INFLUENCE OF SELECTION AT WEANING ON YEARLING WEIGHT RATIOS

by

JAMES VANMIDDLESWORTH

B. S., Kansas State University, 1973

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Animal Science and Industry

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1975

Approved by:

Robert R. Schalles

Major Professor

TABLE OF CONTENTS

Page

ACKNOWLEDGEMENTS iv

INTRODUCTION 1

REVIEW OF LITERATURE 2

Genetic Correlations 2

Yearling Weight Ratio Adjustments 3

PROCEDURE AND METHODS 4

RESULTS AND DISCUSSION 6

SUMMARY 12

LITERATURE CITED 13

APPENDIX 14

ABSTRACT 24

LIST OF TABLES

Page

TABLE 1.
Comparison of Yearling Weight Ratio Adjustment Methods 9

TABLE 2.
Comparison of Adjustment Methods 10

APPENDIX TABLE 1.
Yearling Weight Ratio Adjustments 15

APPENDIX TABLE 2.
Kansas State University Unselected Population 16

ACKNOWLEDGMENTS

The author wishes to express his sincerest appreciation to Dr. Robert R. Schalles, major professor, for his inspirations, guidance and understanding throughout the author's graduate work.

A special thanks is extended to Dr. George Milliken and Dr. Howard Bird for their statistical help and interest in the research.

I wish to thank all faculty members and graduate students for their considerations and togetherness throughout the author's master program.

I give deepest gratitude to my wife, Sheryl, for her persistance and encouragement throughout my work in attainment of a Master of Science.

INTRODUCTION

With lower beef prices and higher cost of production cattlemen must be more efficient in production. This is true in both commercial and purebred operations.

The common way of making comparisons for selection is the use of ratios, particularly weaning weight ratio and yearling weight ratio. Multi-stage selection is usually practiced. Some animals are culled at one time and final selection is made at a later time. This method reduces expenses on animals that will probably never be top individuals.

However, culling at weaning decreases the ratio of top individuals at yearling because of less variation and a genetic relationship between these traits. Because of this one might be tempted to use less selection at weaning in order to keep yearling weight ratios higher.

This thesis is concerned with the evaluation of correction factors so any amount of selection can be practiced at weaning and not decrease the yearling ratios.

REVIEW OF LITERATURE

Genetic Correlations

Petty (1964) reported average correlation estimates where the genetic correlations were calculated using the sire component of variance and covariance. Weighted averages of the correlations were determined by the method of "Z" transformation using the number of sires in each estimate. Petty estimated the genetic correlation between weaning weight and post-weaning feedlot weight to be .740, and between weaning weight and post-weaning pasture weight to be .567.

Koch, Gregory and Cundiff (1974) studied selection response in three lines of Hereford cattle selected for weaning weight, yearling weight, or index of yearling weight and muscling score. They reported genetic correlations between weaning weight and yearling weight of .72± .11 for bulls and .70± .08 for heifers.

Petty and Cartwright (1966) summarized correlation estimates found in the literature reporting an overall average and a weighted average where the average offspring per sire was eleven. The genetic correlation (weighted average) between weaning weight and final feedlot weight was .79. The weighted average genetic correlation between weaning weight and yearling pasture weight was .67.

Wilson, Dinkel, Ray and Minyard (1963) collected records on 473 grade Hereford steers raised to weaning age on 17 private ranches throughout South Dakota. After being fed out the final weight was obtained by adding the total feedlot gain to the age adjusted weaning weight. The genetic correlation between adjusted weaning weight and adjusted final weight was .33.

Mangus and Brinks (1972) estimated breeding values of yearling bulls for various traits using performance information from correlated traits. The genetic correlation between weaning weight and adjusted yearling weight was .86.

Brinks, Clark and Kieffer (1965) reported the intensity and effectiveness of selection for several economic traits in a closed Hereford line over 25 years of inbreeding and selection. The genetic correlation between weaning weight and 12-month weight was .71.

Ellis (1973) reported the results from more than 100 bulls that were evaluated at weaning and again at yearling age. A genetic correlation of .68 was calculated between weaning weight and yearling weight.

