Effect of Supplemental Feeding on Performance and Value of Tennessee Feeder Calves Grazing Summer Pasture[1]

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INTRODUCTION

Tennessee continues to be one of the largest producers of marketable weaning age beef cattle in the United States. Recent figures (Tennessee Agriculture, 1997) indicate that Tennessee has approximately 1.1 million beef cows which can make available some 800,000 weaning age feeder steers and heifers to be marketed in the state of Tennessee each year (85% calf crop, 20% heifers saved for replacement, 10% sires saved for replacement). Traditionally, these weaning age cattle may be marketed by several options ranging from the producer selling freshly weaned calves direct from the cow to the marketing of yearling age calves. The yearling age calves will have normally gone through either a summer or winter forage based grazing system. Only a limited number of Tennessee producers will elect to retain ownership of their cattle through finishing, therefore these cattle may change ownership a number of times from weaning to slaughter. Since a majority of these cattle will be sold by the Tennessee producer prior to entering the feedlot phase of the animal's lifetime, any means of increasing value of these cattle would have a positive impact for the Tennessee beef producer. The purpose of this study was to investigate the value of supplemental feeding of beef calves grazing a warm season perennial grass (bermudagrass) and the subsequent effect on feedlot performance and carcass merit.

EXPERIMENTAL PROCEDURES

A total of 24 head of purchased crossbred, Medium and Large frame #1 stocker calves were used in this trial. Calves were purchased from a single source and delivered to the Martin station in mid-June, 1997. Calves were vaccinated, implanted with Ralgro® and then randomly sorted into two grazing groups. Data collected at the beginning of the trial included live weight and hip height plus rib fat, rib eye area, rump fat and intramuscular fat by ultrasound (Pie Scanner 200, equipped with ASP-18 3.5 MHz linear array probe). The two groups were then placed onto existing Common bermudagrass pastures with a stocking rate of about 1.2 head/acre. Pastures were not clipped or managed in any way during the grazing trial in order to represent a "low-quality, poorly managed summer forage system." One group was designated as the **Control** group and received only free-choice grazing, water and mineral supplement (Tennessee Farmer's Cooperative Item #663, 2:1 Cattle Mineral). The second group, designated as the **Supplement** group, received free-choice grazing, water, mineral plus a commercial backgrounding supplement (Tennessee Farmer's Cooperative Item #456, All Natural Cattle Pellet-R, 16% crude protein, with Rumensin®) at the rate of 4 lb/hd/day. Weights and measures (Table 1) were obtained at the beginning of the grazing trial (Gr 0), at 56 days on pasture (Gr 56) and at the completion of the 112 day grazing period (Gr 112).

At the conclusion of the 112 day grazing period, cattle were reassembled into a single group, dewormed, implanted with Ralgro® and placed onto a concrete dry-lot (former dairy facility) for finishing. Cattle were initially fed hay free choice and then limit fed increasing increments of whole shell corn with decreasing increments of hay over a 21 day adaptation period until reaching a 100% whole shell corn based diet. Animals were then weighed and measured (Table 2) upon entry into the feedlot phase of the study (Fd 0) with repeated measurements at 35 days on feed (Fd 35) and the conclusion of the 107 day feedlot phase (Fd 107). The feedlot ration utilized in this study consisted of whole shell corn, beef supplement (Tennessee Farmer's Cooperative Item #94417, Pro-Choice Beef Concentrate R-Ty) at the rate of 2 lb/hd/day plus coarsely ground hay (3 lb/hd/day). Supplement and hay were fed at the prescribed fixed rate with corn provided ad libitum and adjusted based on consumption figures. Daily feed weights were recorded and feed was available to cattle at all times.

Statistical analysis of data was accomplished by the GLM procedure of SAS (1995).

RESULTS AND DISCUSSION

Grazing Phase

Least squares means of the weights and measurements of the control (n = 12) and supplemented (n = 12) cattle during the grazing period are presented as Table 1.

Table 1. Least square means for live animal linear and ultrasound measurements during the grazing phase of trial.

