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An estimation of genetic trend in weaning weights of beef cattle using field data

R. Leland Anderson

To the Graduate Council:

I am submitting herewith a thesis written by R. Leland Anderson entitled "An estimation of genetic trend in weaning weights of beef cattle using field data." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Animal Science.

Haley M. Jamison, Major Professor

We have read this thesis and recommend its acceptance:

D.O. Richardson, William R. Backus, J.B. McLaren

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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J B McLaren

Accepted for the Council:

Hilton A. Smith

Vice Chancellor
Graduate Studies and Research

AN ESTIMATION OF GENETIC TREND IN WEANING WEIGHTS OF BEEF CATTLE USING FIELD DATA

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee

R. Leland Anderson

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ABSTRACT

The data used in this study were from the Tennessee Beef Cattle Improvement Program weaning records of 10,501 Angus and Hereford calves accumulated over the nine year period, 1964 through 1972. The calves were classified according to weaning age (within the range of 120 to 300 days inclusive), sex (bulls, heifers, and steers), age of dam (by years from 2 to 10 years inclusive and 11 years and over), month of birth, management (creep or non-creep fed), year and breed in preliminary analyses. An adjusted 205-day weight that removed as much of the sources of environmental variation as possible was previously calculated on all calves. The calves were divided into four sub-groups according to breed and management. The purpose of this study was to determine an estimate of genetic trend in each of the four sub-groups.

Least-squares estimates were calculated for each herd using two models. One model yielded a regression of performance on time, while the second model regressed performance on time for each sire. Mean regression coefficients were then calculated for each breed-management sub-group. Using these values, estimates of genetic change due to sire differences were calculated. These estimates for Hereford non-creep-fed, Angus non-creep-fed, Hereford creep-fed, and Angus creep-fed calves were -.30, 3.49, 5.42, and 17.67 pounds per year, respectively.

No attempt has been made in the past to obtain estimates of genetic trends using beef cattle field data. However, a portion of the results obtained in this study compare favorably with similar work by Holbert (1975) using data from experimental herds.

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CHAPTER I

INTRODUCTION

Livestock numbers in Tennessee have increased at a rapid rate in the past two decades. On January 1, 1955 there were 351,000 cows that had calved and 115,000 replacement heifers. On January 1, 1975, there were 1,293,000 adult cows and 300,000 replacement heifers.

Tennessee is basically a cow-calf state where brood cows are maintained and calves are sold as feeders at weaning. The economic value of feeder calves is determined primarily by quality and weaning weight. Therefore, the beef cattle producer has to be aware of the genetic potential of his herd with respect to these traits. Selection is the single most effective tool that a beef cattle breeder has at his disposal to improve the genetic quality of his herd.

Realization of genetic progress is relatively slow in the beef herd due to a number of contributing factors. The bovine generation interval is longer than in most farm animals, and multiple births, which increase possible selection intensity, are relatively rare in cattle. Only a part of the superiority of the selected animals over the unselected herd average is transmitted to the offspring. Environmental effects contributing to an individual's performance are not transmitted from generation to generation. Therefore, only a portion of the selection differential of the parents is ever realized.

Producer awareness of the factors that influence their selection effectiveness is necessary to make the most genetic progress. Formerly, visual appraisal was the only criterion of selection in most herds. Recent increased interest in performance testing has resulted in the collection of large volumes of preweaning performance data on calves produced in breeders' herds.

The objectives of this study were to analyze data collected from the Tennessee Beef Cattle Improvement Program and calculate estimates of the genetic trends.

CHAPTER II

REVIEW OF LITERATURE

Environmental and genetic sources of variation play an important role in growth from birth to weaning in beef cattle. Such sources as season of birth, age of calf at weaning, sex of calf, and age of dam have been investigated exclusively in various breeding studies. These studies have been conducted under many different environments. Therefore, reported variation in their effects was not surprising. Equally as many studies have been conducted whereby estimates of genetic parameters have been obtained. Estimates of genetic trends in beef cattle data concerning growth rate from birth to weaning are less numerous.

I. SEASON OF BIRTH

The environmental surroundings of the calf and its dam during the preweaning period depends largely on the season in which the calf is born. The most important influence of seasonal differences is the variation in feed supply. These seasonal effects have a great deal of variation among different sections of the country.

It must be realized that an increase in calf performance during the suckling period depends upon reaching optimum efficiency of forage utilization for both cow and calf. Maximum efficiency of forage use can be made by correctly matching the month of parturition with a given season in a particular area.