Yearling Weight Ratio Adjustments

Beef improvement Federation (1974) reported a formula to adjust yearling weight ratio for selection on weaning weight. This formula divides the adjusted yearling weight by the sum of the average 205-day weight of all calves at weaning plus the average 160 day post weaning gain of calves that were fed to yearling age.

PROCEDURE AND METHODS

Weaning and yearling weight was collected on calves from the Polled Hereford herd at Kansas State University from 1966 through 1974. The cows with their calves were uniformly distributed among 4 native pastures. At the beginning of each month all animals were weighed, and rotated to a different pasture. At weaning all calves, heifers and bulls, were brought in to the beef research unit for further research. Following 3 to 4 week weaning periods the bulls were put on a 140 day post weaning trial in which they were fed, individually, a ration consisting of 75% grain and 25% chopped hay. The heifers were put on a growth study and were fed as a group.

Adjusted weaning weights were calculated using the procedure recommended by the Beef Improvement Federation (1974) according to the following equation:

$$\text{Adj. 205-day wt.} = \left[\left(\frac{\text{Act. Wean. Wt.-Birth Wt.}}{\text{Age in Days}}\right) 205 + \text{Birth wt.}\right] \text{Age of Dam Adj.}$$

Age of dam adjustment was as follows:

Age of dam	Adjustment
2	1.15
3	1.10
4	1.05
5-10	1.00
over 10	1.05

Yearling weights were also adjusted according to the procedure recommended by Beef Improvement Federation. The equation is:

$$\text{Adj. 365 day wt.} = \left(\frac{\text{Actual ylg. Wt.-Act. Wn. Wt.}}{\text{Days between wts.}}\right) 160 + \text{205 day adj. wt.}$$

Ratios were figured on a within sex and within year basis. They were calculated by dividing weaning weight by the average weight of the group in that year and of that sex. This method is also used in figuring the ratio for yearling weights.

All calves were kept past a yearling age, allowing the effect of different selection intensities on the ratios to be studied. Paper culling of different percents were applied to determine these differences between the yearling weight ratio after culling and the true yearling weight ratio with no cull. Paper selection was applied at weaning.

The Beef Improvement Federation (1974) formula to adjust yearling weight ratios for selection on weaning weight is:

$$\frac{W+P}{\bar{W}u+\bar{P}s} \times 100$$

where W+P = adjusted yearling weight of the individual.

$\bar{W}u$ = average 205 day adjusted weight of all calves weaned contemporarily with the calf in question.

and $\bar{P}s$ = average 160 day post-weaning gain of all calves tested in a contemporary sex-management group.

Our research was concerned with the development of another formula, based on selection intensity, that would make an adjustment that would come closer to the true yearling weight ratio and make calculation of the ratio easier.

To test for significant difference between the Beef Improvement Federation formula and the Selection Intensity formula the F test (Snedecor and Cochran 1971) was performed on the squared deviations from the true ratio.

RESULTS AND DISCUSSION

The selection intensity formula derived is:

$$X_{adj.} = X_t + ir_a\sigma_p$$

where $X_{adj.}$ = ratio after adjustment.

X_t = ratio before adjustment.

i = the change in standard units of the mean of a normal distribution due to a given amount of selection.

r_a = genetic correlation between weaning weight and yearling weight.

and σ_p = phenotypic standard deviation for yearling weight ratios.

This formula originated from a selection formula (Falconer, 1960). A change produced by selection causes a change in the population mean which is the response to selection. The measure of the selection applied is the average superiority of the selected calves at weaning, which is called the selection differential.

The magnitude of the selection differential depends on the proportion of the population included among the selected group, and the phenotypic standard deviation of the character. This makes the selection differential = $i\sigma_p$.

where i = change in the mean due to selection.

and σ_p = phenotypic standard deviation.

The standard deviation, which measures the variability, is a property of the population, and sets the units in which the response is expressed. If the genetic correlation between weaning weight and yearling weight is r_a then the selection differential on yearling weight is $ir_a\sigma_p$. So, if the selected group has the mean $\bar{X}_t$ then the mean of the whole group would have been $\bar{X} = \bar{X}_t - i r_a \sigma_p$. Since the ratio is decreased at yearling when selection is applied at weaning, then adding $i r_a \sigma_p$ to the yearling ratio after selection will adjust the individual to his true yearling weight ratio.

