1999 Animal Science Research Report

LIGHT VS HEAVY WEIGHT STEERS GRAZING OLD WORLD BLUESTEM AT THREE STOCKING RATES. I. CATTLE PERFORMANCE AND ECONOMIC ANALYSIS

Pages 200-207

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Story in Brief

Gains of light and heavy weight calves grazing Plains Old World bluestem at three stocking rates were evaluated during the summers of 1997 and 1998. Initial weights of mixed breed light weight steers (LHT) were 311 ± 37 lb in 1997 and 353 ± 51 lb in 1998. Initial weights of mixed breed heavy weight steers (HWT) were 584 ± 37 lb in 1997 and 547 ± 29 lb in 1998. Initial stocking rates for both sizes of steers were light, 350 lb of live weight/acre; moderate, 450 lb of live weight/acre (increased to 550 lb live weight/acre in 1998); and heavy, 750 lb of live weight/acre. Heavy steers had greater ADG than LHT steers during both years. Increasing stocking rate resulted in a linear decline in ADG for HWT steers in 1997 and LHT steers in 1998. However, ADG did not decline linearly with increasing stocking rate for LHT calves during 1997 or HWT calves during 1998. Both LHT and HWT steers had lower ADG at all three stocking rates during 1998 compared with 1997. Gain per acre was greater for LHT than HWT calves at all three stocking rates during both years. Furthermore, the value of gain for LHT steers was greater than the value of gain for HWT steers during both years; thus, gross return/acre was greater for LHT than for HWT steers during both years. Light weight steers had greater gain/acre and gross return/acre than heavy weight steers in both 1997 and 1998 when stocked at equal rates, despite having lower average daily gain.

Key Words: Growing Cattle, Stocking Rate, Old World Bluestem

Introduction

In recent years, some producers have begun to select younger, lighter weight calves for grazing programs (Purvis et al., 1996). Average daily gain of light cattle is often lower than ADG of heavier cattle. However, if light cattle are stocked at a similar rate (lb live weight/acre) as heavier cattle, there will be more light cattle stocked/acre and weight gain/acre may be greater.

Some of the factors which may influence performance of grazing ruminants are species, live weight, and age (Seman et al., 1991). Body size and(or) weight of the grazing ruminant may often have some influence on grazing behavior and forage intake, therefore, live weight gain may depend, in part, on body size. Leaver (1970) reported that young, light weight calves are particularly sensitive to changes in gazing management and(or) forage availability. Therefore, light weight calves may be more sensitive to changes in forage quantity and quality than heavier cattle. Investigation of the effects of stocking rate on steers of different initial weights may help identify what size or weight of calf can provide the greatest returns from grazed forages.

The objectives of this study were to determine ADG and gain/acre of light and heavy weight steers grazing Plains Old World bluestem during the summer at three stocking rates. Forage intake, diet quality, and grazing time data for this trial are reported in a companion paper in this report.

Materials and Methods

Study Site. The study site was located at the Bluestem Research Range seven miles southwest of Stillwater, OK. Steers grazed Plains Old World bluestem (*Bothriochloa ischaemum* L Keng: OWB) May 29 through August 5 during 1997 (69 d), and May 15 through August 31 during 1998 (109 d). The length of the trial was extended 40 d during 1998 in order to more accurately graze OWB throughout its grazing season. One hundred pounds of N/acre and a herbicide (Grazeon P+D® : 2,4-D + Picloram) were applied to the pastures early in the growing season both years.

Cattle and Stocking Rates. In year 1, 1997, 214 mixed breed light weight steers (average initial wt: 311 ± 37 lb; LHT) and 115 mixed breed heavier weight steers (average initial weight: 584 ± 37 lb; HWT) were used. Initial stocking rates were: light, 350 lb live weight/acre; moderate, 450 lb live weight/acre; and heavy, 750 lb live weight/acre.

In year 2, 1998, 193 mixed breed light weight steers (initial wt: 353 ± 51 lb; LHT) and 126 mixed breed heavier weight steers (initial weight: 547 ± 29 lb; HWT) were used. The light and heavy stocking rates were the same as year one except that the moderate rate was increased to 550 lb live weight/acre.

