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I am submitting herewith a thesis written by Harry Lee Peeler, Jr., entitled "Genotype X Nutritional Interactions of Two Year Old Females in Terms of Reproductive Status." I have examined the final 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.

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GENOTYPE X NUTRITIONAL INTERACTIONS OF TWO YEAR OLD FEMALES IN TERMS OF REPRODUCTIVE STATUS

A Thesis

Presented for the

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Degree

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Harry Lee Peeler, Jr.

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ABSTRACT

One hundred twenty first calf, two year old, Angus, Angus-Hereford, and Hereford females were studied over a three year period (40 each in 1981, 1982, and 1983). Females were allotted to either Kentucky 31 tall fescue (*Festuca arundinacea* Schreb.), legume pastures (30-40% legume), or fescue pasture. Legumes consisted of red clover (*Trifolium pratense* L.), Korean and Kobe lespedeza (*Lespedeza stipulacea* Maxim), and ladino clover (*Trifolium repens* L.). Forage intake and digestibility were determined from March 1 to September 21 by feeding Cr_2O_3 in a carrier feed twice daily and collecting weekly A.M. and P.M. fecal samples. Fecal samples were analyzed for calcium, chromium, dry matter, and crude fiber which were used as components to calculate dry matter (DM) intake, DM digestibility, and digestible DM intake for each female each week. Females were observed for signs of first estrus twice daily at feeding for a duration of approximately 2 hrs./feeding.

No significant interaction of breed and pasture type ($P>.10$) on weight and fat at first heat were detected although a trend was noticed that females were fatter at heat than at March 1. A breed of sire effect was noticed on milk production at heat with the dams of Angus sired calves on fescue pasture producing larger quantities of milk as compared to the dams with Hereford sired calves. Females on fescue-legume pastures had higher DM intakes and digestible DM intakes at heat as compared to females on fescue pastures. No significant effects ($P>.10$) were found with DM digestibility at heat.

Calf weight and milk production paralleled each other within each treatment. Females grazing fescue-legume with Hereford sired calves produced more milk and weaned heavier calves than dams with Angus sired calves. For fescue pastures, Angus and Angus-Hereford dams with Angus sired calves produced larger amounts of milk from day 120 to day 240 and weaned heavier calves than those with Hereford sired calves.

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CHAPTER I

INTRODUCTION

The most conclusive measures of the relationship of the beef female and her environment is reproductive rate. Reproductive rate is of absolute importance due to its economic impact in determining success or failure for todays cow-calf producer. Since reproduction has the lowest priority of nutrient use, a deficiency of nutrients results in reproductive failure. This relationship makes reproductive rate an expressive measure of the nutritional status of the beef female.

The objectives of this experiment were to determine the effects of Angus, Angus-Hereford, and Hereford first-calf females grazing fescue-legume or fescue pastures in terms of their reproductive status and describe the interactions of pasture type, breed of sire and dam in terms of performance. Dam and calf weights with estimates of ultrasonic backfat, milk production, dry matter intake, dry matter digestibility, and digestible dry matter intake were used to determine the nutritional status of the females at first estrus as compared to selected dates.

CHAPTER II

REVIEW OF LITERATURE

I. BODY MEASUREMENTS AS INDICATORS OF NUTRITIONAL AND REPRODUCTIVE STATUS

Relationship of Body Measurements and Nutrition

Influence of prepartum nutrition. The effects of nutrition in the prepartum period of beef heifers has long been of concern to the beef cattle producer. Opinions concerning the desirable nutrition range from a low energy, low protein maintenance diet to a higher energy, higher protein diet fed during this development period. Eckles (1915) stated that even when feeding conditions were extreme there was little effect on reproduction. Reports from Fleck et al. (1980) and Lemenager et al. (1980b) disagree in that they found heifers fed a low energy diet had lower conception rates and conceived later in the breeding season than their high energy counterparts. Similar results have been found with heifers wintered at low levels of protein (Short and Bellows, 1971).

Fleck et al. (1980) found that heifers with higher first winter gains had larger pelvic areas, higher birth weights, and fewer calving problems as 2-year olds. This is in agreement with Reid (1960) and Bond et al. (1970) that calves born to heifers on a high energy diet were heavier than calves born to heifers on a low energy diet. Many researchers have found that the effects of a high energy diet did not end with parturition but was responsible in shortening the interval from calving to first estrus (Joubert, 1954a; Wiltbank et al., 1962; Christenson et al., 1967; Dunn et al., 1969; Clanton and Zimmerman, 1970; Kropp et al., 1973; Holloway et al., 1975; Haresign, 1979). Although a lower energy diet was found to increase the interval from calving to first estrus, Clanton and Zimmerman (1970) found a lower protein ration fed during the winter had little effect on the postpartum interval.

Influence of postpartum nutrition. Dunn et al. (1969) found a greater percentage of cows pregnant on a high postpartum energy level (87%) than those on a low postpartum energy level (64%) at 120 days after calving. Similar results have been reported by Wiltbank et al. (1962, 1964) and Fleck et al. (1980). Wiltbank et al. (1962) found that although there was no significant difference between a high or low energy level on the interval from calving to uterine involution, there was a trend for the cows on a low energy level either before or after calving to involute more slowly. It has been suggested that the interval length from parturition to first breeding may be of more importance in obtaining adequate conception rates than is the involution state of the uterus since no significant difference in conception rates was found between involuted and non-involuted cows bred within similar postpartum periods (Perkins and Kidder, 1963). Work by Gardner (1969b) contradicts these results in that he found the interval from calving to first estrus paralleled the rapidity of uterine involution and that the involution time expressed a larger effect on the interval to first estrus than either the high or low energy treatments. This researcher further stated that neither level of energy intake before or after calving expressed a significant effect on fertility. These findings are supported by Carstairs et al. (1980) who found no differences in days to conception attributed to differing energy intakes imposed from parturition to 84 days postpartum.

In considering total reproductive performance, Wiltbank et al. (1964) showed that post-calving level of energy intake was probably more crucial than pre-calving levels. A high postpartum energy level was found essential in young suckled cows during their lactation periods. Both Joubert (1954b) and Oxenreider and Wagner (1971) found that young suckled cows on a low or medium energy diet during lactation exhibited a longer period of postpartum anestrus than cows on the high energy diet. These effects occurred even though a normal maintenance ration was fed before parturition. Hill et al. (1970) reported data indicating that the difference in overall fertility in undernourished heifers was not embryonic death but fertilization failure.

<u>Influence of nutrition on weight change</u>. Much research has been performed on body weight and condition changes and the effect of these changes on reproduction in cattle. To obtain these changes a variety of feeding regimes ranging from very low to very high quality have been utilized. Research has shown that heifers wintered on low planes of nutrition, then summered on a higher plane of nutrition, attempt to compensate for the winter weight loss (Short and Bellows,

1971; Kropp et al., 1973; Holloway et al., 1975; Lemenager et al., 1980b). Although heifers wintered on a low nutritional plane exhibited compensatory growth during the summer, conception rates were found to be lower than those of heifers maintained on a high nutritional plane (Lemenager et al., 1980b).

Relationship of Body Measurements and Reproduction

Influence of growth patterns on reproduction. Eckles et al. (1918) found that a ration high in digestible nutrients increased growth rate and shortened the time to maturity; whereas, a ration low in digestible nutrients during the development period prolonged the growth rate with a tendency for reduced size at maturity. Improved reproduction of young cows through their second breeding as 2-year olds has also been attributed to rapid growth obtained by feeding high energy diets from weaning to 1-year of age. Fleck et al. (1980) in the same study stated that although the second winters growth as bred heifers was beneficial, it was not as important as the first winter growth. Crichton et al. (1959) found disadvantages in animals raised on a high then changed at 11 months of age to a low plane of nutrition as compared to those animals on a low-low plane of nutrition. Since these animals were larger their maintenance requirements were greater, making less nutrients available for growth.

Influence of weight:height ratio on reproduction. Klosterman et al. (1968) found condition and weight:height ratio to be highly correlated as cows with a high degree of condition gained weight while those in poor condition lost weight. Lemenager et al. (1980a) reported data indicating that although weight:height ratio and condition changes occurred during the breeding season, conception rates were not significantly different between breed groups studied.

Olson et al. (1982) found no significant difference between small and very large cows on percentage pregnant, calf crop born, and calf crop weaned. These workers agree with Hays and Brinks (1980) who reported that taller cows were slightly more productive than their shorter counterparts in that they produced heavier, faster gaining calves.

Influence of weight change on reproduction. Weight changes of cattle during the breeding season have been shown to be related to reproductive efficiency with cows losing the most weight experiencing delay in remating and lower conception rates (Warnick et al., 1967; Haresign, 1979). Improvements in fertility have been shown to be possible if cows are managed in a manner that allows them to gain weight at the time of service. These results indicate the association between fertility and rate of body weight change over the long run, although no evidence has been found to show a beneficial effect on fertility in short term body weight gains (Youdan and King, 1977; Haresign, 1979).

Influence of condition changes on reproduction. A critical body condition concept has been proposed by Haresign (1979) below which reproduction is thought to be impaired; provided the cow is still in a negative energy balance. Higher conception rates of cows gaining in weight and condition at the time of service would provide support for this concept. Ellis et al. (1983) found that condition scores measured throughout the year appeared to be related to pregnancy rates with the non-pregnant cows having less condition than pregnant cows. In addition to higher conception rates, Godfrey et al. (1982) found that cows gaining in weight and condition at calving had a shorter interval to estrus than cows losing weight and condition.

Relation of Characteristics of Nutritional Status on Reproduction

Influence of nutritional status on puberty. Under todays management systems of breeding heifers at 14 to 15 months to calve at 24 months of age, the age at puberty becomes critical. Short and Bellows (1971) found that the management of heifers during the winter after weaning largely determined the age at which the heifers reached sexual maturity. Many workers have found that heifers on a higher plane of nutrition during the postweaning winter period were heavier and younger at puberty than heifers wintered on a lower nutritional plane (Joubert, 1954b; Reid, 1960; Wiltbank et al., 1966, 1969; Dufour, 1974).

Relation of Nutritional Status and Cow Productivity

As discussed previously, weight and condition changes are indicative of nutritional status and can have a major impact on the productive life span of the beef heifer (Warnick et al., 1967;

Haresign, 1979). Performance of females has been found to be affected by the under feeding of energy and protein during the winter, even though these females gain more weight in the grazing season as compared to more optimum fed groups (Baker et al., 1982). These workers proposed that provided cows are given the opportunity to recover, it was unlikely that a nutritional level associated with a weight loss of 1 kg per day during the first two months of lactation would have a major influence on cow productivity. The results in this study were obtained using adult cows, and may not be appropriate in comparison with younger cattle that are still growing. Roy (1978) found that a growth rate of 0.7 kg per day postweaning is required for satisfactory reproduction and performance of heifers. Haresign (1979), Ducker et al. (1982), and Ellis et al. (1983) indicate that heifers with higher growth rates and condition scores at 15 months of age were more fertile than those whose condition scores were allowed to deteriorate over the breeding season.

II. BLOOD COMPONENTS AS INDICATORS OF NUTRITIONAL AND REPRODUCTIVE STATUS

Relation of Blood Components and Nutrition

Recently plasma free fatty acids (FFA) levels have been shown to be sensitive indicators of nutritional status (Reid and Hinks, 1962b). Evidence reported by Annison (1960) and Reid and Hinks (1962a) show that plasma FFA level is a more sensitive parameter of undernutrition than levels of blood glucose or ketones in the open and pregnant ewe.

Many factors can affect the composition of blood, such as physiological and nutritional factors. Sources of physiological variation include season (Braun, 1946), day to day variation (Brooks and Hughes, 1932), breed (Heyns, 1971), age (Kitchenham et al., 1971), and stage of production (Radloff et al., 1966). Nutritional factors that affect blood composition include protein level (Meacham et al., 1964; Belyea et al., 1975) and energy level (Reid and Hinks, 1962a; Bowden, 1971).

Seasonal and day to day variation in blood composition are difficult to interpret due to the confounding influence of feeding management (Braun, 1946). Manston et al. (1977) found seasonal variations in urea with higher concentrations in the summer period of outdoor grazing as compared to indoor feeding in the winter. These workers postulated that higher summer concentrations were probably due to larger dietary intakes of nitrogen during this grazing season. Day to day variations have been studied extensively for glucose and FFA levels (Bowden, 1971; Bassett, 1974; Fisher et al., 1975). Reports from Coggins and Field (1976) state that a 40% reduction in FFA and a 38% increase in ketone bodies were found in beef cattle between 1.5 and 3.5 hours after feeding as compared levels before feeding. During this same time frame, these researchers observed an 11% reduction in plasma glucose levels and a 16% increase in urea nitrogen concentrations.

Serum total proteins in beef cattle have been shown to increase (Kitchenham and Rowlands, 1976) and inorganic phosphate to decrease

(Shirley et al., 1968) from the first lactation. In younger cattle, blood glucose concentrations have been found to be considerably higher than glucose concentrations in the mature animal (Manston et al., 1977). These workers attributed the decrease in glucose concentrations during the animals first year of life to rumen development and metabolite changes utilized as energy sources by the mature ruminant. Although age has been shown to affect the glucose concentration in cattle, Bowden (1971) found no significant change in FFA concentrations with age.

Pregnancy, parturition, and lactation are all associated with changes in the levels of blood constituents. There is often a two- to three-fold increase in FFA concentrations during late pregnancy and early lactation as compared to non-lactating animals (Radloff et al., 1966; Roberts et al., 1978). These researchers also found decreases of 8 to 18% in blood glucose concentrations from parturition to the end of the first month of lactation. Rowlands et al. (1975) reported negligible changes in magnesium and inorganic phosphate with only slight increases in calcium concentrations in early lactation.

Dietary protein intake has been shown to affect the concentration of urea N in the blood plasma of cattle. Large protein intakes result in high urea concentrations; whereas, low protein intakes are associated with low urea concentrations (Manston et al., 1975). Belyea et al. (1975) confirms previous workers results by comparing different diets and concluding that dietary protein can affect urea and protein concentrations in the blood.

Fisher et al. (1975) reported that after reducing feed intake by 50%, a 10% decline in glucose concentrations associated with a 30% rise in plasma FFA concentration was noted. Bowden (1971) found similar results in that by increasing dietary energy intake, FFA concentrations decreased and glucose concentrations increased. In a later paper, Bowden and Kozub (1979) reported ranges of glucose concentrations from 41.7 to 67.9 mg/100 ml with an average of 49.3 mg/100 ml, and FFA concentrations from 319 to 618 μeq/l with an average of 458 μeq/l.

Relation of Blood Componenets and Reproduction

Patterson et al. (1964) found that up to 10 days prepartum there was no significant difference between non-esterfied fatty acid (NEFA) levels and glucose levels in two groups of ewes fed a normal plane of nutrition. After placing one of the groups on a reduced dietary intake, glucose was lowered significantly, and NEFA levels increased significantly. Similar results have been reported by Adler et al. (1963), Radloff et al. (1966), Radloff and Schultz (1966), and Blum et al. (1982) that FFA levels increase due to lower dietary intake and physical activity.

Radloff et al. (1966) discovered that blood glucose and FFA concentrations were highest at parturition as compared to the time of peak milk production; which was attributed to the hormonal and stress conditions at calving. Plasma FFA concentrations declined five to six weeks postpartum, and remained relatively constant throughout the rest of the trial. Blood glucose and ketone concentrations made typical changes immediately postpartum, with glucose the lowest and ketones the highest two weeks postpartum, before returning to normal values. This inverse relationship between glucose and ketone bodies has also been reported by Gardner (1969a).

Hart et al. (1978) stated that body weight loss and higher NEFA levels, especially during early lactation, indicate that during this period the higher yielding cows were utilizing both dietary energy and body tissue to promote milk production. Due to lower metabolic demands of lower yielding cows lactation period, they were able to maintain a positive energy balance during lactation. This is supported by steady increases in body weight and the lack of significant differences between NEFA concentrations at peak lactation and during the dry period. In contrast, Oxenreider and Wagner (1971) found that even after adjusting dietary intake for milk production, lactation and decreased energy intake depressed body weight and glucose levels.

Hart et al. (1978) showed that throughout lactation higher levels of insulin were related to low milk production, which agrees with the results of Kronfeld et al. (1963) who reported lower milk yields for cattle treated with exogenous insulin. In addition to higher insulin levels, the low yielding cows mobilized fat at a lower rate which is shown by lower levels of NEFA (Hart et al., 1978). The negative correlation of insulin and FFA concentrations have been similarly reported by Bassett (1974) in his studies with fed and fasted sheep. Energy intake has also been shown to influence the concentration of insulin in the blood (McCann and Reimers, 1982) with lower insulin concentrations in energy deficient cows. In addition to the effects of energy level on glucose and insulin concentrations discussed previously, Harris et al. (1965) reported cows wintered on optimum fed diets maintained blood levels of hemoglobin, vitamin A, calcium, and phosphorus; but, those wintered on a restricted energy diet showed depressed levels of vitamin A and hemoglobin.

Blood glucose levels below 30 mg/100 ml blood have been associated with low returns to service (McClure, 1968). This researcher found that cows losing large amounts of weight during time of mating and having falling blood glucose levels resulted in infertility. He supported his finding by administering insulin to pre-estrus cows which lowered blood glucose concentrations and depressed pregnancy rates. Downie and Gelman (1976) reported similar results with rising levels of glucose characteristic of fertile services and falling levels of glucose associated with infertile services. These characteristics were found to hold true regardless of changes in body weight. Furthermore, a trend was noted that fertile matings were most often followed by a decrease in glucose; whereas, infertile matings were usually followed by increasing levels of plasma glucose. In contrast, Mason et al. (1973) stated that during various phases of the estrus cycle, glucose concentrations did not vary significantly.