The intensity of selection depends only on the proportion of the population included in the selected group, and provided the distribution of phenotypic values is normal, it can be determined from tables of the properties of the normal distribution. If p is the proportion selected and Z is the height of the ordinate at the point of truncation, then it follows from the mathematical properties of the normal distribution that

$$i = \frac{Z}{p}$$

The genetic correlation (r_a) used was that of Petty and Cartwright (1966) of .79. Since this was a weighted overall average taken from various data it should be a good estimation of the genetic correlation between weaning weight and yearling weight in most populations.

The phenotypic standard deviation was calculated from the total population at yearling. Since all calves in the Kansas State University Polled Hereford research herd were kept until after a yearling weight was taken, a phenotypic standard deviation of 9.00 units was calculated for yearling weight ratios. This standard deviation applies to any breed of cattle or to any size of herd since the deviation was calculated on the yearling weight ratios.

Various levels of selection were calculated for the calf crops of the Polled Hereford herd from 1968-1973 inclusive.

This includes 348 animals of which 161 were bulls and 187 were heifers (Appendix table 2). Truncation selection within sex, year groups was used.

A comparison was made between the Beef Improvement Federation and Selection Intensity formulas.

The Beef Improvement Federation formula assumes that all calves will have the same 160 day post weaning gain, indicating a genetic correlation of zero between weaning weight and yearling weight. However it has been shown (Petty and Cartwright, 1966, and others) that weaning weight and yearling weight are highly correlated. This correlation is taken into account in the Selection Intensity formula.

At 96% cull the mean yearling weight ratio, using Selection Intensity formula, was significantly closer ($P<.05$) to the true yearling weight ratio than the Beef Improvement Federation formula (table 1). It also had less variance. This was also true at the 80% culling level but not significantly so ($P<.05$). However, at 20% culling both the Selection Intensity formula and the Beef Improvement Federation formula were very close to the true yearling weight ratio mean. The Selection Intensity formula had less variance at the 20% level.

The 1973 heifer calf crop will demonstrate the adjustment formulas. Heifer number 358 (table 2) had the highest weaning weight ratio of 127. With 96% of the calf crop culled at weaning her actual yearling weight ratio (after cull) is 95. This value is available from most record keeping organizations. Had there been no selection at

TABLE 1. COMPARISON OF YEARLING WEIGHT RATIO ADJUSTMENT METHODS

% Cull t Weaning	True Yearling Ratio		Adjustment with Selection Intensity Formula			Adjustment with BIF Formula		
	Mean	Variance	Mean	Variance	($deviation^2$)[c]	Mean	Variance	($deviation^2$)[c]
96	109.1	72.54	114.7	.005	1261.73[a]	115.9	97.61	2989.61[b]
80	110.0	56.06	109.9	10.54	970.57[a]	111.0	56.25	1206.29[a]
20	102.6	60.16	102.5	46.77	233.02[a]	102.7	60.41	235.14[a]

[a,b] Sum of squared deviations in the same row with different superscripts are significantly different ($P<.05$).

[c] Sum of the squared deviations from true yearling weight ratio.

TABLE 2. COMPARISON OF ADJUSTMENT METHODS

I.D.	Year of Birth	Sex	Weaning Weight Ratio	True Yearling Weight Ratio	Actual Yearling Weight Ratio After Culling	Selection Intensity Adjustment[a]	BIF Adjustment
823	1968	Bulls	119	105	100	115	107
914	1969		123	103	100	115	111
63	1970		123	120	100	115	112
146	1971		133	121	113	127	133
129	1971		129	93	87	102	103
228	1972		122	105	99	114	111
230	1972		120	106	101	115	112
361	1973		126	106	97	111	108
359	1973		123	118	108	122	120
334	1973		123	105	96	110	107
840	1968	Heifers	119	105	100	115	113
956	1969		123	124	100	115	114
78	1970		133	105	100	115	142
1102	1971		138	108	103	118	126
182	1971		118	100	97	111	118
232	1972		126	112	96	110	109
262	1972		123	123	104	119	119
358	1973		127	102	95	110	113
332	1973		122	112	105	119	125