Calves born in January through March were heavier at weaning than those born in other months according to Rollins and Guilbert (1954); Clum, Kidder, and Koger (1956); Marlowe, Kincaid and Litton (1958); Reynolds et al. (1958); and Dinkel, Minyard, and Ray (1963).

Sellers, Willham, and deBaca (1970) reported calves born in the winter (December, January, and February) and in the spring (March, April, and May) had similar weaning weights.

II. AGE OF CALF AT WEANING

Average age at weaning of beef calves varies among the geographical area of the United States. In the northern half of the United States calves were weaned at a younger age, approximately 180 days (Brinks et al., 1961; Dawson et al., 1954; Hohenboken and Brinks, 1969; Koch, 1951; Koch and Clark, 1955b; Minyard and Dinkel, 1960; and Shelby, Clark and Woodward, 1955) than in the southern half of the nation where calves are generally weaned at 240 days of age (Brown, 1958; High, 1968; Marlowe, Mast and Schalles, 1965; McLaren, 1970; McGuire, 1969; Neville, 1962; and Rollins and Wagnon, 1956).

Other workers (Brinks et al., 1962; Koch, Schleicher and Arthand, 1955; Marlowe and Gaines, 1958; and Swiger et al., 1962) noted a linear relationship between rate of gain and age of calf when the breeding season was limited to 90 to 120 days and the age at weaning was from 180 to 210 days. Barker (1964), Brown (1960) and Rollins and Guilbert (1954) found that when average weaning age was 240 days or more, adjustments are necessary to compensate for variation in age when comparing the rate of gain of early and late calves.

Variation in age at weaning accounts for a larger fraction of the variation in weaning weight than any other variable (McLaren, 1970).

Several linear functions have been used to compute weaning weight (WW) at a standard age (SA) or a constant. One of the most frequently used methods is:

$$\text{Age-Constant Weight} = \frac{WW - BW}{WA} \times SA + BW$$

Where: WW = Weaning weight

BW = Birth weight, actual or estimated

SA = Standard age

WA = Actual weaning age in days

III. SEX OF CALF

Published results indicate almost unanimous agreement on the effects of sex of calf. In general, bull calves grow faster than steers, and steers grow faster than heifers.

Several workers, Marlowe and Gaines (1958); Loganathan (1962); Barker (1964); Cunningham and Henderson (1965) and Brinks *et al*. (1961) found that heifer calves gained about 5 percent less than steers and 6 percent less than bulls from birth to weaning.

IV. AGE OF DAM

Estimates of the effects of age of dam on weaning weight and average daily gain from birth to weaning have been made by many research workers. These studies have been carried out with various breeds and under varying environmental conditions. A summary of these effects is shown in Table I.

TABLE I

A SUMMARY OF ESTIMATED EFFECTS OF AGE OF DAM ON WEANING WEIGHT

Author	Ages of Dams										
	2	3	4	5	6	7	8	9	10	11	12
	Weaning Weight (lb.)										
Knapp et al. (1942)	---	-29.0	-16.0	-5.0	0.0	0.0	-5.0	-10.0	-39.0	-51.0	---
Botkin and Whatley (1953)	---	-35.0	-15.0	---	---	---	---	---	---	---	---
Burgess, Landblom and Stonaker (1954)	-36.0	-24.0	-16.0	-8.0	0.0	0.0	0.0	-12.0	-24.0	---	---
Rollins and Guilbert (1954)	---	-18.0	-11.0	-5.0	0.0	0.0	-7.0	-13.0	-21.0	-31.0	---
Koch and Clark (1955a)	---	-41.0	-18.0	-6.0	0.0	-7.0	-6.0	-12.0	-24.0	---	---
McCormick, Southwell and Warwick (1956)	-107.0	-68.0	-42.0	22.0	10.0	0.0	-31.0	-31.0	-31.0	-31.0	---
Clark et al. (1958)	---	-44.0	-19.0	-7.0	-1.0	0.0	3.0	-3.0	1.0	---	---
Pahnish et al. (1958)	---	-50.0	-25.0	---	---	---	---	---	---	---	---
Minyard and Dinkel (1960)	-69.0	-33.0	-21.0	-13.0	-4.0	-3.0	0.0	-9.0	-23.0	-24.0	---
Magee et al. (1961)	-50.0	-15.0	-10.0	---	---	---	---	---	---	---	---
Hamann, Wearden and Smith (1963)	-64.0	-22.0	-1.0	4.0	23.0	27.0	32.0	---	---	---	---
Minyard and Dinkel (1965)	-80.0	-45.0	-30.0	-21.0	-4.0	-3.0	0.0	-8.0	-16.0	-24.0	-38.0

