Weight and Grade of Calf at Weaning as a Criterion for Selection of the Female Beef Breeding Herd

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Summary

The weight and grade of a calf at weaning can be used to evaluate the productivity of the beef breeding cow. There is considerable variation between individuals even within the relatively constant environment of one herd. Therefore, these criteria should constitute a major consideration for selection of the cow herd.

Before using weaning weight of calf for estimating the maternal ability of its dam the actual weight should be corrected to (i) constant age, (ii) steer equivalent and (iii) mature dam equivalent. Results from three herds involving 392 cow:calf comparisons have been analysed and these weight corrections estimated.

Weight and grade at weaning was found to be highly correlated with weight and grade at 16 months.

The records from the three herds have been listed. Standard grading and conditioning systems have been presented.

The use of a ***rating value*** for the calf and ***a production index*** for the cow have been discussed, together with the use of weaning records in the selection programme.

INTRODUCTION

The function of a beef breeding cow is to produce a live calf, and to rear it to maximum weight, grade and condition. This maternal ability of a cow can be assessed by the weaning record of her calf (Koch and Clark, ***1955d).*** When this is compared with the weaning records of other cows' calves, reared in the same environment, it provides a factual basis for selection. However, even in the same herd and for calves weaned on the same day (as is usual practice), the actual weaning weight and grade of an individual calf may be influenced by such factors as season of birth, age at weaning, sex, age of dam, sire and paddock differences.

The present paper discusses corrections for some of these, with the object of adjusting weights to that of a "standard" calf, which is a steer, reared by a mature cow and weaned at a constant age. Sire differences have not been considered, but overseas estimates give low heritability levels for weaning weight and grade of calves, so that sire effects are probably small compared with other factors (Koch and Clark, 1955*c* and ***d;*** Shelby ***et al.,*** 1955; Peacock ***et al., 1956).***

The second purpose of this paper is to discuss the application of selection based on this procedure.

SOURCE OF DATA AND PROCEDURE

Data for the present analysis have been drawn from three herds A, B and C and include only purebred steer and heifer calves. which were born within the usual calving season. These have been summarised for the 1957 weaning in Table I.

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TABLE I.

Particulars of Three Herds for 1957 Weaning.

Herd	Location	Breed	No. of Cow: Calf comparisons	Calving season 1956	Weaning		
					Date	Mean Age (days)	Mean Wt. (lb)
A	"South Bukalong," Bombala	Hereford	218	Aug.-Nov.	29.iv-3.v.57	213	441
B	"Kyleston," Bombala	Shorthorn	91	Aug.-Dec.	25-26.iv.57	208	449
C	Belabula Farms, Canowindra	Aberdeen Angus	83	May-Sept.	19.ii.57	240	464

The following records were taken:—

(i) *Calf.*— (a) At birth: date, sex, ear tag number, any other points of identification (e.g. eyelid pigmentation in Herefords and coat colour in Shorthorns), and dam number.

(b) At weaning: weight, grade and condition.

(ii) Cow.-At weaning: weight, grade, condition (also notes on bad temperament, cancer eye, mastitis or physical disabilities).

The grading system followed that presented by Guilbert and Hart (1951). It was based on a visual assessment of an animal's beef type, conformation, quality and character. This was a subjective assessment; however, as far as possible, grade was dissociated from weight and condition.

The four grades were as follows:—

A. Animals capable of maintaining standard in top studs and of raising standard in most studs.

B. Animals capable of maintaining standard in most studs and of raising the standard of commercial herds.

C. Animals capable of maintaining standard in good commercial herds.

D. Animals incapable of maintaining standard in commercial herds and which should be culled.

Within each grade provision was made for three sub-grades. These were designated A+, A, A-; B +, B, B—; etc.

Five classes of condition were recognised: 5—prime; 4—fat; 3—forward store; 2—backward store; l-thin or poor.

Preliminary examination of the data on weaning weight from herds A and B for 1956 and 1957 revealed both a sex and an age-of-dam effect. The 3, 4, 10 and 11 year old cows weaned lighter calves than the 5-9 year old cows.* This is a well established pattern as reported by Knapp et *al.* (1942), Knox and Koger (1945), and Koch and Clark (1955a). The 5-9 year old cows were regarded as the mature dams for the purposes of this analysis which, it is interesting to note, is standard practice in the dairy industry.