[a] $ir_a\sigma_p = 15$.

weaning her true yearling weight ratio would have been 102. The Selection Intensity formula adjustment factor for 96% cull (Appendix table 1) is 15. Adding 15 ($ir_a\sigma_p$) to the heifers actual yearling weight ratio of 95 gives an adjusted yearling weight ratio of 110. To use the Beef Improvement Federation formula the average 160 day post weaning gain of all calves selected must be calculated (101 lbs.). This is added to the average adjusted 205 day weaning weight (427 lbs.) for all calves at weaning. Dividing this sum into the adjusted 365 day yearling weight (599 lbs.) and multiplying by 100 gives an adjusted yearling weight ratio of 113.

It was concluded that as the amount of selection decreases, the difference in accuracy of one formula over the other is decreased. However, since the Selection Intensity formula is easier to make the adjustment, this formula seems to be more useful.

SUMMARY

Cattlemen today are using ratios to make selections and comparisons instead of weaning and yearling weights. However, culling at weaning decreases the ratio of top individuals at yearling because of the genetic relationship between these weights. This makes calves have a smaller ratio than they really should have. This problem can be eleviated by an adjustment of the yearling weight ratio.

A comparison was made between the Beef Improvement Federation formula and the formula derived in this study which adjusts the yearling weight ratio according to selection intensities.

Various levels of selection were calculated on the Kansas State University Polled Hereford herd to test these formulas. At higher levels of culling, the selection intensity formula more accurately adjusted ($P<.05$) the yearling weight ratios than the Beef Improvement Federation formula. With less culling the differences in accuracy of the formulas decreased with very little difference at 20% culling.

The selection intensity formula was easier to use because of the additive adjustment factor.

LITERATURE CITED

Ellis. 1973. Proceedings of Beef Improvement Federation Research Symposium and Annual Meeting. April.

BIF. 1974. 3rd Edition. Guidelines for Uniform Beef Improvement Programs. Beef Improvement Federation Recommendation. USDA:December.

Brinks, J. S., R. T. Clark and N. M. Kieffer. 1965. Evaluation of Response to Selection and Inbreeding in a Closed Line of Hereford Cattle. USDA Technical Bulletin No. 1323:March.

Falconer, D. S. 1960. Introduction to Quantitative Genetics. The Ronald Press Company. New York.

Gardner, Eldon J. 1972. 4th Edition. Principles of Genetics. John Wiley & Sons, Inc.

Koch, R. M., K. E. Gregory and L. V. Cundiff. 1974. Selection in Beef Cattle II. Selection Responses. J. Anim. Sci. 39:462.

Mangus, W. L. and J. S. Brinks. 1972. Predicting Breeding Values of Yearling Beef Bulls. Colorado State Cattlemen's Report.

Petty, R. R., Jr. 1964. Comparison of Selection Procedures and Indexes for Growth and Conformation Traits for Beef Bulls, Heifers and Cows. Department of Animal Science, Texas A & M University:June.

Petty, R. R., Jr. and T. C. Cartwright. 1966. A Summary of Genetic and Environmental Statistics for Growth and Conformation Traits of Young Beef Cattle. Technical Report No. 5. Department of Animal Science, Texas A & M University.

Snedecor, G. W. and W. G. Cochran. 1971. Statistical Methods. Sixth Edition. The Iowa State University Press. Ames, Iowa.

Wilson, L. L., C. A. Dinkel, D. E. Ray and J. A. Minyard. 1963. Beef Cattle Selection Indexes Involving Conformation and Weight. J. Anim. Sci. 22:1086.