CHAPTER III

MATERIALS AND METHODS

I. ANIMAL MANAGEMENT

One hundred twenty, 2-year old, Angus, Angus-Hereford, and Hereford first calf heifers were studied over a three year period (40 females per year for 1981, 1982, and 1983, Table 1). Cows entered the study in October from four University of Tennessee Experiment Stations where they were bred to Angus or Hereford bulls to calve January through March of each year. After calving, all cows were exposed to either Angus or Hereford bulls from mid-April to mid-July for rebreeding for their second calf. All male calves were castrated in April of each year with all calves weaned in mid-October.

Females were randomly allotted during the fall prior to intensive measurement to either fescue or fescue-legume pastures with two pastures per pasture type. Each fescue pasture had a stocking rate of nine cow-calf pairs per pasture (1.11 cow-calf pairs per ha.) while the fescue-legume pastures had a stocking rate of 11 cow-calf pairs per pasture (1.23 cow-calf pairs per ha.). Animals were rotated weekly within pasture type. Water and a commercial salt-trace mineral mixture were available at all times.

II. PASTURE MANAGEMENT

Pastures consited of four 8.0 ha. fescue-legume or fescue pastures with two replicates per treatment. Fescue-legume pastures

TABLE 1. Assignment of Cattle to Pasture Treatments[a]

			Pasture Type					
			Fescue-Legume			Fescue		
Dam	Sire	Calf	Year			Year		
Breed	Breed	Sex	1981	1982	1983	1981	1982	1983
Angus	Angus	Steer	5	2	1	1	1	1
		Heifer	1	3	1	4	2	1
	Hereford	Steer	2	2		2	2	1
		Heifer		4	2	3	3	
Hereford	Angus	Steer	3		1	1	1	
		Heifer	2	2	1	1		1
	Hereford	Steer	3	2	1	1	3	1
		Heifer	4	2	1	1	2	1
Hereford x Angus	Angus	Steer	1		4			1
		Heifer	1	2	3	3	2	4
	Hereford	Steer	1	1	3		2	5
		Heifer		2	3			2

[a]Refers to the number of cattle on pasture type.

consisted of 60-70% Kentucky-31 tall fescue (Festuca arundinacea Schreb.) and 30-40% red clover (Trifolium pratense L.), Korean and Kobe lespedeza (Lespedeza stipulaua Maxim.) and ladino clover (Trifolium repens L.). Fertilizer rates for the fescue-legume pasture consisted of 78.6 kg/ha. phosphorous (P), 67.4 kg/ha. potassium (K) in 1981; none in 1982; 31.8 kg/ha. nitrogen (N), 64.8 kg/ha. P, 55.3 kg/ha. K in 1983. Although no fertilizer was applied to the fescue-legume pastures in 1982, they were renovated with 6.7 kg/ha. red clover, 5.6 kg/ha. Kobe lespedeza, and 3.4 kg/ha. Korean lespedeza.

Fescue pastures consisted of 90% Kentucky-31 tall fescue, 10% common bermudagrass (Cynadon dactylon L.), and some white clover in 1983. Fescue pastures were rid of the white clover contamination by spraying with Banvel in early June of each year. Fertilizer rates for the fescue pastures consisted of 38.2 kg/ha. N in 1981 and 1982, and 31.8 kg/ha. N in 1983. No seed was applied to the fescue pastures any of the three years.

III. MEASUREMENT OF FORAGE INTAKE AND DIGESTION

Females were fed approximately 346 grams of a chromic oxide (Cr_2O_3) carrier feed twice daily at 0800 and 1600 hours (Hopper, 1977). Females were fed from February 24 to September 29 in 1981, March 1 to September 15 in 1982, and March 6 to September 21 in 1983. One A.M. and one P.M. fecal sample was collected from each cow each week either by rectal stimulation or by picking up fresh samples in the pastures. Samples were composited to provide one sample per cow per week, dried in a 60°C oven for 7-10 days then ground through a 1.0 millimeter screen. Dried, ground fecal samples were analyzed for chromium (Williams et al., 1962), dry matter, calcium, and crude fiber utilizing A.O.A.C. (1975) procedures. Fecal dry matter (DM) output was determined by the Cr_2O_3 dilution method for each week of the trial. These values were then used in equations developed by Wehner (1982) to calculate DM intake (DMI), DM digestibility (DMD), and digestible DM intake (DDMI). These equations were:

Fecal DM output = Cr_2O_3 fed/Cr_2O_3 in feces

DMI = -11.19 + (2.51 x FOUT) + (.95 x Ca) + (.41 x CF) - (.1446 x FOUT x CF) + (.08 x DM) + (.2302 x FOUT x DM) - (.0599 x Ca x DM)

DMD = (DMI - FOUT)/DMI

DDMI - DMI x DMD

IV. INDICATORS OF NUTRITIONAL STATUS

Blood samples consisted of control samples and samples taken within 24 hours of signs of first estrus. Control samples from the 40 cows studied in 1981 were taken November 26, 1980. For the cows studied in 1982, 40 samples were taken December 18, 1981, and 20 samples each on January 21 and February 2, 1982. Controls for the 40 cows used in 1983 were taken December 15, 1982 and March 16, 1983. In obtaining the blood samples, 35-50 ml of blood were drawn from the jugular and sealed in a tube containing 2-3 ml of heparin (1981 and 1982) or sodium citrate (1983) as an anticoagulant. After the samples were drawn and sealed, the tubes were placed in ice until processing upon returning to the laboratory. Samples were centrifuged at 3 x 1000 rpm for approximately 25 minutes at which time the plasma level was pipetted off and frozen until analyzed for free fatty acids by a modified version of Trout et al., (1960).

V. MILK PRODUCTION

Lactation yields were estimated using the calf suckle technique with seven estimates in 1981 and nine each in 1982 and 1983. Calves were seperated from their dams and penned approximately 1800 hours the day before estimates were taken with the cows being returned to their respective pastures. At approximately 0600 hours on the day of estimation, calves were weighed and placed with their dams to nurse. After nursing, calves were seperated and reweighed with the weight difference assumed to be a 12 hour milk production. Cows were again returned to their respective pastures and the procedure repeated at 1800 hours with the two estimates combining for a 24 hour estimate of milk production.

VI. COW MEASUREMENTS AND BODY COMPOSITION

Cow measurements were obtained at the beginning of each trial each year and again at weaning using a grid chute and photographs. Hook width measured with a precision caliper, weights and fat thickness measured ultrasonically (Swain et al., 1966) at the twelfth rib were also determined at this time. Slides were enlarged to life size so height, depth, length from point of shoulder to hooks, and length from point of shoulder to pins could be determined. In all years cows were weighed and ultrasonic fat measurements were taken bi-weekly until May and monthly thereafter. Calf weights were obtained from the morning milk production data and again at weaning.

VII. STATISTICAL ANALYSIS

Data for each pair used for comparison of least square means were obtained from the following models:

1. DM intake (kg/day) = B_0DMI + (B_1DMI x Julian day) + (B_2DMI x (Julian day)^2) + (B_3DMI x (Julian day)^3) + (B_4DMI x (Julian day)^4).
2. DM digestibility (kg/day) = B_0DMD + (B_1DMD x Julian day) + (B_2DMD x (Julian day)^2) + (B_3DMD x (Julian Day)^3) + (B_4DMD x (Julian day)^4).
3. Digestible DMI (kg/day) = DMI (Julian day) x DMD (Julian day).
4. Fecal output (kg/day) = B_0FOUT + (B_1FOUT x Julian day) + (B_2FOUT x (Julian day)^2) + (B_3FOUT x (Julian day)^3) + (B_4FOUT x (Julian day)^4).
5. Cow weight (kg) = A + (A_1 x sin (C x Julian day)) +(A_2 x cos (C x Julian day)) +(A_3 x (sin (2 x C x Julian day))) + (A_4 x (cos (2 x C x Julian day))).
6. Cow fat (mm) = B_0CFT + (B_1CFT x Julian day) + (B_2CFT x Julian day)^2).

7. Milk production (kg/day) = B_0MP + (B_1MP x Julian day) + (B_2MP x (Julian day)^2).

8. Calf weight (kg) = $B_0CALFWT$ + ($B_1CALFWT$ x Julian day) + ($B_2CALFWT$ x (Julian day)^2).

Variables involving changes in these measurements for specific days were determined by evaluating the above equations. Analysis of variance procedures were conducted on the dependent variables: DM intake, change in DM intake, DM digestibility, changes in DM digestibility, digestible DMI, changes in digestible DMI, fecal output, change in fecal output, cow weight, change in cow weight, cow fat, changes in cow fat, milk production, changes in milk production, calf weight, changes in calf weight, and cow measurements (depth, length-point of shoulder to hips, length-point of shoulder to pins, height, weight, hookwidth, and fat thickness) made at the beginning and end of each year. The model, Y = yr., sex of calf, pasture type, breed of dam, breed of sire, calf birthdate, calf birthdate x pasture type, calf birthdate x breed of dam, calf birthdate x breed of sire, pasture type x breed of dam, pasture type x breed of sire, breed of dam x breed of sire, pasture type x breed of dam x breed of sire was used to calculate residual standard deviations and least square means for each variable.

CHAPTER IV

RESULTS AND DISCUSSION

I. PERFORMANCE AND FORAGE INTAKE AND DIGESTIBILITY AT DAY 60 AND DAY OF FIRST HEAT

Breed and pasture type were found to have significant effects (P<.10) on milk production at the first of March relative to the time of first heat of females in 1981, 1982, and 1983 (Table 2). There was a tendency for dams with Angus sired calves on fescue-legume pastures to produce more milk (1.41 vs. 0.68, respectively) than the Hereford sired calves. The opposite was true for the fescue pastures with all dam breeds with Hereford sired calves producing more milk on day 60. A possible explanation for this pasture type x breed of sire interaction could be due to the Hereford sired calves from the Angus-Hereford and Hereford dams larger size at birth enabling them to consume larger quantities of milk and be more agressive nursers. In the case of the Angus dams on fescue pastures, a pasture type x breed of dam interaction was indicated with these dams producing more milk on fescue pasture than other dam breeds on either pasture treatment. Holloway and Totusek (1973) reported that calves from Angus dams had lighter birth weights (P<.05) and were heavier weaning weights (P<.005) than calves from Hereford dams.

Although no significant differences were found in cow weight and fatness, a trend was noticed that females on both pasture treatments were fatter at heat than at the first of March. Similar

TABLE 2

Item		Level of Significance[b]				RSD[c]
	f	Pasture Type X Breed of Dam	Pasture Type X Breed of Sire	Breed of Dam X Breed of Sire	Pasture Type X Breed of Dam X Breed of Sire	
Weight[d]		NS	NS	NS	NS	55.296
Fat[e]		NS	NS	NS	NS	3.777
Milk Produ		0.021	0.086	NS	NS	5.495
Fecal Outp		NS	NS	NS	NS	2.126
Dry Matter		NS	NS	NS	NS	2.462
Dry Matter Digestib		NS	NS	NS	NS	0.242
Digestible Intake[d]		NS	NS	NS	NS	2.231

[a]Le
Breed, Cal
Dam x Bree

[b]Nu

[c]Re

[d]Va

[e]Ul

results were reported by Ducker et al. (1982) in that no relation was found between live weight change and fertility. Trends were also noticed for females on fescue-legume pastures to have larger DM intakes with higher DM digestibility than females on the fescue pastures although these trends were not found to be significant.

II. FORAGE INTAKE AND DIGESTIBILITY AT DAY 89 AND DAY OF FIRST HEAT

Breed of sire and pasture type x breed of dam was shown to have significant effects on fecal output on day 89 with the dams with Hereford sired calves on both pasture types and the Angus-Hereford dams on fescue exhibiting the highest fecal outputs (Table 3). Fecal output on day 89 tended to be higher although not significant ($P>.10$) than at heat. Significance was noted between pasture type and breed of sire ($P<.10$) on DM intake at day 89. Females on fescue-legume pastures were found to have higher DM intake at day 89 than females on fescue pastures. A breed of sire effect was noted across both treatments showing that dams with Hereford sired calves consumed more dry matter than the dams with Angus sired calves. Breed of dam x breed of sire and pasture type x breed of dam x breed of sire effects were found for DM digestibility on day 89. Hereford dams with Angus sired calves on both pasture treatments showed higher DM digestibility than Hereford dams with Hereford sired calves. The pasture type x breed of dam x breed of sire effect consisted of Angus, Angus-Hereford, and Hereford dams with Angus sired calves having higher DM digestibility than their Hereford sired counterparts.

		Level of Significance[b]				
reed of Dam	Breed of Sire	Pasture Type X Breed of Dam	Pasture Type X Breed of Sire	Breed of Dam X Breed of Sire	Pasture Type X Breed of Dam X Breed of Sire	RSD[e]
NS	0.091	0.033	NS	NS	NS	0.408
NS	NS	NS	NS	NS	NS	0.017
NS	0.033	NS	NS	NS	NS	0.845
NS	NS	NS	NS	NS	NS	0.037
NS	NS	NS	NS	0.055	0.046	0.044
NS	NS	NS	NS	NS	NS	0.002
NS	NS	NS	NS	NS	NS	0.784
NS	NS	NS	NS	NS	NS	0.046
NS	NS	NS	NS	NS	NS	1.781
NS	NS	NS	NS	NS	NS	0.039
NS	NS	NS	NS	NS	NS	1.384
NS	NS	NS	NS	NS	NS	0.041
NS	NS	NS	NS	NS	NS	0.149
NS	NS	NS	NS	NS	NS	0.004
NS	NS	NS	NS	NS	NS	3.175
NS	NS	NS	NS	NS	NS	0.111

Females on fescue-legume pastures exhibited higher DM intakes and digestible DM intakes ($P<.05$) than females on fescue pasture at day 89 and day of first heat (Table 3).

Daily change in DM intake followed the same trend as DM intake enabling the females on the fescue-legume pastures to meet their nutrient needs and express estrus 2.5 days earlier than females on fescue pastures. Many workers have shown that females fed high energy diets exhibited estrus earlier after calving than did females on low energy diets (Christenson et al., 1967; Dunn et al., 1969; Hansen et al., 1982). Although no significant differences were found in DM digestibility and change in DM digestibility at heat and March 30; digestible DM intake at heat was found to be affected by pasture type. Females on the fescue-legume pastures consumed more digestible dry matter at heat than those on the lower quality fescue pastures.

III. COW PERFORMANCE AT DAY 89 AND DAY OF FIRST HEAT

A breed of dam x breed of sire effect was noticed for cow fat on day 89 due to Angus and Hereford dams siring calves by Hereford bulls being fatter than those with calves sired by Angus bulls. This trend was not noted for crossbred females (Table 4). Although no significant effects were found for milk production on day 89, a pasture type x breed of dam and a pasture type x breed of sire effect was noticed on the change in milk production at day 89. The pasture type x breed of dam interaction consisted of the Angus-Hereford dams

TABLE

Item	Level of Significance[b]				
	ure Type X ed of Dam	Pasture Type X Breed of Dam	Breed of Dam X Breed of Sire	Pasture Type X Breed of Dam X Breed of Sire	RSD[c]
Weight B					
Δ Weight					
Cow Fat	NS	NS	NS	NS	72.699
Δ Cow Fa	NS	NS	NS	NS	1.079
Milk Pro	NS	NS	0.082	NS	3.494
Δ Milk P	NS	NS	NS	NS	3.523
Weight a	NS	NS	NS	NS	3.094
Δ Weight	.0.028	0.059	NS	NS	0.093
Cow Fat a	NS	NS	NS	NS	81.492
Δ Cow Fat	NS	NS	NS	NS	1.048
Milk Prod	NS	NS	NS	NS	3.828
at Heat	NS	NS	NS	NS	0.018
Δ Milk Pr					
at Heat	NS	NS	NS	NS	4.249
·	NS	NS	NS	NS	0.078

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on the fescue-legume pastures having greater declines in milk on day 89 relative to the other breeds, whereas for fescue pastures the trend was noted that Angus-Hereford dams had the smallest decline on day 89 relative to the other breeds. For the fescue-legume pastures there was a trend for dams with Hereford sired calves to have a smaller change in milk production on day 90 while dams with Angus sired calves resulted in a smaller change in milk production for the fescue treatments.

Breed and pasture type and their interaction were found to have no significant effect on cow weight, cow fat, and changes within each of these variables at the time of heat. Breed of sire was found to have a significant effect ($P<.10$) on milk production at heat across both pasture treatments. On fescue-legume pastures, Angus dams with Angus sired calves produced larger quantities of milk while all dam breeds on the fescue treatments with Angus sired calves producing the most milk as compared to those dams with Hereford sired calves. Although significant effects were found for milk production at heat, no such effects were noticed for the change in milk production at heat.

IV. FACTORS AFFECTING COW WEIGHT AND COW FAT TRENDS OVER THE LACTATION

Breed and pasture type and their interactions were found to have no significant influence on weight ($P>.10$, Table 5) until the last weight in October at weaning. Conflicting results were reported by Backus (1983) in that females on fescue-legume gained more weight during lactation than did those females on fescue pastures.

Cow backfat from day 60 to 120 were found to have significant (P<.10, Table 5) effects due to the interaction of pasture type x breed of dam x breed of sire. Angus and Angus-Hereford dams on fescue-legume pastures and Angus and Hereford dams on fescue pastures with Angus sired calves tended to have more backfat than these same dam breeds with Hereford sired calves. In addition, the Hereford dams on fescue-legume and Angus-Hereford dams on fescue treatments with Hereford sired calves tended to have more backfat than the same dam breeds with Angus sired calves. Pasture type x breed of sire effects (P<.05) were noted for backfat at day 150 at which time the Angus sired calves from Angus and Angus-Hereford dams on fescue-legume expressed larger amounts of backfat than the Angus sired calves from Hereford dams. On this same date the Angus and Angus-Hereford dams on fescue pastures with Angus sired calves proved to have less backfat than their Hereford sired counterparts. Trends were noticed from day 180 to day 240 for the effects of breed of sire and pasture type x breed of sire on backfat. Hereford and Angus-Hereford dams on fescue-legume with Hereford sires tended to be fatter than these two dam groups with Angus sired calves.