All stocking rate x cattle type combinations were replicated each year resulting in a total of 12 groups. Steers were randomly assigned to one of the pasture x treatment combinations on the initial weigh date. Steers were weaned, vaccinated and dewormed prior to their arrival in Stillwater. All steers received a Synovex-C® implant during 1997, and a Ralgro® implant during 1998 prior to initiation of the trial. Steers had ad libitum access to water and salt and received no supplements during either year.

In an attempt to equalize fill across treatments, all cattle were placed in the same tallgrass prairie pasture 3 to 4 d prior to all weigh dates. Approximately 12 to 16 h prior to weighing, cattle were moved to a small holding area devoid of grass and water was withheld until weighing.

Economic Analysis. Gross returns to summer grazing were calculated by multiplying the weight gain of steers by the value of weight gain for each size of steer. The value of gain was calculated using the 10-yr, seasonally adjusted Oklahoma City National Stockyards purchase and selling prices for medium-frame, No. 1 steers (Trapp, 1999). Trapp (1999) reported base prices for cattle in 100 lb increments, therefore, regression analysis was used to develop price equations in order to more accurately predict the value of the weights for steers in this trial. Quadratic regression resulted in an r^2 of .998, the $Sy\bullet x$ was .49, and the prediction equation was $Y = 150.11 - .1579x + .000084x^2$, therefore, this equation was used to adjust purchase and selling prices.

Statistical Analysis. Steer performance data were analyzed using the GLM procedure of SAS (1992) as a replicated 2 x 3 factorial arrangement of treatments. Year was included in the model as a random variable. Least squares analysis and the P-DIFF procedure of SAS was used to separate treatment means when a significant ($P<.05$) F-Test was detected. Regression and indicator (dummy regression) analyses were conducted using PROC REG of SAS (1992) to determine the response of ADG and gain per acre of steers as stocking rate increased and difference in response between LHT and HWT steers.

Results and Discussion

Average daily gains were greater ($P<.01$; Table 1) for HWT than for LHT steers during both years. As stocking rate (lb/acre) increased, ADG of HWT steers decreased ($P=.06$; $Y=3.27 - .0011x$, $Sy\bullet x=.19$, $r^2=.62$) linearly during 1997 (Figure 1). However, there was not ($P=.40$) a linear relationship between ADG and stocking rate for LHT steers during

1997; therefore, a prediction equation and supporting statistics were not reported. A linear decrease (P=.03; Y=1.88 - .00054x, Sy• x=.08, r^2=.73) in ADG was observed as stocking rate increased for LHT calves during 1998 (Figure 2), but there was not (P=.35) a linear relationship between these variables for HWT steers during 1998, thus, a prediction equation and supporting statistics were not reported for HWT steers during 1998. There was a significant (P<.05) interaction in the response of LHT and HWT steers to stocking rate between years. Furthermore, ADG for both LHT and HWT steers was greater (P<.05) during 1997 than 1998 (Table 1). A decline in ADG as stocking rate increased would be expected for both LHT and HWT steers independent of year to year variation. However, the interaction regarding the relationship between steer type and stocking rate among years makes it difficult to draw conclusions regarding the response of LHT or HWT weight steers to increasing stocking rate. The decline in gain and the interaction in the response of steer type to stocking rate between years may have been influenced, in part, by the vast differences in precipitation and temperature between the two years. However, the decline in gains between the two years may have also been due to the longer grazing season during 1998. Late season gains may have declined during 1998 due to declining forage quality. Precipitation, temperature, and forage quality factors are reported in a companion paper in this research report.

Gain per acre increased (P<.05) as stocking rate increased for both LHT and HWT steers during 1997 and 1998. Prediction equations and supporting statistics are reported in Figures 3 and 4. Furthermore, gain/acre was greater (P<.05) for LHT than HWT steers at all stocking rates. Gain per acre increased (P<.05) at a greater rate as stocking rate increased for LHT as compared with HWT steers (detected by indicator regression analysis). Therefore, gain/acre was not only greater at each stocking rate for LHT cattle, but the difference in gain/acre between LHT and HWT steers increased as stocking rate increased. The combination of greater gain/acre and greater rate of increase in gain/acre as stocking rate increased demonstrates an advantage of light weight cattle in terms of total gain/acre despite the fact that the ADG of light cattle may often be less than that of older, heavier cattle.

