Performance and Economic Comparisons of Alternative Beef Production Systems for Fall-Weaned Calves

**T. L. Mader, G. W. Horn,
O. L. Walker, L. E. Walters,
S. L. Armbruster and W. E. McMurphy**

Story in Brief

Studies were conducted to compare live and carcass weight gains and economic returns of fall-weaned steer calves carried through on different production systems. In one system steers were placed directly in the feedlot. In the other systems steers were carried as stockers on wheat pasture or bermudagrass hay (stocker phase) before grazing small grains-interseeded bermudagrass (SG/B) pastures throughout the summer or being fed to finish in feedlot. Steers from each of the two stocker programs were also grazed to heavier weights on SG/B pastures for 63 days before being finished in feedlot.

Live and carcass weight gains of steers grazed on wheat pasture or fed bermudagrass hay during the stocker phase were 1.16 and .90 lb/day (wheat pasture) and .39 and .16 lb/day (bermudagrass hay). In the finishing phase, performance of steers stockered on wheat pasture was initially greater than that of steers fed bermudagrass hay during the stocker phase. Of all steer groups finished in feedlot, average daily gains of the initial feedlot steers were the lowest; however, their feed efficiencies were the best (6.37 lb feed DM/lb gain).

Enterprise budgets were developed for each beef production system. Steers stockered on wheat pasture and/or grazed 63 days or throughout the summer on SG/B pastures paid all production costs and a residual return to the producer. Grazing steers 63 days on SG/B pastures increased returns $41.46 and $34.43 per head for steers from the respective wheat pasture and bermudagrass hay stocker programs. The bermudagrass hay stocker program was not profitable. Break-even analysis indicated that gains of nearly 1 lb per day were needed to pay all non-feed and feed costs of steers carried through the winter on bermudagrass hay. Breakeven daily gains of steers stockered on wheat pasture were 1.3 lb.

Introduction

During the fall of 1976, a project was begun at the Southwestern Livestock and Forage Research Station (El Reno, Oklahoma) to compare cattle performance and economics of some alternative stocker and finishing programs for fall-weaned calves. Data relative to the performance and economics ($ returned per head) of cattle of the different production systems, during the first year of the project, have been reported (Mader *et al.*, 1978a and 1978b). The results of the second year of the project are reported herein.

Experimental Procedure

Cattle

One-hundred and thirteen (113) fall-weaned Hereford x Angus steer calves were purchased through an order buyer. After being carried through a receiving program of about three weeks, during which the calves grazed native tall grass pastures, the calves were randomly allotted to the treatment groups shown in Figure 1.

Initial Feedlot Group

Twelve steers (four pens of three head/pen) were placed in drylot and fed *ad libitum* a finishing ration of whole shelled corn, cottonseed hulls and supplement. The ration contained 40 percent cottonseed hulls initially, and corn was substituted for the hulls at a rate of about 1 percent per day until the steers were on a ration of 87 percent whole shelled corn, 5 percent cottonseed hulls and 8 percent supplement. The supplement contained 60 percent crude protein on a dry matter basis.

Stocker Phase

Ninety-four (94) of the remaining steers were allotted to two groups of 47 steers per group and were placed on 1) wheat pasture or 2) a dormant bermudagrass pasture and fed bermudagrass hay *ad libitum* from November 9, 1977 to March 29, 1978. Core samples of about one-third of the bales of bermudagrass hay fed were taken weekly for crude protein and *in vitro* dry matter digestibility (IVDMD) determinations.

A mineral mix consisting of 2 parts dicalcium phosphate, 1 part trace-mineralized salt and 5 percent cottonseed meal was fed free choice to each group of steers.

Initial (seven steers) and intermittent slaughter groups (four steers/stocker group) were killed immediately prior to and after the stocker phase so dressing percentage and carcass composition could be measured. Dressing percentages of the initial slaughter group, wheat pasture and bermudagrass hay-fed steers *after* the stocker phase were 49.39 ± .80, 56.53 ± .47 and 48.47 ± 1.01 percent, respectively.

