factors would cause the variances to diverge, which is undesirable. However, when considering sex adjustments, BIF recommends multiplicative factors. These data are again in agreement as variances of heifer subclasses for each trait are consistently smaller than bull subclasses; therefore, multiplicative factors would tend to give more equality of variance within adjusted groups.

Birth weight

Birth weight is of importance to producers because of its strong relationship with calving difficulty. It is well documented that calf birth weight increases with advancing cow age and that bull calves tend to weigh more than heifer calves. Therefore, to compare differences in calf birth weights, adjustments for age of dam and sex should be made.

The sex by age-of-dam interaction was not significant, indicating that the same age-of-dam adjustment is appropriate for both bulls and heifers. Table 2 presents additive age-of-dam correction factors for birth weight. On the average, Angus calves raised by 2-year-old cows were 8 lb lighter at birth than calves from mature Angus cows, which agrees with BIF recommendations; however, Hereford calves from first-calf heifers were 11 lb lighter than calves from mature cows. To adjust birth weights for calves from 3-year-old cows to a mature-dam basis, 3 and 4 lb for Angus and Hereford calves, respectively, should be added to actual birth weights, while adjustments for calves from 4-year-old cows are 2 and 1 lb, respectively. These adjustments are in agreement with BIF, that suggests 5- and 2-lb corrections for calves from 3- and 4-year-old cows, respectively.

Heifer calves can be adjusted to a bull basis by multiplying their birth weight by 1.06 for both Hereford and Angus breeds (Table 5). The recommendation of BIF is slightly higher (1.07).

Weaning weight

A trait of major economic importance to breeders is calf weaning weight as it represents pounds of saleable product. It is also important to evaluate weaning weights

Table 2. Additive age of dam correction factors for birth weight

Age of dam	OSU data		
	Angus (lb)	Hereford (lb)	BIF (lb)
2-year-old	+8	+11	+8
3-year-old	+3	+4	+5
4-year-old	+2	+1	+2
5- to 10-year-old	0	0	0

to obtain estimates of differences in cow mothering ability and calf growth potential to aid in selection of replacements and culling of cows. Weaning weights in this study were first adjusted to an average calf age of 205 days by the following formula:

$$205\text{-day weaning weight (lb)} = \frac{\text{actual weaning wt} - \text{birth wt}}{\text{age in days}} \times 205 + \text{actual birth weight}$$

Since the age-of-dam by sex interaction was significant ($P < .05$) for both Hereford and Angus calves, separate age-of-dam corrections were developed for each sex within each breed (Table 3). Adjustments to put weaning weights on a mature-dam basis for Angus bulls were +70, +40 and +19 lb for calves from 2-, 3- and 4-year-old cows, respectively, while heifer calf adjustments were smaller at +55, +32 and +12 lb, respectively. Weaning weight adjustments for Hereford calves differed from Angus correction factors. Additive corrections for Hereford bull calves were +100, +48 and +12 lb for 2-, 3- and 4-year-old dams, respectively. Heifer adjustments, like the Angus data, were smaller at +70, +33 and +10 lb, respectively.

BIF recommendations (Table 3) tend to be lower for 2-year-old dam adjustments, approximately the same for 3-year-old dams and slightly higher for 4-year-old dams. Part of these differences may be explained by the range conditions on which cows and calves were maintained. Milk-producing ability of 2-year-old dams may have been hindered by nutritional conditions common in Oklahoma while BIF recommendations are generalized for the average of calves throughout the entire country.

Once weaning weights have been adjusted to a constant calf age and mature-dam basis, producers may wish to adjust for sex differences so comparisons of cows' progeny may be made. This can be done by multiplying 205-day, age-of-dam-adjusted heifer weaning weights by 1.07 for Angus and 1.06 for Hereford to put them on a bull standard basis (Table 5).

Yearling weight

Yearling weight is an important indicator of growth performance and thus receives considerable attention in many performance testing programs. Only animals that have been treated alike since weaning should be compared for this trait. Normally, yearling weights are computed and reported for each sex separately since heifer and bull calves usually are placed under different postweaning management systems. Yearling weights adjusted to 365 and 425 days for bulls and heifers, respectively, were analyzed to determine age-of-dam correction factors.

Table 4 presents age-of-dam adjustments for postweaning ADG and yearling weights. Age of dam had no significant effect for bull calves of each breed on postweaning ADG. Age-of-dam effects on 365-day yearling weights for bull calves are of approximately the same magnitude as age-of-dam effects at weaning. For these reasons, this study is in agreement with BIF and suggests adjusted 365-day weight for Hereford and Angus bull calves on full feed postweaning should be calculated as follows:

$$\text{adjusted 365 day weight (lb)} = \frac{\text{actual final wt} - \text{actual wn wt}}{\text{numbers of days between wts}} \times 160 + \text{205-day, age of dam adj wn wt}$$

Table 3. Additive age of dam correction factors for weaning weights

Age of dam	OSU data					
	Angus (lb)		Hereford (lb)		BIF (lb)	
	Bulls	Heifers	Bulls	Heifers	Bulls	Heifers
2-year-old	+70	+55	+100	+70	+60	+54
3-year-old	+40	+32	+48	+33	+40	+36
4-year-old	+19	+12	+12	+10	+20	+18
5- to 10-year-old	0	0	0	0	0	0

Table 4. Additive age of dam correction factors for postweaning ADG and yearling weights

Trait	OSU data				
	Age of dam	Angus		Hereford	
		Bulls ^a	Heifers	Bulls ^a	Heifers
Postweaning ADG(lb/day)	2	0	-.09	0	-.11
	3	0	-.05	0	-.04
	4	0	-.02	0	-.02
	5	0	0	0	0
Yearling wt (lb) ^b	2	+71	+34	+81	+44
	3	+44	+21	+49	+24
	4	+16	+7	+1	+5
	5				

^aOverall F test for age of dam not significant ($P < .25$).

^b365-day adjusted weights for bulls and 425-day adjusted weights for heifers.

Table 5. Multiplicative correction factors to correct heifer weights to a bull basis

Trait	OSU data		BIF
	Angus	Hereford	
Birth weight	1.06	1.06	1.07
205-day weaning weight	1.07	1.06	NA ^a

^aNot available; no BIF recommendation for sex correction of weaning weights.

However, this study suggests that when considering adjustments for long yearling weights of heifer calves managed at a lower nutritional level after weaning, other calculations should be used. Yearling weight correction factors for Angus heifers are +34, +21 and +7 lb for 2-, 3- and 4-year-old dams, respectively, while Hereford heifer adjustments are +44, +24 and +5 lb, respectively (Table 4). The postweaning ADG age-of-dam adjustments suggest a compensatory gain of heifers raised to weaning by younger cows in both Hereford and Angus breeds. Also, the magnitude of age-of-dam correction factors for heifers at weaning is larger than for those used to adjust 425-day weight. Therefore, this study indicates heifer weights adjusted to 425 days of age should be directly adjusted for age-of-dam effects rather than adding the postweaning gain to age-of-dam adjusted weaning weights as recommended for bulls.

Reproductive Performance of Various Two-Breed Cross Cow Groups

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Story in Brief

Eight crossbred cow groups (Hereford-Angus, Angus-Hereford, Simmental-Angus, Simmental-Hereford, Brown Swiss-Angus, Brown Swiss-Hereford, Jersey-Angus and Jersey-Hereford) were mated to Charolais and Limousin bulls to produce three-breed cross calves over a 2-year period. A total of 404 and 390 crossbred cows were exposed to breeding for the 1978 and 1979 calf crops, respectively.