(i) ***Age of Calf Effect.***—Data from the 1957 weaning were classified according to the paddock, the sex of calf, and for the three ages of dam (3, 4, and 5-9 year old). The regression (b) of weaning weight on age of calf at weaning was calculated within these sub-groups. As there were no significant differences amongst the b values for different ages of dam, a pooled regression coefficient was estimated for each sex. This pooled coefficient for steers was greater than the value for heifers in all herds, although the difference was significant in only one (Herd A). Separate b values for sex were therefore used in all herds. Age of calf corrections in Table IV are based on these.

According to Koger and Knox (1945b) the differences in regressions of weight on age of calf for different groups raised in the same environment, is ascribable mainly to differences in their mean weight. To examine this in herd A the respective b values were regressed on the mean age-corrected weight** for each age-of-dam class within both sexes-the value found being $b' = 0.0235 \pm 0.0212$. Although this regression was not significant the approach is considered a reasonable one.

(ii) *Age-of-dam* ***and Sex Effects.***—To estimate age-of-dam and sex effects, an analysis of variance by the standard method of unweighted means was applied to the mean weaning weights corrected for age of calf (Tables II and III). In making this age

*Age of dam refers to a cow's age at calving.

**The mean weight of calves was corrected to a standard age of 210 days.

The corrected weight W was calculated from the formula $W = w + db$, where w is the weight at weaning, d the standard age minus the age at weaning, and b the regression coefficient for the appropriate sex and age of dam.

correction the *pooled* b value for each sex was used. Sex and age-of-dam effects were highly significant, but there was no interaction between them. This permitted the calculation of a sex difference common to all age-of-dam groups ; this was done by finding the weighted mean of the differences between sexes for each age-of-dam.

TABLE II.

Mean Weight of Calves in Herd A. Corrected to Standard Age of 210 Days.

Herd	Sex	Age of Dam (years)					
		3		4		5-9	
		lb	*	lb		lb	
A	Heifers	409	(35)	408	(13)	427	(68)
	Steers	429	(30)	437	(14)	463	(58)
B	Heifers	397	(15)	419	(7)	444	(25)
	Steers	437	(11)	459	(7)	486	(26)

*Number of animals shown in brackets.

TABLE III.

Analysis of Variance of Mean Age Corrected Weaning Weights in Herd A.

Source of Variation	d/f	s.s.	m.s.	F
Sex	1	1176.000	1176.000	9.68**
Age of dam	2	794.064	397.032	3.27*
Interaction	2	66.690	33.345	n.s.
Total	5	2036.754		
Error	204	613662.4579	121.5292	

**Significant at 1% level.
*Significant at 5% level.

Age-of-dam effects were similarly found by pooling over sexes. The correction factors for both effects are given in Table IV.

Discussion

(i) Correction *Factors.*—Corrections were not developed for weaning grade. On overseas evidence (Koch and Clark **1955a)** these appear to be considerably less important than the corrections for weaning weight.

The correction factors for weight, presented in Table IV, vary from herd to herd. Nevertheless, for each factor, the common trend is in keeping with. overseas reports (Knapp ***et al.,*** 1942; Koger and Knox, **1945a;** Koch, 1951; and Koch and Clark, **1955*a*).**

The mean age for herd C was so different from the "standard" age that the sex corrections were not the same at the two ages. Both sets are shown in Table IV.

TABLE IV.

Correction Factors.
Used to Standardise 1957 Weaning Weights in Herds A, B and C.

Correction for:	Class	Pounds to be added to Actual Wt.			
		Herd A	Herd B	Herd C	
	*	210 days	210 days	210 days	240 days
Sex	Heifer calves	29	41	28	38
	Steer calves	0	0	0	0
Age of dam at calving (years)	3	26	48	—	—†
	4	22	26	—	—
	5+	0	0	—	—
Age of calf at weaning (days)	For each day of age a heifer is under or over age shown	±0.96	±1.62	±1.48	
	For each day of age a steer is under or over age shown	±2.15	±1.81	±1.81	
Weight of Standard Calf (lb)		463	486	—	485

*Weaning weight corrected to age shown.
†Age of dam not known.

The most accurate corrections for any given herd should be those estimated from the immediate data. However, with further records, it may be possible to develop approximate correction factors for general application as is done in extension work in U.S.A.