Finishing Phase

At the end of the stocker phase, 40 steers within each of the two stocker groups were randomly assigned to five treatment groups I - V or VI - X (Figure 1). Each treatment group consisted of two pens (replications) of four steers/pen. Steers were fed in their respective treatment groups until it was judged their carcasses would grade low-choice, at which time they were killed at a commercial packing plant.

Groups I and VI were grazed to heavier weights on SG/B pastures from March 29 to May 31, 1978 (63 days) before being finished in drylot. Groups III and VIII were grazed on SG/B pastures and fed complete mixed rations *ad libitum*. Each of the two replications of four steers/replication in treatment groups III and VIII were assigned "paired" replicates from the following groups of steers. One group grazed SG/B pastures and was fed nothing but the mineral mix utilized in the stocker phase (treatment groups II and VII). The second group was placed in drylot and limit-fed (groups IV and IX). The third group was fed *ad libitum* in drylot (groups V and X) the same rations that groups III and VIII were fed on SG/B pastures.

Drylot groups IV and IX were limit-fed daily the same amount of ration that their paired group on SG/B consumed. The amount of ration fed daily to the drylot, limit-fed groups were adjusted weekly. Additional "put-and-take" steers were used in the SG/B pastures that Groups II and VII steers grazed in order to fully utilize the available forage.

The small grains-interseeded (SG/B) pastures were seeded with 50 lb Triumph 64 wheat and 50 lb Bonel rye per acre during the third week of September, 1977, with a John Deere Powr-Till Seeder. Fifty lb of nitrogen was applied per acre in early October and again in February.

All steer weights used to calculate live weight gains were taken after over-night shrinks (usually about 16 hr without feed and water).

Results and Discussion

Stocker Phase

Weight gains of steers during the stocker phase are shown in Table 1. Live and carcass daily weight gains of steers were 1.16 and .90 lb (wheat pasture) and .39 and .16

Table 1. Performance of steers during stocker phase.

Item	Wheat pasture	Bermudagrass hay[c]
Initial live wt, lb	475	482
Final live wt, lb	637[a]	537[b]
ADG (live), lb	1.16[a]	0.39[b]
ADG (carcass), lb	0.90[a]	0.16[b]

[a,b]Means with different lettered superscripts are statistically different (P<.05).
[c]Mean crude protein and TDN were 11.58 ± .41 and 48.50 ± .81 percent, respectively.

Table 2. Performance of steers from two previous stocker programs when grazed on small grains-interseeded bermudagrass pastures and then finished in drylot.

Item	Wheat pasture	Bermudagrass hay
Initial wt, lb	643[a]	539[b]
Final wt, lb	1051	1020
ADG, lb		
SG/B[c]	2.39[a]	1.84[b]
Drylot	3.03	3.12
SG/B and drylot	2.76	2.67
Feed/gain[d]	8.21	7.53

[a,b]Means with different lettered superscripts are statistically different (P<.05).
[c]While grazing small grains-interseeded bermudagrass pastures (63 days).
[d]Pounds feed dry matter per pound of gain (drylot period).

lb (bermudagrass hay-fed steers), respectively. Due to snow and/or ice cover during January and February, bermudagrass hay was fed to steers on wheat pasture for a total of 29 days, which would account for their relatively low gains. The bermudagrass hay fed to steers on dormant bermudagrass pastures was 3.73 percentage units higher in crude protein (11.58 *vs* 7.85) and 4.36 percentage units higher in estimated TDN (48.50 *vs* 44.14) than the hay fed during the first year of the project. The improvement in hay quality increased steer gains markedly from .0 lb the first year to .39 lb the second year.

Finishing Phase

During the first year of the project, feed consumption of steers fed grain on SG/B pastures was high (e.g., approximately 80 percent of their paired, *ad libitum*-fed groups in drylot) and their return (dollars/head) was the lowest. Similar levels of grain consumption by steers fed on SG/B pastures was observed the second year. Therefore, data relative to the steers fed on SG/B pastures and their paired, limit-fed groups in drylot are not included in this report.