	Number Days on Pasture					
	Gr 0		Gr 56		Gr 112	
Variable	Control	Suppl.	Control	Suppl.	Control	Suppl.
Live wt, lb.	551	547	638[a]	686[a]	672[b]	766[b]
Rib fat, in.	.070	.055	.080	.084	.081	.097
Rump fat, in.	.106	.091	.109[c]	.128[c]	.102[d]	.198[d]
REA, sq. in.	6.42	5.96	NA	NA	6.64[e]	7.60[e]
IMFAT, %	1.69	1.85	1.09	1.29	2.32	2.39
Hip height, in.	44.6	45.0	45.0	45.8	46.0[f]	47.5[f]

Means with common superscript within each days on pasture group are significantly (P < .05 or greater) different.

There were no statistically significant differences in the two groups of cattle for

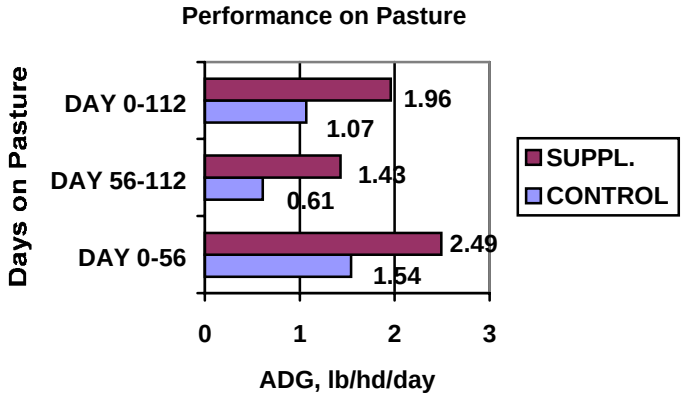

Figure 1. Illustration of average daily gain by grazing period.

any variable measured at the beginning of the grazing trial (Table 1). However, it is apparent that supplemental feeding did have a significant effect on growth and performance of the two groups (Figure 1). The average daily gain (ADG) for the control cattle from Gr 0 to Gr 56 was 1.54 lb/hd/day versus 2.49 lb/hd/day for a difference of 0.95 lb/hd/day (P<. 05). This difference in rate of gain continued into the second half of the grazing period (Gr 56 to Gr 112) with ADG's of 0.61 and 1.43 respectively for the control and supplemented groups. The 112 day figures for gain for the control group of 1.07 lb/hd/day closely parallel gains of 0.73 to 1.47 lb/hd/day reported by others for cattle grazing bermudagrass (McCormick, 1964; Chapman, et al., 1972). The difference in rate of gain from the first half of the grazing season to the second half could be attributed to decreased nutritive value of the bermudagrass pasture expected with increasing maturity (Prine and Burton, 1956). The increased gain for the supplemented group each period suggests an apparent additive effect of the supplemental feed when provided at the rate of 4 lb/hd/day.

Since live weight data (Table 1) shows that supplemental feeding added a significant amount of weight gain to the steers, it is important to determine where the animal is adding tissue and of what types. Initial ultrasound rib fat was 0.070 in. for the control calves versus 0.055 in. for the supplement group, a non-significant (P >. 05) difference. After 112 days on pasture, the two groups measured 0.081 and 0.097 respectively, still a non-significant difference (P > .05). However, the control cattle had increased rib fat by 0.011 in. while the supplemented cattle had increased by 0.042 in. during the 112 days indicating that the additional feed was having an effect on fat deposition and body condition score of the calves during the grazing period. In addition, the supplemented cattle had larger rib eyes, were taller at the hip and had more rump fat than the control group (Table 1). Intramuscular fat estimation via ultrasound technology was also recorded at each evaluation period to differentiate internal tissue changes. While there was no significant difference between the two groups of cattle at any measurement period, both groups tended to decrease in intramuscular fat from Gr 0 to Gr 56 and then increase from Gr 56 to Gr 112. This decrease of probable tissue intramuscular fat from freshly weaned calves while grazing pastures has been noted in earlier trials (Gresham and Onks, unpublished data). The relative increase for the supplemented cattle from Gr 56 to Gr 112 might be explained by the additional level of nutrition but the corresponding increase in the control cattle was unexpected and will be a point of interest in future studies.

