PHYSIOLOGICAL MATURITY EFFECTS ON LIVE CATTLE PERFORMANCE, CARCASS CHARACTERISTICS AND ECONOMIC RETURNS

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CHAPTER I

INTRODUCTION

In todays beef industry there are numerous production, management and marketing philosophies practiced. There is no one correct method that will work for every cattleman in the nation, nor should there be. However, to make the beef industry as competitive as the other meat industries, producers, feeders and packers must try to achieve a certain level of compatibility. Compatibility must be reached in order to achieve a product that is cost effective and appealing to the consumer while still being affordable.

Diversification of the U.S. feeder cattle population during the past two decades (Dolezal 1983), has resulted in many different types of cattle which require different management and marketing techniques. According to Dolezal (1983), the influx of new cattle breeds and intensified use of crossbreeding has led to a dramatic change in size, body type and growth response; thus resulting in an increase in variability of growth and development during the finishing phase. With increased size and growth rate of calves some producers have started placing their calves directly in the feedlot after weaning.

Couple increased environmental concerns, drought and increased pressure to remove cattle from public lands in the West with the increased growth rate of calves, and early weaning directly to the feedlot becomes a realization. However, profitability, health and nutrition become an increasing concern to the feedlot manager with this practice.

Within the packing industry there are concerns as to the ability of the younger cattle to grade and still produce a desirable carcass. In order for beef producers to maximize their profit potential under the current quality grading system they must design their management and marketing procedures toward the production of "U. S. Choice" beef. However, the degree of marbling required to achieve "U. S. Choice" is a late developing fat depot that when coupled with production practices to attain sufficient marbling often results in overfattening of slaughter cattle. Decreased yield grade is then the result of the over finished beef carcass, thus making these carcasses less desirable to the packers.

These younger cattle have to overcome one final obstacle, consumer acceptability. The American consumer is becoming more health conscious every day; however, a portion of the population does not wish to sacrifice eating quality (Savell et al., 1987). The common myth among older beef consumers is that beef has to be grazed and then finished to give it a more hearty, beefy flavor.

Therefore, this study was conducted to evaluate the effects that chronological age and different production schemes have on live animal performance, carcass characteristics and economic returns to the feeder. This study also served as a data base for further in depth studies examining carcass traits and economics of each growing and finishing phase.

CHAPTER II

REVIEW OF LITERATURE

I. Production Traits

General. For several centuries animal growth has perplexed man, due primarily to the fact that relatively little is known of the true genetic mechanisms that regulate growth and the physiological boundaries that govern its progress. Considering the growth process from two aspects, Fowler (1968) described it as the increase of body mass (weight) per unit time and the changes in body form resulting from differential growth of component parts.

Patterns of tissue growth and development are not identical for all cattle. However, relative tissue growth in cattle does appear to follow a definite sequence from birth to maturity: bone is early developing, muscle is intermediate and fat is late developing (Berg and Butterfield, 1966; Mukhoty and Berg, 1971; Berg et al., 1978). Bone growth postnatally proceeds at a slower rate than muscle growth, causing the proportion of muscle to bone to increase with increases in animal weight (Waldman et al., 1971 and Berg and Butterfield, 1976). During the growth process, several genetic and environmental factors have been shown to influence the proportions of muscle, fat and bone.

Cattle Growth. Growth of calves during the first three months depends largely on the cow's milk; after that, feed other than milk is most important (Thompson and O'Mary, 1983). Furthermore, after the first three months postpartum, calves digest high quality forage almost efficiently as mature cows. Ensminger (1965) and Lusby et al. (1981) reported that gains on young animals are more economical because of the low fat content of young animals in comparison with older animals as well as higher feed consumption per unit of weight by young animals. Increased plane of nutrition is positively correlated to growth and development. Thus, superior nutrition and management are essential for successful early weaning. Berg (1968) suggested that a high plane of nutrition will cause the onset of fattening to occur earlier relative to an animal's muscle and bone growth, whereas a low plane tends to retard fat growth. Guenther et al. (1965) found that a low plane of nutrition retarded fat and muscle growth but had no apparent effect on bone. Further, they found that no differences in lean content were evident at a constant live weight when comparing calves fed a high plane of nutrition versus those fed a moderate level; however, rate of lean deposition favored the high plane calves.

Bertrand and Johnson (1988) found that steers fed a high concentrate diet directly after weaning had higher average daily gains and better feed efficiencies when compared to steers that were backgrounded on cool season pastures and then placed in the feedlot. Furthermore, the efficiency of converting feed to gain with backgrounded steers decreased while feed consumption increased as the length of feeding increased. Prichard et al. (1988) reported that steers not backgrounded on pasture had higher mean average daily gains. Steers placed directly into the feedlot after weaning (zero background), or placed in the feedlot after a wintering period of minimum gain (delayed feedlot), tended to be more efficient in converting feed to weight gain than steers backgrounded on cool-season annual pasture.

Ridenour et al. (1982) reported that cattle fed high concentrate diets during the growing phase were more efficient in converting feed to gain than those cattle grown on a 50:50 roughage to concentrate diet. Steers that were grown on wheat pasture until reaching 273 kg body weight had the highest average daily gain during the finishing phase. However, steers initially grown on high concentrate diets, followed by a finishing phase, had the highest average daily gains over the entire experiment. Furthermore, the average feed to gain ratio of the steers grown on the high concentrate diet was superior to that of the steers backgrounded on 50:50 roughage to concentrate diet over the entire trial which was expected because of differences in energy density in the respective diets. These findings are consistent with those found by Pope et al. (1963), Wilder et al. (1964), and Ellis (1965).

Compared to yearlings, calves in the feedlot had average daily gains that were 0.22 lb/day less; however, the calves had the highest average daily gain on a lifetime basis because they were slaughtered an average of 126 days younger than the yearlings (Hickok et al., 1992).

II. Carcass Traits

General. According to McCampbell et al. (1971) early weaning (four months) had no significant effect on carcass characteristics of feedlot steers when initial feedlot weights were held constant. However, steers fed submaintenance rations before going into the feedlot produced carcasses with more outside fat, less marbling and lower carcass grades than steers fed to gain 0.2 to 0.3 lb per head daily during the prefeedlot period (Thompson et al., 1970).

Researchers generally agree that level of nutrition greatly influences the onset and rate of fattening. It was suggested by Berg and Butterfield (1976) that among animals fed a positive energy balance, bone and muscle growth proceed together maintaining a genetically determined ratio. The amount of fat deposited depends upon the amount of surplus energy remaining over maintenance of bone and muscle requirements.

When observing compositional differences among cattle of the same weight that have been produced on different levels of nutrition, Murray et al. (1974) reported that younger (faster growing) animals will have less bone, less muscle and more fat than older (slower growing) animals. However, Hickok et al. (1992) found that calves tended to have more marbling and higher quality grades than the yearlings, but the differences were not statistically significant. Furthermore, actual backfat, yield grade and percentage of kidney, pelvic and heart fat were not different between age groups.

Quality Grade. Numerous studies have suggested that quality grade increases with time on feed (Moody et al. 1970; Zinn et al., 1970b; Campion et al. 1975; Harrison et al. 1978). Factors used to determine quality grade are influenced by time on feed, thus an apparent increase in quality grade is observed. Prior et al. (1977) and Harrison et al. (1978) reported that increasing days on feed and dietary energy intake increased marbling score. Furthermore, they reported that lean texture tended to be finer in longer fed cattle. Schroeder et al. (1980) reported that cattle fed for longer periods of time had brighter more youthful appearing lean.