An opposite trend was noticed on the fescue pastures with most dam breeds having Angus sired calves having more backfat than the dams with Hereford sired calves (Table 6). In addition to these effects, a breed of dam effect was noticed on day 240 with the Hereford

TABL

Item	Level of Significance[b]				RSD[c]
	asture Type X 3reed of Dam	Pasture Type X Breed of Sire	Breed of Dam X Breed of Sire	Pasture Type X Breed of Dam X Breed of Sire	
Weight	NS	NS	NS	NS	69.017
Weight	NS	NS	NS	NS	72.946
Weight	NS	NS	NS	NS	79.746
Weight	NS	NS	NS	NS	80.823
Weight	NS	NS	NS	NS	76.916
Weight	NS	NS	NS	NS	74.982
Weight	NS	NS	NS	NS	78.078
Cow Fat	NS	NS	NS	0.031	0.558
Cow Fat	NS	NS	NS	0.036	0.543
Cow Fat	NS	NS	NS	0.063	0.557
Cow Fat	NS	0.071	NS	NS	0.588
Cow Fat	NS	0.049	NS	NS	0.641
Cow Fat	NS	0.041	NS	NS	0.732
Cow Fat	NS	0.046	NS	NS	0.878

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TABLE 6.

Item	C Level of Significance[b] Cre Type X d of Dam	Pasture Type X Breed of Sire	Breed of Dam X Breed of Sire	Pasture Type X Breed of Dam X Breed of Sire	RSD[c]
Calf weight 60[d]					
Calf weight 90	NS	NS	NS	0.084	14.637
Calf Weight 120	NS	0.054	NS	NS	17.217
Calf Weight 150	NS	0.027	NS	NS	22.341
Calf Weight 180	NS	0.020	NS	NS	27.467
Calf Weight 210	NS	0.016	NS	NS	31.967
Calf weight 240	NS	0.014	NS	NS	35.894
Milk Production	NS	0.014	NS	NS	39.602
Milk Production	.029	NS	NS	NS	5.466
Milk Production	NS	NS	NS	NS	3.046
Milk Production	NS	0.016	NS	NS	2.613
Milk Production	NS	0.004	NS	NS	2.888
Milk Production	NS	0.002	NS	NS	2.682
Milk Production	NS	0.003	0.069	NS	2.077
Mean Milk Produc	NS	NS	NS	NS	2.863
	NS	0.026	NS	NS	1.882

[a]Least sq
Calf Birthdate x
Type x Breed of C

[b]Numeric v

[c]Residual

[d]Calf weig

[e]Milk prod

dams on the higher quality fescue-legume pastures maintaining more backfat than the other dam groups on this treatment. Wiltbank et al. (1962) stated that weight and condition were significantly affected by either high or low energy treatments with post-calving levels having noticeable effects on changes in body weight and condition score. Similar results were reported by Brown et al. (1980) and McCurley et al. (1981) in that females on low quality pastures producing large quantities of milk maintained less weight and backfat during the intermediate and ending portion of lactation than those dams with smaller amounts of milk produced.

V. FACTORS INFLUENCING CALF WEIGHT AND MILK PRODUCTION TRENDS DURING LACTATION

Hereford dams with Hereford sired calves on fescue-legume and Angus-Hereford dams with Hereford sired calves on fescue pastures tended to be heavier than the other breeds respectively at day 60 indicating a pasture type x breed of dam x breed of sire effect ($P<.10$, Table 6). A trend was indicated throughout the rest of the period (until day 240) that the Hereford sired calves on fescue-legume pastures and the Angus sired calves on fescue pastures weighed more than their respective counterparts. Benyshek et al. (1973) reported a highly significant ($P<.10$) positive linear relationship between adjusted cow weight and calf growth. Neither breed of dam nor pasture type x breed of dam effects were significant in the reported calf weights from day 60 to day 240. Responses of average daily gain of calf to milk yield has been shown to be essentially a linear relationship with total milk yield having a higher correlation with average daily gain than other milk yield variable (Jeffery and Berg, 1971).

Milk production at day 60 was influenced by a pasture type x breed of dam effect with the Angus-Hereford dams on fescue-legume pastures producing more milk than other dam breeds on fescue-legume or fescue pastures (1.77 vs. 1.06 kg). A trend was noticed from day 120 to day 210 for the dams on fescue-legume pastures to produce more milk with Hereford sired calves than those with Angus sired calves. During this same time period, the Angus and Angus-Hereford females with Angus sired calves on fescue pastures produced larger amounts of milk than those dam breeds with Hereford sired calves. These trends indicate a significant ($P<.05$) pasture type x breed of sire interaction with milk production on these dates. Chenette and Frahm (1981) reported that breed of calf-sire had significant effects on butterfat traits and neared significant levels as a source of variation for daily milk yields. In addition to this interaction, a breed of dam x breed of sire effect was noticed on day 210 with the Angus-Hereford dams on fescue-legume pastures having Hereford calf sires producing 1.36 kg more milk than Angus-Hereford dams with Angus sired calves. Mean milk production followed similar trends with Angus-Hereford and Hereford dams with Hereford sired calves on fescue-legume having a larger average milk production than the dams with Angus sired calves. On the fescue pastures, Angus and

Angus-Hereford dams with Angus sired calves maintained a higher average milk production than the Hereford sired calves from the same dam breeds.

VI. FACTORS INFLUENCING BODY MEASUREMENTS

No significant effects were found between breed and pasture type on depth and length from the point of shoulder to the hooks at either the initation or completion of the trials (P>.10, Table 7). Although no significant effects were found on length from the point of shoulder to pins at the initation of the trial, there was a pasture type x breed of dam interaction shown for the final measurement. At this time, Hereford dams on fescue-legume pastures were found to be longer from the point of the shoulder to pins than the other dam breeds on either pasture treatment. Initial height measurements (Fall Height) showed influences of pasture type x breed of dam and pasture type x breed of sire interaction. Pasture type x breed of dam effects consisted of the Angus dams on fescue-legume and fescue pastures being taller than other dam breeds on both treatments. No significant effects were found related to the height measurements taken at the completion of the trials.

Initial weight (Fall Weight) was not significantly affected by either breed or pasture type; however, the final weight (Weight 2) was found to have a significant pasture type x breed of sire effect (P<.10, Table 7). Means show that at the time of weaning all dam breeds with Hereford sired calves on fescue pastures were heavier

	Level of Significance[b]				
reed of Sire	Pasture Type X Breed of Dam	Pasture Type X Breed of Sire	Breed of Dam X Breed of Sire	Pasture Type X Breed of Dam X Breed of Sire	RSD[c]
NS	NS	NS	NS	NS	21.411
NS	NS	NS	NS	NS	106.075
NS	NS	NS	NS	NS	58.098
NS	0.090	0.013	NS	NS	42.625
NS	NS	NS	NS	NS	60.901
NS	NS	NS	0.003	NS	6.770
NS	NS	NS	NS	NS	1.021
NS	NS	NS	NS	NS	23.271
NS	NS	NS	NS	NS	48.344
NS	0.022	NS	NS	NS	55.113
NS	NS	NS	NS	NS	42.581
NS	NS	0.095	NS	NS	71.465
NS	NS	NS	NS	NS	74.771
NS	NS	NS	NS	NS	1.047

than the dams with Angus sired calves on this treatment. Initial hookwidths were found to be affected by breed of dam x breed of sire interactions where Angus dams with Angus sired calves on both pasture treatments were found to have the largest hookwidths. No significant effects were noted for the final hookwidth measurement or backfat thickness at either measurement (P>.10). Conflicting results have been reported by Olson et al. (1982) in that large cows possessed higher amounts of backfat as well as the largest body size as compared to small or intermediate size females.

VII. FACTORS AFFECTING TRENDS IN FORAGE INTAKE AND DIGESTIBILITY THROUGH LACTATION

Dry matter intake at day 60 was found to be affected by both breed of dam and breed of dam x breed of sire interactions. Hereford dams on both treatments were found to have higher intakes at day 60 than the Angus or Angus-Hereford dams on either treatment. Within these two groups of Hereford dams, the dams with Angus sired calves consumed the most dry matter as compared to those with Hereford sired calves on both treatments. Pasture type had significant effects (P<.10, Table 8) on dry matter intake from day 90 to day 240, showing that females on fescue-legume pastures consumed more dry matter than females on fescue pastures. Similar results have been reported by Holloway et al. (1979) and Beaver (1983). During the time period of day 90 and day 120, a breed of sire effect was noted in that dams with Hereford sired calves had larger intakes than those with Angus

TABLE 8.

Item	Co Cal	Level of Significance[b] Pasture Type X Breed of Dam	Pasture Type X Breed of Sire	Breed of Dam X Breed of Sire	Pasture Type X Breed of Dam X Breed of Sire	RSD[c]
Dry Matter Inta		NS	NS	0.030	NS	1.776
Dry Matter Inta		NS	NS	NS	NS	0.855
Dry Matter Inta		NS	NS	NS	NS	1.083
Dry Matter Inta		NS	0.056	NS	NS	1.085
Dry Matter Inta		NS	0.032	NS	NS	0.857
Dry Matter Inta		0.059	NS	NS	NS	0.745
Dry Matter Inta		0.047	NS	NS	NS	0.925
Dry Matter Dige		NS	NS	NS	NS	0.199
Dry Matter Dige		NS	NS	NS	NS	0.047
Dry Matter Dige		0.007	0.099	NS	NS	0.043
Dry Matter Dige		0.045	NS	NS	NS	0.043
Dry Matter Dige		NS	NS	NS	NS	0.048
Dry Matter Dige		NS	NS	NS	NS	0.049
Dry Matter Dige		NS	NS	NS	NS	0.052
Digestible Dry Intake 60[f]		NS	NS	NS	NS	1.891
Digestible Dry Intake 90		NS	NS	NS	NS	0.835
Digestible Dry Intake 120		NS	NS	NS	NS	0.981
Digestible Dry Intake 150		NS	0.055	NS	NS	0.929
Digestible Dry Intake 180		NS	NS	NS	NS	0.777
Digestible Dry Intake 210		NS	NS	NS	NS	0.670
Digestible Dry Intake 240		NS	NS	NS	NS	0.795

[a]Least sq
Calf Birthdate x
Pasture Type x B

[b]Numeric

[c]Residual

[d]Dry matte

[e]Dry matte

[f]Digestibl

sired calves. From day 150 to day 180, dams with Hereford sired calves on fescue-legume pastures consumed larger amounts of dry matter than their counterparts grazing fescue pastures. A pasture type x breed of dam effect was noticed on day 210 and day 240 showing that Herefords consumed relatively more on fescue-legume, whereas Angus-Herefords consumed more on fescue.

Breed and pasture type showed no significant effects on dry matter digestibility at day 60, although there was a significant effect of pasture type ($P<.10$, Table 8) for dry matter digestibility on day 90 and day 180 with higher digestibility expressed for fescue-legumes pastures. This trend for higher digestibility was continued throughout the rest of the trial. Dry matter digestibility at day 120 was affected by pasture type x breed of dam and pasture type x breed of sire. These effects resulted in the Angus-Hereford dams with Hereford sired calves on fescue-legume pastures showing higher digestibilities than Angus-Hereford dams with Hereford sired calves on fescue pastures. Similar results were noticed with the Angus-Hereford dams on fescue-legume pastures at day 150.

Digestible dry matter intake at day 60 was not affected by either breed of dam, breed of sire, or pasture type ($P>.10$, Table 8). A possible explaination of this effect is that at this early date, females were still consuming hay and differences in pasture quality were negligible due to the seasonal influence on the forage. Pasture type influenced digestible dry matter intake from day 90 throughout the remainder of the trial, possibly as a result of the fescue-legume pastures maintaining the advantage of being higher in digestible dry matter as compared to the fescue pastures. These results are supported by Holloway et al. (1979) and Beaver (1983) where they reported higher digestible dry matter intake for females grazing fescue-legume than on fescue pastures. Digestible dry matter intake at day 150 was affected by a pasture type x breed of sire interaction with the dams on fescue pastures with Hereford sires having significantly lower ($P<.10$) digestible dry matter intakes as compared to the dams with Angus sired calves.

VIII. CONCLUSIONS

These results indicate that although there was no significant ($P>.10$) interactions of breed and pasture type on weight and fat at the time of heat, a trend was noticed that females were fatter at heat than day 60. Significant interactions were found on milk production at heat with Angus dams having Angus sired calves producing higher amounts of milk; whereas, all dams on fescue pastures with Angus sired calves exhibited increased production. Females on the fescue-legume pastures consumed more dry matter at heat as compared to those on fescue pastures. No significant effects of breed and pasture type on dry matter digestibility at heat were found, although digestible dry matter intake at heat was higher for females on fescue-legume pastures.

No significant influence of breed and pasture type were noticed for cow weight until the completion of the trials, at which time females on fescue pastures with Hereford sired calves were found to weigh more than those with Angus sired calves. Trends in backfat were noticed with Angus and Angus-Hereford dams on fescue-legume pastures having Angus sired calves as they expressed more backfat than their Hereford sired counterparts. Similar results were found on fescue pastures up until day 120 when dams with Hereford sires gained the advantage and increased backfat thickness during the remainder of the trials. Calf weight and milk production followed similar trends, with dams on fescue-legume pastures with Hereford sired calves producing more milk and having heavier calves than Angus sired calves. Angus and Angus-Hereford dams with Angus sired calves on fescue were found to produce more milk and have heavier calves than those with Hereford sired calves. Hereford dams on fescue-legume pastures increased significantly ($P<.05$) in length from the point of the shoulder to the pins as determined by comparing the initial and final body measurements. Similar, although not significant, results were noted with most dam breeds on both treatments.

A trend was noticed for dry matter intake to be larger for dams on fescue-legume pastures than those on fescue pastures. During this trend, Hereford sired calves consumed larger amounts of dry matter than those with Angus sired calves. Angus and Angus-Hereford dams with Hereford sired calves expressed higher dry matter digestibilities on fescue-legume pastures than Angus or Hereford dams with Angus sired calves. Digestible dry matter intake was found to be higher throughout the trials on fescue-legume pastures as compared to fescue pastures.

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APPENDIX

Key for identification, breed and allotment of females and coefficients of regression analysis obtained from measurements of intake, fecal output (FOUT), digestibility, weight, cow fat (FAT), milk production (MP), and calf weight (CALFWT) for Tables A1 through A12.

Cowno.	= Identification number of individual female.
Breed	= 1 indicates Angus; 2 indicates Hereford; 3 indicates Angus-Hereford.
TMT	= 1 indicates fescue-legume pastures; 2 indicates fescue pastures.
B_0X	= Y intercept of DMI, FOUT, DMD, DDMI, FAT, MP, and CALFWT. Where X = variable name.
A	= Y intercept of weight.
B_1X	= Coefficient of linear effect of DMI, FOUT, DMD, DDMI, FAT, MP, and CALFWT. Where X = variable name.
A_1	= Coefficient of linear effect of weight.
B_2X	= Coefficient of cubic effect of DMI, FOUT, DMD, DDMI, FAT, MP, and CALFWT. Where X = variable name.
A_2	= Coefficient of cubic effect of weight.
B_3X	= Coefficient of quadratic effect of DMI, FOUT, DMD, and DDMI. Where X = variable name.
A_3	= Coefficient of quadratic effect of weight.
B_4X	= Coefficient of quartic effect of DMI, FOUT, DMD, and DDMI. Where X = variable name.
A_4	= Coefficient of quartic effect of weight.
C	= Coefficient of quintic effect of weight.