Live weight gains and feed efficiencies (drylot only) of steers grazed to heavier weights on SG/B pastures for 63 days after the stocker phase before being finished in drylot are shown in Table 2.

Gains of the bermudagrass hay-fed steers were about 23 percent less than those of wheat pasture steers (1.84 vs 2.39 lb/day) during the 63-day period on SG/B pastures. However, during the subsequent drylot period, daily gains were slightly higher for steers fed bermudagrass hay (3.12 vs 3.03 lb) during the stocker phase.

In situations where steers of similar type and condition such as those at the beginning of this study are carried through stocker programs which effect large differences in gains and fleshiness at the end of the stocker program, it would be anticipated that steers held on the lower plane of nutrition would make compensatory

gains during the post-stocker finishing phase. Daily gains and carcass fat content of the wheat pasture steers were .77 lb and 10.1 percent greater than the steers fed bermudagrass hay during the stocker phase. However, compensatory gains, as reflected by increased gains and improved feed efficiencies, were not consistently observed during the finishing phase by steers fed bermudagrass hay during the stocker phase (Tables 2 and 3).

Performance of steers during the finishing phase is shown in Table 3. Daily gains of steers that grazed SG/B pastures throughout the summer were slightly greater (1.51 *vs* 1.46 lb) for steers fed bermudagrass hay during the stocker phase. Gains of steers placed directly in drylot after the stocker phase were greater for steers stockered on wheat pasture (3.67 *vs* 3.16 lb). Steers stockered on wheat pasture consumed about 1.25 lb more feed dry matter per day during the finishing phase than the bermudagrass hay-fed steers. Drylot feed efficiencies of steers stockered on wheat pasture were more variable than, but not statistically different (P>.05) from, those of the steers fed bermudagrass hay during the stocker phase.

Carcass characteristics of steers in the finishing phase are shown in Table 4. Steers from the wheat pasture stocker phase had greater rib eye areas and lower yield grades, but marbling scores were lower than carcasses of steers fed bermudagrass hay during the stocker phase. Total days in drylot were less for steers from the wheat pasture stocker phase, however.

Steers that were stockered on wheat pasture and then grazed on SG/B pastures through the summer were slaughtered on September 26, 1978. Although their carcass data are not shown in Table 4, hot carcass weight, dressing percent and yield grade averaged 493 lb, 54.9 percent and 2.58, respectively, while carcass quality grade was between average- and high-good.

Performance and carcass data of the steers that were initially placed in drylot (November 9, 1977) versus that of steers stockered on wheat pasture or bermudagrass hay prior to being finished by feeding *ad libitum* in drylot are shown in Table 5. Live and carcass average daily gains of steers initially placed in the drylot were lower (P<.05) than those of either group of steers that was carried through as stockers before being finished in drylot. Feed dry matter consumption of the initial feedlot steers was low for reasons that cannot be explained. However, improved feed efficiencies, expressed as feed required per pound of carcass gain, were observed for the initial feedlot steers.

Table 3. Performance of steers during finishing phase.

Stocker phase:	Wheat pasture			Bermudagrass hay		
Group:	SG/B[e] then drylot	SG/B[f]	Drylot	SG/B[e] then drylot	SG/B[f]	Drylot
Initial wt, lb	643[b]	634[b]	639[b]	539[a]	534[a]	536[a]
Final wt, lb	1051[d]	897[b]	965[c]	1020[cd]	806[a]	1004[cd]
Hot carcass wt, lb	667[b]		603[a]	613[a]		638[ab]
Days fed in drylot	85		89	117		148
Total days in finishing phase	148	180	89	180	180	148
ADG (live), lb	2.76[bc]	1.46[a]	3.67[d]	2.67[b]	1.51[a]	3.16[c]
ADG (carcass), lb	2.05[a]		2.72[b]	1.95[a]		2.55[b]
Feed DM intake, lb	24.85		25.59	23.49		24.43
Feed/gain (live)[g]	8.21		7.00	7.53		7.73
Feed/gain (carcass)[g]			9.41			9.57

[abcd]Means with different lettered superscripts are statistically different (P<.05).
[e]Grazed small grains-interseeded bermudagrass pastures 63 days then finished in drylot.
[f]Grazed small grains-interseeded bermudagrass pastures for entire finishing phase.
[g]Pounds feed dry matter per pound gain in drylot.