Yield Grade. Numerical yield grade tends to increase as time on feed increases due to increases in kidney, pelvic and heart fat, subcutaneous fat and carcass weight. Significant increases in percent of kidney pelvic and heart fat due to increased time on feed has been reported by Moody et al. (1970), Harrison et al. (1978), and Ridenour et al. (1982). Subcutaneous fat measured at the 12th rib increased significantly as time on feed increased (Moody et al. 1970; Oltjen et al., 1971; Bowling et al., 1978 and Harrison et al., 1978). These same researchers also observed significantly heavier carcasses as time on feed increased. Ribeye area also increases as time on feed increases thus lowering the numerical yield grade, however, on a per unit weight basis the increase in ribeye area was not proportional to the increase in carcass weight (Hedrick et al., 1965 and Moody et al., 1970). Estimated retail yield decreases as time on feed increases (Winchester and Howe, 1955; Cramer et al., 1964; DuBose et al., 1967; Garrigus et al., 1967; Busch et al., 1968 and Moody et al., 1970).

This review of literature has indicated that there are several factors to be considered in producing consumer acceptable beef at reasonable cost while returning a profit to the producer. The practical implications of how these factors, or combination of these factors, can be used to produce the product the consumer wants while providing a profit for the producer is challenging at best. There have been inferences drawn to each factor concerning which production technique is the best; however, a study to examine the interrelationship between each factor appears warranted.

CHAPTER III

MATERIALS AND METHODS

One hundred and sixty four steers were selected for uniformity in chronological age and genotype from two different ranches in Western Oklahoma. Calves were produced from Angus crossbred dams sired by Angus bulls. Steer calves were selected at approximately three months of age and were allotted to one of five different growing (management) treatments (T): 1) early weaned directly to the feedlot, 2) normal weaned and placed in the feedlot, 3) regular weaned and backgrounded on wheat pasture for 112d then placed in the feedlot, 4) regular weaned, dry wintered on native range and then grazed on early intensively managed native range for 68d prior to feedlot placement 5) regular weaned, dry wintered, season long grazed on native range for 122d, and then placed in the feedlot. Steers were allotted randomly to one of the five treatments, each containing 28 steers (14 from each ranch) with 7 head per pen.

Each treatment was fed a standardized feedlot diet containing 12.4% protein (Table 1) with the exception of the early weaned calves which were started on an 18% all natural protein diet (3 to 5 months of age) (Table 2), switched to

TABLE 1. FEEDLOT DIET COMPOSITION (FINAL DIET).

Item	Diet % of DM
Corn, dry rolled	79.61
Alfalfa hay, ground	5.02
Cottonseed hulls	3.90
Molasses, cane	4.38
Cottonseed meal	3.55
Meat and bone meal	1.42
Distillers grains, corn	.87
Salt	.35
Calcium carbonate	.35
Urea, 46% N	.30
Ammonium sulfate	.21
Vitamin A & D_3[a]	.00375
Rumensin, 60 gram/lb	.018
Trace mineral premix	.014
Calculated analysis	
NEm	94.63
NEg	60.39
Crude Protein	12.40

[a] Contained 88,000 IU vitamin A and 88 IU vitamin D_3 per gram.

TABLE 2. FEEDLOT DIET COMPOSITION (18% STARTER DIET).

Item	Diet % of DM
Corn, dry rolled	52.97
Alfalfa hay, ground	7.80
Cottonseed hulls	10.00
Molasses, cane	3.75
Soybean meal 44	23.02
Calcium carbonate	1.25
Dicalcium phos.	.83
Salt	.30
Rumensin, 60 gram/lb [a]	.02
Vitamin A-30[a]	.02
Vitamin E 226800[b]	.02
Trace mineral premix	.01
Tylan 40[a]	.01
Calculated analysis	
NEm	87.14
NEg	55.00
Crude Protein	18.00

[a] Additive package formulated to provide 30,000 IU vitamin A per day, 26.4 grams per ton of Rumensin and 10 grams per ton of Tylan.

[b] Formulated to provide 600 IU vitamin E per day.

a 16% all natural protein diet (5 to 6 months of age) (Table 3), adjusted to a 13.4% protein diet (6 to 7 months of age) (Table 4), and finally placed on the standardized 12.4% protein diet at about 8 months of age. Cattle were adapted over 14 days through a series of four diets to a 91% concentrate diet. In the workup diets, alfalfa hay and cottonseed hulls (2 to 1 ratio) replaced corn to achieve 50%, 60%, 70%, and 80% concentrate levels, except early weaned steers were initiated on 50% concentrate and then elevated to 80% concentrate. Steers in T2, (7 to 9 months of age, averaging 243 kg), consumed the standard 12.4% protein diet ad libitum. T3 steers were approximately 11 to 13 months of age at the start of the finishing phase and averaged 344 kg. Treatment three steers were regular weaned, then grazed clean tilled wheat pasture (Pioneer 2157) for 112d which averaged 902 kg of DM/HA, and received no supplement other than free choice access to a commercial mineral mixture. T4 steers were regular weaned, dry wintered on native range then early intensively grazed on native range for 68 days before starting the finishing phase at approximately 16 to 18 months of age and an average weight of 378 kg. Steers in T5 were regular weaned, dry wintered on native range then season long grazed on native range for 122d before entering the finishing phase at an average weight of 409 kg and approximately 18 to 20 months of age. Cattle were weighed every 28d, average daily gain and feed efficiency were then calculated. One steer was

TABLE 3. FEEDLOT DIET COMPOSITION (16% STARTER DIET).

Item	Diet % of DM
Corn, dry rolled	59.25
Alfalfa hay, ground	6.58
Cottonseed hulls	10.00
Molasses, cane	3.75
Soybean meal 44	18.22
Calcium carbonate	1.50
Dicalcium phos.	.33
Salt	.30
Rumensin, 60 gram/lb [a]	.02
Vitamin A-30[a]	.02
Trace mineral premix	.01
Tylan 40[a]	.01
Vitamin E 226800[b]	.002
Calculated analysis	
NEm	88.67
NEg	56.00
Crude Protein	16.00

[a] Additive package formulated to provide 30,000 IU vitamin A per day, 26.4 grams per ton of Rumensin and 10 grams per ton of Tylan.

[b] Formulated to provide 50 IU vitamin E per day.

TABLE 4. FEEDLOT DIET COMPOSITION (14% STARTER DIET).

Item	Diet % of DM
Corn, dry rolled	73.79
Alfalfa hay, ground	4.65
Cottonseed hulls	7.00
Molasses, cane	3.75
Soybean meal 44	8.32
Calcium carbonate	1.34
Urea, 46% N	.50
Salt	.30
Dicalcium phos.	.29
Rumensin, 60 gram/lb [a]	.02
Vitamin A-30[a]	.01
Trace mineral premix	.01
Tylan 40[a]	.01
Calculated analysis	
NEm	92.35
NEg	59.00
Crude Protein	13.40

[a] Additive package formulated to provide 30,000 IU vitamin A per day, 26.4 grams per ton of Rumensin and 10 grams per ton of Tylan.

injured while on wheat pasture and was kept in a pen until they went to the feedlot where he finished the trial, no other health problems were encountered during the entire trial.

All cattle were routinely processed at weaning as follows: vaccinated with IBR-PI3 (modified live virus; i.m.) and 7 way clostridial bacterin and injected with ivermectin. T1 calves received a shot of Nasalgen one week after arrival at the feedlot. All cattle were implanted with Synovex S. T1 calves received their first implant at approximately 101d on feed and then again every 84d there after. T2 calves received their first implant at approximately 8 months of age and then every 84d there after. T3, 4, and 5 cattle received their first implants before going to wheat or grass and were then reimplanted approximately every 84d there after, except the T5 (season long) cattle which received implants before grass but were never reimplanted.

At the beginning of each feedlot treatment four animals were transported to the Oklahoma State University Meat Laboratory where they were slaughtered and emptied of gastrointestinal contents, these were designated as prekills (Table 5). Empty body weight before each treatment was then calculated using the carcass weight, the weights of the emptied internal organs, the hide, head and feet. The left side was chilled for 72hr, weighed in air then suspended in a tank of 4°C water and weighed while freely suspended.

TABLE 5. NUMBER OF ANIMALS, AVERAGE WEIGHT AND AGE OF ANIMALS DESIGNATED AS PRE-KILLS.