Feedlot Phase

Upon conclusion of the grazing phase of the study, cattle were removed from the bermudagrass pasture and placed into the feedlot as previously described. Since there were apparent performance differences during the grazing phase of the trial, it would be of particular interest to observe if there would be a "carry-over" effect for the supplemented cattle or if the nutritionally stressed control cattle would demonstrate compensatory gain. Table 2 and Figure 2 reflect performance and measurement data for the cattle during the feedlot phase of the trial.

Table 2. Least square means for live animal linear and ultrasound measurements during the feedlot phase of trial.

	Number Days in Feedlot					
	Fd 0		Fd 35		Fd 107	
Variable	Control	Suppl.	Control	Suppl.	Control	Suppl.
Live wt, lb.	715[a]	810[a]	849[b]	942[b]	1055[c]	1180[c]
Rib fat, in.	.095	.107	.149	.171	.286	.235
Rump fat, in.	.141[d]	.206[d]	.209[e]	.277[e]	.420	.450
REA, sq. in.	7.78	8.10	NA	NA	12.3	12.8
IMFAT, %	2.74	2.63	2.83	3.03	4.31	4.43
Hip height, in.	47.3	48.8	48.1	49.5	50.0[f]	52.1[f]
Marbling score					Small[43]	Small[13]

Means with common superscript within each days in feedlot group are significantly (P <. 05 or greater) different.

At the conclusion of the grazing phase (Gr 112) the average weights for the control and supplemented groups were 672 and 766 lb (Table 1) respectively. During the adaptation period (21 days), the control cattle gained 43 lb while the supplemented cattle gained 44 lb to reach the live weight figure for Fd 0 reflected in Table 2.

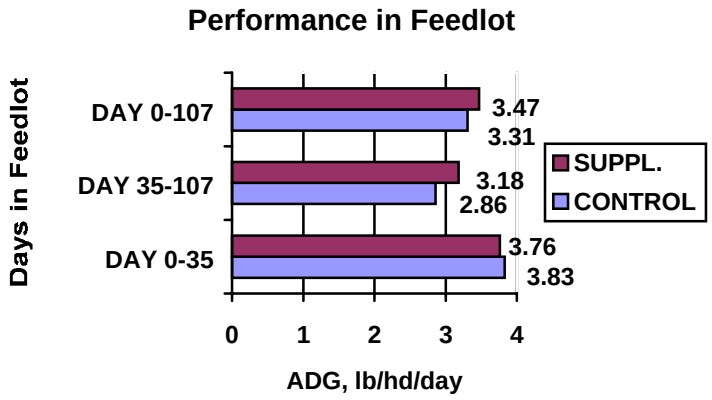

Figure 2. Illustration of average daily gain by feedlot period.

During the first 35 days in the feedlot (Figure 2), the control cattle had a slight but non-significant advantage in gain of 3.83 lb/hd/day versus 3.76 for the supplemented group. Therefore, it would appear no compensatory gain is occurring for the control cattle with both groups performing uniformly in the feedlot, at least over the first 35 days. Similar results are noted from Fd 35 to Fd 107 with both groups experiencing expected decreased rates of gain, but again no significant difference between the two groups. The overall average daily gain (107 days on feed) of 3.31 and 3.47 lb/hd/day for the two groups is consistent for average day gains expected for cattle being fed whole shell corn as reported in other studies (Owens, et al., 1997).

The average feed conversion rate (pen conversion rates) for all feeds consumed per lb of gain during the feedlot phase was:

Ingredient	Pounds
Whole shell corn	6.31
Beef pellet	0.60
Ground hay	0.89
TOTAL	7.80

Owens, et al., (1997) reported an average feed conversion of 5.95 lb grain/lb gain for whole shell corn from several studies and this is in close agreement with the 6.31 lb of corn per lb of gain experienced in this trial. The recommended guideline for the beef pellet utilized in this trial did not include use of any hay as an additional source of roughage. However, previous feeding trials at this station using both steam-flaked and whole shell corn plus pellets and no additional source of roughage, had been characterized by conditions common to low levels of acidosis (Owens, et al., 1998). The added hay did have a positive effect on visible digestive disturbances.

