INFLUENCE OF WINTER BACKGROUNDING PROGRAM AND SUMMER GRAZING PROGRAM ON PERFORMANCE OF STEERS GRAZING TALLGRASS PRAIRIE

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Story in Brief

During an 84-day period, 160 beef steers (initial weight 463 lb) were backgrounded prior to summer grazing on one of four treatments: dormant native range with 2 lb/day 38% protein supplement, or a high concentrate (90% conc.) ration limit-fed, based on NEg requirements, to result in 1.0, 1.5, or 2.0 lb gain/day. On May 1, the four groups were split and allocated to either an 84-day intensive-early stocking (2X stocking density) program or a 153-day seasonlong stocking program on native range. Weights and ultrasound backfat were monitored during the background and grazing periods. Forage intake was measured once during the grazing period on six calves from each treatment. Gain on dormant native range during the backgrounding period was .95 lb/day. Gains for the limit-fed steers were spread at the desired increments but were .51 to .55 lb/day higher than projected. Ultrasound backfat depth increased with increasing gain. During summer grazing, the cattle previously on dormant range gained more weight and tended to accumulate more backfat than the limit-fed cattle. Limit-fed steers lost backfat during the grazing period. Backgrounding treatment did not affect forage intake. For intensive-early stocking, the relationship between daily gain during backgrounding (X) and grazing (Y) was: Y=2.27-.49X. For seasonlong stocking, the relationship was Y=1.72-.33X. Total gain/steer was lower on intensive-early stocking due to the shortened grazing period but adjusted gain per acre was 47% higher because of increased stocking density.

(Key Words: Cattle, Grazing Systems, Rangeland, Compensatory Gain.)

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Introduction

Stocker cattle production is an important segment of the beef industry in the Southern Great Plains. Generally, cattle prices favor the purchase of stocker cattle in the fall/winter months but fall/winter is the period of poorest forage quality on rangeland and warm-season pastures. Weight gains by cattle over the winter are low and unpredictable resulting in high interest costs and feed costs. Therefore producers are faced with either purchasing relatively inexpensive cattle with high variable costs of production or purchasing relatively expensive cattle in the spring with lower variable inputs.

Many of the wintering programs for stockers are intended to hold cattle at low rates of gain, therefore preparing them for compensatory gain on summer pasture. Although wintering at higher rates of gain may reduce gain on summer pasture, improved performance in the winter phase may increase total weight gain and profitability. One predictable means of improving winter performance would be backgrounding on high concentrate rations limit-fed to produce a desired rate of gain (Zinn, 1987; Gill and Lusby, 1989; Lake, 1987). The relationship between level of gain during the backgrounding phase and gain in the grazing phase must be understood in order to project economies of different management programs.

Intensive-early stocking (IES) is a grazing program which can increase weight gain per unit of land area by 20 to 40% (Smith and Owensby, 1976; Olson, 1988; McCollum et al., 1990). This is accomplished by shortening the summer grazing season by approximately one-half and increasing stocking density (head/acre) two or three times normal.

A study was conducted to determine the effects of accelerated winter gains on the performance of beef steers grazing rangeland during the late spring/summer grazing season. Subsequent feedlot performance was also monitored (McLean, 1990). This paper reports on performance during the winter and summer grazing phases.

Materials and Methods

Winter phase

One-hundred sixty head of bull and steer calves (initial wt=463 lb) were purchased in January, 1989, and transported to the Pawhuska Research Station in north central Oklahoma. Following processing, all calves were placed in pens of 20 head. The cattle had ad libitum access to prairie grass hay and were fed 2.0 lb/head/day of 38% CP pellets. After 14 days, bull calves were castrated and all calves were implanted, weighed, and scanned by ultrasound to estimate backfat depth. Calves were then allocated to two replications of four winter nutritional management programs. One treatment group (DW) was placed on dormant tallgrass prairie rangeland and fed 2.0 lb/head/day of 38% CP range cubes. A salt/mineral supplement was provided free choice. The remaining treatment groups were confined to drylot and limit-fed a high concentrate diet (Table 1) in sufficient quantities to promote 1.0 (LG), 1.5 (MG), or 2.0 (HG) lb gain/head/day. Daily feed allowances were based on estimated NEg content of the ration and energy requirements of the steers (NRC, 1984; Gill and Lusby, 1989). Daily feed allowances were adjusted every 14 days based on the projected gains of the cattle. The calves were fed once daily between 9 a.m. and 10 a.m.