Trait	EW	NW	WP	DW*	EIG	SLG
Number of Animals	4	4	4	4	4	4
Avg. Wt., kg	149	229	343	287	368	394
Age (months)	3	8	12	12	17	19

* DW = Dry Winter

These weights were used to determine specific gravity using the procedures of Garrett and Hinman (1969).

A constant s.c. fat thickness (1.02 cm) was used as the slaughter endpoint in this experiment. Days fed and visual appraisal were used to determine when pens (7 hd) would average 1.02 cm of s.c. fat thickness. Pens of steers that were identified as ready for slaughter were fasted for approximately 12 hr without feed but with access to water, weighed, and transported to slaughter. At the onset of the experiment cattle were transported to the O.S.U. Meat Laboratory for slaughter, however, due to the rate at which cattle were ready to be slaughtered and the lack of available room for carcasses, place of slaughter was changed to a commercial packing plant. Carcasses were chilled for approximately 24 hr postmortem, then assigned a quality and yield grade (USDA, 1989). Left sides were then transported to the Oklahoma State University Meat Laboratory. Sides were then fabricated into primal and trimmed sub-primal cuts and weighed with 2.54, 1.27, and .64 cm of s.c. fat thickness.

Economic data was calculated using the livestock enterprise budget design as described by Kay (1986). Actual cattle performance was used in calculating profit or loss, breakeven costs, feed cost of gain, and total cost of gain. Actual livestock input and sale prices (USDA, 1991), were used in conjunction with ratioed costs for feed and interest (USDA, 1991), in calculating ten year average budgets for profit or loss, breakeven costs, feed cost of gain, and total cost of gain. Carcass prices were prices reported on the USDA blue sheet for the actual sale day of each pen of cattle, from which carcass value was computed.

Statistical analyses were conducted using SAS's general linear model function utilizing orthogonal contrasts to compare steers placed directly into the feedlot (T1, and 2) versus steers that were grazed (T3, 4, and 5), early weaned steers versus normal weaned steers, wheat pasture steers versus grazed steers (T4, and 5) and early intensively grazed steers versus season long grazed steers. Model included cattle source, treatment and cattle source*treatment. Data was tested for cattle source*treatment interactions. Data is presented by main effects except where there is a source*treatment interaction. In this event the interaction is discussed in the text.

CHAPTER IV

RESULTS AND DISCUSSION

Cattle Performance

Mean initial weights, days fed, and mean adjusted slaughter weights are presented in table 6. T1 calves were on feed for an average of 287d and were slaughtered at an average weight of 519 kg. T2 steers were slaughtered at an average weight of 530 kg averaging 199d on feed. Steers in T3 were fed for an average of 134d and were slaughtered at an average weight of 567 kg. T4 steers were fed for an average of 123d and were slaughtered averaging 567 kg. Cattle in T5 were slaughtered at an average weight of 550 kg after being fed for 101d.

Least square means for cattle performance traits are presented in table 7. Steers that were grown on wheat before entering the feedlot had the highest average daily gain in the feedlot for the entire trial. This is consistent with findings of Ridenour et al. (1982), who found that steers grown on wheat had the highest average daily gains in the feedlot. Cattle that were backgrounded either on wheat or grass (T3, T4 and T5) had higher average daily gains ($P < .020$) than those cattle that went directly

TABLE 6. EXPERMENTAL DESIGN, TREATMENT INITIAL WEIGHT AND ADJUSTED SLAUGHTER WEIGHT.

Treatment	1	2	3	4	5
Background	Early wean	Normal wean	Wheat pasture	Early intensive	Season long (SLG)
Feedlot age, mo	3	8	12	17	19
Number, head	28	28	28	28	28
Initial wt, kg	141	243	344	382	413
Days fed	287	198	134	123	101
Slaughter wt, kg[a]	519	530	567	567	550

[a]Adjusted to 64% dress.

TABLE 7. LEAST SQUARES MEANS FOR LIVE CATTLE PERFORMANCE.

	Treatment					Contrast			
	EW	NW	WP	EIG	SLG	1[a]	2[b]	3[c]	4[d]
ADG (kg/d)	1.32	1.45	1.66	1.50	1.37	0.020	0.073	0.008	0.047
F:G	5.33	5.65	6.31	7.59	8.33	0.009	0.622	0.037	0.256
ADFI (kg/d)	7.02	8.19	10.51	11.41	11.30	0.0005	0.092	0.139	0.846

[a]Grazed vs. direct to feedlot.
[b]Early weaned vs. normal weaned.
[c]Wheat pasture vs. grass background.
[d]Early intensively grazed vs. season long grazed.

into the feedlot (T1 and T2) without backgrounding. This is contradictory to findings reported Bertrand and Johnson (1988) who reported that steers fed a high concentrate diet directly after weaning had higher average daily gains. Furthermore, the cattle grown on wheat had higher average daily gains (1.66 kg/day) than those cattle that were backgrounded on grass (1.50 and 1.37 kg/day for T4 and T5 respectively). Early intensively grazed steers had significantly higher average daily gains than those that were grazed season long ($P < .04$).

T1 steers had the most desirable feed efficiency (5.33 kg feed/ kg gain). Research has suggested that improved feed efficiency in the early weaned calves is due to higher feed consumption per unit of weight (Ensminger, 1965 and Lusby et al., 1981). Cattle that went directly into the feedlot (T1 and T2) had significantly better feed efficiencies when compared to those cattle that were backgrounded before the feedlot ($P < .009$). Additionally, cattle grown on wheat pasture had significantly more desirable feed efficiencies than those cattle that were backgrounded on grass ($P < .037$; 6.32 vs. 7.55 and 8.36 kg feed/ kg gain, respectively). Furthermore, there was a cattle source*treatment interaction between the cattle in T5 resulting in the cattle from the Arnett source having significantly better feed efficiencies than the Guymon source at $P < .002$ (9.19 vs. 7.53 kg feed/ kg gain). This was attributed to the fact that the Arnett cattle were later maturing and thus were more efficient in their conversion due to their location on the growth curve than the cattle from Guymon that were more mature and further along on the growth curve.

Average daily feed intake was lowest in the early weaned cattle due to the fact that they maintained a lighter average weight while in the feedlot, these cattle also had smaller total gut capacity due to lack of forage in the diet consumed during development. Steers that were placed directly into the feedlot consumed significantly less feed than those that were backgrounded before entering the feedlot ($P < .0005$). This maybe due to the increased capacity of the digestive tract in the forage backgrounded cattle. Bertrand and Johnson (1988) found that steers backgrounded on grass before the feedlot had significantly higher feed consumption than steers placed in the feedlot directly after weaning.

Slaughter Traits

Least squares means for slaughter traits are presented in table 8. Hot carcass weights were lowest for the steers in T1, however, there were no statistical differences between the treatments. A trend was noticed for lighter carcass weights in the cattle that went directly to the feedlot after weaning versus the cattle that experienced a backgrounding program ($P < .065$). There was a cattle source*treatment interaction for carcass weight in T2, 3,

TABLE 8. LEAST SQUARES MEANS FOR SLAUGHTER TRAITS.

Treatment	EW	NW	WP	EIG	SLG
Hot carcass weight (kg)	333	339	362	363	352
REA, (sq cm)	78.0	80.6	81.3	83.2	83.2
REA (cm/kg)	.23	.24	.22	.23	.24

and 4. Steers from the Guymon source in T2 trended toward higher carcass weights than steers from the Arnett source ($P < .063$). T3 steers from the Arnett source had significantly heavier carcass weights than did the cattle from Guymon ($P < .006$). Arnett cattle were larger framed. According to Dolezal et al. (1992), slaughter weight and carcass weight increased with increases in frame size. Guymon steers in T4 displayed significantly ($P < .045$), heavier carcass weights than cattle from the Arnett source. The Guymon cattle entered the feedlot in this phase after being dry wintered, and grazed early on a better forage than did the Arnett steers.