Table 4. Steer carcass characteristics.

Stocker phase:	Wheat pasture		Bermudagrass hay	
Group:	SG/B[c] then drylot	Drylot	SG/B[c] then drylot	Drylot
Dressing percent	63.57[b]	62.50[b]	60.09[a]	63.51[b]
Fat thickness, in.	.74[ab]	.62[a]	.69[ab]	.83[b]
REA, sq. in.	11.68[b]	11.34[ab]	10.59[a]	11.07[ab]
KPH fat, %	2.31	2.63	2.38	2.19
Yield grade	3.61	3.24	3.63	3.90
Marbling score[d]	14.13[ab]	12.38[a]	15.00[ab]	15.25[b]
Quality grade[e]	10.00	9.00	10.50	10.50

[ab]Means with different lettered superscripts are statistically different (P<.05).
[c]Grazed small grains-interseeded bermudagrass pastures 63 days then finished in drylot.
[d]17 = average modest; 14 = average small; 11 = average slight.
[e]12 = high choice; 10 = low choice; 8 = average good.

Table 5. Performance and carcass data of initial feedlot steers versus steers carried through as stockers before being finished in drylot.

Group:	Initial feedlot	Wheat pasture	Bermudagrass hay
Initial wt, lb	458	639*	536*
Final wt, lb	941	965	1004
Days in stocker program	0	140	140
Days in drylot	194	89	148
Total no. of days	194	229	288
Feed DM intake, lb	15.81	25.59	24.43
ADG (live), lb	2.49	3.67*	3.16*
ADG (carcass), lb	1.87	2.72*	2.55*
Feed/gain (live), lb[a]	6.37	7.00	7.73
Feed/gain (carcass), lb[a]	8.47	9.41	9.57
Hot carcass weight, lb	589	603	638
Dressing percent	62.58	62.50	63.51
Fat thickness, in.	.79	.62*	.83
REA, sq. in.	10.80	11.34	11.07
KPH fat, %	3.63	2.63*	2.19*
Yield grade	3.98	3.24*	3.90
Marbling score[b]	17.33	12.38*	15.25*
Quality grade[c]	11.25	9.00*	10.50

*Significantly different from initial feedlot group (P<.05).
[a]Pounds feed dry matter per pound of gain.
[b]17 = average modest; 14 = average small; 11 = average slight.
[c]12 = high choice; 10 = low choice; 8 = average good.

In general, except for marbling score and quality grade, the carcass characteristics of steers stockered on wheat pasture before being finished in drylot were the most desirable. Carcass characteristics of steers fed bermudagrass hay during the stocker phase and the initial feedlot steers were similar; quality grade of carcasses of both groups was above low-choice.

Enterprise Budget Analysis

The Oklahoma State University Budget Generator was used to analyze the economic potential of the stocker and finishing programs. Each enterprise budget was

developed from management and feeding data for steers within the respective treatment groups during this study. In order to eliminate differences in costs not related to treatment, the average initial weight of all steers was adjusted to 475 lb. Similarly, the average initial weight of all steers entering the finishing phase was adjusted, within stocker groups, to a common weight. Steer gains and feed efficiencies used in the budgets are nearly identical to the actual observed values. One exception is the average daily gains for the 63-day, post-stocker period of 1) steers grazed on SG/B prior to being finished in drylot, and 2) steers that remained on pasture all summer. These were averaged, within the previous stocker treatment groups, since they were managed similarly during the 63-day, post-stocker period.

Feeder and fed steer prices utilized in the budgets were obtained from modifications of projected annual averages developed by area extension farm management specialists. Adjustments for variation in cattle prices for the months steers were bought and sold were made by multiplying the annual average price by 10-year-average ratios, which reflect the seasonal variation in the cattle market during the past 10 years.