TABLE I (continued)

Author	Ages of Dam 2	3	4	5	6	7	8	9	10	11	12
					Weaning Weight (lbs.)						
Cardellino *et al.* (1971)[Kg]	-83.6	-38.5	-5.1	0.0	0.0	0.0	0.0	0.0	---	---	---
Cardellino *et al.* (1971)[Kg]	-58.7	-32.6	-8.8	0.0	0.0	0.0	0.0	0.0	---	---	---
Hohenboken and Brinks (1971)[Kg]	-59.0	-32.6	-14.5	0.0	---	---	---	---	---	---	---
Bair *et al.* (1972)	-70.4	-44.0	-17.6	-8.8	0.0	0.0	0.0	0.0	-22.0	0.0	0.0
Robertson (1974)	-60.1	-27.0	-13.2	-9.2	0.0	---	---	---	---	-4.6	---

V. HERITABILITY

The importance of heritability in a genetic study involving quantitative traits was emphasized by Lush (1945). He pointed out the value of heritability as a predictor in expressing the reliability of phenotypic value as an estimate of breeding value and suggested further that the precision of the estimate was a function of the standard error of the estimate of heritability. Some of the more recent estimates are presented in Table II.

VI. GENETIC AND PHENOTYPIC CORRELATIONS

Falconer (1967) defined the genetic correlation between two traits as the ratio of the genetic covarriance to the product of their genetic standard deviations. The relationship between two traits which can be measured directly is the phenotypic correlation. Recent estimates of phenotypic and genetic correlations are presented in Table III.

VII. GENETIC TREND

Estimates of genetic trend, the annual rate of genetic progress, allow comparison of expected and realized genetic change and allow an assessment of progress in traits of economic importance. Reliable estimates have not been available in the past from field data involving beef cattle. However, some work has been done with swine and dairy data.

Most of the recent research in this area involves regression approaches. These methods are founded on the following expectations of regression, as proposed by Smith (1962) and presented by Powell and Freeman (1974):

TABLE II

RECENT ESTIMATES OF HERITABILITY FOR WEANING WEIGHT

Source	Year	Animals	Breed[a]	Heritability Weaning Weight
Cunningham and Henderson[b]	1965a	7,971	A, H, S	0.59
Marlowe and Vogt[b]	1965	20,424	A, H	0.38
Swiger et al.	1965	480	A, H, S	0.58
Jamison	1966	3,503	A, H	0.39
Butts	1966	479	A	0.40
Busch and Dinkel	1967	679	A	0.54
Harricharan et al.[b]	1967	17,023	A	0.31
High	1968	2,747	A, H	0.50
McGuire	1969		A, H	0.26
Hohenboken and Brinks[b]	1969	4,722	A	0.25
McLaren[b,c]	1970	12,855	A, H[d]	0.37
			A, H[e]	0.60
			C[f]	0.59
Dunn et al.[b]	1970	737	A, H, S	0.42
Hohenboken and Brinks	1971	1,386	H	0.24
Vesely and Robison[b]	1971	1,692	H	0.50
Dinkel and Busch[b]	1973	679	H	0.40
Francoise, Vogt, and Nolan[b]	1973	2,550	A, H	0.81

[a]Angus, Hereford, Shorthorn, and Charolais.

[b]These estimates were made using records of calves in commercial herds.

[c]These estimates are an average of those found across adjustment methods used for weaning weight.

[d]Creep-fed.

[e]Non-creep-fed.

[f]Charolais calves by themselves.

TABLE III

RECENT ESTIMATES OF PHENOTYPIC AND GENETIC CORRELATIONS FOR WEANING WEIGHT AND WEANING TYPE SCORE

Source	Year	Animals	Breed[a]	Correlation	
				Phenotypic	Genetic
Cunningham and Henderson[b]	1965a	7,971	A, H, S	0.32	0.48
Marlowe and Vogt[b]	1965	20,424	A, H	0.23	0.23
Harricharan _et al_.[b]	1967	17,023	A		0.18
High	1968	2,747	A, H	0.40	0.54
McGuire	1969		A, H	0.32	0.24
McLaren[b,c]	1970	12,855	A, H[d]	0.427	0.315
			A, H[e]	0.475	0.603
			C[f]	0.378	0.706
Dunn _et al_.	1970	737	A, H, S	0.345	-0.31
Vesely and Robison	1971	1,692	H	0.54	0.11
Francoise, Vogt and Nolan[b]	1973	2,550	A, H	0.34	0.34

[a]Angus, Hereford, Shorthorn, and Charolais.