Least squares means and contrast probabilities for quality traits are presented in table 9. Skeletal maturity was the most youthful for calves slaughtered in T1, however, there were no significant differences between treatment except for cattle in T5. Steers in T5 had more advanced skeletal maturity (A^{60} vs. A^{49}) at $P < .02$. T5 steers were 5 months older than T1, 2, 3, and 4 averaged, (20 vs. 15 months), thus there was a higher degree of skeletal maturity evident. Lean maturity was significantly ($P < .0005$), lowest for steers that were placed in the feedlot directly after weaning when compared to cattle in the remaining treatments. It was theorized that lean maturity was lower for these cattle because of number of days fed on a high energy diet. This is consistent with findings by Prior et al. (1977) and Harrison et al. (1978), who reported that

TABLE 9. LEAST SQUARES MEANS FOR CARCASS QUALITY GRADE TRAITS.

	Treatment					Contrast			
	EW	NW	WP	EIG	SLG	1[a]	2[b]	3[c]	4[d]
Maturity[e]									
Skeletal	A45	A59	A51	A39	A60	0.666	0.086	0.731	0.024
Lean	A34	A34	A46	A37	A46	0.0005	0.780	0.026	0.002
Overall	A40	A46	A49	A38	A53	0.137	0.085	0.317	0.006
Marbling[f]	Sm40	Sm19	Sm22	Sm49	Sm32	0.842	0.547	0.556	0.629
% Choice	82.1	67.9	71.4	89.3	75.0	0.783	0.489	0.546	0.489

[a]Grazed vs. direct to feedlot.
[b]Early weaned vs. normal weaned.
[c]Wheat pasture vs. grass background.
[d]Early intensively grazed vs. season long grazed.
[e]"A"=approximately 9-30 months of chronological age at slaughter (USDA, 1989).
[f]Sm=small amount of marbling; minimum requirement for U.S. Choice quality.

increasing days on feed and energy level in the diet caused finer lean texture. Furthermore, Schroeder et al. (1980) found that cattle fed for longer periods of time had brighter more youthful appearing lean. Steers in T3 appeared to have less youthful lean than did steers in T4 and 5 ($P < .026$). Early intensively grazed steers produced more youthful appearing lean compared to steers from T5 ($P < .002$), this was attributed to the number of days fed an high energy diet. Due to the significant differences observed in the skeletal and lean maturity the most youthful appearing carcasses were those produced in T1 and 2 when compared to the carcasses produced by steers in T3, 4, and 5, however, these differences were not statistically significant. Carcasses from steers in T4 were statistically less mature than those carcasses produced in T5 ($P < .006$). Marbling score was not significantly different between any of the contrasts that were performed. Percent choice was not statistically significant between treatments or cattle sources. There was a decrease in quality grade in the normal weaned calves, (slaughtered at an average age of 14 months), suggesting a possible physiological change occurring during this time that may not allow these cattle to express marbling well enough to attain "U.S. Choice".

Table 10 represents least squares means and contrast probabilities for yield grade data. Contrasts showed no

TABLE 10. LEAST SQUARES MEANS FOR CARCASS YIELD GRADE TRAITS.

	Treatment					Contrast			
	EW	NW	WP	EIG	SLG	1[a]	2[b]	3[c]	4[d]
Adj fat, cm	1.55	1.42	1.47	1.45	1.30	0.507	0.483	0.503	0.355
Ribeye, sq cm	78	80.6	81.3	83.2	83.2	0.143	0.479	0.539	0.870
KPH, %	2.57	2.38	2.25	2.39	1.93	0.102	0.399	0.653	0.088
Carcass wt, kg	333	339	362	363	352	0.065	0.660	0.691	0.487
Yield grade	3.4	3.3	3.4	3.3	3.0	0.625	0.522	0.410	0.291
% YG 4's	28.5	14.3	7.1	21.4	3.6	0.374	0.438	0.728	0.343

[a]Grazed vs. direct to feedlot.
[b]Early weaned vs. normal weaned.
[c]Wheat pasture vs. grass background.
[d]Early intensively grazed vs. season long grazed.

significant differences in adjusted fat thickness, ribeye area, percent of kidney, pelvic, and heart fat, numerical yield grade and percent yield grade 4's between treatments, however, there was a cattle source*treatment interaction. Steers from Arnett in T1 had significantly more ($P < .0001$), adjusted fat than steers from Guymon in the same treatment (1.80 vs 1.30 cm, respectively). This large of a difference in adjusted fat accentuates the need for close management of the early weaned calves, as they can become excessively finished very rapidly. No observed statistical differences occurred among the other treatments. Cattle from the Arnett source had statistically larger ribeye areas ($P < .009$), than steers from the Guymon ranch in T3 (84.76 and 78.33 sq. cm). Furthermore, there was a trend ($P < .076$), toward larger ribeye areas in the steers from Arnett when compared to steers from the Guymon source in T5. Steers provided by the Arnett source for T1 had more KPH than steers from Guymon ($P < .003$). Increased KPH was due to more total fat in the Arnett T1 steers, further indicating that an elevated level of cattle management is required when finish feeding and marketing early weaned cattle. An interaction occurred for yield grade within T1, steers from Guymon had an numerical yield grade of 3.07, significantly different ($P < .0001$), from the Arnett steers which had a numerical yield grade of 3.92. Numerical yield grade was higher for the Arnett cattle because their adjusted fat thickness was .50 cm thicker than the fat thickness on the Guymon steers.

Within T1, steers from the Arnett source had 50% yield grade 4's, this was due to increased adjusted fat thickness which raised the numerical yield grade. Steers from Guymon in T1 had 7.14% yield grade 4's. This data suggests that early weaned calves may be fed to attain a desirable yield grade but, if not closely managed, they may become over finished very quickly.

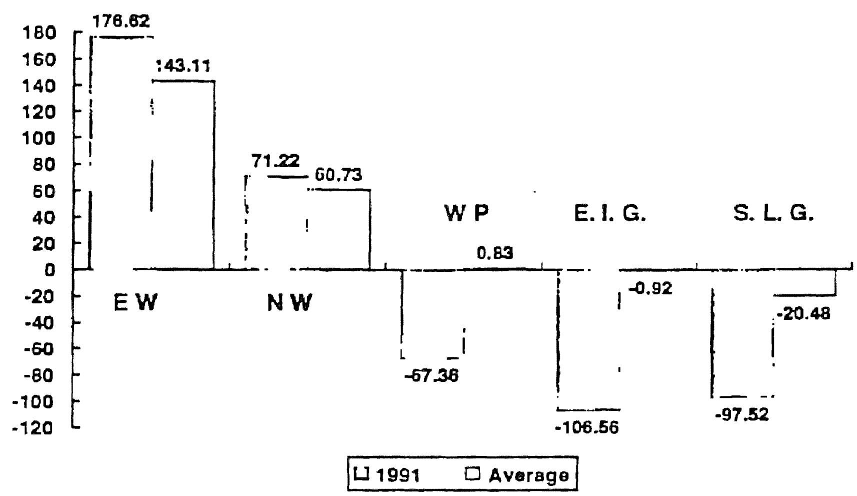
Economic Returns

Economic data is presented in table 11 on a treatment basis for returns to the feeder based on the live cattle performance observed in this experiment. Returns from each treatment are compared on a live sale basis and on a carcass basis. T1 steers provided the largest return to the feeder, based on live sale or carcass sale. However, steers in T3 and 5 provided the least amount of variability between live sale returns and carcass returns. Steers in T3 and 5 had the lowest percentage of yield grade 4 carcasses, thus on a carcass basis they experienced the fewest discounts. Profitability was highest for T1 steers, both on a live and carcass basis (Figure 1). In 1991 they returned approximately $176.62/hd on a live sale basis and $139.65/hd on a carcass sale basis. Steers from T4 returned the largest loss of the 5 treatments, loosing approximately -$106.56/hd on a live basis and -$171.09/hd on a carcass basis. It is important to note that this data is for the feedlot returns only and that 1991 prices did not follow