(ii) ***The Value of Weaning*** Records.-Weight and grade of the animal at time of marketing is the really important criterion for the beef breeder. When stock are sold as vealers or weaners, weaning weight and grade are directly related to production and financial return. However, when cattle are sold at older ages their weaning records are only of direct value in the selection programme if they are a good prediction of the stock at the later age. The correlation coefficients between weaning records and 16 month old records were estimated in herd A. These were for heifer weights $r_{88} = 0.81$ and steer weights $r_{90} = 0.78$; for heifer grades $r_{86} = 0.41$ and steer grades $r_{89} = 0.38$; they are all significant at the 0.001 level. These correlations were estimated on the actual records of the 1956 weaning. It is probable that, if the weights and grades had been corrected as outlined herein, the values might have been lower. Nevertheless, these correlations, particularly for weight, indicate the high prediction value of weaning records.

The considerable variation between individuals for both corrected weaning weight and for weaning grade is illustrated in Figures 1 and 2.

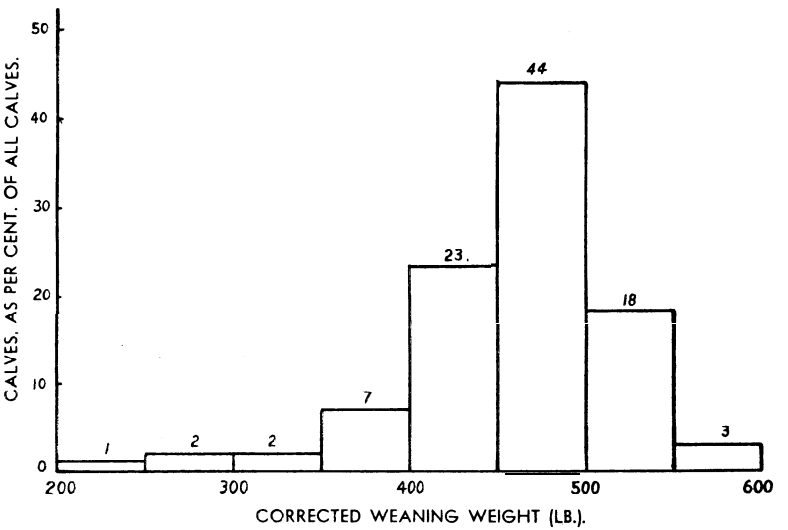

Fig. 1.—Distribution of Corrected Weaning Weight for 1957 weaning in herd A.

The repeatability of weaning weight and of weaning grade for successive calves from the same cow has been reported as being from 34 to 66 per cent. and from 22 to 33 per cent. respectively (Koger and Knox, 1947 ; Gregory et ***al.,*** 1950; Koch, 1951; Botkin and Whatley, 1953; Koch and Clark, 1955*a*; Rollins and Guilbert, 1954 and Rollins and Wagnon, 1956). Repeatabilities of this order indicate that weaning weight and grade of her calf is a good indication of a cow's lifetime production. Weaning records, therefore, provide a useful basis for selection and culling among breeding cows. They should also find particular application in the selection of high producing replacement cows based on the weaning record of their first calves. Rollins and Guilbert (1954) claim that some

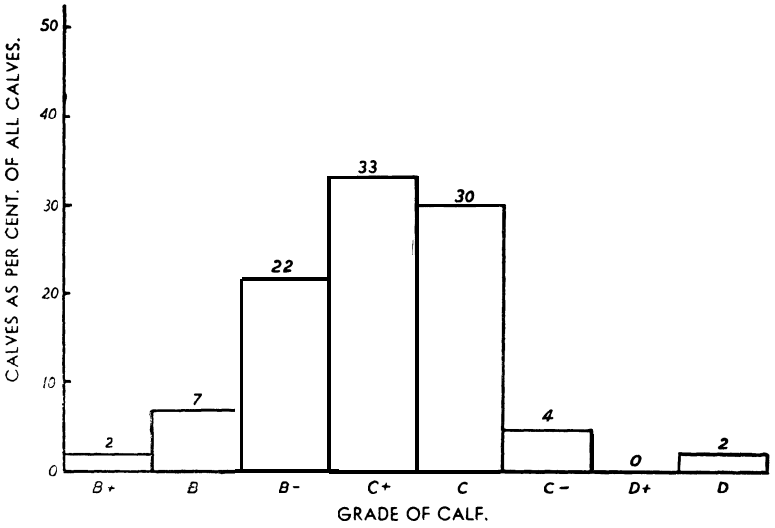

Fig. 2.—Distribution of Weaning Grades for 1957 Weaning in Herd A.

culling of first calf heifers on the basis of a ***partial*** suckling period of 4 months can be done profitably.