TABLE A1. Beta Values for 1981 Dry Matter Intake and Fecal Output (kg/day)

OBS	COWNO	BREED	TMT	B0DMI	B1DMI	B2DMI	B3DMI	B4DMI	AFOUT	B1FOUT	B2FOUT	B3FOUT	B4FOUT
1	892	2	2	12.497	-0.0476	0.0001316	-0.0000002	7.93227E-11	17.6805	-0.30567	0.00234598	-0.000008134	1.05931E-08
2	1191	1	1	5.352	0.0590	-0.0005334	0.0000029	-6.21423E-09	18.5048	-0.32358	0.00249457	-0.000008673	1.13118E-08
3	1291	1	2	24.598	-0.3948	0.0034934	-0.0000139	2.00978E-08	13.4770	-0.22368	0.00167862	-0.000005741	7.37525E-09
4	1692	2	1	17.667	-0.2320	0.0020457	-0.0000073	8.89704E-09	14.7881	-0.24404	0.00190076	-0.000006776	9.36509E-09
5	1693	1	1	3.637	0.2113	-0.0027632	0.0000131	-2.08077E-08	28.2406	-0.58670	0.00486864	-0.000017740	2.38336E-08
6	2291	1	1	0.183	0.2076	-0.0020436	0.0000095	-1.63701E-08	8.9424	-0.09277	0.00058169	-0.000001776	2.15359E-09
7	2491	1	2	-1.053	0.2863	-0.0024882	0.0000082	-9.37593E-09	16.8455	-0.27122	0.00203890	-0.000006993	9.14268E-09
8	2692	2	1	13.438	-0.1817	0.0020127	-0.0000082	1.08894E-08	13.2906	-0.20645	0.00153419	-0.000005228	6.83425E-09
9	3191	3	2	5.928	0.1605	-0.0019691	0.0000084	-1.19242E-08	16.2752	-0.26942	0.00205595	-0.000007134	9.44290E-09
10	3692	2	2	8.388	0.0213	-0.0001444	-0.0000002	1.39290E-09	10.2291	-0.13606	0.00093848	-0.000003044	3.80650E-09
11	4092	2	1	61.060	-1.3698	0.0120602	-0.0000438	5.60494E-08	4.6656	-0.02017	0.00006873	-0.000000149	1.45240E-10
12	4391	1	2	9.402	-0.0924	0.0014604	-0.0000080	1.34786E-08	15.9811	-0.28230	0.00218720	-0.000007630	9.98052E-09
13	4691	1	1	-0.635	0.2618	-0.0028807	0.0000139	-2.36682E-08	21.7431	-0.40254	0.00321191	-0.000011476	1.54396E-08
14	5591	2	2	3.599	0.1334	-0.0013243	0.0000056	-9.05727E-09	12.8497	-0.20225	0.00150890	-0.000005152	6.73123E-09
15	5893	1	2	6.533	0.0542	-0.0005372	0.0000017	-1.65604E-09	17.0065	-0.31405	0.00248195	-0.000008772	1.15881E-08
16	6291	1	2	31.518	-0.5585	0.0048609	-0.0000187	2.61933E-08	17.2793	-0.30878	0.00240879	-0.000008445	1.11097E-08
17	6292	1	2	47.301	-1.0045	0.0090860	-0.0000352	4.92658E-08	33.4519	-0.71464	0.00604232	-0.000022381	3.06345E-08
18	6391	2	1	22.992	-0.3816	0.0037733	-0.0000157	2.29313E-08	17.5697	-0.28944	0.00218976	-0.000007534	9.83009E-09
19	6491	2	1	5.611	0.0904	-0.0013218	0.0000077	-1.46131E-08	19.3617	-0.34378	0.00270542	-0.000009598	1.29157E-08
20	7091	1	2	17.819	-0.3021	0.0031417	-0.0000135	2.01129E-08	26.7730	-0.53272	0.00438007	-0.000015962	2.17219E-08
21	7292	2	1	21.789	-0.3801	0.0034527	-0.0000121	1.42883E-08	23.4578	-0.45658	0.00374275	-0.000013674	1.87859E-08
22	7691	2	2	9.477	-0.0104	0.0000960	-0.0000013	3.49300E-09	12.2615	-0.19162	0.00141237	-0.000004774	6.12740E-09
23	7791	2	1	-20.588	0.9125	-0.0093358	0.0000396	-5.98074E-08	10.6374	-0.11750	0.00074095	-0.000002284	2.74977E-09
24	7991	2	1	13.386	-0.0124	-0.0006711	0.0000052	-1.04155E-08	30.5059	-0.61596	0.00506268	-0.000018363	2.46965E-08
25	8191	2	1	18.437	-0.1719	0.0010606	-0.0000027	2.20046E-09	16.4679	-0.27618	0.00213250	-0.000007487	1.00660E-08
26	8291	1	1	38.385	-0.7505	0.0062837	-0.0000213	2.48869E-08	31.1644	-0.65181	0.00546975	-0.000020188	2.76394E-08
27	8293	1	2	39.206	-0.7493	0.0066400	-0.0000258	3.64579E-08	26.7297	-0.54076	0.00442992	-0.000016001	2.13464E-08
28	8692	2	1	17.850	-0.1075	-0.0002646	0.0000054	-1.31268E-08	14.6219	-0.23081	0.00171935	-0.000005859	7.61819E-09
29	8693	1	1	12.563	-0.1246	0.0011081	-0.0000037	4.16950E-09	18.6584	-0.33643	0.00268175	-0.000009638	1.31770E-08
30	10091	2	1	30.899	-0.5349	0.0043253	-0.0000143	1.64528E-08	20.2374	-0.39214	0.00323489	-0.000011938	1.66547E-08
31	10191	3	2	9.101	0.0857	-0.0012599	0.0000054	-7.56867E-09	16.1561	-0.25707	0.00191907	-0.000006547	8.50617E-09
32	10693	1	2	-3.102	0.3424	-0.0033034	0.0000125	-1.66140E-08	28.3413	-0.56613	0.00461664	-0.000016633	2.21797E-08
33	10891	2	1	44.939	-0.9233	0.0081411	-0.0000299	3.89271E-08	19.0084	-0.32454	0.00246977	-0.000008642	1.13285E-08
34	11191	3	1	0.594	0.2638	-0.0029208	0.0000131	-2.01517E-08	29.1024	-0.59538	0.00501162	-0.000018711	2.61839E-08
35	13693	1	2	-13.336	0.5085	-0.0042486	0.0000148	-1.86937E-08	5.7679	-0.05796	0.00037235	-0.000001156	1.48036E-09
36	13893	1	1	33.411	-0.5695	0.0043608	-0.0000139	1.56602E-08	24.6249	-0.50409	0.00419166	-0.000015380	2.09885E-08
37	17091	1	1	8.568	0.0208	-0.0006033	0.0000045	-9.81196E-09	14.4858	-0.24393	0.00187605	-0.000006548	8.70787E-09
38	60191	3	1	26.179	-0.3862	0.0026521	-0.0000067	4.52200E-09	17.8281	-0.32293	0.00254944	-0.000009036	1.20713E-08
39	61391	3	2	7.499	0.0977	-0.0011457	0.0000041	-4.53653E-09	12.4669	-0.18464	0.00133227	-0.000004444	5.65981E-09
40	61791	3	1	31.755	-0.5654	0.0047390	-0.0000164	2.01193E-08	18.9593	-0.34012	0.00268262	-0.000009520	1.27784E-08

TABLE A2. Beta Values for 1982 Dry Matter Intake and Fecal Output (kg/day)

OBS	COWNO	BREED	TMT	B0DMI	B1DMI	B2DMI	B3DMI	B4DMI	AFOUT	B1FOUT	B2FOUT	B3FOUT	B4FOUT
41	402	1	1	-38.659	1.28669	-0.011151	0.0000404	-5.32697E-08	34.338	-0.9033	0.0093828	-0.000039777	5.92408E-08
42	702	1	1	-8.556	0.45095	-0.003255	0.0000089	-7.90546E-09	37.956	-1.0797	0.0121817	-0.000057143	9.46783E-08
43	804	2	1	-58.069	1.73582	-0.014833	0.0000532	-6.88768E-08	7.423	-0.1514	0.0022321	-0.000011875	2.08334E-08
44	1C04	2	2	-20.283	0.75806	-0.006706	0.0000238	-2.39488E-08	-16.836	0.4639	-0.0035733	0.000011159	-1.17439E-08
45	1804	2	2	-28.956	1.15029	-0.012036	0.0000512	-7.60298E-08	3.259	0.0350	-0.0005407	0.000002297	-2.38595E-09
46	2102	1	1	-30.622	1.06346	-0.009277	0.0000333	-4.22178E-08	23.099	-0.5158	0.0050277	-0.000020987	3.17378E-08
47	2402	1	2	14.089	-0.12843	0.001269	-0.0000061	1.10084E-08	39.827	-1.0060	0.0097682	-0.000039800	5.83353E-08
48	2902	3	2	20.567	-0.21066	0.001128	-0.0000017	-7.39145E-10	29.208	-0.7362	0.0074779	-0.000031690	4.79705E-08
49	3002	1	2	-5.870	0.41842	-0.004195	0.0000172	-2.51105E-08	1.308	0.0717	-0.0007405	0.000002651	-2.47515E-09
50	3404	2	1	6.760	-0.04978	0.002078	-0.0000146	2.91356E-08	27.430	-0.7042	0.0074299	-0.000032767	5.15488E-08
51	3502	1	2	-25.939	1.08647	-0.011043	0.0000455	-6.51737E-08	7.723	-0.1348	0.0015473	-0.000007336	1.26177E-08
52	3803	1	1	-34.642	1.18803	-0.010279	0.0000360	-4.37718E-08	14.219	-0.2961	0.0033477	-0.000016196	2.79896E-08
53	3902	1	1	2.708	-0.02628	0.002690	-0.0000195	3.83378E-08	32.801	-0.8585	0.0087989	-0.000037698	5.78072E-08
54	4404	2	1	-31.519	1.04663	-0.008801	0.0000314	-4.09110E-08	0.693	0.0373	0.0002194	-0.000003174	7.76431E-09
55	4604	2	1	-1.463	0.19134	-0.000241	-0.0000056	1.71014E-08	17.173	-0.4399	0.0050191	-0.000023567	3.89864E-08
56	4802	1	1	9.252	-0.16681	0.003835	-0.0000227	3.99954E-08	36.416	-0.9596	0.0098812	-0.000042177	6.37195E-08
57	5402	3	1	-38.252	1.34899	-0.012800	0.0000505	-7.11940E-08	5.736	-0.0191	-0.0000026	0.000000397	-7.64628E-10
58	5602	2	2	9.931	0.03000	-0.000652	0.0000031	-3.62042E-09	14.245	-0.2740	0.0025034	-0.000009871	1.45940E-08
59	6102	1	2	-30.869	1.12171	-0.010952	0.0000444	-6.40636E-08	6.095	-0.0681	0.0007958	-0.000003922	7.35871E-09
60	6202	1	2	-65.419	2.21798	-0.022872	0.0000980	-1.49420E-07	5.922	-0.0963	0.0013662	-0.000007485	1.41118E-08
61	6203	1	2	-9.961	0.53192	-0.005301	0.0000213	-2.95674E-08	-11.529	0.4209	-0.0040169	0.000015589	-2.09979E-08
62	6602	2	1	-50.381	1.46999	-0.011943	0.0000412	-5.23369E-08	-11.326	0.3784	-0.0029161	0.000008818	-8.66058E-09
63	6804	2	2	-13.421	0.70384	-0.007591	0.0000328	-4.89319E-08	1.990	0.0610	-0.0007797	0.000003428	-4.44178E-09
64	7403	1	1	-9.660	0.39078	-0.001378	-0.0000051	2.31665E-08	47.931	-1.3399	0.0143225	-0.000063464	9.99656E-08
65	7804	2	2	-6.365	0.48811	-0.005346	0.0000232	-3.48829E-08	21.515	-0.4896	0.0046752	-0.000018954	2.78654E-08
66	8401	1	1	-41.608	1.32991	-0.011605	0.0000431	-5.82212E-08	21.197	-0.3783	0.0027673	-0.000008030	7.89579E-09
67	8603	1	2	-4.242	0.45923	-0.005169	0.0000226	-3.36108E-08	-4.765	0.2588	-0.0026986	0.000011562	-1.71142E-08
68	8802	1	2	-7.749	0.61788	-0.006996	0.0000310	-4.72475E-08	20.706	-0.4062	0.0034471	-0.000012590	1.70364E-08
69	9402	3	1	-15.270	0.61043	-0.004856	0.0000160	-1.89173E-08	18.719	-0.3855	0.0035223	-0.000013943	2.04474E-08
70	9602	2	1	-7.659	0.45310	-0.003515	0.0000103	-9.54677E-09	15.835	-0.4074	0.0049155	-0.000024595	4.28743E-08
71	9802	2	2	-9.696	0.44895	-0.003410	0.0000091	-5.59245E-09	-11.622	0.4663	-0.0046044	0.000018387	-2.53783E-08
72	16202	1	1	-35.645	1.06916	-0.008248	0.0000260	-2.88144E-08	26.380	-0.6732	0.0070898	-0.000031299	4.92801E-08
73	16302	1	1	18.844	-0.39844	0.005794	-0.0000304	5.20929E-08	17.416	-0.4028	0.0040740	-0.000016697	2.42651E-08
74	16502	1	1	-9.226	0.59341	-0.006382	0.0000289	-4.64937E-08	1.509	0.1524	-0.0022698	0.000012085	-2.07097E-08
75	60401	3	1	-30.960	0.94205	-0.006788	0.0000187	-1.53626E-08	38.627	-0.9443	0.0091725	-0.000037918	5.68181E-08
76	61001	3	2	6.592	0.09375	-0.000968	0.0000030	-1.33163E-09	7.940	-0.1138	0.0013354	-0.000006852	1.28900E-08
77	61401	3	2	-12.062	0.62230	-0.006262	0.0000257	-3.69215E-08	-14.027	0.5277	-0.0049766	0.000018880	-2.48384E-08
78	61501	3	2	30.590	-0.48058	0.003831	-0.0000138	1.97926E-08	12.071	-0.2271	0.0021643	-0.000009160	1.47940E-08
79	62301	3	1	13.252	-0.30626	0.005319	-0.0000302	5.51071E-08	28.178	-0.7485	0.0080811	-0.000035886	5.66292E-08
80	62401	3	1	-55.080	1.83417	-0.017444	0.0000696	-9.97030E-08	29.454	-0.5837	0.0048407	-0.000017245	2.28800E-08

TABLE A3. Beta Values for 1983 Dry Matter Intake and Fecal Output (kg/day)

OBS	COWNO	BREED	TMT	B0DMI	B1DMI	B2DMI	B3DMI	B4DMI	AFOUT	B1FOUT	B2FOUT	B3FOUT	B4FOUT
81	414	3	1	9.517	-0.0952	0.0018966	-0.0000114	2.10943E-08	9.2717	-0.11636	0.0007293	-0.000001875	1.52880E-09
82	1812	3	1	5.939	0.0432	0.0002911	-0.0000046	1.13667E-08	7.1385	-0.06059	0.0001748	0.000000441	-1.96779E-09
83	2112	1	1	34.947	-0.8652	0.0103841	-0.0000496	8.06440E-08	21.6463	-0.47844	0.0043397	-0.000016029	2.05146E-08
84	3013	3	1	1.094	0.1622	-0.0004543	-0.0000023	7.73345E-09	14.3514	-0.22477	0.0015570	-0.000004454	4.13821E-09
85	3312	2	1	-19.175	0.5050	-0.0016492	-0.0000053	2.27152E-08	1.2027	0.09974	-0.0012446	0.000005924	-9.79063E-09
86	4214	3	1	4.046	0.0384	0.0009683	-0.0000087	1.76744E-08	9.0033	-0.13557	0.0010589	-0.000003333	3.32805E-09
87	5212	1	2	31.022	-0.5214	0.0043554	-0.0000156	2.02221E-08	16.2183	-0.26037	0.0017778	-0.000004911	4.34921E-09
88	5311	1	1	42.571	-1.0620	0.0120412	-0.0000552	8.74219E-08	20.2017	-0.42739	0.0038297	-0.000014512	1.96734E-08
89	7013	3	1	25.044	-0.5679	0.0072143	-0.0000353	5.75309E-08	5.2976	0.01477	-0.0006270	0.000003940	-7.45495E-09
90	7213	3	1	5.068	0.0158	0.0011801	-0.0000095	1.87137E-08	7.4023	-0.03950	-0.0002424	0.000003013	-6.93639E-09
91	7712	3	1	-4.412	0.2817	-0.0013478	0.0000004	5.09061E-09	20.9721	-0.44897	0.0040983	-0.000015480	2.03730E-08
92	9112	2	1	53.495	-1.4541	0.0166990	-0.0000768	1.21313E-07	-0.1073	0.16417	-0.0019729	0.000008940	-1.39698E-08
93	9214	3	2	-7.141	0.4558	-0.0043616	0.0000171	-2.42252E-08	12.1181	-0.20346	0.0015783	-0.000005270	6.32236E-09
94	10413	3	1	12.684	-0.0632	0.0007787	-0.0000044	7.95362E-09	9.8248	-0.06739	-0.0002268	0.000003658	-8.60275E-09
95	11012	1	1	17.156	-0.1901	0.0017580	-0.0000069	9.43709E-09	23.2850	-0.47144	0.0039540	-0.000014022	1.75938E-08
96	11813	3	2	40.905	-0.7757	0.0067033	-0.0000248	3.28450E-08	12.3361	-0.14666	0.0005954	0.000000282	-3.66562E-09
97	12214	2	1	23.389	-0.4792	0.0058652	-0.0000286	4.71798E-08	13.8537	-0.25680	0.0023028	-0.000008971	1.24910E-08
98	12311	2	1	23.651	-0.5277	0.0065573	-0.0000315	5.08327E-08	11.2258	-0.18323	0.0014097	-0.000004342	4.32853E-09
99	12411	2	2	28.514	-0.5352	0.0049552	-0.0000192	2.60462E-08	16.6311	-0.30416	0.0023236	-0.000007478	8.47058E-09
100	12613	3	1	-1.959	0.2592	-0.0013788	0.0000014	2.29925E-09	8.9732	-0.07600	0.0002987	0.000000058	-1.74307E-09
101	12813	3	2	2.870	0.2982	-0.0032121	0.0000126	-1.68060E-08	-6.8319	0.41097	-0.0047333	0.000020886	-3.16789E-08
102	13214	2	2	14.407	-0.1921	0.0022549	-0.0000109	1.81737E-08	21.2852	-0.46843	0.0040947	-0.000015158	2.02092E-08
103	13312	3	2	-19.955	0.7566	-0.0066567	0.0000241	-3.11256E-08	15.6749	-0.23791	0.0015602	-0.000004138	3.46606E-09
104	13512	2	2	17.372	-0.1889	0.0016785	-0.0000065	8.86441E-09	16.8914	-0.25597	0.0017092	-0.000004662	4.01508E-09
105	14012	3	2	1.032	0.3952	-0.0048750	0.0000227	-3.61456E-08	18.5874	-0.25532	0.0012886	-0.000001446	-2.47162E-09
106	14613	3	1	0.208	0.0057	0.0025832	-0.0000196	3.84385E-08	3.0734	0.08203	-0.0012785	0.000006484	-1.09628E-08
107	50212	1	2	19.258	-0.3371	0.0040529	-0.0000196	3.20518E-08	12.4536	-0.15964	0.0008681	-0.000001499	-2.83401E-10
108	51212	1	1	69.961	-1.6626	0.0165315	-0.0000692	1.02853E-07	32.3462	-0.72264	0.0065120	-0.000025166	3.49579E-08
109	51812	3	2	39.163	-0.6849	0.0057944	-0.0000217	2.95875E-08	9.5057	-0.02420	-0.0008298	0.000006460	-1.28034E-08
110	53112	3	2	0.682	0.2456	-0.0025295	0.0000106	-1.58848E-08	1.0229	0.16892	-0.0023397	0.000011598	-1.92607E-08
111	53912	3	2	9.504	0.1213	-0.0023454	0.0000130	-2.25532E-08	23.2785	-0.42969	0.0031937	-0.000010017	1.11207E-08
112	54012	1	2	4.202	0.2132	-0.0024034	0.0000102	-1.51841E-08	4.3310	0.12346	-0.0023527	0.000013158	-2.33502E-08
113	54912	3	2	-1.632	0.4365	-0.0050823	0.0000226	-3.43689E-08	13.3733	-0.11430	0.0001912	0.000001640	-4.88747E-09
114	60111	3	1	-32.807	1.1207	-0.0096974	0.0000341	-4.24068E-08	17.6596	-0.33792	0.0028016	-0.000009719	1.17324E-08
115	60211	3	1	6.613	0.0768	-0.0003582	-0.0000002	1.84434E-09	0.5690	0.18888	-0.0026560	0.000013437	-2.27564E-08
116	60411	3	2	-14.636	0.7710	-0.0082545	0.0000363	-5.63941E-08	11.5189	-0.12660	0.0004746	0.000000815	-4.87464E-09
117	60711	3	1	41.561	-0.9912	0.0110149	-0.0000503	7.96966E-08	14.4009	-0.21845	0.0013984	-0.000003517	2.50672E-09
118	61211	3	1	3.440	0.0840	0.0001879	-0.0000045	1.07829E-08	14.1553	-0.21454	0.0016254	-0.000005567	7.00410E-09
119	61311	3	2	3.932	0.1567	-0.0012491	0.0000031	-1.15555E-09	11.7328	-0.08818	-0.0001205	0.000002942	-6.43529E-09
120	61411	3	2	10.892	-0.0252	0.0001476	-0.0000012	3.61069E-09	12.4994	-0.13535	0.0004956	0.000000067	-1.87119E-09