TABLE 11. LIVE CATTLE ECONOMICS (DOLLARS/.4545 kg)

Trait	EW	NW	WP	EIG	SLG
Breakeven	$66.20	71.95	77.35	80.46	79.98
Sale Price	$81.50	78.00	72.00	72.00	72.00
Live Return	$940.51	918.84	906.48	907.20	879.84
Total Cost of Gain	$0.468	0.509	0.561	0.661	0.739
Profit/Loss	$176.62	71.22	-67.36	-106.56	-97.54
Avg	143.11	60.73	0.83	-0.92	-20.48
Max	206.13	185.07	75.15	88.18	92.93
Min	68.07	-1.26	-95.05	-106.56	-97.54
Std	39.45	55.74	58.84	49.90	53.48

FIGURE 1. PROFIT/LOSS FOR TREATMENTS 1 THRU 5 FOR 1991 AND FOR TEN YEAR AVERAGE.



normal patterns (Figure 2), in that the fed cattle market experienced higher than average highs and lower than average season lows. Based on ten year average prices and adjusted costs, the steers in T1 returned the highest profit to the feeder with an approximate ten year average profit of $143.11/hd and the cattle managed thru T5 returned the largest approximate ten year loss of -$20.48/hd. Cattle finished in T1 returned the highest profit due to the timeliness of marketing, these cattle were sold in April which is generally the peak of the yearly fed cattle market. The cattle in T3 where marketed in late July which is historically the low in the fed cattle market. These cattle only returned approximately $.83/hd profit over a ten year average. Total cost of gain, figured in a simplified budget was lowest ($.47/.4545 kg) for the steers fed in T1, thus their breakeven costs were the lowest at $66.20/.4545 kg for 1991 when compared to all other treatments. T5 steers had the highest cost of gain at $.74/.4545 kg but, cattle fed in T4 had the highest breakeven cost of $80.46/.4545 kg. Breakevens for cattle fed in T3 were the most erratic when compared over ten years to the July live cattle price, they were the most stable for the cattle fed in T1 when compared to the April live cattle price over ten years, and the cattle in T5 had the most cyclic pattern when comparing breakevens to ten years of December live cattle prices (Figure 3).

FIGURE 2. 1991 LIVE CATTLE PRICES VS. TEN YEAR AVERAGE.

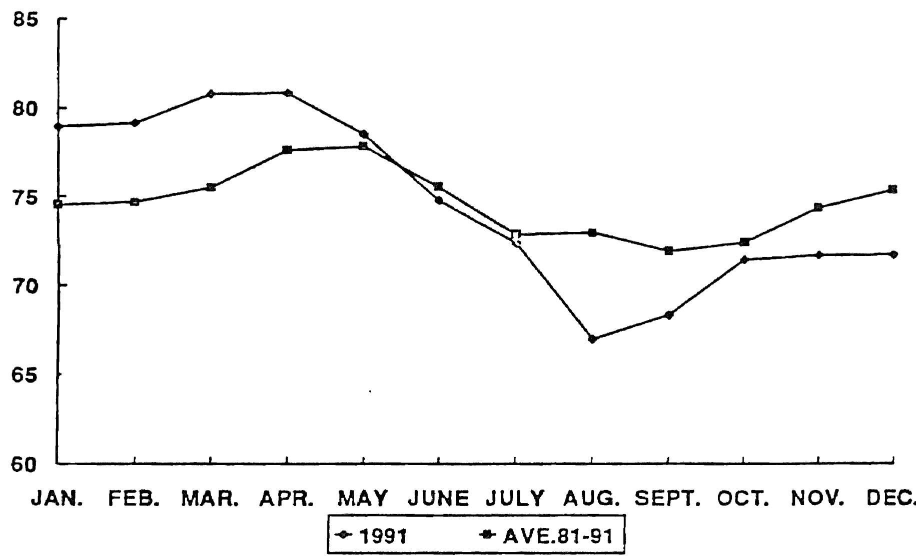
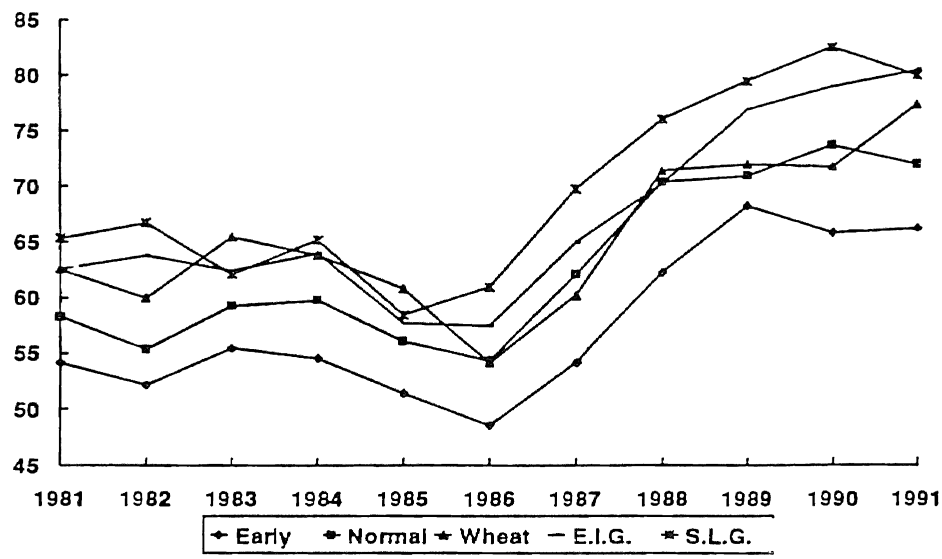


FIGURE 3. FIVE TREATMENT BREAKEVEN FOR TEN YEARS.



CHAPTER V

CONCLUSIONS

The objective of this study was to examine the effects of cattle age at feedlot placement on subsequent growth traits, carcass composition, and economic returns to the feeder. The use of a constant fat thickness endpoint permitted direct comparisons between treatments on growth, carcass, and economic characteristics evaluated in this study.

Results indicate that young calves may be fed, given enough days on feed, to produce a packer and consumer desirable carcass. Furthermore, this study indicates that younger cattle may be fed to produce high returns due to the timeliness of marketing, provided these cattle are managed properly. Management systems such as early weaning, wheat pasture, or deferred grazing may be developed to correspond to growth differences among differing types of cattle. These systems may be adapted to producers individual needs to most effectively utilize the available resources. It is important that the producer/ feeder realizes cattle type and relates type to the available resources.

This study supported previous research which found that younger cattle are more efficient during the finishing phase. All of the cattle in this study produced acceptable carcasses, including the early weaned calves. The early weaned calves in this study had slightly more s.c. fat than the other treatments, but, this problem could possibly be controlled by feeding these cattle for fewer days resulting in fewer yield grade 4 carcasses. Decreasing the number of yield grade 4's would increase the profit potential of the early weaning system. It is important to note that the performance data in this study was collected from primarily Angus crossbred cattle. These interrelationships need to be examined over a wide range of breed types. The economic data is based on 1991 prices, which were considered atypical, indicating that broader economic analysis needs to be conducted on each system.

LITERATURE CITED

Berg, R. T. 1968. Genetic and environmental influences on growth in beef cattle. In: G. A. Lodge and G.E. Lamming (Ed.) Growth and Development of Mammals. p. 429. Plenum Press, New York.

Berg, R. T., B. B. Anderson and T. Liboriussen. 1978. Growth of bovine tissues. 1. Genetic influences on growth patterns of muscle, fat and bone in young bulls. Anim. Prod. 26:245.

Berg, R. T. and R. M. Butterfield. 1966. Muscle:bone ratio and fat percentage as measures of beef carcass composition. Anim. Prod. 8:1.