Probably the most apparent result when analyzing the data in Tables 1 and 2 are the differences in average daily gain for the two groups of cattle. While the cattle fed the supplement in the grazing trial had a significantly greater rate of gain on pasture, once in the feedlot and on full feed there was no significant difference in rate of gain for the

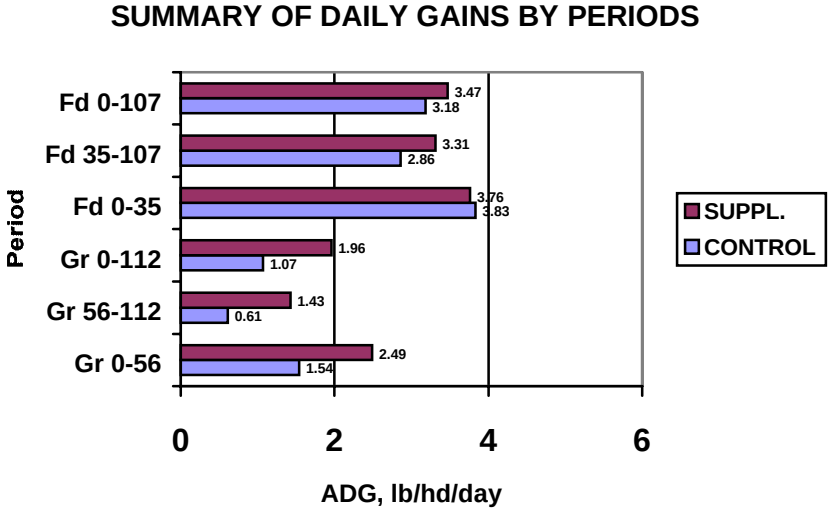

Figure 3. Average daily gain of cattle on pasture and in feedlot by period of measurement.

control or supplemented cattle (Figure 3). At the end of the grazing trial (Table 1) the supplemented cattle had a weight advantage of 94 lb. and at the end of 107 days in the feedlot (Table 2) the advantage was 125 lb. While the difference in the weights are statistically significant, it is apparent that the difference was due to increased rate of gain during the grazing phase as opposed to the feedlot phase. Similar results were obtained

by Elizalde, et al. (1998) with cattle grazing tall fescue and supplemented with cracked corn or corn gluten feed. The other noticeable differences in the two groups of cattle were that the supplemented cattle continued to be taller at the hip indicating an increased rate of skeletal growth and the control cattle tended to be slightly fatter as measured by rib fat.

Rump fat has been studied as a possible additional factor to consider value and compositional differences in cattle. In this study, the faster growing supplemented cattle had a significantly heavier layer of subcutaneous fat over the rump and this advantage continued until the end of the feedlot phase (Tables 1 and 2). A significant difference in rump fat was observed after 56 days on pasture up to the final feedlot measurement at 107 days. Earlier studies (Gresham and Onks, unpublished data) indicated that younger cattle have greater variation in rump fat than rib fat and that this might be a factor to consider in attempting to predict future performance. The results from this trial are inconclusive, however future reports will more fully investigate the possible role of rump fat in assessing value differences in feeder cattle.

Carcass data measuring rib fat, rib eye area and intramuscular fat was collected at harvest and was not significantly different from the ultrasound results presented at the end of the feeding trial (Table 2). The control cattle averaged a Small^{43} degree of marbling while the supplemented cattle had a Small^{13} degree of marbling, with both groups averaging Low Choice quality grade.