TABLE A4. Beta Values for 1981 Dry Matter Digestibility and Digestible Dry Matter Intake (kg/day)

OBS	COWNO	BREED	TMT	B0DMD	B1DMD	B2DMD	B3DMD	B4DMD	B0DDMI	B1DDMI	B2DDMI	B3DDMI	B4DDMI
1	892	2	2	-0.2867	0.018378	-0.0001288	0.0000004	-4.70036E-10	-7.705	0.37783	-0.003088	0.000009759	-1.08597E-08
2	1191	1	1	-0.8476	0.027296	-0.0001876	0.0000006	-8.35812E-10	5.269	0.20815	-0.003675	0.000022200	-4.24382E-08
3	1291	1	2	0.3369	0.003107	0.0000107	-.0000001	2.92329E-10	6.568	0.04613	-0.000559	0.000001564	-1.14554E-09
4	1692	2	1	0.6285	-0.007162	0.0001065	-.0000005	6.51485E-10	-9.063	0.63440	-0.007824	0.000039339	-6.72834E-08
5	1693	1	1	-1.1657	0.041921	-0.0003544	0.0000013	-1.84514E-09	22.788	-0.24145	0.000481	0.000004631	-1.50558E-08
6	2291	1	1	0.7609	-0.010613	0.0001224	-.0000005	5.56942E-10	1.895	0.21872	-0.003389	0.000021022	-4.15444E-08
7	2491	1	2	-0.4123	0.020504	-0.0001428	0.0000004	-4.82176E-10	-15.746	0.65220	-0.005453	0.000017836	-2.03206E-08
8	2692	2	1	-0.1663	0.012060	-0.0000573	0.0000001	-1.40561E-10	-9.564	0.64072	-0.007878	0.000039304	-6.70746E-08
9	3191	3	2	-0.5920	0.027337	-0.0002237	0.0000008	-1.07091E-09	-5.422	0.34862	-0.002742	0.000007869	-7.05397E-09
10	3692	2	2	-0.1755	0.015930	-0.0001073	0.0000003	-3.47710E-10	-9.891	0.34688	-0.001882	0.000001845	3.95014E-09
11	4092	2	1	2.5662	-0.052934	0.0004753	-.0000017	2.18225E-09	41.667	-0.70349	0.004356	-0.000007010	-5.27125E-09
12	4391	1	2	-0.9710	0.034451	-0.0002542	0.0000008	-1.00495E-09	-16.435	0.61762	-0.005691	0.000021270	-2.84016E-08
13	4691	1	1	0.3831	-0.002932	0.0000677	-.0000003	2.89052E-10	-10.162	0.71600	-0.009222	0.000047072	-8.08216E-08
14	5591	2	2	-0.8554	0.032737	-0.0002651	0.0000010	-1.41102E-09	-6.479	0.39635	-0.004051	0.000016863	-2.52728E-08
15	5893	1	2	0.4525	-0.002442	0.0000786	-.0000004	7.38644E-10	-3.091	0.31574	-0.003167	0.000012371	-1.72055E-08
16	6291	1	2	0.3117	0.002368	0.0000219	-.0000002	3.74279E-10	-7.918	0.39217	-0.003211	0.000010033	-1.08386E-08
17	6292	1	2	-0.6105	0.027545	-0.0002143	0.0000007	-9.64496E-10	34.646	-0.76905	0.007115	-0.000027422	3.73952E-08
18	6391	2	1	-0.0143	0.006447	0.0000110	-.0000002	4.63153E-10	-0.593	0.22880	-0.001640	0.000003673	-1.68939E-09
19	6491	2	1	0.4429	-0.003854	0.0000668	-.0000002	2.05413E-10	-5.174	0.54800	-0.007252	0.000037526	-6.47605E-08
20	7091	1	2	0.0885	0.004219	0.0000218	-.0000002	3.75857E-10	10.510	-0.07601	0.000953	-0.000005444	1.00608E-08
21	7292	2	1	-0.4049	0.017202	-0.0001096	0.0000004	-6.20774E-10	-6.052	0.60617	-0.008425	0.000044606	-7.78080E-08
22	7691	2	2	-0.2419	0.017555	-0.0001189	0.0000003	-3.50913E-10	-7.489	0.34116	-0.002858	0.000009970	-1.31021E-08
23	7791	2	1	-1.7288	0.059049	-0.0005461	0.0000022	-3.21174E-09	-5.222	0.56594	-0.007636	0.000040634	-7.27592E-08
24	7991	2	1	-1.1423	0.041222	-0.0003535	0.0000014	-1.97835E-09	31.061	-0.27110	-0.000447	0.000012989	-3.29194E-08
25	8191	2	1	-0.1820	0.017398	-0.0001412	0.0000005	-7.98316E-10	-45.292	1.65626	-0.017993	0.000081936	-1.31175E-07
26	8291	1	1	-0.3544	0.018485	-0.0001421	0.0000006	-9.91780E-10	-4.116	0.60611	-0.008459	0.000043725	-7.45530E-08
27	8293	1	2	-0.0643	0.011547	-0.0000556	0.0000001	-3.23768E-11	-3.887	0.32441	-0.003334	0.000013823	-2.06813E-08
28	8692	2	1	-0.0554	0.016513	-0.0001677	0.0000008	-1.30289E-09	-10.080	0.58470	-0.007022	0.000035800	-6.31131E-08
29	8693	1	1	-0.7293	0.026507	-0.0001962	0.0000007	-9.69044E-10	-19.978	1.02622	-0.012784	0.000063821	-1.08110E-07
30	10091	2	1	-0.1434	0.016548	-0.0001381	0.0000006	-9.72314E-10	-6.867	0.59893	-0.008059	0.000042054	-7.30108E-08
31	10191	3	2	-0.3595	0.020685	-0.0001612	0.0000006	-7.21291E-10	-10.983	0.46244	-0.003549	0.000010409	-1.05165E-08
32	10693	1	2	-0.2458	0.016282	-0.0001069	0.0000003	-3.93052E-10	6.111	0.04451	-0.000314	-0.000000193	2.34848E-09
33	10891	2	1	0.7384	-0.010772	0.0001319	-.0000005	6.77597E-10	-0.262	0.40761	-0.006001	0.000033759	-6.20097E-08
34	11191	3	1	-0.2092	0.016322	-0.0001284	0.0000005	-8.55932E-10	12.520	0.15814	-0.004608	0.000031712	-6.29060E-08
35	13693	1	2	-0.6044	0.028014	-0.0002198	0.0000008	-9.62207E-10	34.682	-0.53618	0.003740	-0.000011622	1.30647E-08
36	13893	1	1	-0.3049	0.021251	-0.0001806	0.0000007	-1.13403E-09	8.976	0.12818	-0.003207	0.000020679	-3.96356E-08
37	17091	1	1	-0.8350	0.033262	-0.0002805	0.0000011	-1.60797E-09	0.951	0.22708	-0.002996	0.000016925	-3.21934E-08
38	60191	3	1	-0.0267	0.013729	-0.0001189	0.0000005	-8.79347E-10	-0.934	0.54264	-0.008264	0.000044774	-7.88357E-08
39	61391	3	2	-0.3144	0.020915	-0.0001608	0.0000005	-6.28645E-10	3.336	0.04692	0.000350	-0.000004665	1.02645E-08
40	61791	3	1	0.1719	0.005936	-0.0000270	0.0000001	-2.05419E-10	-18.663	0.98906	-0.011530	0.000053965	-8.73193E-08

TABLE A5. Beta Values for 1982 Dry Matter Digestibility and Digestible Dry Matter Intake (kg/day)

OBS	COWNO	BREED	TMT	B0DMD	B1DMD	B2DMD	B3DMD	B4DMD	B0DDMI	B1DDMI	B2DDMI	B3DDMI	B4DDMI
41	402	1	1	-2.3710	0.081476	-0.0007686	0.000003	-4.35475E-09	-58.549	1.75093	-0.015948	0.0000608	-8.38688E-08
42	702	1	1	-0.9520	0.046129	-0.0004766	0.0000021	-3.25228E-09	-22.791	0.78592	-0.007170	0.0000277	-3.90869E-08
43	804	2	1	-3.2782	0.105906	-0.0010122	0.0000041	-5.87331E-09	-75.205	2.16144	-0.019698	0.0000756	-1.04508E-07
44	1004	2	2	0.7322	0.001824	-0.0000568	3.00000E-07	-6.47986E-10	-10.685	0.45627	-0.004318	0.0000163	-2.12411E-08
45	1804	2	2	-1.3483	0.055761	-0.0005621	0.0000024	-3.68110E-09	-32.215	1.11525	-0.011495	0.0000489	-7.36439E-08
46	2102	1	1	-3.2416	0.099728	-0.0009117	0.0000036	-5.02270E-09	-48.586	1.42826	-0.012785	0.0000481	-6.50830E-08
47	2402	1	2	-3.0478	0.102623	-0.0010041	0.0000041	-5.93496E-09	-26.526	0.90404	-0.008814	0.0000353	-5.01467E-08
48	2902	3	2	-1.5640	0.067223	-0.0007282	0.0000032	-5.06328E-09	-8.641	0.52553	-0.006350	0.0000300	-4.87097E-08
49	3002	1	2	-0.1089	0.019773	-0.0002007	9.00000E-07	-1.46356E-09	-9.766	0.42134	-0.004192	0.0000176	-2.67087E-08
50	3404	2	1	-1.5716	0.059523	-0.0005695	0.0000023	-3.40345E-09	-20.670	0.65441	-0.005352	0.0000182	-2.24132E-08
51	3502	1	2	-1.1266	0.054835	-0.0005807	0.0000025	-3.81697E-09	-33.662	1.22129	-0.012590	0.0000528	-7.77914E-08
52	3803	1	1	-1.8260	0.065487	-0.0006281	0.0000026	-3.80345E-09	-48.456	1.47472	-0.013560	0.0000520	-7.16064E-08
53	3902	1	1	-2.0721	0.072008	-0.0006657	0.0000026	-3.79674E-09	-28.564	0.78379	-0.005586	0.0000159	-1.59499E-08
54	4404	2	1	-0.6328	0.034868	-0.0003414	0.0000014	-2.22149E-09	-31.351	0.98303	-0.008744	0.0000333	-4.69086E-08
55	4604	2	1	-0.8830	0.043003	-0.0004240	0.0000018	-2.65682E-09	-18.961	0.63327	-0.005199	0.0000175	-2.07526E-08
56	4802	1	1	-2.3119	0.079298	-0.0007429	0.000003	-4.28885E-09	-28.091	0.81070	-0.006124	0.0000194	-2.31524E-08
57	5402	3	1	-0.7065	0.032071	-0.0002695	1.00000E-06	-1.31079E-09	-37.077	1.16034	-0.010646	0.0000410	-5.70705E-08
58	5602	2	2	-0.7016	0.036825	-0.0003675	0.0000015	-2.28055E-09	-5.673	0.34959	-0.003691	0.0000156	-2.26098E-08
59	6102	1	2	-3.4539	0.115119	-0.0011541	0.0000048	-7.15438E-09	-46.454	1.46371	-0.014442	0.0000592	-8.68069E-08
60	6202	1	2	-5.7675	0.197351	-0.0021427	0.0000097	-1.55299E-08	-90.527	2.91007	-0.030740	0.0001351	-2.11747E-07
61	6203	1	2	-0.0231	0.016308	-0.0001508	6.00000E-07	-8.98521E-10	-11.714	0.47276	-0.004617	0.0000186	-2.63132E-08
62	6602	2	1	-1.0147	0.038440	-0.0003240	0.0000012	-1.67003E-09	-43.431	1.18567	-0.009590	0.0000333	-4.30330E-08
63	6804	2	2	-0.3021	0.027771	-0.0002926	0.0000013	-2.00231E-09	-15.606	0.64742	-0.006843	0.0000294	-4.44633E-08
64	7403	1	1	-1.8541	0.068138	-0.0006498	0.0000026	-3.73765E-09	-43.526	1.30767	-0.011322	0.0000399	-4.95438E-08
65	7804	2	2	-2.4273	0.087896	-0.0008929	0.0000038	-5.64952E-09	-29.202	1.01894	-0.010468	0.0000442	-6.59385E-08
66	8401	1	1	-3.6079	0.101894	-0.0008484	0.000003	-3.80776E-09	-62.806	1.70824	-0.014372	0.0000511	-6.61169E-08
67	8603	1	2	1.0816	-0.010498	0.0000712	-2.00000E-07	2.58848E-10	0.379	0.20470	-0.002512	0.0000112	-1.67409E-08
68	8802	1	2	-1.8465	0.067407	-0.0006471	0.0000026	-3.74533E-09	-28.455	1.02412	-0.010443	0.0000436	-6.42839E-08
69	9402	3	1	-2.1304	0.068155	-0.0005890	0.0000022	-3.02408E-09	-35.540	1.02349	-0.008527	0.0000301	-3.93044E-08
70	9602	2	1	-1.7634	0.071104	-0.0007416	0.0000033	-5.23232E-09	-29.586	1.01256	-0.009673	0.0000390	-5.71263E-08
71	9802	2	2	-1.5396	0.053392	-0.0004794	0.0000018	-2.53915E-09	-18.441	0.56452	-0.004486	0.0000139	-1.40622E-08
72	16202	1	1	-3.3412	0.106081	-0.0010014	0.000004	-5.87348E-09	-62.025	1.74233	-0.015337	0.0000573	-7.80945E-08
73	16302	1	1	-0.3169	0.024789	-0.0002143	8.00000E-07	-9.93510E-10	0.348	0.04677	0.001145	-0.0000106	2.20652E-08
74	16502	1	1	-0.1099	0.015125	-0.0001075	3.00000E-07	-4.08056E-10	-10.905	0.44714	-0.004191	0.0000171	-2.62261E-08
75	60401	3	1	-5.6067	0.162803	-0.0014988	0.0000058	-8.25581E-09	-73.808	2.02416	-0.017517	0.0000638	-8.37436E-08
76	61001	3	2	-1.3310	0.055166	-0.0005651	0.0000024	-3.61012E-09	-19.100	0.70925	-0.007102	0.0000289	-4.12532E-08
77	61401	3	2	-0.7409	0.038259	-0.0004176	0.0000019	-3.14817E-09	-20.456	0.73667	-0.007527	0.0000321	-4.87456E-08
78	61501	3	2	0.3164	0.012248	-0.0001490	7.00000E-07	-1.13748E-09	15.992	-0.18293	0.001012	-0.0000022	1.78459E-09
79	62301	3	1	-0.7689	0.037071	-0.0003395	0.0000013	-1.78945E-09	-18.997	0.56502	-0.003990	0.0000108	-9.27953E-09
80	62401	3	1	-2.9260	0.086409	-0.0007395	0.0000027	-3.61476E-09	-79.845	2.25637	-0.020403	0.0000780	-1.08212E-07

TABLE A6. Beta Values for 1983 Dry Matter Digestibility and Digestible Dry Matter Intake (kg/day)