Berg, R. T. and R. M. Butterfield. 1976. New Concepts of Cattle Growth. University of Sydney Press, Sydney.

Bertrand, J. E., and D. D. Johnson. 1988. Animal performance and carcass characteristics of beef steers finished without backgrounding versus backgrounding prior to finishing. In: Florida State University Animal Sci. Res. Rep. pp 144-150.

Bowling, R. A., J. C. Riggs, G. C. Smith, Z. L. Carpenter and O. D. Butler. 1978. Production, carcass, and palatability characteristics of steers produced by different management systems. J. Anim. Sci. 46:333.

Busch, D. A., C. A. Dinkel, D. E. Schafer, H. J. Tuma and B. C. Breidenstein. 1968. Predicting edible pportion of beef carcasses from rib separation data. J. Anim. Sci. 27:351.

Campion, D. R., J. D. Crouse and M. E. Dikeman. 1975. Predictive value of USDA beef quality grade factors for cooked meat palatability. J. Food Sci. 40:1225.

Cramer, C. L., W. C. Stringer, H. D. Naumann and V. Rhodes. 1964. An analysis of retail yield of beef carcasses. Mo. Agr. Exp. Sta. Res. Bull. 858.

Dolezal, H G. 1983. Effects on feeder cattle frame size, muscle thickness and age class on growth and carcass traits. PhD. dissertation, Colorado State University, Fort Collins.

DuBose, L. E., T. C. Cartwright and R. J. Cooper. 1967. Predicting steak and roast meat from production and carcass traits. J. Anim. Sci. 26:688

Ellis, G. F. 1965. All concentrate feeding research. Feedstuffs 37;50.

Ensminger, M. E. 1965. The Stockman's Handbook, 3rd ed. Danville, IL., Interstate Printers and Publishers.

Fowler, V. R. 1968. Body development and some problems of its evaluation. In: G. A. Lodge and G. E. Lamming (Ed.) Growth and Development of Mammals. p. 195. Plenum Press, New York.

Garrett W. N. and N. Hinman. 1969. Re-evaluation of the relationship between carcass density and body composition of beef steers. J. Anim. Sci. 28:1.

Garrigus, R. R., H. R. Johnson, N. W. Thomas, W. L. Firth and M. D. Judge. 1967. Effect of feeding regime on bovine body composition. I. Quantitative and qualitative carcass traits. Report to NC-58 Technical Committee Purdue University, Lafayette, Indiana.

Guenther, J. J., D. H. Bushman, L. S. Pope and R. D. Morrison. 1965. Growth and development of the major carcass tissues in beef calves from weaning to slaughter weight with reference to the effect of plane of nutrition. J. Anim. Sci. 24:1184.

Harrison, A. R., M. E. Smith, D. M. Allen, M. C. Hunt, C. L. Kastner and D. H. Kropf. 1978. Nutritional regime effects on quality and yield characteristics of beef. J. Anim. Sci. 47:383.

Hedrick, H. B., J. C. Miller, G. B. Thompson and R. R. Freitag. 1965. Factors affecting longissimus dorsi area and fat thickness of beef and relations between these measurements and retail yield. J. Anim. Sci. 24:333.

Hickok, D. T., R. R. Schalles, M. E. Dikeman and D. E. Franke. 1992. Comparison of feeding calves vs. yearlings. Kansas State University Cattlemen's Day 1992. p. 64.

Kay R. D. 1986. Enterprise and partial budgeting. In: Farm Management Planning, Control, and Implementation. pp 65-82. McGraw-Hill, Inc.

Lusby, K. S., R. P. Wettemann and E. J. Turman. 1981. Effects of early weaning calves from first-calf heifers on cow and heifer perrformance. J. Anim. Sci. 53:1193.

McCampbell, H. C., O. E. Sell and W. E. Neville. 1971. Carcass characteristics of early-late weaned Hereford steers fed on and off winter temporary pastures. J. Anim. Sci. 32:17.

Moody, W. G., J. E. Little, F. A. Thrift, L. V. Cundiff and J. D. Kemp. 1970. Influence of length of feeding a high roughage ration on quantitative and qualitative characteristics of beef. j. Anim. Sci. 31:866.

Mukhoty, H. and R. T. Berg. 1971. Influence of breed and sex on the allometric growth patterns of major bovine tissues. Anim. Prod. 13:219.

Murray, D. M., N. M. Tulloh and W. H. Winter. 1974. Effects of three different growth rates on empty body weight, carcass weight and dissected carcass composition of cattle. J. Agr. Sci. 82:535.

Oltjen, R. R., T. S. Rumsey and P. A. Putnam. 1971. All forage diets for finishing beef cattle. J. Anim. Sci. 32:327.

Pope, L. S., L. E. Walters, G. R. Waller and W. D. Campbell. 1963. Fattening cattle on all concentrate rations based on steam rolled milo. Oklahoma Agr. Exp. Sta. MP-70. p. 82.

Prichard, D. L., J. E. Bertrand and D. D. Johnson. 1988. Effect of backgrounding regime on animal performance and carcass characteristics of beef steers finished for various periods in the feedlot. Florida Beef Cattle Research Report. p.177.

Prior, R. L., R. H. Kohlmeier, L. V. Cundiff, M. E. Dikeman and J. D. Crouse. 1977. Influence of dietary energy and protein on growth and carcass composition in different biological types of cattle. J. Anim. Sci. 45:132.

Ridenour, K. W., H. E. Kiesling, G. P. Lofgreen and D. M. Stiffler. 1982. Feedlot performance and carcass characteristics of beef steers grown and finished under different nutrition and management programs. J. Anim. Sci. 54:1115.

Savell, J. W., R. E. Branson, H. R. Cross, D. M. Stiffler, J. W. Wise, D. B. Griffin and G. C. Smith. 1987. National consumer retail beef study: palatability evaluations of beef loin steaks that differed in marbling. J. Food Sci. 52:517.

SAS. 1985. SAS User's Guide: Basics. SAS Inst., Inc., Cary, NC.

Schroeder, J. W., D. A. Cramer, R. A. Bowling and C. W. Cook. 1980. Palatability, shelflife and chemical differences between forage and grain finished beef. J. Anim. Sci. 50:852.

Thompson, G. B., H. B. Hedrick and A. J. Dyer. 1970. Backgrounding effects on subsequent feedlot performance. J. Anim. Sci. 31:256.

Thompson, G. B. and C. C. O'Mary. 1983. The Feedlot. p.79. Lea and Febiger.

USDA. 1989. Offficial United States standards for grades of carcass beef. AMS-USDA, Washington, DC.

USDA. 1991. Agricultural Marketing Service. Livestock and Seed Division. Livestock Detailed Quotations, Oklahoma City Market.

USDA. 1991. National Agricultural Statistics Service. Agricultural Prices. Selected monthly and annual issues.

USDA. 1991. National Carlot Meat Report Livestock and Grain Market News, Des Moines, IA.

Waldman, R. C., W. J. Tyler and V. H. Brungardt. 1971. Changes in the carcass composition of Holstein steers associated with ration energy levels and growth. J. Anim. Sci. 32:611.

Wilder, W. A., Jr., M. B. Wise, E. R. Barrick, I. J. Ellis and C. Z. McSwain. 1964. Influence of adding cottonseed hulls to an all concentrate ration for finishing beef calves. North Carolina Agr. Exp. Sta., Rep. 125.

Winchester, C. F. and P. E. Howe. 1955. Relative efforts of continuous and interrupted growth on beef steers. U.S.D.A. Tech. Bull. 1108.

Zinn, D. W., C. T. Gaskins, G. L. Gann and H. B. Hedrick. 1970b. Beef muscle tenderness as influenced by days on feed, sex, maturity and anatomical location. J. Anim. Sci. 31:307.

APPENDIX

BUDGETS AND CARCASS RETURNS

FIGURE 4. TEN YEAR AVERAGE LIVE CATTLE PRICES VS. TEN YEAR AVERAGE EARLY WEANED BREAKEVEN PRICES.