IMPLICATIONS

Results of this study point out the potential value of using supplemental feed for Tennessee feeder calves grazing poor or marginal quality summer forages. While a rate of gain of almost 1.0 lb/hd/day might be acceptable to some, supplemental feeding can certainly offer an economic advantage to the producer, especially with retained ownership through the feedlot phase. The following examples could be used to illustrate potential income differences for the two management systems (sell after backgrounding versus retaining ownership through finishing):

Example 1. Selling calves after grazing, values in dollars per head.

	CONTROL	SUPPLEMENT
Initial value of calf	$440.80	$437.60
	(551 @ .80)	(547@ .80)
Gross value after pasture	504.00	536.20
	(672 @ .75)	(766 @ .70)
Increased value on pasture	63.20	98.60
Feed cost (448 lb @ $140/ton)	0.00	31.36*
Net increase in value over feed cost	63.20	67.24
Advantage for supplement cattle		**4.04**

*****Feed cost figure does not include cost for labor or facilities.

Price differentials for each weight group (500-600, 600-700 and 700-800) were established at $5.00/cwt (Sleigh, et al., 1997). With this example, the advantage for supplementing the cattle for 112 day is a net of $4.04 per head over cost of feed (feed cost is $140 per ton, feed 4 lb/hd/day for 112 days). The initial response to the significant advantage in gain on pasture must be tempered by the decreasing value of the calf per unit of body weight on the feeder calf market as body weight increases.

Example 2. Retaining ownership and finishing cattle, values in dollars per head.

	CONTROL	SUPPLEMENT
Initial value of calf off pasture	$504.00	$536.20
	(672 @ .75)	(766 @ .70)
Gross value after finishing	675.20	755.20
	(1055 @ .64)	(1180 @ .64)
Weight gain in feedlot	383	414
Increased value in feedlot	171.20	219.00
Feed cost (Gain x 0.428*)	-163.92	-177.19
Net increase in value	7.28	41.81
Advantage for supplement cattle		**34.53**

*Corn @ $110.00 per ton
Beef pellet @ $235.00 per ton
Hay @ $21.00 per ton (low quality, tub-ground round bales)

Example 2 demonstrates the potential value of the increased gain on pasture when "carried-over" and retained in the feedlot. Since both groups of cattle performed almost identical in the feedlot phase, the realized value difference results from the increased weight gain on the pasture. Should the producer sell after backgrounding, an increase of only $4.04 per head is realized after cost of feed is included and the decreased value for heavier calves is considered. However, a producer who retains ownership past backgrounding will not be penalized for the increased weight and flesh condition that might influence feeder calf price. In this example, supplementation resulted in an increase of $109.05 per head above the initial value of the calf while the control calf increased $70.43. Since the increased gain on pasture is retained, this would allow the owner to either sell a heavier steer from the feedlot after the same number of days on feed or possibly reduce the days on feed by about 35 days in the feedlot (assuming a 3.5 lb/hd/day rate of gain). In addition, the supplemented cattle were leaner with a larger rib eye area and less rib fat at harvest, therefore cattle priced on a grid system might also reap a premium since they would have an advantage in yield grade with no sacrifice in quality grade.

SUMMARY

Tennessee beef producers are always looking for ways to increase value of feeder calves after backgrounding. Supplemental feeding of calves grazing a perennial summer pasture such as bermudagrass should have a significant effect on pounds of calf to sell.

While limited value might be realized if supplemented calves are sold direct from the backgrounding program, retaining ownership through finishing on whole shell corn and beef pellet might be a viable alternative to consider in some years. If only 25% of the 800,000 potential feeder calves normally marketed annually are backgrounded using supplemental feed, then retained and fed to finishing under the scenario outlined as Example 2, this could add up to $7 million additional revenue to the Tennessee beef industry. If these cattle were to be finished in the state, this would create a potential market for an estimated 250,000 tons of corn plus supplements. While cattle finishing in Tennessee is traditionally not popular because of lack of markets, location of packing plants and other reasons, Tennessee producers might consider this alternative if they have adequate facilities, equipment and feed cost is competitive.

[1]Mention of a particular tradename or product does not imply endorsement by the University of Tennessee over similar or equal products.

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