OBS	CCWNO	BREED	TMT	B0DMD	B1DMD	B2DMD	B3DMD	B4DMD	B0DDMI	B1DDMI	B2DDMI	B3DDMI	B4DDMI
81	414	3	1	-0.2189	0.014464	-0.0000567	0.0000000	3.66274E-10	-1.108	0.0480	0.000989	-0.0000091	1.92460E-08
82	1812	3	1	0.2061	0.005587	0.0000124	-.0000003	6.74228E-10	1.825	0.0053	0.001204	-0.0000098	2.05133E-08
83	2112	1	1	-0.1056	0.012031	-0.0000127	-.0000004	1.18430E-09	11.383	-0.3408	0.005687	-0.0000324	5.89357E-08
84	3013	3	1	-0.8463	0.031742	-0.0002202	0.0000006	-5.86186E-10	-13.076	0.3907	-0.002160	0.0000033	1.28931E-09
85	3312	2	1	-0.4650	0.019096	-0.0000745	-.0000001	5.95395E-10	-22.155	0.4533	-0.000848	-0.0000096	3.01675E-08
86	4214	3	1	-0.2263	0.018656	-0.0001148	0.0000002	-3.88076E-11	-5.709	0.1920	-0.000225	-0.0000050	1.40215E-08
87	5212	1	2	0.7116	-0.008195	0.0001263	-.0000007	1.13793E-09	28.099	-0.6330	0.006260	-0.0000259	3.81422E-08
88	5311	1	1	0.6293	-0.007882	0.0001573	-.0000009	1.67153E-09	26.349	-0.7468	0.009284	-0.0000450	7.38019E-08
89	7013	3	1	0.9704	-0.020517	0.0003067	-.0000016	2.73997E-09	19.068	-0.5709	0.007812	-0.0000395	6.56629E-08
90	7213	3	1	-0.1350	0.012036	-0.0000237	-.0000002	6.63500E-10	-2.533	0.0627	0.001332	-0.0000121	2.49435E-08
91	7712	3	1	-1.3436	0.045711	-0.0003531	0.0000011	-1.11003E-09	-23.217	0.6634	-0.004733	0.0000128	-1.08157E-08
92	9112	2	1	1.7622	-0.044062	0.0005414	-.0000026	4.11783E-09	51.648	-1.5789	0.018492	-0.0000858	1.36285E-07
93	9214	3	2	-1.2542	0.049402	-0.0004467	0.0000017	-2.37286E-09	-22.467	0.7567	-0.006965	0.0000268	-3.72924E-08
94	10413	3	1	0.2320	0.001337	0.0000804	-.0000007	1.35668E-09	3.571	-0.0043	0.000957	-0.0000074	1.50342E-08
95	11012	1	1	-1.1033	0.041260	-0.0003379	0.0000011	-1.36721E-09	-7.460	0.3231	-0.002619	0.0000088	-1.05485E-08
96	11813	3	2	1.1039	-0.019900	0.0002561	-.0000013	2.08408E-09	24.447	-0.5063	0.004898	-0.0000201	2.94429E-08
97	12214	2	1	-0.4370	0.023927	-0.0001705	0.0000005	-3.95352E-10	-2.087	0.09432	0.000688	-0.0000089	2.02317E-08
98	12311	2	1	0.1927	0.005326	0.0000224	-.0000003	8.23280E-10	12.782	-0.35078	0.005150	-0.0000269	4.58108E-08
99	12411	2	2	0.0762	0.008450	-0.0000218	-.0000001	3.19898E-10	10.815	-0.19944	0.002302	-0.0000103	1.52569E-08
100	12613	3	1	-0.7375	0.029819	-0.0002170	0.0000006	-6.06648E-10	-15.384	0.46331	-0.002933	0.0000064	-3.01123E-09
101	12813	3	2	0.6112	-0.009440	0.0001743	-.0000010	1.69263E-09	-4.580	0.25787	-0.001827	0.0000044	-2.29687E-09
102	13214	2	2	-0.4727	0.027293	-0.0002094	0.0000006	-6.65232E-10	-6.014	0.24501	-0.001456	0.0000024	1.04374E-09
103	13312	3	2	-1.5923	0.046718	-0.0003430	0.0000010	-1.11482E-09	-33.573	0.93215	-0.007615	0.0000258	-3.13031E-08
104	13512	2	2	-1.0304	0.034897	-0.0002634	0.0000008	-9.52519E-10	-5.929	0.23636	-0.001625	0.0000045	-4.25136E-09
105	14012	3	2	-1.2815	0.044037	-0.0003563	0.0000012	-1.42081E-09	-18.025	0.66628	-0.006350	0.0000250	-3.52324E-08
106	14613	3	1	-0.0263	0.000775	0.0001425	-.0000011	2.09927E-09	-0.906	-0.13814	0.004539	-0.0000291	5.42079E-08
107	50212	1	2	0.2573	-0.001447	0.0001149	-.0000008	1.56309E-09	6.873	-0.17825	0.003179	-0.0000181	3.21689E-08
108	51212	1	1	-0.3479	0.021053	-0.0001436	0.0000004	-3.14634E-10	36.964	-0.93095	0.009992	-0.0000441	6.79560E-08
109	51812	3	2	1.4035	-0.030381	0.0003729	-.0000018	2.88085E-09	27.275	-0.58228	0.005759	-0.0000243	3.64815E-08
110	53112	3	2	0.2332	0.000040	0.0000720	-.0000005	1.01092E-09	0.009	0.06760	-0.000111	-0.0000013	3.73444E-09
111	53912	3	2	-0.2105	0.016087	-0.0000999	0.0000002	-1.12517E-10	-4.180	0.29039	-0.003037	0.0000129	-1.91294E-08
112	54012	1	2	0.4405	-0.006273	0.0001679	-.0000010	1.88998E-09	-0.248	0.09326	-0.000087	-0.0000028	7.88528E-09
113	54912	3	2	-1.0487	0.037063	-0.0003154	0.0000012	-1.56159E-09	-14.793	0.54306	-0.005221	0.0000209	-2.97403E-08
114	60111	3	1	-1.8422	0.061506	-0.0005198	0.0000018	-2.19066E-09	-49.146	1.44454	-0.012687	0.0000458	-5.85583E-08
115	60211	3	1	1.0777	-0.024397	0.0003454	-.0000018	3.03167E-09	8.146	-0.15960	0.002617	-0.0000144	2.51539E-08
116	60411	3	2	0.3803	0.003209	-0.0000008	-.0000001	3.27716E-10	-16.137	0.65586	-0.006690	0.0000282	-4.21275E-08
117	60711	3	1	0.4676	-0.005548	0.0001558	-.0000010	1.81443E-09	25.550	-0.72443	0.009110	-0.0000446	7.36635E-08
118	61211	3	1	-0.3034	0.013878	-0.0000424	-.0000001	5.04820E-10	-8.641	0.21143	-0.000275	-0.0000049	1.38937E-08
119	61311	3	2	-0.4456	0.014660	-0.0000250	-.0000002	7.40978E-10	-7.337	0.22976	-0.000954	-0.0000007	6.76646E-09
120	61411	3	2	0.3044	-0.004833	0.0001506	-.0000009	1.66811E-09	1.668	0.00667	0.000775	-0.0000062	1.30636E-08

TABLE A7. Beta Values for 1981 Cow Weight (kg) and Cow Fat (mm)

OBS	COWNO	BREED	TMT	A	A1	A2	A3	A4	C	B0FAT	B1FAT	B2FAT
1	892	2	2	377.708	6.102	21.142	12.942	4.939	0.0083453	15.7724	-0.04401	0.00003370
2	1191	1	1	326.910	22.040	-13.582	-7.338	2.189	0.0111163	22.1611	-0.08390	0.00008260
3	1291	1	2	333.100	15.133	6.623	4.243	-14.413	0.0091890	6.3615	-0.01595	0.00001380
4	1692	2	1	385.817	-27.953	43.908	-14.251	22.246	0.0067972	33.9878	-0.12975	0.00012670
5	1693	1	1	257.592	-4.627	24.115	1.883	19.843	0.0078513	10.5823	-0.02631	0.00001560
6	2291	1	1	309.606	29.484	-2.586	-10.386	-2.395	0.0106591	25.0668	-0.09482	0.00009430
7	2491	1	2	395.322	1.621	-31.773	5.203	3.726	0.0120072	14.0812	-0.05053	0.00005160
8	2692	2	1	394.855	-1.021	-29.376	15.208	-0.839	0.0121909	22.1987	-0.07697	0.00007610
9	3191	3	2	384.113	31.283	-9.322	-15.209	2.978	0.0105625	35.1287	-0.13001	0.00012520
10	3692	2	2	327,809	4.853	32.694	18.167	-2.957	0.0087776	33.5059	-0.12724	0.00012260
11	4092	2	1	326.178	22.978	6.459	-12.802	-1.259	0.0097845	33.3318	-0.11598	0.00010700
12	4391	1	2	317.560	7.434	24.502	13.671	0.423	0.0087404	27.4929	-0.09828	0.00009010
13	4691	1	1	.	.	.	.	.	.	25.3994	-0.09523	0.00009720
14	5591	2	2	.	.	.	.	.	.	17.4328	-0.06521	0.00006440
15	5893	1	2	314.514	3.386	24.020	11.107	3.980	0.0083870	29.4650	-0.10272	0.00009030
16	6291	1	2	.	.	.	.	.	.	27.7073	-0.10043	0.00009670
17	6292	1	2	.	.	.	.	.	.	14.5972	-0.05361	0.00005170
18	6391	2	1	386.811	3.593	29.622	9.393	-10.790	0.0088646	20.0142	-0.07153	0.00006890
19	6491	2	1	335.788	17.299	29.525	3.454	-16.530	0.0091500	34.0259	-0.13125	0.00012970
20	7091	1	2	351.489	20.762	27.056	14.628	-9.460	0.0089086	30.2603	-0.11354	0.00011060
21	7292	2	1	326.900	9.829	24.431	7.221	-20.125	0.0092302	23.4716	-0.09830	0.00008570
22	7691	2	2	307.306	1.392	26.913	14.423	5.727	0.0086778	33.3160	-0.12185	0.00011480
23	7791	2	1	365.018	10.356	-43.773	5.909	11.195	0.0117554	44.0644	-0.16678	0.00016180
24	7991	2	1	347.589	5.995	23.984	9.696	-11.451	0.0090538	28.5991	-0.11067	0.00011070
25	8191	2	1	383.230	-40.504	-13.006	-4.365	-14.864	0.0129198	41.6102	-0.15452	0.00014810
26	8291	1	1	.	.	.	.	.	.	27.9573	-0.09900	0.00008880
27	8293	1	2	336.576	-20.915	-17.012	3.755	2.986	0.0123152	25.0698	-0.09276	0.00008970
28	8692	2	1	342.042	-33.178	35.931	-2.610	24.789	0.0079665	21.1805	-0.08016	0.00007950
29	8693	1	1	288.979	-13.189	-21.232	10.574	5.306	0.0123315	25.5037	-0.09039	0.00008340
30	10091	2	1	281.688	-9.941	-25.805	6.192	7.026	0.0120752	14.3792	-0.05553	0.00005620
31	10191	3	2	332.246	-3.769	-27.118	3.972	-4.992	0.0120593	14.8039	-0.05438	0.00005320
32	10693	1	2	327.920	2.195	15.216	6.967	11.262	0.0079624	9.1092	-0.03090	0.00002900
33	10891	2	1	.	.	.	.	.	.	31.4214	-0.12263	0.00012490
34	11191	3	1	.	.	.	.	.	.	13.4923	-0.05464	0.00006560
35	13693	1	2	356.388	0.385	18.381	16.281	1.780	0.0100358	11.3931	-0.03841	0.00003797
36	13893	1	1	341.355	-9.797	-20.082	2.514	3.575	0.0070729	11.9023	-0.04155	0.00004260
37	17091	1	1	306.457	24.959	-1.940	6.017	0.529	0.0106269	26.9833	-0.10326	0.00010060
38	60191	3	1	365.229	-9.034	16.931	-0.795	5.116	0.0113830	26.4465	-0.09796	0.00009633
39	61391	3	2	362.463	17.298	-17.807	0.630	7.010	0.0112025	19.7446	-0.07545	0.00008000
40	61791	3	1	346.191	-6.661	-34.131	7.597	2.065	0.0119069	12.4655	-0.04312	0.00004140

TABLE A8. Beta Values for 1982 Cow Weight (kg) and Cow Fat (mm)

OBS	COWNO	BREED	TMT	A	A1	A2	A3	A4	C	B0FAT	B1FAT	B2FAT
41	402	1	1	414.324	-41.486	3.244	4.826	19.138	0.0099614	4.60698	-0.028178	0.0001331
42	702	1	1	391.139	-24.368	27.298	13.629	9.364	0.0114579	4.22269	-0.029340	0.0001282
43	804	2	1	357.834	-21.978	19.204	13.825	11.526	0.0103760	5.09153	-0.038888	0.0001583
44	1004	2	2	336.662	-19.304	-1.782	5.907	19.082	0.0096222	4.10915	-0.030982	0.0001261
45	1804	2	2	341.189	-16.233	11.614	-9.058	7.546	0.0098762	3.54223	-0.033740	0.0001182
46	2102	1	1	348.102	-16.642	19.744	3.831	12.866	0.0099896	3.35778	-0.030260	0.0001115
47	2402	1	2	403.098	-17.026	7.236	3.023	18.560	0.0082786	4.80229	-0.037476	0.0001100
48	2902	3	2	358.151	-28.308	6.242	-6.594	12.598	0.0082713	2.85989	-0.025590	0.0000983
49	3002	1	2	326.489	-7.405	19.680	6.532	12.807	0.0114297	3.43647	-0.020540	0.0000602
50	3404	2	1	348.797	-36.254	5.078	-1.867	16.874	0.0093210	2.10722	-0.012136	0.0000670
51	3502	1	2	391.653	-30.394	6.923	3.819	20.788	0.0092729	3.13740	-0.023084	0.0000933
52	3803	1	1	344.445	-25.366	3.959	-2.414	15.385	0.0092266	2.56552	-0.014750	0.0000592
53	3902	1	1	362.406	-42.347	-7.785	-7.536	17.055	0.0082809	2.18120	-0.021481	0.0000935
54	4404	2	1	361.619	-31.840	-8.483	-1.805	11.598	0.0085880	4.07315	-0.033421	0.0001511
55	4604	2	1	351.778	-21.142	10.504	7.819	19.484	0.0100953	3.89033	-0.037468	0.0001488
56	4802	1	1	315.996	-26.442	18.922	10.409	15.328	0.0104722	2.75802	-0.028410	0.0001155
57	5402	3	1	333.468	-20.774	17.166	7.041	18.477	0.0100921	2.24225	-0.020803	0.0000942
58	5602	2	2	345.428	-20.561	13.551	-0.544	17.578	0.0102622	2.58673	-0.008500	0.0000304
59	6102	1	2	363.233	-16.286	28.975	3.264	11.295	0.0106659	3.18896	-0.025205	0.0000722
60	6202	1	2	360.742	-16.829	18.463	2.562	8.552	0.0103012	2.63803	-0.010009	0.0000326
61	6203	1	2	395.177	-7.651	4.021	12.236	9.630	0.0111825	2.14772	-0.009603	0.0000508
62	6602	2	1	343.699	-20.256	20.187	17.741	10.781	0.0105987	2.56887	-0.021105	0.0001169
63	6804	2	2	338.757	-30.259	3.354	-10.970	2.663	0.0082137	3.23420	-0.028452	0.0001188
64	7403	1	1	352.489	-12.765	18.383	14.575	11.431	0.0108432	3.79436	-0.035667	0.0001166
65	7804	2	2	365.623	-16.750	5.642	8.172	13.872	0.0105162	4.28638	-0.026098	0.0000991
66	8401	1	1	330.000	1.744	15.172	17.260	11.987	0.0087222	2.30517	-0.015151	0.0000401
67	8603	1	2	375.881	-11.299	16.975	9.022	14.726	0.0105030	2.72418	-0.018575	0.0000463
68	8802	1	2	363.503	-24.220	8.258	5.921	15.495	0.0093704	2.19068	-0.014208	0.0000775
69	9402	3	1	346.086	-8.640	15.113	10.264	13.471	0.0107013	2.31327	-0.018438	0.0000735
70	9602	2	1	346.562	-21.552	11.810	7.770	17.811	0.0101052	2.96653	-0.019254	0.0000953
71	9802	2	2	368.393	-11.453	23.088	9.025	15.130	0.0107362	3.75802	-0.028410	0.0001155
72	16202	1	1	325.156	-15.544	24.338	5.122	9.231	0.0109349	3.81297	-0.021392	0.0000617
73	16302	1	1	342.462	-36.044	14.120	0.964	21.786	0.0097297	3.15329	-0.031942	0.0001197
74	16502	1	1	351.954	-45.011	-13.047	-35.144	-16.166	0.0086905	1.67759	-0.007802	0.0000275
75	60401	3	1	332.707	-8.577	16.298	16.579	2.220	0.0113817	3.18166	-0.024406	0.0000947
76	61001	3	2	371.439	-19.450	11.310	8.819	16.862	0.0103261	2.78948	-0.016761	0.0000671
77	61401	3	2	342.800	-9.926	11.374	-0.394	12.534	0.0102223	2.36879	-0.011799	0.0000408
78	61501	3	2	334.764	-30.090	-5.308	-4.086	0.869	0.0068670	2.38993	-0.017546	0.0000611
79	62301	3	1	324.478	-27.032	6.260	3.012	18.282	0.0097410	2.20747	-0.017042	0.0000937
80	62401	3	1	345.361	-3.857	18.570	14.860	7.927	0.0100785	2.76045	-0.021307	0.0000790

TABLE A9. Beta Values for 1983 Cow Weight (kg) and Cow Fat (mm)