Grazing phase

After 84 days on the four nutritional treatments, the cattle were again weighed, scanned and implanted following a 16 h overnight period without feed and water. Each winter treatment replication was then randomly divided into two groups with similar average weights and assigned to either

Table 1. Ingredient composition of growing supplement.

Ingredient	% As fed
Corn, #2 whole shelled	81.08
Supplement	18.92
Supplement composition	
Soybean meal	61.45
Cottonseed meal	20.60
Calcium carbonate	12.10
Dicalcium phosphate	2.87
Salt	1.69
Potassium chloride	.86
Vitamin A - 300,000 IU/gram	.14
Rumensin 60[a]	.13
Tylan 40[a]	.07
Trace mineral premix[b]	.06
Vitamin E - 226800	.03

[a] Elanco Products Co., A Division of Eli Lily and Co., Indianapolis, IN.
[b] Contained as percentage of trace mineral mix: Zn, 24%; Mn, 16%; Fe, 4%; Cu, 2.4%; I, .16%; Co, .05%; Se, .08%.

intensive-early stocking (IES) or seasonlong stocking (SLS) for the summer grazing season. Seasonlong stocking (SLS) is defined as continuous grazing from late April to late September at the recommended moderate stocking rate. Intensive-early stocking is defined as continuous grazing from late April to mid-July at a stock density (head/acre) twice that of SLS but at a stocking rate (head/days/acre) similar to SLS. Rangeland on the station is typical of the Cross Timbers vegetation type with a mosaic of oak/hickory forests and tallgrass prairies.

On July 15, 1989, 84 days into the summer grazing season, all cattle were again weighed, scanned and implanted following an overnight period without feed and water. The SLS groups were returned to pasture and the IES groups were transported 310 miles to Goodwell, Oklahoma to be finished. The SLS cattle remained on pasture for an additional 69 days (153 days total grazing) prior to being shipped to the same location for finishing. Protein supplement (1.0 lb/head/day, 38% CP cubes) was fed to the SLS cattle during the final 69 day grazing period. Weights and backfat estimates were recorded prior to shipment.

Forage intake

Midway through the first 84 days of grazing, six steers were selected from the mean weight class of each winter treatment group. A slow-release chromic oxide bolus was administered to each animal and the animals were returned to pasture. Fecal grab samples were collected from each steer at 7 a.m. and 7 p.m. on days 9 and 14 after bolus administration. The samples were composited within day and steer and analyzed for DM, ash, chromium, and indigestible ADF.

Three esophageally fistulated steers were used to sample forage. Masticate was collected during 30 min grazing periods on days 9 and 14. Diet samples were composited across days within steer and analyzed for DM, ash and indigestible ADF (AOAC, 1984; M.L. Galyean, pers. comm.).

Forage digestibility was estimated from ratios of fecal and masticate indigestible ADF. Fecal output was estimated from the ratio of daily chromium payout from the bolus and fecal chromium concentration. Forage intake was estimated as the ratio of fecal output to forage indigestibility.

Statistical analyses

Data were analyzed using the GLM procedure of SAS. The model for the winter phase, the forage intake trial and the final 69 days of the grazing season included winter treatment and replication. Comparisons for the first 84 days of the grazing season and the total grazing season were made using a model containing winter treatment, grazing treatment, replication and winter treatment x grazing treatment. Least significant difference procedures were used to separate means when a significant (P<.05) model effect was present.

Regression equations among winter gains and gains during the grazing phase were developed for the first 84-day period of grazing and for the entire 153-day season. In both cases, one group of equations was based on means from the winter treatment groups. A second group was developed without regard to winter treatment.

Results and Discussion

Winter phase

Weight gains during the winter phase were relatively high for the DW treatment cattle. With the exception of approximately 10 days of snow, weather conditions were mild and conducive to gains that were higher than expected. Performance of the limit-fed cattle was also greater than projected from the estimated ration energy density and daily feed allowances. The desired targets for average gain were set at intervals of .50 lb/head/day beginning at 1.0 lb/head/day. Although the actual average daily gains were spread at the desired intervals, all limit-fed treatment groups gained .49 to .53 lb/day more than projected (Table 2). Bloat and acidosis were not problems during the feeding period.

Table 2. Peformance of steers during 84 day winter phase.