APPENDIX

APPENDIX TABLE 1. YEARLING WEIGHT RATIO ADJUSTMENTS

% Cull	% Selected	i^{a}	$(ir_{a}\sigma_{p})^{b}$
5	95	0.1086	1
10	90	0.1954	1
15	85	0.2744	2
20	80	0.3475	2
25	75	0.4236	3
30	70	0.4966	4
35	65	0.5700	4
40	60	0.6435	5
45	55	0.7196	5
50	50	0.7978	6
55	45	0.8796	6
60	40	0.9653	7
65	35	1.059	8
70	30	1.159	8
75	25	1.271	9
80	20	1.390	10
85	15	1.555	11
90	10	1.759	13
96	4	2.064	15
97	3	2.270	16
98	2	2.415	17
99	1	2.640	19
99.5	.5	2.900	21

[a]i = change in mean due to a given % culling.

[b]adjustment to be added to yearling weight ratio after selection is practiced at weaning.

APPENDIX TABLE 2. KANSAS STATE UNIVERSITY UNSELECTED POPULATION

Animal I.D.	Sex	Year of Birth	Adjusted 205 Day Weaning wt.	Adjusted 365 Day Yearling wt.
823	Bull	1968	486	869
816		1968	480	927
810		1968	475	935
812		1968	457	867
821		1968	429	822
834		1968	421	804
842		1968	423	796
832		1968	392	765
841		1968	384	775
843		1968	371	752
914	Bull	1969	468	845
931		1969	445	933
904		1969	425	808
941		1969	427	926
925		1969	416	917
930		1969	404	876
961		1969	405	894
907		1969	400	891
935		1969	397	814
958		1969	395	842
908		1969	390	863
940		1969	389	796
948		1969	388	756
920		1969	385	833
966		1969	384	882
954		1969	375	822
919		1969	364	802
951		1969	328	679
936		1969	322	712
903		1969	298	710
902		1969	242	671
63	Bull	1970	553	986
5		1970	517	953
20		1970	511	962
82		1970	496	850
53		1970	481	953
37		1970	477	791
79		1970	476	805
38		1970	469	794
54		1970	468	826
34		1970	464	812
29		1970	462	796
50		1970	455	824
65		1970	457	813
41		1970	450	817
56		1970	446	849

APPENDIX TABLE 2. Continued

Animal I.D.	Sex	Year of Birth	Adjusted 205 Day Weaning wt.	Adjusted 365 Day Yearling wt.
51	Bull	1970	433	808
72		1970	413	847
58		1970	408	785
62		1970	392	822
45		1970	384	638
22		1970	376	762
12		1970	335	803
146	Bull	1971	544	948
129		1971	530	733
106		1971	514	927
189		1971	486	876
111		1971	480	896
155		1971	474	908
125		1971	460	918
185		1971	453	863
119		1971	443	833
187		1971	426	822
110		1971	421	774
136		1971	422	826
193		1971	423	778
133		1971	420	770
117		1971	414	782
171		1971	413	800
180		1971	413	802
144		1971	412	712
1103		1971	402	830
164		1971	393	763
195		1971	395	802
1104		1971	389	739
177		1971	373	762
175		1971	367	757
137		1971	366	755
138		1971	361	734
197		1971	356	714
156		1971	349	731
115		1971	344	704
147		1971	335	701
154		1971	335	553
143		1971	325	651
198		1971	315	722
228	Bull	1972	564	906
230		1972	554	916
220		1972	544	894
234		1972	533	909
2101		1972	521	976
233		1972	512	873

APPENDIX TABLE 2. CONTINUED

Animal I.D.	Sex	Year of Birth	Adjusted 205 Day Weaning wt.	Adjusted 365 Day Yearling wt.
205	Bull	1972	509	894
244		1972	502	928
235		1972	496	967
236		1972	498	899
2126		1972	496	932
242		1972	491	862
240		1972	484	813
229		1972	476	876
237		1972	477	834
279		1972	474	865
210		1972	471	784
2125		1972	470	874
216		1972	458	957
2110		1972	457	841
295		1972	450	927
214		1972	437	867
2120		1972	437	898
260		1972	427	863
2127		1972	426	830
274		1972	417	806
2103		1972	409	882
2115		1972	407	756
2121		1972	407	803
245		1972	401	819
238		1972	397	842
241		1972	391	797
261		1972	393	839
2128		1972	326	647
361	Bull	1973	588	935
334		1973	572	926
359		1973	574	1043
324		1973	559	995
337		1973	560	989
3122		1973	555	950
329		1973	547	966
304		1973	538	966
343		1973	527	976
346		1973	529	856
327		1973	522	910
355		1973	521	897
3105		1973	522	957
340		1973	517	924
345		1973	508	831
3119		1973	510	887
354		1973	503	855
3120		1973	488	920