OBS	COWNO	BREED	TMT	A	A1	A2	A3	A4	C	B0FAT	B1FAT	B2FAT
81	414	3	1	407.820	2.128	15.9842	9.257	19.8022	0.0092380	4.41232	-0.012243	0.0000379
82	1812	3	1	305.970	-1.013	16.5713	10.685	12.8451	0.0093659	1.76877	-0.008464	0.0000494
83	2112	1	1	317.678	-15.826	23.3302	3.103	3.7557	0.0116783	2.19259	-0.020888	0.0000999
84	3013	3	1	370.224	-8.534	19.7909	7.304	17.4781	0.0095795	4.70266	-0.032600	0.0001138
85	3312	2	1	380.417	-27.217	-6.9473	2.592	9.2473	0.0095704	2.67658	-0.015701	0.0000971
86	4214	3	1	368.380	-6.643	10.0157	11.365	4.6297	0.0101551	5.06674	-0.022770	0.0000991
87	5212	1	2	351.602	0.841	20.1749	4.928	9.8234	0.0122952	2.33397	-0.026924	0.0001448
88	5311	1	1	335.272	-20.654	12.0161	3.574	21.2836	0.0087821	2.36444	-0.018925	0.0000964
89	7013	3	1	362.195	-19.754	20.3141	10.196	5.3846	0.0115173	3.46770	-0.037225	0.0002029
90	7213	3	1	339.609	-5.161	9.8932	11.801	-2.2034	0.0133358	2.45393	-0.019927	0.0001204
91	7712	3	1	366.339	-8.164	24.9401	13.582	-3.9750	0.0132042	3.31520	-0.020018	0.0001083
92	9112	2	1	357.716	-19.333	3.7870	5.094	16.0233	0.0097968	1.96072	-0.011810	0.0000752
93	9214	3	2	372.275	-3.553	12.9226	0.721	13.6534	0.0089141	5.38577	-0.028375	0.0000894
94	10413	3	1	344.222	-5.334	2.2180	3.886	11.9412	0.0092103	2.03398	-0.005272	0.0000418
95	11012	1	1	317.701	-13.776	13.0372	9.744	8.0196	0.0096770	2.67834	-0.027879	0.0001243
96	11813	3	2	313.882	-0.318	18.4774	9.338	1.3726	0.0108328	3.18219	-0.029460	0.0001202
97	12214	2	1	316.673	-12.664	17.3209	1.427	20.5826	0.0084641	3.03423	-0.037751	0.0001678
98	12311	2	1	375.310	-25.151	29.5621	-0.361	4.4365	0.0112615	2.91260	-0.021003	0.0001169
99	12411	2	2	359.948	-8.154	17.8624	7.886	16.6593	0.0087662	2.59366	-0.026448	0.0001268
100	12613	3	1	339.626	-9.789	18.6963	15.353	0.3749	0.0128649	2.75443	-0.026984	0.0001362
101	12813	3	2	374.429	4.294	18.6756	8.696	9.8432	0.0086605	4.06887	-0.028846	0.0001002
102	13214	2	2	298.781	-22.116	17.5637	-10.101	15.2588	0.0071841	3.05113	-0.037281	0.0001569
103	13312	3	2	313.827	0.593	24.4211	4.514	16.6666	0.0087100	2.34075	-0.022520	0.0000816
104	13512	2	2	368.765	-18.879	12.2027	10.612	10.0317	0.0101429	2.67768	-0.013656	0.0000515
105	14012	3	2	389.997	-4.607	19.8819	10.302	12.4927	0.0091822	4.61750	-0.042381	0.0001612
106	14613	3	1	359.416	-4.729	16.7589	19.704	11.2608	0.0099986	3.02394	-0.028883	0.0001408
107	50212	1	2	308.445	-5.044	34.3619	-5.098	20.6329	0.0084151	1.70427	-0.012211	0.0000450
108	51212	1	1	308.511	-3.084	12.6874	-6.679	10.8482	0.0087581	2.34683	-0.024344	0.0001189
109	51812	3	2	338.336	-15.034	5.9662	-0.115	9.1084	0.0089708	2.36543	-0.022053	0.0001191
110	53112	3	2	319.521	-32.365	13.2974	-0.390	6.8316	0.0102413	2.52352	-0.023669	0.0001060
111	53912	3	2	319.082	-1.547	18.1070	3.126	18.7848	0.0083834	3.26921	-0.031769	0.0001301
112	54012	1	2	331.577	-8.591	9.7419	10.559	5.4665	0.0100236	3.46809	-0.032188	0.0001400
113	54912	3	2	373.336	-5.168	12.8100	10.932	13.5476	0.0125991	3.82481	-0.036930	0.0001540
114	60111	3	1	338.127	-22.743	5.9748	-1.973	9.9587	0.0090529	3.17371	-0.034387	0.0001689
115	60211	3	1	356.488	-4.271	22.4117	5.932	19.8464	0.0089558	3.32797	-0.031752	0.0001352
116	60411	3	2	416.155	-16.424	3.4592	1.927	14.2021	0.0089676	3.29718	-0.026650	0.0001457
117	60711	3	1	361.712	-16.000	-2.6840	-4.130	17.5664	0.0088070	2.59811	-0.016235	0.0001072
118	61211	3	1	381.731	-4.813	2.8867	15.995	-1.1370	0.0107203	3.65120	-0.024962	0.0001420
119	61311	3	2	342.838	-5.093	23.6335	-5.482	17.9605	0.0090180	3.06132	-0.024418	0.0000931
120	61411	3	2	304.233	2.135	21.1350	4.424	21.6527	0.0087336	3.42880	-0.040827	0.0001587

TABLE A10. Beta Values for 1981 Milk Production and Calf Weight (kg)

OBS	COWNO	BREED	TMT	B0MP	B1MP	B2MP	B0CALFWT	B1CALFWT	B2CALFWT
1	892	2	2	18.0610	-0.16514	0.00043748	-6.938	0.892596	-0.0009883
2	1191	1	1	16.7916	-0.15440	0.00042048	23.099	0.360890	0.0008653
3	1291	1	2	6.0749	0.01388	-0.00009027	6.101	0.441024	-0.0000143
4	1692	2	1	16.6770	-0.14065	0.00038972	19.742	0.548798	0.0002576
5	1693	1	1	9.3920	-0.01966	-0.00005534	6.199	0.484224	0.0001391
6	2291	1	1	12.7177	-0.09736	0.00028819	23.414	0.317889	0.0010525
7	2491	1	2	0.5859	0.03198	-0.00011158	16.904	0.486529	-0.0000363
8	2692	2	1	6.9942	0.00578	-0.00008482	18.116	0.411847	0.0007528
9	3191	3	2	5.7913	0.02098	-0.00015059	-16.818	0.910332	-0.0011481
10	3652	2	2	5.2281	0.01742	-0.00010523	15.314	0.422859	0.0005044
11	4092	2	1	0.5241	0.08147	-0.00029212	22.439	0.121488	0.0016098
12	4391	1	2	3.2337	0.03304	-0.00015241	-1.246	0.686158	-0.0005780
13	4691	1	1	2.3028	0.06751	-0.00026354	11.658	0.433761	0.0007308
14	5591	2	2	3.3209	0.03714	-0.00015558	2.137	0.409487	-0.0000317
15	5893	1	2	12.1872	-0.09062	0.00022977	-17.304	0.732685	-0.0004865
16	6291	1	2	8.4894	-0.01893	-0.00000395	4.316	0.767074	-0.0008816
17	6292	1	2	3.3465	0.00950	-0.00006396	-0.571	0.716614	-0.0006221
18	6391	2	1	16.5933	-0.13785	0.00037075	-0.849	0.743345	-0.0002573
19	6491	2	1	14.0840	-0.09792	0.00026213	21.850	0.331012	0.0006434
20	7091	1	2	13.4816	-0.07845	0.00016590	-6.200	0.824765	-0.0009320
21	7292	2	1	10.0051	-0.03599	0.00001896	18.459	0.316721	0.0006217
22	7691	2	2	2.6574	0.01635	-0.00006214	3.707	0.498995	-0.0001849
23	7791	2	1	8.7404	-0.00319	-0.00006895	26.048	0.417035	0.0005213
24	7991	2	1	8.3499	-0.03801	0.00006002	21.293	0.248922	0.0009974
25	8191	2	1	5.5382	0.02220	-0.00012610	16.065	0.273876	0.0007854
26	8291	1	1	9.8123	-0.07717	0.00021818	4.552	0.758585	-0.0008703
27	8293	1	2	24.3799	-0.26009	0.00074537	20.711	0.101353	0.0017858
28	8692	2	1	11.0566	-0.06270	0.00012351	-6.288	0.617959	0.0000079
29	8693	1	1	20.6244	-0.21011	0.00063835	7.665	0.530733	0.0004856
30	10091	2	1	1.8917	0.07966	-0.00029983	16.726	0.182859	0.0010193
31	10191	3	2	6.2379	-0.04451	0.00011003	11.688	0.457456	-0.0000618
32	10693	1	2	5.5795	-0.00843	-0.00001896	0.307	0.732308	-0.0010111
33	10891	2	1	15.0085	-0.13591	0.00039013	25.938	0.059478	0.0014424
34	11191	3	1	18.1672	-0.19820	0.00059344	4.469	0.332830	0.0003849
35	13693	1	2	22.5333	-0.20266	0.00052211	-26.385	0.811113	-0.0008398
36	13893	1	1	15.1719	-0.15471	0.00044883	15.172	0.306940	0.0007254
37	17091	1	1	4.4932	0.08359	-0.00038828	23.888	0.243943	0.0012824
38	60191	3	1	6.0489	0.00520	-0.00008709	17.099	0.417526	0.0004743
39	61391	3	2	5.6002	-0.01831	0.00005405	3.898	0.779763	-0.0006315
40	61791	3	1	5.6885	-0.02409	0.00008467	15.287	0.350170	0.0009537

TABLE A11. Beta Values for 1982 Milk Production and Calf Weight (kg)

OBS	COWNO	BREED	TMT	B0MP	B1MP	B2MP	B0CALFWT	B1CALFWT	B2CALFWT
41	402	1	1	7.1401	0.00513	-0.00008771	-19.488	0.808941	-0.00054511
42	702	1	1	-2.0465	0.14488	-0.00052618	-14.233	0.834285	-0.00051695
43	804	2	1	-2.3977	0.12302	-0.00038251	2.566	0.580261	-0.00011823
44	1004	2	2	10.6972	-0.08105	0.00019267	-11.474	0.661986	-0.00034784
45	1804	2	2	10.2005	-0.08559	0.00024007	12.808	0.512587	-0.00020269
46	2102	1	1	8.3733	-0.02893	0.00001829	1.860	0.656848	0.00010883
47	2402	1	2	6.7214	-0.02577	0.00004250	13.814	0.403845	0.00038167
48	2902	3	2	14.1271	-0.08800	0.00016909	0.451	0.925924	-0.00061543
49	3002	1	2	4.0790	-0.02292	0.00006317	14.440	0.472540	0.00020693
50	3404	2	1	7.0575	-0.03741	0.00006538	-19.341	0.868379	-0.00061739
51	3502	1	2	-0.5467	0.08421	-0.00027708	-1.187	0.673101	-0.00010763
52	3803	1	1	8.8582	-0.04956	0.00009160	-0.234	0.645203	-0.00012857
53	3902	1	1	6.7797	-0.03611	0.00007805	-8.882	0.843054	-0.00053468
54	4404	2	1	-2.8253	0.11692	-0.00036171	-1.930	0.698849	-0.00002753
55	4604	2	1	14.4520	-0.13006	0.00031727	-2.495	0.772638	-0.00027986
56	4802	1	1	-1.9632	0.10120	-0.00032967	-8.755	0.687911	-0.00006765
57	5402	3	1	0.1475	0.08968	-0.00035784	-12.539	0.741011	-0.00025973
58	5602	2	2	15.2906	-0.11791	0.00028199	-4.494	0.716500	-0.00020336
59	6102	1	2	14.7977	-0.12515	0.00032783	1.219	0.778167	-0.00058206
60	6202	1	2	18.3243	-0.19328	0.00055122	8.627	0.662688	-0.00022195
61	6203	1	2	20.7818	-0.17878	0.00040077	4.781	0.395796	-0.00002405
62	6602	2	1	6.0420	0.01992	-0.00014246	-14.859	0.748181	-0.00045655
63	6804	2	2	2.5433	0.01600	-0.00007273	8.631	0.517226	-0.00031950
64	7403	1	1	4.2922	0.01046	-0.00005396	-1.697	0.910122	-0.00087661
65	7804	2	2	10.8981	-0.07291	0.00015656	-3.576	0.663808	-0.00052170
66	8401	1	1	3.6921	0.05779	-0.00022479	-16.281	0.718251	-0.00036158
67	8603	1	2	13.3257	-0.11848	0.00031994	2.505	0.725555	-0.00031808
68	8802	1	2	8.0917	-0.06370	0.00015403	1.111	0.652554	-0.00043773
69	9402	3	1	0.3422	0.07849	-0.00028210	6.706	0.448670	-0.00014763
70	9602	2	1	3.7899	0.00898	-0.00007497	-1.169	0.563347	0.00002266
71	9802	2	2	9.5395	-0.08796	0.00026021	1.463	0.503038	-0.00014993
72	16202	1	1	7.2496	-0.02597	0.00001457	-5.334	0.846452	-0.00064177
73	16302	1	1	7.6440	-0.03222	0.00007501	-2.359	0.777832	-0.00007666
74	16502	1	1	4.8564	0.05085	-0.00023128	-12.332	0.956881	-0.00062139
75	60401	3	1	11.7754	-0.09383	0.00023194	-2.362	0.586640	-0.00015251
76	61001	3	2	2.7035	0.04832	-0.00020069	7.079	0.550161	-0.00006967
77	61401	3	2	11.5309	-0.09888	0.00025159	5.226	0.696454	-0.00009143
78	61501	3	2	5.6748	-0.01050	0.00000103	3.625	0.580811	-0.00023029
79	62301	3	1	0.7862	0.02877	-0.00008623	-5.039	0.673832	-0.00020583
80	62401	3	1	6.6704	0.00318	-0.00006197	-26.139	0.864954	-0.00057629

TABLE A12. Beta Values for 1983 Milk Production and Calf Weight (kg)

CBS	COWNO	BREED	TMT	A	A1	A2	A3	A4	C	BOFAT	B1FAT	B2FAT
81	414	3	1	407.820	2.128	15.9842	9.257	19.8022	0.0092380	4.41232	-0.012243	0.0000379
82	1812	3	1	305.970	-1.013	16.5713	10.685	12.8451	0.0093659	1.76877	-0.008464	0.0000494
83	2112	1	1	317.678	-15.826	23.3302	3.103	3.7557	0.0116783	2.19259	-0.020888	0.0000999
84	3013	3	1	370.224	-8.534	19.7909	7.304	17.4781	0.0095795	4.70266	-0.032600	0.0001138
85	3312	2	1	380.417	-27.217	-6.9473	2.592	9.2473	0.0095704	2.67658	-0.015701	0.0000971
86	4214	3	1	368.380	-6.643	10.0157	11.365	4.6297	0.0101551	5.06674	-0.022770	0.0000991
87	5212	1	2	351.602	0.841	20.1749	4.928	9.8234	0.0122952	2.33397	-0.026924	0.0001448
88	5311	1	1	335.272	-20.654	12.0161	3.574	21.2836	0.0087621	2.36444	-0.018925	0.0000964
89	7013	3	1	362.195	-19.754	20.3141	10.196	5.3846	0.0115173	3.46770	-0.037225	0.0002029
90	7213	3	1	339.609	-5.161	9.8932	11.801	-2.2034	0.0133358	2.45393	-0.019927	0.0001204
91	7712	3	1	366.339	-8.164	24.9401	13.582	-3.9750	0.0132042	3.31520	-0.020018	0.0001083
92	9112	2	1	357.716	-19.333	3.7870	5.054	16.0233	0.0097968	1.96072	-0.011810	0.0000752
93	9214	3	2	372.275	-3.553	12.9226	0.721	13.6534	0.0069141	5.08577	-0.028375	0.0000894
94	10413	3	1	344.222	-5.334	2.2180	3.886	11.9412	0.0092103	2.03398	-0.005272	0.0000418
95	11012	1	1	317.701	-13.776	13.0372	9.744	8.0196	0.0096770	2.67834	-0.027879	0.0001243
96	11813	3	2	313.882	-0.318	18.4774	9.338	1.3726	0.0108328	3.18219	-0.029460	0.0001202
97	12214	2	1	316.673	-12.664	17.3209	1.427	20.5826	0.0084641	3.03423	-0.037751	0.0001678
98	12311	2	1	375.310	-25.151	29.5621	-0.361	4.4365	0.0112615	2.91260	-0.021003	0.0001169
99	12411	2	2	359.948	-8.154	17.8624	7.886	16.6593	0.0087662	2.59366	-0.026448	0.0001268
100	12613	3	1	339.626	-9.789	18.6963	15.353	0.3749	0.0128649	2.75443	-0.026984	0.0001362
101	12813	3	2	374.429	4.294	18.6756	8.696	9.8432	0.0086605	4.06887	-0.028846	0.0001002
102	13214	2	2	298.781	-22.116	17.5637	-10.101	15.2588	0.0071841	3.05113	-0.037281	0.0001569
103	13312	3	2	313.827	0.593	24.4211	4.514	16.6666	0.0087100	2.34075	-0.022520	0.0000816
104	13512	2	2	368.765	-18.879	12.2027	10.612	10.0317	0.0101429	2.67768	-0.013656	0.0000515
105	14012	3	2	389.997	-4.607	19.8819	10.302	12.4927	0.0091822	4.61750	-0.042381	0.0001612
106	14613	3	1	359.416	-4.729	16.7589	19.704	11.2608	0.0099986	3.02394	-0.028883	0.0001408
107	50212	1	2	308.445	-5.044	34.3619	-5.098	20.6329	0.0084151	1.70427	-0.012211	0.0000450
108	51212	1	1	308.511	-3.084	12.6874	-6.679	10.8482	0.0087581	2.34683	-0.024344	0.0001189
109	51812	3	2	338.336	-15.034	5.9662	-0.115	9.1084	0.0089708	2.36543	-0.022053	0.0001191
110	53112	3	2	319.521	-32.365	13.2974	-0.390	6.8316	0.0102413	2.52352	-0.023669	0.0001060
111	53912	3	2	319.082	-1.547	18.1070	3.126	18.7848	0.0083834	3.26921	-0.031769	0.0001301
112	54012	1	2	331.577	-8.591	9.7419	10.559	5.4665	0.0100236	3.46809	-0.032188	0.0001400
113	54912	3	2	373.336	-5.168	12.8100	10.932	13.5476	0.0125991	3.82481	-0.036930	0.0001540
114	60111	3	1	338.127	-22.743	5.9748	-1.973	9.9587	0.0090529	3.17371	-0.034387	0.0001689
115	60211	3	1	356.488	-4.271	22.4117	5.932	19.8464	0.0089558	3.32797	-0.031752	0.0001352
116	60411	3	2	416.155	-16.424	3.4592	1.927	14.2021	0.0089676	3.29718	-0.026650	0.0001457
117	60711	3	1	361.712	-16.000	-2.6840	-4.130	17.5664	0.0088070	2.59811	-0.016235	0.0001072
118	61211	3	1	381.731	-4.813	2.8867	15.995	-1.1370	0.0107203	3.65120	-0.024962	0.0001420
119	61311	3	2	342.838	-5.093	23.6335	-5.482	17.9605	0.0090180	3.06132	-0.024418	0.0000931
120	61411	3	2	304.233	2.135	21.1350	4.424	21.6527	0.0087336	3.42880	-0.040827	0.0001587

Key for identification, breed and allotment of females with initial and final body measurements and weights for Tables A13 through A18.