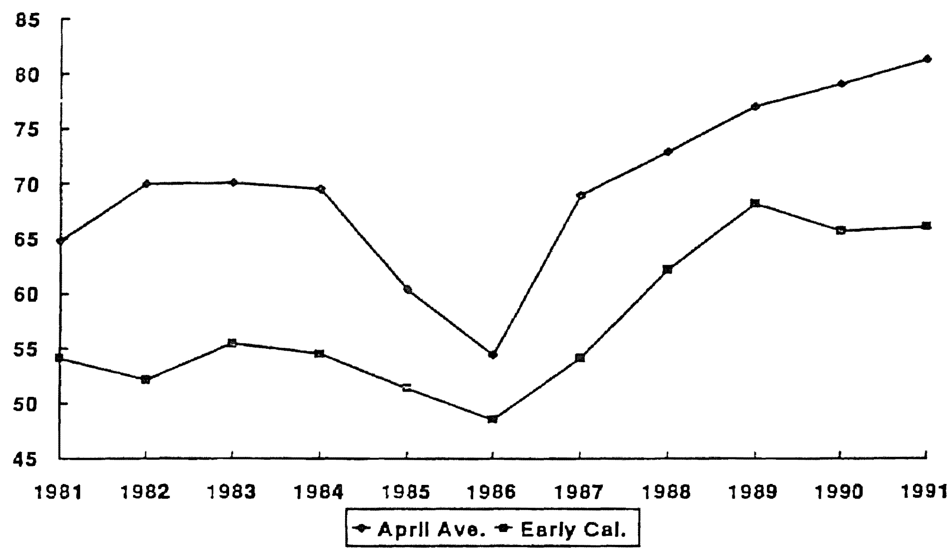


FIGURE 5. TEN YEAR AVERAGE LIVE CATTLE PRICES VS. TEN YEAR AVERAGE NORMAL WEANED BREAKEVEN PRICES.

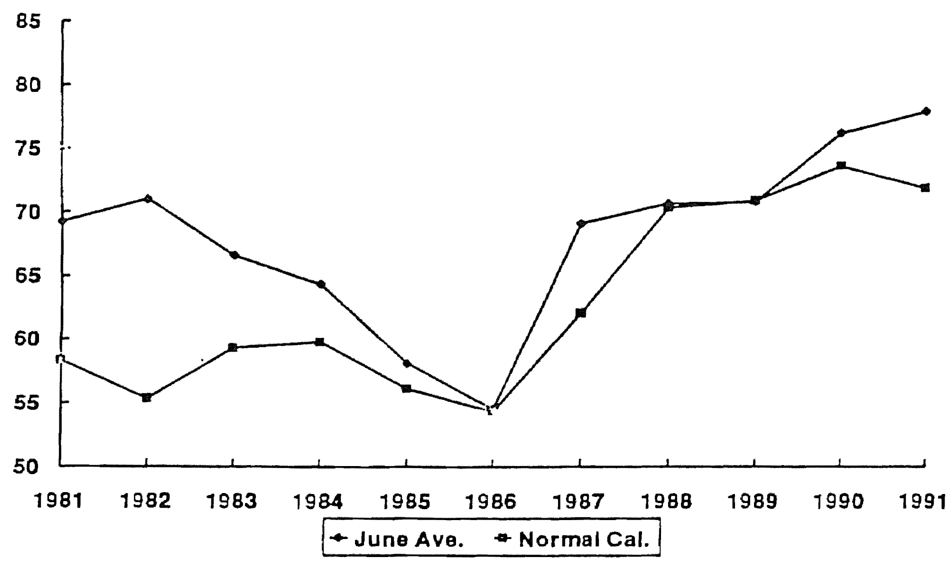


FIGURE 6. TEN YEAR AVERAGE LIVE CATTLE PRICES VS. TEN YEAR AVERAGE WHEAT PASTURE BREAKEVEN PRICES.

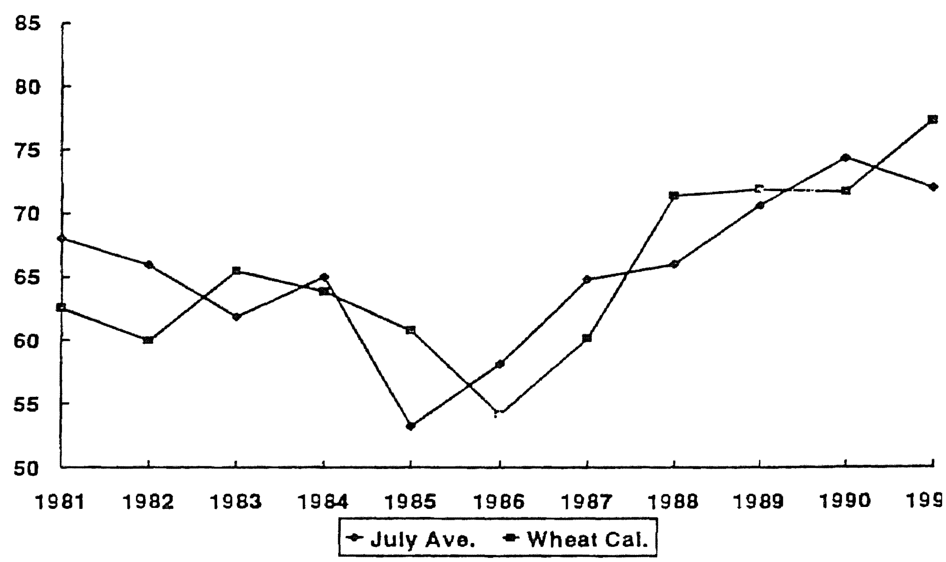


FIGURE 7. TEN YEAR AVERAGE LIVE CATTLE PRICES VS. TEN YEAR AVERAGE EARLY INTENSIVE GRAZING BREAKEVEN PRICES.

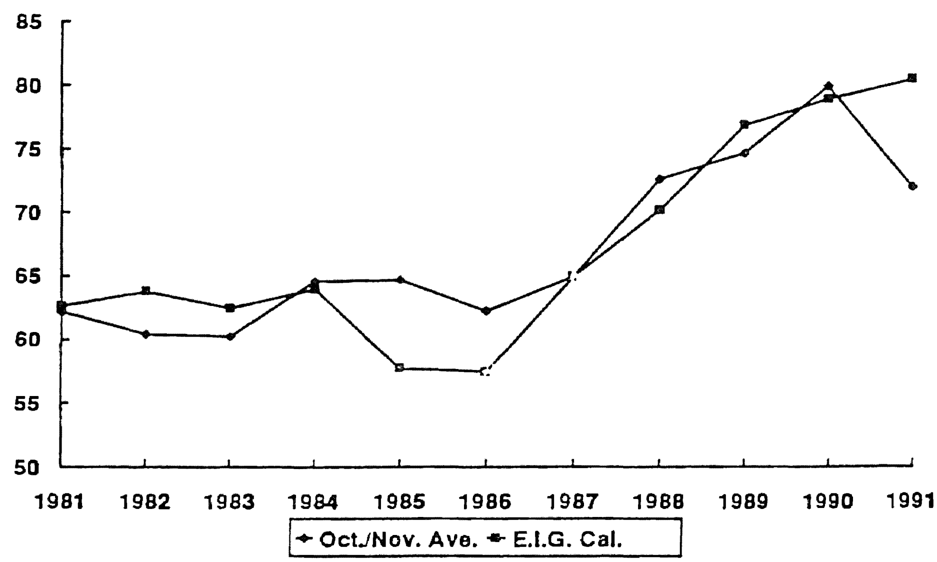


FIGURE 8. TEN YEAR AVERAGE LIVE CATTLE PRICES VS. TEN YEAR AVERAGE SEASON LONG BREAKEVEN PRICES.