APPENDIX TABLE 2. CONTINUED

Animal I.D.	Sex	Year of Birth	Adjusted 205 Day Weaning wt.	Adjusted 365 Day Yearling wt.
321	Bull	1973	487	899
318		1973	482	844
351		1973	482	932
3152		1973	471	873
308		1973	461	844
348		1973	464	858
322		1973	451	888
3110		1973	442	859
3126		1973	437	849
3150		1973	437	887
312		1973	435	815
3111		1973	434	938
3136		1973	436	764
352		1973	429	785
316		1973	427	867
317		1973	418	819
319		1973	421	881
3154		1973	414	858
3108		1973	398	838
385		1973	390	811
3145		1973	383	812
3148		1973	376	738
3159		1973	368	757
840	Heifer	1968	449	546
815		1968	443	572
808		1968	438	594
844		1968	424	547
833		1968	415	544
814		1968	410	555
809		1968	393	554
818		1968	388	517
819		1968	371	537
837		1968	373	502
826		1968	374	481
804		1968	365	478
822		1968	364	482
811		1968	350	500
845		1968	350	479
830		1968	346	507
806		1968	335	475
807		1968	330	559
956	Heifer	1969	442	634
909		1969	440	580
950		1969	440	601
924		1969	429	611
917		1969	400	499

APPENDIX TABLE 2. CONTINUED

Animal I.D.	Sex	Year of Birth	Adjusted 205 Day Weaning wt.	Adjusted 365 Day Yearling wt.
934	Heifer	1969	402	527
923		1969	386	500
932		1969	384	509
964		1969	383	523
946		1969	374	525
949		1969	352	529
963		1969	350	475
913		1969	343	509
918		1969	342	503
937		1969	342	493
921		1969	338	509
926		1969	333	473
957		1969	320	517
959		1969	304	418
910		1969	298	501
945		1969	299	439
78	Heifer	1970	540	452
49		1970	530	556
61		1970	504	476
69		1970	483	502
33		1970	443	462
57		1970	441	441
76		1970	438	419
73		1970	431	464
14		1970	426	454
25		1970	425	472
36		1970	425	397
68		1970	426	464
60		1970	418	465
48		1970	413	418
13		1970	408	455
64		1970	371	409
4		1970	398	426
30		1970	381	376
27		1970	377	443
18		1970	369	378
15		1970	364	421
16		1970	365	398
6		1970	360	336
81		1970	347	390
28		1970	321	401
47		1970	320	415
74		1970	317	350
23		1970	311	339
1102	Heifer	1971	542	629
182		1971	465	587

APPENDIX TABLE 2. CONTINUED

Animal I.D.	Sex	Year of Birth	Adjusted 205 Day Weaning wt.	Adjusted 365 Day Yearling wt.
196	Heifer	1971	455	635
127		1971	446	667
142		1971	443	605
121		1971	434	667
150		1971	432	575
114		1971	425	609
176		1971	422	647
134		1971	418	658
173		1971	416	623
123		1971	413	582
184		1971	412	623
158		1971	405	558
169		1971	404	618
103		1971	396	535
112		1971	389	580
166		1971	385	567
148		1971	381	624
194		1971	381	623
191		1971	378	553
135		1971	372	562
141		1971	375	583
122		1971	371	569
107		1971	367	566
126		1971	366	569
139		1971	361	561
199		1971	360	549
1107		1971	357	551
108		1971	353	572
192		1971	353	536
168		1971	341	545
1106		1971	342	531
172		1971	332	498
145		1971	302	512
232	Heifer	1972	522	670
262		1972	510	733
2116		1972	499	681
221		1972	490	529
223		1972	482	590
250		1972	482	668
2105		1972	476	643
231		1972	471	625
227		1972	469	659
211		1972	466	683
252		1972	467	612
207		1972	457	605
2118		1972	461	650