The weaning gain of the calf is our best measure of milking ability of the cow (Knapp and Black, 1941; Gifford, 1953; and Rollins and Guilbert, 1954). Although a calf's weaning weight and grade is a useful guide for the selection of its dam, the work of Koch and Clark (1955b, 1955d) suggests that it should not be used as the basis for selection of the calf itself as a future breeder.

(iii) ***How to Use the Records.***—To use weaning records for selection of the dam, each calf is given a rating according to its corrected weight and grade (Riggs and Maddocks, 1955). Linholm and Stonaker (1957) have shown that weaning weight is the most important trait affecting nett income. Table V presents a set of rating values giving two-thirds emphasis to weight and one-third to grade. Lower values indicate superior dams while higher values indicate inferior dams. Herd improvement would follow the systematic elimination of cows with highest rating calves. Also improvement of replacement stock should result from the mating of the top bulls to the dams whose calves rate lowest. The distribution of rating values for 1957 weaning in Herd A is illustrated in Figure 3.

Where individual records are available over several years, a ***cow's production, index*** can be developed as an average of the ratings of all the calves she has produced. This index must be revised each year after the last calf has been rated (Riggs and Maddocks, 1955).

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TABLE V.

Chart for Rating Cows on Weight and Grade of Calves.

Values weighted to give two-thirds emphasis to Weaning Weight, one-third to Grade.

Corrected Weaning Weight Range (lb)	GRADE											
	A+	A	A—	B+	B	B—	C+	C	C—	D+	D	D—
	RATING OF COW											
701 and above	3	4	5	6	7	8	9	10	11	12	13	14
676-700	5	6	7	8	9	10	11	12	13	14	15	16
651-675	7	8	9	10	11	12	13	14	15	16	17	18
626-650	9	10	11	12	13	14	15	16	17	18	19	20
601-625	11	12	13	14	15	16	17	18	19	20	21	22
576-600	13	14	15	16	17	18	19	20	21	22	23	24
551-575	15	16	17	18	19	20	21	22	23	24	25	26
526-550	17	18	19	20	21	22	23	24	25	26	27	28
501-525	19	20	21	22	23	24	25	26	27	28	29	30
476-500	21	22	23	24	25	26	27	28	29	30	31	32
451-475	23	24	25	26	27	28	29	30	31	32	33	34
426-450	25	26	27	28	29	30	31	32	33	34	35	36
401-425	27	28	29	30	31	32	33	34	35	36	37	38
376-400	29	30	31	32	33	34	35	36	37	38	39	40
351-375	31	32	33	34	35	36	37	38	39	40	41	42
326-350	33	34	35	36	37	38	39	40	41	42	43	44
301-325	35	36	37	38	39	40	41	42	43	44	45	46
276-300	37	38	39	40	41	42	43	44	45	46	47	48
251-275	39	40	41	42	43	44	45	46	47	48	49	50
250 and below	41	42	43	44	45	46	47	48	49	50	51	52

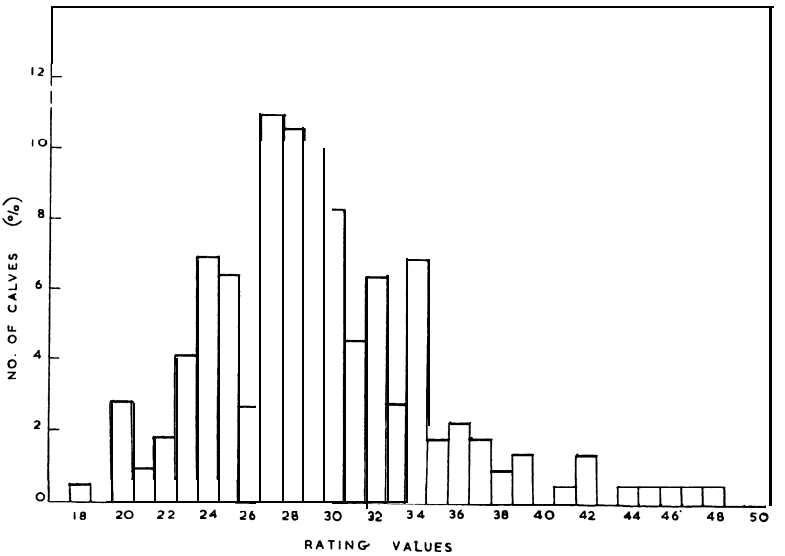

FIG. 3—Distribution of rating values for 1957 weaning in herd A.

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