[b]These estimates were made using records of calves in commercial herds.

[c]These estimates are an average of those found across adjustment methods used for weaning weight.

[d]Creep-fed.

[e]Non-creep-fed.

[f]Charolais calves by themselves.

$$E\ ({}^{b}p.T) = g + t$$

$$E\ ({}^{b}p.T/s) = .5_{g} + t$$

$$E\ (b(p - \overline{p}).T/s) = -.5_{g}$$

E means expectations of the equation that follows. Regression estimates are represented by b. The regression of performance (p) on time T, bp.T represents the total trend, g + t, while expectation of the regression within sires (${}^{b}p.T/s$) is only t + $.5_{g}$, because the sires are not allowed to vary and only dams contribute to genetic progress. The expected value of the regression within sires on time of deviations from the population mean ($\overline{p}$), b(p - $\overline{p}$).T/s, could be written as (t + $.5_{g}$) - (t + g), thus the regression is equal to -.5g. One of the possible combinations of these equations to estimate total genetic trend is: $g = 2(b_{p.T} - b_{p.T/s})$.

CHAPTER III

EXPERIMENTAL PROCEDURE

I. SOURCE OF DATA

The data used in this study were collected during the nine-year period between 1964 and 1972 by the Tennessee Beef Cattle Improvement Program (TBCIP). Weaning records of 36,521 calves were collected in 395 herds. The data represents 201 Angus, 138 Hereford, 8 Shorthorn, 25 Charolais, 1 Red Poll, 2 Santa Gertrudis herds, and 28 herds with other breeds. This body of data has been described previously by Robertson (1974) and Brown (1975).

The TBCIP began in 1956 as a joint project between the Tennessee Agricultural Experiment Station (Animal Science Department) and the University of Tennessee Agricultural Extension Service. The Extension Service assumed the responsibility for administration of the program and collection of the data, and the Experiment Station was responsible for processing and analyzing the data.

These 395 farms were located throughout the state of Tennessee. The climatic conditions and management practices under which the calves were produced varied widely. Calves were born throughout the year; however, the smallest number were born in June, July, August, and September; and the largest number were born in January, February, and March. Most Tennessee producers practiced a restricted calving season (90 to 120 days), but some producers practiced year-round calving.

Weaning records for each calf include parentage, breed, birth date, age of dam, weaning weight, and weaning age of calf. In addition to weaning weight, type or conformation score, condition grade of calf, and feed management practices were recorded for each calf. Birth weights were not required, but cows were required to be registered in the program before calving. Weaning weights were adjusted to an age-constant basis using birth-weight constants. The birth-weight constants used were average birth weights assumed for Angus and Hereford calves. These were 65 and 60 lbs. for Angus and 70 and 65 lbs. for Hereford male and female calves, respectively. The breed of the calf was designated from the breed of the sire and the dam. The TBCIP system for coding breed classified Horned and Polled Hereford separately. However, the calves of the two breeds were designated by a single breed code (Hereford) in this study. All breeds and breed crosses, except registered Hereford (Horned and Polled), registered Angus, grade Hereford, and grade Angus, were eliminated from this study due to the small number of calves represented by these breeds.

Weaning weights of calves were generally taken when the calves were between 120 and 300 days of age. Beginning in 1966, all weaning weights were taken between 160 and 300 days of age.

A total of 26,020, or 71.2 percent, of the 36,521 weaning records were eliminated for failure to conform to one or more of the restrictions imposed on records to be included in this study. If weaning weight, birth date, sire number, breed of sire, age of dam, breed of dam, or conformation score of calf was missing, the record was deleted. If management practice code (creep or non-creep) was missing, the calf was likewise eliminated. All calves weaned at less than 120 days of age or over 300 days of age were omitted from this study. Any farm with less than two sires within one year and any sire with less than three calves were not included. On some farms, multiple-sire groups were used during a breeding season and the sire of individual calves could not be determined; records of these calves were eliminated. Some herds conformed to the restrictions imposed for less than five years; records of these calves were also discarded. Fifty-six herds met the restrictions imposed; however, seven were discarded because there was no continuity of sire from one year to the next. Records from these herds were eliminated from the analysis. A total of 10,501 individual records from 49 herds were found suitable for this study.