After the best estimate of operating inputs, machinery and equipment requirements, labor requirements and production receipts have been determined for each production system and entered into the computerized budget program, an analysis of the production system is printed out. Production costs are broken down into operating, capital, ownership, labor and pasture categories; thus, returns to land, labor, capital, machinery, overhead, risk and management are obtained. The breakdown of cost and returns enables producers to make decisions based upon their own production resource situation.

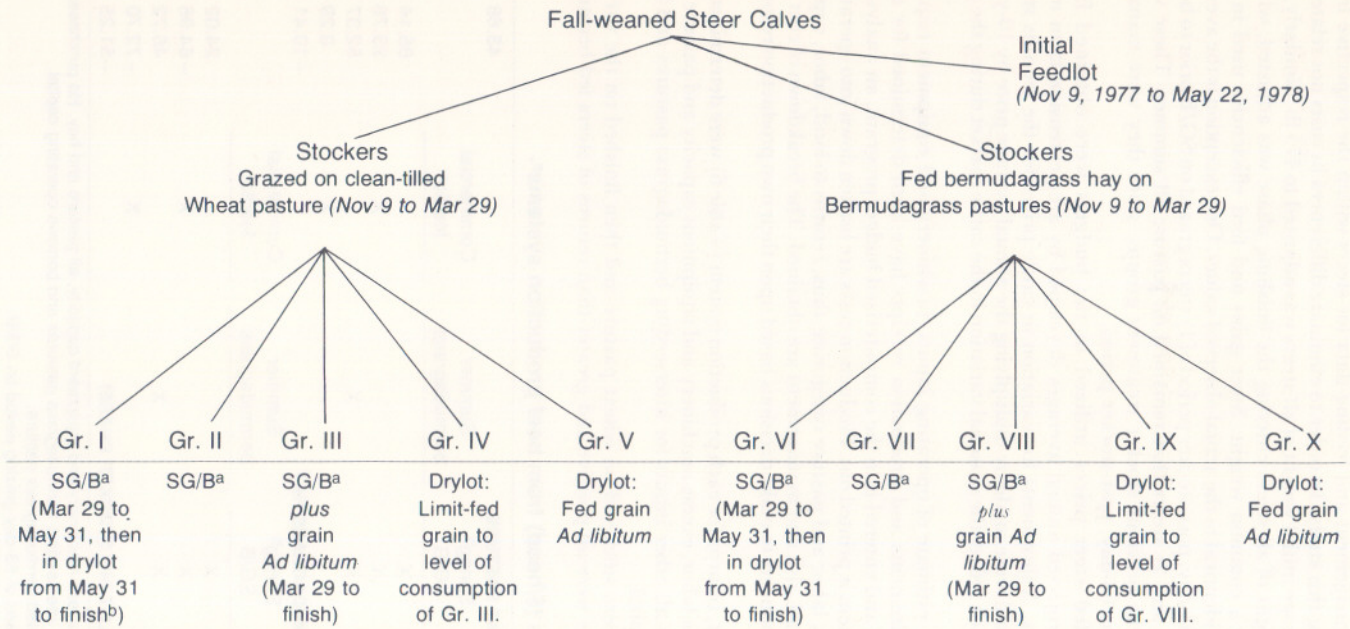
For this report, returns for each production system (Table 6) were determined for a producer who has labor, excess machinery and equipment capacity and pasture and hay. He purchases all other inputs for interseeding bermudagrass pastures and borrows operating capital.

Returns of steers stockered on wheat pasture and then finished on the various production systems were all positive and greater than returns of steers fed bermuda-

Table 6. Returns ($/head) from beef production systems[a].

Stocker phase: WHEAT PASTURE				43.68
Finishing system	Spring[b] SG/B	Summer bermudagrass	Commercial feedlot	
I[c]	X			85.14
I[d]	X		X	23.76
II	X	X		52.37
V			X	8.29
Stocker Phase: BERMUDAGRASS HAY				−10.41
Finishing system	Spring[b] SG/B	Summer bermudagrass	Commercial feedlot	
VI[c]	X			24.02
VI[d]	X		X	−64.96
VII	X	X		46.72
X			X	−72.70
COMMERICAL FEEDLOT (NO STOCKER PHASE)				−51.25

[a]Producer has labor, excess machinery and equipment capacity, all pasture and hay. He purchases the other inputs, pays for interseeding bermudagrass pastures and borrows operating capital.
[b]Small grains-interseeded bermudagrass pasture.
[c]Feeder cattle sold at end of 63-day grazing period on SG/B.
[d]Fed cattle sold at end of feedlot period.