APPENDIX TABLE 2. CONTINUED

Animal I.D.	Sex	Year of Birth	Adjusted 205 Day Weaning wt.	Adjusted 365 Day Yearling wt.
209	Heifer	1972	456	605
271		1972	453	695
203		1972	438	587
280		1972	438	599
288		1972	440	633
2108		1972	437	581
268		1972	431	585
2117		1972	430	646
201		1972	426	611
272		1972	419	653
2124		1972	409	584
239		1972	395	525
258		1972	398	553
266		1972	393	553
282		1972	386	576
2112		1972	365	525
286		1972	358	558
294		1972	354	546
278		1972	335	515
289		1972	334	501
2899		1972	319	484
2106		1972	305	496
358	Heifer	1973	537	599
332		1973	519	659
3138		1973	509	672
341		1973	502	635
362		1973	482	721
3112		1973	485	652
3161		1973	484	665
315		1973	474	677
360		1973	468	631
309		1973	461	685
325		1973	456	564
320		1973	453	494
353		1973	454	508
3116		1973	455	666
398		1973	451	602
3132		1973	449	597
303		1973	445	544
3158		1973	447	568
311		1973	440	558
386		1973	440	587
3130		1973	438	636
310		1973	432	554
349		1973	434	573
3100		1973	432	589

APPENDIX TABLE 2. CONTINUED

Animal I.D.	Sex	Year of Birth	Adjusted 205 Day Weaning wt.	Adjusted 365 Day Yearling wt.
347	Heifer	1973	428	577
3135		1973	429	604
3133		1973	429	572
301		1973	426	553
314		1973	378	563
326		1973	422	631
356		1973	425	581
3147		1973	426	657
335		1973	416	545
306		1973	413	549
3127		1973	412	518
302		1973	405	473
330		1973	409	595
350		1973	402	541
3137		1973	403	579
389		1973	395	601
3140		1973	391	599
336		1973	385	549
3128		1973	387	593
391		1973	382	549
328		1973	377	466
399		1973	360	556
331		1973	343	579
339		1973	333	520
305		1973	315	529

INFLUENCE OF SELECTION AT WEANING ON YEARLING WEIGHT RATIOS

by

JAMES VANMIDDLESWORTH

B. S., Kansas State University, 1973

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Animal Science and Industry

KANSAS STATE UNIVERSITY

Manhattan, Kansas

1975

ABSTRACT

Selection at weaning causes a decrease of the yearling weight ratio. The amount of this decrease is dependent on the amount of selection applied. As the selection intensity increases the yearling weight ratio decreases.

A formula was derived in this research to adjust the yearling weight ratio according to the amount of selection. The purpose of this formula is to make the adjusted ratio the same as if no culling had taken place (true yearling weight ratio).

This Selection Intensity formula is:

$$X_{adj.} = X_t + i r_a \sigma_p$$

where $X_{adj.}$ = ratio after adjustment.

X_t = ratio before adjustment.

i = the change in the mean due to selection.

σ_p = the phenotypic standard deviation for the yearling weight ratios = 9.00.

and r_a = the genetic correlation between weaning weight and yearling weight = 0.79.

The formula recommended by Beef Improvement Federation (1974) to adjust yearling weight ratios after selection on weaning weight is:

$$\frac{W + P}{\bar{W}u + \bar{P}s} \times 100$$

where W+P = adjusted yearling weight of the individual.

$\bar{W}u$ = average 205 day adjusted weight of all calves weaned contemporarily with the calf in question.

and $\bar{P}s$ = average 160 day post-weaning gain of all calves tested in a contemporary sex-management group.

A comparison was made between these formulas considering the ease of use and accuracy of adjustment.

Various levels of selection were calculated on a normally distributed population using truncation selection to test these formulas.

At higher levels of culling the selection intensity formula more accurately adjusted ($P<.05$) the yearling weight ratios than the Beef Improvement Federation formula. With less culling the differences in accuracy of the formula decreased with verry little difference at 20% culling.

The selection intensity formula was easier to use because of the additive adjustment factor.