	Dormant range	Programmed gain, lb/d 1.0	1.5	2.0
		---------------- lb/hd	----------------	
Initial weight	467	459	463	465
Final weight	547^{a}	587^{b}	631^{c}	677^{d}
Gain	79.8^{a}	127.7^{b}	166.7^{c}	211.2^{d}
Daily gain	$.95^{a}$	1.52^{b}	1.99^{c}	2.51^{d}
Backfat depth		---------------- in	----------------	
Initial	.083	.083	.083	.087
Final	$.087^{a}$	$.118^{b}$	$.114^{bc}$	$.126^{c}$
Change	$.008^{a}$	$.035^{b}$	$.047^{bc}$	$.059^{c}$

a,b,c Row and column means with different superscripts are different (P<.05).

At the end of the winter phase, weights of the treatment groups were spread over a 130 lb range with treatment groups separated by approximately 40 lb weight intervals from low to high (Table 2). Although the winter treatments resulted in weight differences (P<.05) among all groups, ultrasound backfat depth after 84 days was most different between the DW cattle and the limit-fed groups. Within the limit-fed groups, the LG cattle carried less (P<.05) backfat than the HG group but the differences were much smaller in comparison to the DW cattle. Change in backfat over the 84-day period reflected the difference between the DW and limit-fed treatments but there was some indication that change in backfat depth increased as level of limit-feeding increased (Table 2).

Grazing phase

No interactions between winter treatment and summer grazing treatment were observed for weight gain and backfat depth during the first 84 days of grazing (Table 3). Cattle from the DW group gained more (P<.05) weight than the LG, MG or HG cattle. Despite the compensatory gain, the DW steers were still 44 and 73 lb lighter (P<.05) than the MG and HG steers at the end of the early grazing period. In contrast to the end of the winter period, steer weights were similar (P>.05) for the DW and LG groups. Steers in the DW group accumulated backfat (.02 in) during the early grazing period while the limit-fed steers lost fat cover (average -.01 in).

Weight gain during the final 69 days of grazing (Table 4) tended to be greater (model P<.08; treatment P<.13) for the DW and LG steers compared to the MG and HG steers indicating that winter treatments were still promoting compensatory gain by the DW and LG groups and/or hindering gain by the MG and HG groups. At the end of 153 days of grazing, the HG cattle tended to be heavier (model P<.12; treatment P<.07) than the three other winter treatments. Changes in backfat depth were similar among all groups.

Steers from the IES grazing treatment were on average 55 lb lighter (732 lb) than SLS steers (787 lb) at the end of their respective grazing seasons. Average gain for the IES cattle was lower (121 lb/head; P<.05) than gains of the SLS steers (169 lb/head; Table 5) because of the shorter grazing season. Seventy-two percent of the weight gain by SLS steers occurred during the IES period. If steer gains are adjusted to reflect the heavier stocking density (2X) on IES, total gains per seasonal steer unit were 42.8% greater for the IES program (Table 5). Comparing among winter treatment groups, IES produced from 38 to 51% more gain per seasonal steer unit than SLS.

The rather uniform spread of winter gains across treatments provided an opportunity to evaluate the relationships among performance level prior

Table 3. Peformance of steers during the first 84 days of grazing.

	Grazing program	Dormant range	Programmed gain, lb/d 1.0	1.5	2.0	Mean
		lb/hd				
Weight	IES	697	714	745	772	732
	SLS	706	721	745	774	736
	Mean	701^{a}	719^{ab}	745^{bc}	774^{c}	
Gain	IES	150.4	124.6	116.0	95.7	121.7
	SLS	155.7	125.7	103.2	95.0	119.9
	Mean	153.0^{a}	125.2^{b}	109.6^{bc}	95.3^{c}	
Daily gain	IES	1.79	1.48	1.39	1.55	1.46
	SLS	1.85	1.50	1.23	1.12	1.43
	Mean	1.83^{a}	1.50^{b}	1.30^{bc}	1.12^{c}	
Backfat depth		in				
Final	IES	.114	.118	.122	.122	.122
	SLS	.110	.114	.114	.122	.114
	Mean	.110	.114	.114	.122	
Change	IES	.020	.004	-.020	-.016	-.002
	SLS	.024	-.012	-.004	-.024	-.004
	Mean	$.023^{a}$	$-.005^{b}$	$-.011^{b}$	$-.019^{b}$	

a,b,c Row and column means with different superscripts are different ($P<.05$).

Table 4. Peformance of steers during the first 69 days of grazing.