[a]Small grains-interseed bermudagrass pastures.
[b]Carcass quality of low choice.

Figure 1. Steer treatment groups.

Table 7. Non-feed and feed costs ($/head/day) for stocker programs.

Production system	Non-feed[a]	Feed[a]	Total	Selling price $/cwt	Breakeven ADG, lb
Wheat pasture	.52	.39	.91	69.50	1.31
SG/B-63 days	.49	.41	.90	66.40	1.36
SG/B-entire summer	.53	.32	.85	56.50	1.51
Bermudagrass hay	.39	.34	.73	73.50	.99
SG/B-63 days	.40	.34	.74	70.50	1.05
SG/B-entire summer	.45	.27	.72	61.80	1.17

[a]Includes all costs used to determine returns of production systems in Table 6. In addition, all livestock, equipment and machinery labor is included in non-feed costs and all bermudagrass hay, wheat and native pasture is included in feed costs.

grass hay during the stocker phase and their respective finishing systems. Returns of steers stockered on wheat pasture were $43.68, $85.14 and $52.37 per head at the end of the stocker phase and after grazing SG/B pastures for 63 days or throughout the summer, respectively. These all-forage production systems also produced the greatest returns the first year of the project.

Returns of steers fed bermudagrass hay during the stocker phase were $-10.41 per head. Grazing steers fed bermudagrass hay during the stocker phase on SG/B pastures for 63 days or through the summer increased returns $34.43 and $57.13 per head over the stocker phase. Steers fed bermudagrass hay during the stocker phase and then 1) grazed on SG/B pastures prior to being finished in the feedlot or 2) placed directly in the feedlot lost $64.96 and $72.70 per head, respectively. These negative returns can be attributed to the low gains during the stocker phase and to the failure of the producer to obtain returns to management and labor when cattle go to the commercial feedlot.

Returns were the best for production systems where the producer managed the steers himself by utilizing his own facilities during the entire production period. Returns were decreased by relinquishing management control of the steers, and thereby having to pay for all incurred management and labor cost. This was the case when the fall-weaned calves were placed directly into the feedlot. Returns were $-51.25 per head partially because the producer was unable to sell any of his own resources in the commercial feedlot.

Break-even gains, selling price per cwt, non-feed and feed costs are shown in Table 7 for the different all-forage beef production systems. Non-feed and feed costs includes all those that were used to determine the returns in Table 6. In addition, all livestock, equipment and machinery labor required in the care of steers was included in non-feed costs, and all bermudagrass hay, wheat and native pasture was included in feed costs.

Mean non-feed costs were 1.38- and 1.31-fold greater than feed cost for steers of the wheat pasture and bermudagrass hay production systems, respectively. Grazing steers on SG/B pastures for 63 days decreased daily non-feed cost slightly with feed cost being increased slightly (wheat pasture) or remaining the same (bermudagrass hay). Total daily costs were decreased by grazing steers throughout the summer on SG/B pastures; however, non-feed costs were substantially greater than that of steers grazed on SG/B pastures for 63 days. The increase in non-feed cost is largely attributed to the decline in selling price of the heavier steers and is reflected in the increased average daily gains needed to breakeven.

Literature Cited

Mader, T. L., G. W. Horn, S. L. Armbruster, L. E. Walters, D. T. Hoskins, F. P. Horn, W. E. McMurphy and O. L. Walker. 1978a. Okla. Agr. Exper. Sta. Res. Rep. MP-103, p. 1.

Mader, T. L., G. W. Horn, O. L. Walker, S. L. Armbruster, L. E. Walters, D. T. Hoskins and W. E. McMurphy. 1978b. Okla. Agr. Exper. Sta. Res. Rep. P-768. p. 47.