Cowno. = Identification number of individual female.

Breed = 1 indicates Angus; 2 indicates Hereford; 3 indicates Angus-Hereford.

TMT = 1 indicates fescue-legume pastures; 2 indicates fescue pastures.

Depth = Initial depth.

Depth 2 = Final depth.

Length H = Initial length from point of shoulder to hips.

Length H2 = Final length from point of shoulder to hips.

Length P = Initial length from point of shoulder to pins.

Length P2 = Final length from point of shoulder to pins.

FALLHT = Initial height at withers.

Height 2 = Final height at withers.

FALLWT = Initial weight.

Weigh 2 = Final weight.

HOOKWDT = Initial hookwidth.

HOOKWDT 2 = Final hookwidth.

SOMO = Initial ultrasonic estimate of fat thickness.

SOMO 2 = Final ultrasonic estimate of fat thickness.

TABLE A13. November 1980 Body Measurements (mm) and Weight (kg) of Females Studied in 1981

OBS	COWNO	BREED	TMT	DEPTH	LENGTHH	LENGTHP	FALLHT	FALLWT	HOOKWDT	SDMO
1	892	2	2	610	925	1250	1135	393	.	5
2	1191	1	1	615	860	1150	1150	352	.	4
3	1291	1	2	650	820	1080	1140	336	.	3
4	1692	2	1	610	730	1005	1075	399	.	5
5	1693	1	1	645	950	1235	1110	283	.	3
6	2291	1	1	645	800	1085	1135	335	.	4
7	2491	1	2	620	900	1210	1155	415	.	3
8	2692	2	1	650	875	1150	1185	394	.	6
9	3191	3	2	650	900	1195	1190	406	.	6
10	3692	2	2	650	875	1185	1150	357	.	5
11	4092	2	1	610	935	1230	1145	330	.	7
12	4391	1	2	600	870	1140	1000	342	.	5
13	4691	1	1	635	925	1235	1135	363	.	5
14	5591	2	2	610	860	1155	1090	338	.	3
15	5893	1	2	605	915	1210	1130	333	.	5
16	6291	1	2	620	925	1240	1180	367	.	5
17	6292	1	2	620	865	1155	1165	347	.	3
18	6391	2	1	620	915	1215	1110	406	.	4
19	6491	2	1	605	910	1175	1085	352	.	5
20	7091	1	2	625	875	1165	1165	376	.	5
21	7292	2	1	620	905	1185	1120	343	.	4
22	7691	2	2	610	900	1170	1080	338	.	6
23	7791	2	1	615	0	1285	1115	403	.	7
24	7991	2	1	610	905	1200	1140	362	.	4
25	8191	2	1	620	885	1195	1145	381	.	7
26	8291	1	1	630	870	1175	1140	352	.	5
27	8293	1	2	635	875	1155	1150	342	.	4
28	8692	2	1	620	870	1145	1100	404	.	3
29	8693	1	1	615	920	1205	1160	301	.	5
30	10091	2	1	560	810	1090	1090	290	.	2
31	10191	3	2	600	865	1140	1150	348	.	3
32	10693	1	2	640	910	1175	1200	339	.	2
33	10891	2	1	620	905	1220	1150	395	.	5
34	11191	3	1	620	875	1150	1135	316	.	3
35	13693	1	2	625	905	1240	1150	348	.	3
36	13893	1	1	610	800	1060	1130	337	.	3
37	17091	1	1	625	895	1165	1090	342	.	4
38	60191	3	1	650	870	1130	1140	371	.	5
39	61391	3	2	625	920	1195	1170	376	.	4
40	61791	3	1	625	920	1170	1185	356	.	3

TABLE A14. November 1981 Body Measurements (mm) and Weight (kg) of Females Studied in 1982

OBS	COWNO	BREED	TMT	DEPTH	LENGTHH	LENGTHP	FALLHT	FALLWT	HOOKWDT	SUNO
41	402	1	1	715	995	1375	1240	415	177	6
42	702	1	1	695	985	1360	1265	404	180	5
43	804	2	1	650	785	1340	1195	368	183	6
44	1004	2	2	650	925	1245	1160	342	168	6
45	1804	2	2	670	1050	1335	1210	394	191	5
46	2102	1	1	705	965	1255	1180	381	172	4
47	2402	1	2	735	1025	1390	1250	420	182	6
48	2902	3	2	660	1035	1375	1210	389	165	4
49	3002	1	2	685	990	1360	1220	363	162	4
50	3404	2	1	645	1010	1375	1190	351	170	3
51	3502	1	2	695	1065	1360	1230	402	185	4
52	3803	1	1	680	1000	1300	1205	356	176	3
53	3902	1	1	685	1040	1380	1255	389	172	3
54	4404	2	1	645	1000	1335	1200	368	178	5
55	4604	2	1	670	995	1310	1200	367	176	6
56	4802	1	1	635	985	1300	1175	340	166	4
57	5402	3	1	650	1030	1400	1195	350	167	3
58	5602	2	2	645	970	1300	1040	375	159	3
59	6102	1	2	680	995	1345	1240	406	178	3
60	6202	1	2	720	1040	1380	1215	392	172	2
61	6203	1	2	710	1020	1340	1230	390	165	3
62	6602	2	1	640	975	1310	1185	334	169	3
63	6804	2	2	670	920	1305	1220	358	168	4
64	7403	1	1	695	985	1305	1215	371	169	5
65	7804	2	2	660	1125	1430	1175	379	173	5
66	8401	1	1	665	970	1280	1230	324	181	3
67	8603	1	2	680	965	1260	1230	381	170	3
68	8802	1	2	690	1005	1340	1225	374	172	3
69	9402	3	1	630	930	1295	1205	356	174	3
70	9602	2	1	670	930	1285	1220	353	168	4
71	9802	2	2	670	980	1295	1220	389	172	5
72	16202	1	1	690	900	1265	1180	366	168	4
73	16302	1	1	680	995	1360	1230	388	170	4
74	16502	1	1	685	985	1315	1265	418	185	2
75	60401	3	1	655	1009	1315	1210	319	166	4
76	61001	3	2	700	1165	1390	1270	371	173	4
77	61401	3	2	660	980	1300	1215	370	169	2
78	61501	3	2	645	905	1225	1200	340	165	3
79	62301	3	1	625	990	1285	1185	318	158	3
80	62401	3	1	645	905	1225	1200	343	169	3

TABLE A15. November 1982 Body Measurements (mm) and Weight (kg) of Females Studied in 1983

OBS	COWNO	BREED	TMT	DEPTH	LENGTHH	LENGTHP	FALLHT	FALLWT	HOOKWDT	SOMU
81	414	3	1	680	985	1290	1190	433	189	5
82	1812	3	1	625	900	1170	990	323	160	2
83	2112	1	1	625	955	1245	1130	336	176	3
84	3013	3	1	670	1060	1370	1155	387	179	5
85	3312	2	1	605	995	1350	1150	378	185	3
86	4214	3	1	650	920	1220	1150	372	189	6
87	5212	1	2	640	975	1255	1155	373	181	3
88	5311	1	1	640	950	1240	1160	357	172	3
89	7013	3	1	655	955	1215	1150	376	183	5
90	7213	3	1	640	950	1235	1145	334	170	3
91	7712	3	1	635	965	1200	1135	367	172	4
92	9112	2	1	625	905	1255	1165	371	182	2
93	9214	3	2	655	950	1260	1170	391	185	5
94	10413	3	1	640	870	1180	1110	349	176	3
95	11012	1	1	610	920	1260	1120	322	191	3
96	11813	3	2	640	945	1200	1150	320	172	4
97	12214	2	1	625	910	1205	1140	348	161	4
98	12311	2	1	650	1050	1370	1195	410	187	3
99	12411	2	2	670	1015	1330	1210	381	182	3
100	12613	3	1	660	960	1240	1125	336	174	3
101	12813	3	2	660	1020	1370	1170	390	183	4
102	13214	2	2	640	900	1210	1110	335	179	4
103	13312	3	2	640	920	1200	1005	344	174	3
104	13512	2	2	650	975	1285	1170	376	189	3
105	14012	3	2	645	1040	1320	1185	408	194	5
106	14613	3	1	660	1035	1340	1150	367	178	3
107	50212	1	2	630	975	1280	1155	353	184	2
108	51212	1	1	610	785	1110	1075	332	167	3
109	51812	3	2	625	935	1225	1070	347	186	3
110	53112	3	2	610	960	1285	1135	342	176	3
111	53912	3	2	640	930	1260	1105	347	171	4
112	54012	1	2	640	945	1235	1130	335	168	4
113	54912	3	2	630	930	1270	1160	387	180	4
114	60111	3	1	650	990	1300	1160	353	174	4
115	60211	3	1	655	910	1230	1190	383	174	4
116	60411	3	2	685	995	1330	1220	426	195	4
117	60711	3	1	650	930	1220	1120	377	171	3
118	61211	3	1	645	1015	1300	1180	370	179	4
119	61311	3	2	670	1005	1270	1140	376	182	3
120	61411	3	2	660	970	1255	1125	329	174	4

TABLE A16. October 1981 Body Measurements (mm) and Weight (kg) of Females Studied in 1981

OBS	COWNO	BREED	TMT	DEPTH2	LENGTHH2	LENGTHP2	HEIGHT2	WEIGH2	HOOKWDT2	SOMO2
1	892	2	2	625	995	1335	1175	365	.	1
2	1191	1	1	620	960	1265	1195	357	.	1
3	1291	1	2	650	915	1170	1160	327	.	1
4	1692	2	1	580	920	1185	1060	362	.	2
5	1693	1	1	615	1020	1330	1145	239	.	0
6	2291	1	1	645	980	1240	1135	353	.	2
7	2491	1	2	670	975	1230	1215	420	.	2
8	2692	2	1	645	1000	1380	1200	427	.	2
9	3191	3	2	660	1020	1360	1255	415	.	2
10	3692	2	2	610	940	1260	1300	334	.	1
11	4092	2	1	590	1050	1255	1160	333	.	2
12	4391	1	2	590	945	1245	1150	318	.	1
13	4691	1	1	670	955	1310	1205	411	.	3
14	5591	2	2	620	980	1265	1135	325	.	1
15	5893	1	2	615	1010	1255	1185	309	.	0
16	6291	1	2	650	920	1260	1220	352	.	2
17	6292	1	2	630	970	1230	1185	315	.	1
18	6391	2	1	640	1020	1290	1170	398	.	2
19	6491	2	1	625	1045	1340	1155	347	.	2
20	7091	1	2	650	980	1320	1200	352	.	2
21	7292	2	1	610	970	1270	1155	332	.	1
22	7691	2	2	600	855	1185	1120	312	.	1
23	7791	2	1	650	1065	1360	1180	399	.	2
24	7991	2	1	620	1015	1320	1170	353	.	2
25	8191	2	1	640	1020	1335	1180	424	.	2
26	8291	1	1	645	960	1300	1170	277	.	0
27	8293	1	2	605	980	1230	1150	359	.	2
28	8692	2	1	610	955	1250	1180	347	.	2
29	8693	1	1	620	955	1210	1140	305	.	1
30	10091	2	1	600	925	1220	1150	311	.	1
31	10191	3	2	630	1010	1250	1165	360	.	1
32	10693	1	2	635	985	1285	1205	313	.	1
33	10891	2	1	645	1050	1405	1180	432	.	3
34	11191	3	1	680	1025	1255	1200	387	.	4
35	13693	1	2	640	1040	1315	1190	356	.	2
36	13893	1	1	640	1050	1300	1165	367	.	2
37	17091	1	1	645	890	1220	1140	323	.	1
38	60191	3	1	650	990	1345	1165	385	.	2
39	61391	3	2	680	955	1275	1210	399	.	3
40	61791	3	1	640	1045	1355	1200	384	.	1

TABLE A17. October 1982 Body Measurements (mm) and Weight (kg) of Females Studied in 1982

OBS	CGWNU	BREEC	TMT	DEPTH2	LENGTHH2	LENGTHP2	HEIGHT2	WEIGH2	HOOKWDT2	SOMO2
41	402	1	1	710	1115	1440	1265	454	205	5
42	702	1	1	705	1050	1390	1300	417	195	5
43	804	2	1	645	1100	1435	1205	381	186	5
44	1004	2	2	615	1025	1320	1170	342	183	4
45	1804	2	2	660	1040	1240	1210	352	196	3
46	2102	1	1	650	965	1305	1185	363	187	3
47	2402	1	2	680	1175	1430	1225	404	198	2
48	2902	3	2	660	1040	1350	1235	374	184	3
49	3002	1	2	645	1025	1355	1195	329	174	2
50	3404	2	1	630	1020	1370	1200	391	195	3
51	3502	1	2	685	1025	1255	1230	413	203	3
52	3803	1	1	660	1035	1355	1220	367	186	2
53	3902	1	1	680	1100	1440	1255	386	195	3
54	4404	2	1	660	1055	1395	1220	381	201	5
55	4604	2	1	640	975	1335	1190	373	186	4
56	4802	1	1	640	1015	1350	1195	334	187	3
57	5402	3	1	665	1015	1310	1205	349	195	3
58	5602	2	2	640	950	1260	1165	366	177	2
59	6102	1	2	670	985	1330	1245	386	174	2
60	6202	1	2	670	1065	1410	1240	373	191	2
61	6203	1	2	690	1025	1340	1225	392	187	3
62	6602	2	1	660	990	1345	1225	375	189	5
63	6804	2	2	680	1080	1400	1225	367	183	4
64	7403	1	1	680	1050	1340	1220	361	186	2
65	7804	2	2	620	1035	1355	1185	368	185	4
66	8401	1	1	670	1050	1320	1220	322	185	1
67	8603	1	2	665	1000	1365	1225	393	196	1
68	8802	1	2	710	1085	1410	1250	385	198	4
69	9402	3	1	650	995	1295	1230	355	186	2
70	9602	2	1	690	1010	1345	1245	363	186	4
71	9802	2	2	680	1080	1405	1250	392	197	4
72	16202	1	1	665	1035	1320	1210	339	184	2
73	16302	1	1	665	1080	1395	1220	359	191	3
74	16502	1	1	650	1020	1360	1250	386	196	1
75	60401	3	1	660	1025	1380	1220	347	183	3
76	61001	3	2	690	1040	1405	1290	383	202	2
77	61401	3	2	660	975	1310	1225	354	193	2
78	61501	3	2	680	1030	1360	1225	358	782	2
79	62301	3	1	640	1080	1365	1215	363	195	4
80	62401	3	1	670	1170	1360	1220	346	179	2

TABLE A18. October 1983 Body Measurements (mm) and Weight (kg) of Females Studied in 1983

OBS	COWNO	BREED	TMT	DEPTH2	LENGTHH2	LENGTHP2	HEIGHT2	WEIGH2	HOOKWDT2	SOMO2
81	414	3	1	630	980	1320	1130	403	195	4
82	1812	3	1	560	890	1165	1030	295	173	2
83	2112	1	1	600	930	1220	1080	346	175	2
84	3013	3	1	590	955	1290	1000	380	184	3
85	3312	2	1	600	990	1275	1110	391	187	3
86	4214	3	1	590	965	1235	1090	372	193	4
87	5212	1	2	590	935	1230	1070	377	191	3
88	5311	1	1	580	910	1240	1090	347	173	3
89	7013	3	1	595	925	1235	1090	384	194	3
90	7213	3	1	580	890	1200	1095	335	177	3
91	7712	3	1	600	935	1250	1080	400	193	5
92	9112	2	1	590	950	1245	1100	376	192	3
93	9214	3	2	590	940	1330	1120	384	187	4
94	10413	3	1	585	865	1180	1055	337	181	2
95	11012	1	1	560	870	1175	1050	327	183	2
96	11813	3	2	585	875	1150	1085	327	181	2
97	12214	2	1	565	905	1250	1080	327	178	2
98	12311	2	1	610	990	1290	1030	406	197	4
99	12411	2	2	610	995	1280	1030	362	188	2
100	12613	3	1	610	915	1220	1075	375	189	4
101	12813	3	2	630	950	1210	1030	358	185	2
102	13214	2	2	545	830	1005	1040	302	169	2
103	13312	3	2	570	830	1150	1050	303	166	1
104	13512	2	2	595	960	1240	1090	399	189	3
105	14012	3	2	605	1010	1310	1125	382	189	3
106	14613	3	1	615	935	1220	1055	339	183	2
107	50212	1	2	575	920	1230	1085	295	168	1
108	51212	1	1	570	860	1200	1050	318	179	2
109	51812	3	2	600	890	1175	1040	370	184	3
110	53112	3	2	560	915	1230	1060	351	187	2
111	53912	3	2	610	900	1155	1050	320	174	2
112	54012	1	2	600	910	1205	1060	347	185	3
113	54912	3	2	610	900	1220	1100	398	174	2
114	60111	3	1	605	940	1240	1095	355	189	3
115	60211	3	1	590	915	1225	1205	337	187	3
116	60411	3	2	620	975	1310	1065	431	205	4
117	60711	3	1	605	875	1170	1090	358	193	4
118	61211	3	1	610	920	1245	1205	383	191	5
119	61311	3	2	610	965	1230	1190	341	187	2
120	61411	3	2	570	885	1305	1065	297	172	2

VITA

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