	Dormant range	Programmed gain, lb/d		
		1.0	1.5	2.0
		lb/hd		
Weight	763	778	789	818
Gain	58.7	55.6	43.9	42.6
Daily gain	.86	.82	.64	.62
Backfat depth		in		
Final	.102	.106	.098	.114
Change	-.008	-.008	-..020	-.008

to grazing and performance during the grazing phase. The relationship between daily gain prior to grazing (X) and daily gain during the first 84 days of grazing (Y) was described by the equation Y=2.27-.49X ($P<.0001$; $r^2=.99$). This relationship is based on treatment means. The relationship for the 153-day season was Y=1.72-.33X ($P<.0001$; $r^2=.98$). Based on the relationships, each additional pound of gain prior to grazing depressed daily gain .49 lb in the early grazing season and .33 lb over the entire 153-day season. The same relationships based on individual cattle, without regard to winter treatment, were Y=2.05-.35X ($P\leq.0001$; $r^2=.32$) for the first 84 days of grazing and Y=1.61-.27X ($P<.0001$; $r^2=.38$).

Forage intake

Forage digestibility and fecal output were similar for the four treatment groups (Table 6). It appeared that forage intake was higher for the treatment groups that were heavier at the start of the grazing season but the differences were not significant ($P>.10$). Intake of DOM was calculated from daily OM intake and forage digestibility and subsequently converted to DE intake and NEm intake (NRC, 1984). These conversions suggested that daily forage intake above maintenance was lowest for the DW cattle and increased with increasing level of winter gain. This trend was not reflected in the actual performance (gain and backfat accumulation) by the cattle during the grazing season.

Accelerated growth during the winter phase resulted in slower growth during spring/summer grazing. Based on treatment means, daily gains during grazing decreased .33 to .49 lb for every 1 lb that winter gain was increased. This decline in summer performance is less severe than noted by

Table 5. Seasonal performance of steers comparison for IES and SLS grazing programs.

	Grazing program	Dormant range	Programmed gain, lb/d 1.0	1.5	2.0	Mean
		------------- lb/hd -------------				
Total gain,	IES	150.6	125.0	116.0	92.3	121.7a
	SLS	214.3	181.3	147.1	137.6	73.0b
	Mean	182.4^{a}	153.0^{b}	131.4^{bc}	116.4^{c}	
Total gain, lb/steer unit	IES	1.8	1.5	1.4	1.1	1.5a
	SLS	1.4	1.2	.9	.9	1.1b
	Mean	1.6^{a}	1.3^{b}	1.2^{bc}	1.0^{c}	
Daily gain	IES	301.4	250.0	231.7	190.5	243.4a
	SLS	214.4	181.3	147.1	137.6	170.2b
	Mean	257.8^{a}	215.6^{b}	189.4^{bc}	164.1^{c}	

^{a,b,c} Row and column means with different superscripts are different ($P<.05$).

Table 6. Forage intake and digestibility of steers during early summer.

	Dormant range	Programmed gain, lb/d 1.0	1.5	2.0
Forage digestibility, %	57.1	58.6	55.6	57.9
Forage intake,				
lb/d	12.3	13.0	14.2	15.1
lb/100 lb BW	1.90	1.94	2.01	2.07
Digestible organic matter intake,				
lb/d	7.1	7.6	7.9	8.7
Fecal output,				
lb/100 lb BW	.81	.81	.89	.87
Forage intake, lb/d				
Maintenance	10	9.9	11.3	10.7
Gain	2.3	3.1	2.9	4.4

Lewis et al. (1989) for cattle in Nebraska. Forage intake during the early season was similar for all groups and therefore could not explain the poorer gains and loss of backfat by the cattle that were wintered on higher planes of nutrition. The loss of fat cover and reduced weight gains in spite of similar forage intakes suggests that wintering programs altered maintenance requirements of the cattle.

The lack of interaction between winter treatments and summer grazing treatments indicates that pregrazing nutrition continued to affect steer performance over the entire 5-month grazing season. Weights suggest that the DW steers had compensated enough to catch the LG steers by the end of the IES period. But daily gains and final weights after 153 day grazing suggest that the DW and LG cattle were still experiencing some compensatory growth.

Averaged across all winter treatments, IES produced 42% more gain than SLS grazing. This advantage is the combined result of a doubling the stock density and adding 72% of the total SLS gain during the IES period.

Due to incomplete compensation by cattle on the lower winter nutrition programs, the combined use of HG and IES produced the most total pounds of gain per unit land area among all systems. Whether this is the economically optimum production system was not determined. The combined use of IES and accelerated winter growth may have some advantages in terms of overall cost of gain. Influence of these programs on subsequent feedlot performance is discussed in another paper (McLean, 1990).

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