II. CLASSIFICATION OF DATA

Animals in this study were divided into four groups according to breed and management systems. The four groups are: Angus creep-fed calves, Angus calves that were not creep-fed, Hereford creep-fed calves, and Hereford calves that received no creep. These groups are referred to in this manuscript as Angus Creep, Angus Non-Creep, Hereford Creep, and Hereford Non-Creep, respectively. The data are categorized by breed, management and year in Table IV. No attempt was made to pool breed or management systems.

III. METHODS OF ANALYSIS

The weaning weights of all calves were adjusted for age of calf, sex of calf, age of dam and season of birth using coefficients as

TABLE IV

DISTRIBUTION OF CALVES USED IN THE ANALYSIS BY BREED, MANAGEMENT, AND YEAR

	Breed			
	Hereford		Angus	
Year	Creep	Non-Creep	Creep	Non-Creep
1964	9	8	51	49
1965	81	373	96	324
1966	62	585	140	410
1967	130	476	131	496
1968	265	755	190	529
1969	313	749	280	312
1970	209	574	110	500
1971	246	446	141	441
1972	299	347	94	280
Total	1,614	4,313	1,233	3,341

estimated by Robertson (1974). The adjusted 205 day weight used in this analysis was referred to as the W7 adjustment by Robertson. The formula employed to calculate this adjusted weight was:

$$W7 = \left[\left[(\text{Weaning Weight} - \text{Birth Weight})/\text{Weaning Age}\right] X\ 205 + \text{Birth Weight}\right] - b_2\ (\text{Weaning Age} - 205)$$

Where b_2 = coefficient of regression of calculated 205 day weight on weaning age

It should be noted that the b_2 values used in these computations were calculated as one value for each management system. The values for b_2 were -.153 and -.30 for creep-fed calves and non-creep-fed calves, respectively.

The data was subjected to a regression analysis on a within herd basis to determine the regression coefficients of adjusted 205-day weight for both year effects and sire within year effects. The following models were fitted for each herd:

$$Y_{ij} = a + b_1 S_{ij} + e_{ij}$$

$$Y_{ij} = a + b_2 Y_j + e_{ij}$$

Where Y_{ij} = the observed adjusted 205 day weight of the ij^{th} individual

a = intercept

$b_i S_{ij}$ = the effect of the i^{th} sire, $i = 1, 2, \ldots n$, within the j^{th} year, $j = 1, 2, \ldots 9$.

$b_2 Y_j$ = the effect of the j^{th} year, $j = 1, 2, \ldots 9$.

e_{ij} = random variation

It should be noted that year was used as a continuous variable while sire was a discrete variable.

Regression coefficients were calculated for each model within herd. A mean regression coefficient was calculated for each model within the four breed-management sub-groups. Weighted regression coefficients were then calculated for each model within the four sub-groups by using the following formula:

$$\bar{x}_w = \frac{\Sigma\, w_i\, x_i}{\Sigma\, w_i}$$

Where $\bar{x}_w$ = the weighted mean regression coefficient

w_i = the reciprocal of the squared standard error of the original regression coefficient.

x_i = the original regression coefficient.

An estimate of genetic change was calculated for each sub-group in the study. This estimate was derived by the following formula:

$$g = 2(b_{p.t} - b_{p.T/S})$$

Where $b_{p.T}$ = the weighted regression coefficient for adjusted 205-day weight with only year in the model.

$b_{p.T/S}$ = the weighted regression coefficient for adjusted 205-day weight with sire and year in the model.

CHAPTER IV

RESULTS AND DISCUSSION

No attempt has been made in the past to obtain estimates of genetic trends using beef cattle field data. In this study, an estimate of genetic change was calculated for each breed-management sub-group. The results, as reported in Table V, indicate differences among the four sub-groups. Estimated genetic change for adjusted weaning weight for the Hereford non-creep group was -0.30 lbs. During the same period, the Angus non-creep group increased adjusted weaning weight by 3.49 lbs. The Hereford creep groups showed an increase of 5.42 lbs., while the Angus creep group showed an increase of 17.67 lbs.

Even though some of the factors influencing the results obtained from this body of data appear to be random effects; for the purpose of making inferences about this data, these effects are considered as fixed. It should be noted that the results obtained in this study apply only to the parameters of the data involved.