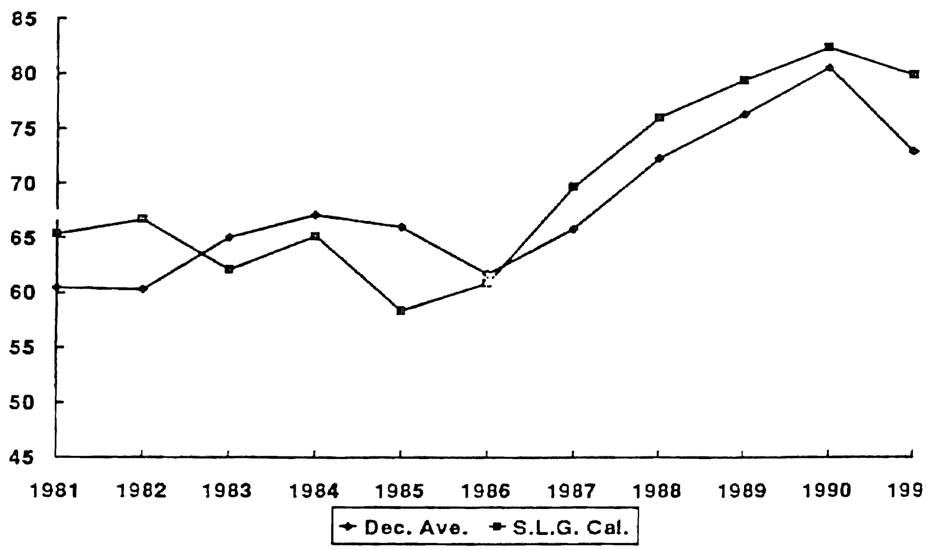


FIGURE 9. 1991 EARLY WEANED BUDGET

BUDGET TITLE: ACTUAL COSTS
TREATMENT: EARLY WEANED
DATE IN: 7/90
DATE OUT: 4/91

PRODUCTION INFORMATION

IN WEIGHT, LB	314
DAYS ON FEED	287
FEED INTAKE, LB/DAY	15.6
FEED CONSUMED, TONS	2.24
ADG, LB/DAY	2.93
OUT WEIGHT, LB	840

	AMOUNT	UNITS	UNIT PRICE	TOTAL
COSTS				
STEER	314	LB	118	370.52
DEATH LOSS	3	%		11.12
VET & MED		HEAD	5.96	5.96
FEED	2.24	TONS	145	324.60
INTEREST	8	%		34.59
YARDAGE	287	DAYS	0.05	14.35
BEEF CHECKOFF		HEAD	1	1.00
IN FREIGHT	314	CWT	0.56	1.76
TOTAL COST				763.89
REVENUE				
STEER	1154	LB	81.5	940.51
PROFIT		HEAD		176.62
BREAKEVEN SALE PRICE		CWT		66.20
FEED COST OF GAIN		LB		0.3864
TOTAL COST OF GAIN		LB		0.4683

FIGURE 10. 1991 NORMAL WEANED BUDGET

BUDGET TITLE:	ACTUAL COSTS
TREATMENT:	NORMAL WEANED
DATE IN:	11/90
DATE OUT:	6/91

PRODUCTION INFORMATION

IN WEIGHT, LB	540
DAYS ON FEED	199
FEED INTAKE, LB/DAY	18.2
FEED CONSUMED, TONS	1.81
ADG, LB/DAY	3.21
OUT WEIGHT, LB	1178

	AMOUNT	UNITS	UNIT PRICE	TOTAL
COSTS				
STEER	540	LB	96.83	522.88
DEATH LOSS	2.5	%		13.07
VET & MED		HEAD	5.76	5.76
FEED	1.81	TONS	145	262.58
INTEREST	8	%		29.35
YARDAGE	199	DAYS	0.05	9.95
BEEF CHECKOFF		HEAD	1	1.00
IN FREIGHT	540	CWT	0.56	3.02
TOTAL COST				847.62
REVENUE				
STEER	1178	LB	78	918.84
PROFIT		HEAD		71.22
BREAKEVEN SALE PRICE		CWT		71.95
FEED COST OF GAIN		LB		0.4115
TOTAL COST OF GAIN		LB		0.5089

FIGURE 11. 1991 WHEAT PASTURE FEEDLOT BUDGET

BUDGET TITLE: ACTUAL COSTS
TREATMENT: WHEAT PASTURE
DATE IN: 3/91
DATE OUT: 7/91

PRODUCTION INFORMATION

IN WEIGHT, LB	765
DAYS ON FEED	134
FEED INTAKE, LB/DAY	23.35
FEED CONSUMED, TONS	1.56
ADG, LB/DAY	3.69
OUT WEIGHT, LB	1259

	AMOUNT	UNITS	UNIT PRICE	TOTAL
COSTS				
STEER	765	LB	91.08	696.76
DEATH LOSS	1	%		6.97
VET & MED		HEAD	7.07	7.07
FEED	1.56	TONS	145	226.85
INTEREST	8	%		24.21
YARDAGE	134	DAYS	0.05	6.70
BEEF CHECKOFF		HEAD	1	1.00
IN FREIGHT	765	CWT	0.56	4.28
TOTAL COST				973.84
REVENUE				
STEER	1259	LB	72	906.48
PROFIT		HEAD		-67.36
BREAKEVEN SALE PRICE		CWT		77.35
FEED COST OF GAIN		LB		0.4592
TOTAL COST OF GAIN		LB		0.5608

FIGURE 12. 1991 EARLY INTENSIVE GRAZING FEEDLOT BUDGET

BUDGET TITLE: ACTUAL COSTS
TREATMENT: EARLY INTENSIVE
DATE IN: 7/91
DATE OUT: 11/91

PRODUCTION INFORMATION

IN WEIGHT, LB	848
DAYS ON FEED	123
FEED INTAKE, LB/DAY	25.36
FEED CONSUMED, TONS	1.55
ADG, LB/DAY	3.35
OUT WEIGHT, LB	1260

	AMOUNT	UNITS	UNIT PRICE	TOTAL
COSTS				
STEER	848	LB	87.41	741.24
DEATH LOSS	0.5	%		3.71
VET & MED		HEAD	7.44	7.44
FEED	1.55	TONS	145	226.15
INTEREST	8	%		23.33
YARDAGE	123	DAYS	0.05	6.15
BEEF CHECKOFF		HEAD	1	1.00
IN FREIGHT	848	CWT	0.56	4.75
TOTAL COST				1013.76
REVENUE				
STEER	1260	LB	72	907.20
PROFIT		HEAD		-106.56
BREAKEVEN SALE PRICE		CWT		80.46
FEED COST OF GAIN		LB		0.5489
TOTAL COST OF GAIN		LB		0.6615

FIGURE 13. 1991 SEASON LONG GRAZING FEEDLOT BUDGET

BUDGET TITLE: ACTUAL COSTS
TREATMENT: SEASON LONG
DATE IN: 8/91
DATE OUT: 12/91

PRODUCTION INFORMATION

IN WEIGHT, LB	918
DAYS ON FEED	101
FEED INTAKE, LB/DAY	25.12
FEED CONSUMED, TONS	1.27
ADG, LB/DAY	3.01
OUT WEIGHT, LB	1222

	AMOUNT	UNITS	UNIT PRICE	TOTAL
COSTS				
STEER	918	LB	82	752.76
DEATH LOSS	0.5	%		3.76
VET & MED		HEAD	6.79	6.79
FEED	1.27	TONS	145	183.94
INTEREST	8	%		18.93
YARDAGE	101	DAYS	0.05	5.05
BEEF CHECKOFF		HEAD	1	1.00
IN FREIGHT	918	CWT	0.56	5.14
TOTAL COST				977.38
REVENUE				
STEER	1222	LB	72	879.84
PROFIT		HEAD		-97.54
BREAKEVEN SALE PRICE		CWT		79.98
FEED COST OF GAIN		LB		0.6051
TOTAL COST OF GAIN		LB		0.7389

VITA

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