In this study, as in other studies using field data, only a portion of the variability can be removed. Several factors, such as nutrition, husbandry and health, may contribute to the accuracy of the estimates when field data are being utilized. There may be a change in the age distribution of the population and some culling based on early performance; the effects of which will be confounded with age differences. In field data the use of the two sires over a long period of time is a source of increasing variability. Many breeders in selecting potential

TABLE V

A SUMMARY OF GENETIC CHANGE WITHIN BREED-MANAGEMENT SUB-GROUPS

Breed-Management Groups	No. Herds	No. Observations	ΔG*
Hereford Non-Creep	14	4,313	-0.30
Hereford Creep	11	1,614	5.42
Angus Non-Creep	16	3,341	3.49
Angus Creep	8	1,233	17.67

*That change in adjusted weaning weight due to genetic trends.

herd sires do not use performance data as a basis for their selection. Differences in physiological ages of cattle could be another source of variation. The effects of genetic trends as a source of variability in sire evaluation is extremely important. The extent of variability is a function of genetic trend and the degree of the non-contemporaneity among sires compared. These differences will not accurately compare a sire used only in a recent period with another sire whose progeny are spread over a number of periods.

It should be noted that this study covered a complete type change in the beef industry; favoring the longer, taller, growthier cattle with heavier mature weights. This was coupled with the fact that performance testing was becoming more of a breeding tool throughout this period. It is highly probable that the ability to buy a bull that increased the performance standards of a herd is, in fact, a part of the overall change made.

In examining the data, there is a great deal of difference among the calculated genetic change values. There are several possible explanations for these differences. The ultimate goal of creep-feeding changed tremendously over the period of time included in this study. Those calves reported as creep-fed during the early part of the study were more likely to be prime feeder calves than those reported during the latter years. Also, with the kind of cattle being selected recently, the nutrients in creep feed are utilized more for growth instead of additional finish. Dry vs. wet years could possibly have an influence on the values calculated from these data. In a dry year, one would expect wider variation between creep and non-creep fed calves than in a normal production year.

The investigator acknowledges that in this data, as in other field data, uncontrollable sources of variation existed. The data contained this variability if, over a five year period, a producer did not change bulls or cull cows. Also, the same is true if a producer saved all heifers and let them calve before culling. It is possible for a producer to increase or decrease the genetic change in the herd while selecting for traits of non-economic importance.

The findings in this study, in regard to Angus non-creep calves were similar to those reported by Holbert (1975). Using records of calves in the experimental herd at Ames Plantation, he found a positive genetic change in Angus non-creep calves.

The Hereford non-creep group failed to make a positive change over the period of time included in this study. There could be two possible explanations for the results. Either the producers were unable to select sires that were superior to the herd average, or they selected replacement females that were superior to the sires they had in use and/or purchased.

It should be noted that in both the Angus Creep and Hereford Creep groups, environmental variation due to management has not been removed. This fact could be in part responsible for the magnitude of the values calculated.

CHAPTER V

SUMMARY

The data used in this study were from the Tennessee Beef Cattle Improvement Program weaning records of 10,501 Angus and Hereford calves accumulated over the nine year period, 1964 through 1972. The calves were classified according to weaning age (within the range of 120 to 300 days inclusive), sex (bulls, heifers, and steers), age of dam (by years from 2 to 10 years inclusive and 11 years and over), month of birth, management (creep or non-creep fed), year and breed in preliminary analyses. An adjusted 205-day weight that removed as much of the sources of environmental variation as possible was previously calculated on all calves. The calves were divided into four sub-groups according to breed and management. The purpose of this study was to determine an estimate of genetic trend in each of the four sub-groups.

Least-squares estimates were calculated for each herd using two models. One model yielded a regression of performance on time, while the second model regressed performance on time for each sire. Mean regression coefficients were then calculated for each breed-management sub-group. Using these values, estimates of genetic change due to sire differences were calculated. These estimates for Hereford non-creep-fed, Angus non-creep-fed, Hereford creep-fed, and Angus creep-fed calves were -.30, 3.49, 5.42, and 17.67 lbs. per year, respectively.

No attempt has been made in the past to obtain estimates of genetic trends using beef cattle field data. However, a portion of the results obtained in this study compare favorably with similar work by Holbert (1975) using data from experimental herds.

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VITA

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After graduation, he had farming interests with his father and grandfather in Tipton County, Tennessee. In the fall of 1972, he accepted a position as Vocational Agriculture Teacher at Brighton High School.

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