Light weight steers had a higher value of weight gain than HWT steers during both years. Purchase and selling weights, adjusted base prices, seasonal indexes, season-long gains, and the calculated value of gain for both LHT and HWT steers are reported in Table 2. The combination of greater gain/acre and higher value of gain for LHT calves resulted in larger gross returns/acre for LHT than HWT steers at all three stocking rates during both years (Figures 5 and 6). Despite lower ADG, gross returns/acre were greater for LHT steers when stocked at similar rates (lb live weight/acre) to HWT steers.

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Table 1. Initial and final weights, and ADG of light vs heavy steers during 1997 and 1998.

	1997 [a]	SE	1998 [b]	SE
Light:				
No. steers	214	--	115	--
Initial wt (lb)	311	2.61	353	3.02
Final wt (lb)	462	5.01	527	5.78
ADG (lb)	2.22[de]	.049	1.58[ce]	.056
Heavy:				
No. steers	193	--	126	--
Initial wt (lb)	584	2.61	547	3.02
Final wt (lb)	766	5.01	734	5.78
ADG (lb)	2.67[df]	.049	1.72[cf]	.056

[a]Gains calculated based on a 69-d grazing period.

[b]Gains calculated based on a 109-d grazing period.

[c,d]Means in a row without common superscripts differ (P<.02).

[e,f]Means in a column without common superscripts differ (P<.01).

Table 2. Adjusted and purchase and selling prices, seasonal indexes, season-long gain, and calculated value of weight gain of light and heavy steers during 1997 and 1998.

Steer type	Year	Body weight	Adjusted price ($)[a]	Seasonal index[b]	Seasonally adj. price($)	Gain[c]	Value/ gain[d]
Light	1997 purchase	311	109.15	103.0	112.42		
	1997 selling	462	95.14	100.1	95.23	151	60.00
Heavy	1997 purchase	584	86.62	103.7	89.83		
	1997 selling	766	78.60	101.7	79.93	182	48.00
Light	1998 purchase	353	104.86	103.0	108.01		
	1998 selling	525	90.43	101.0	91.33	172	57.00
Heavy	1998 purchase	546	89.01	103.7	92.30		
	1998 selling	733	79.64	101.7	80.99	187	48.00

[a]Calculated from 10-year average base price structure reported by Trapp (1999), adjusted

according to: $Y = 150.11 - .1579x + .000084x^2$.

[b]Seasonal price indexes for each weight range during April and August (Trapp, 1999).

[c]Season-long gains for respective steer weight groups.

[d]Value of gain ($/100 lb) = (selling wt x (adjusted selling price x seasonal index)) − (purchase wt x (adjusted purchase price x seasonal index))/Gain.

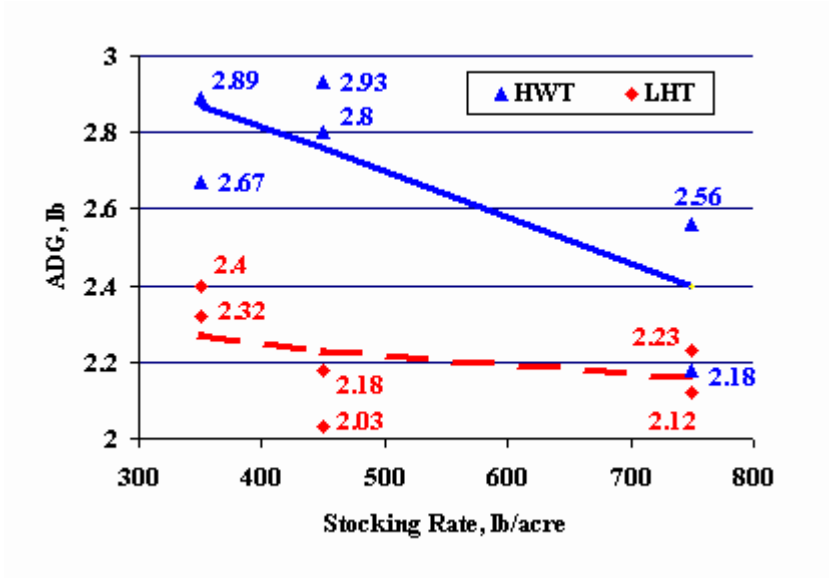

Figure 1. Relationship between average daily gain and stocking rate for light and heavy steers during 1997.

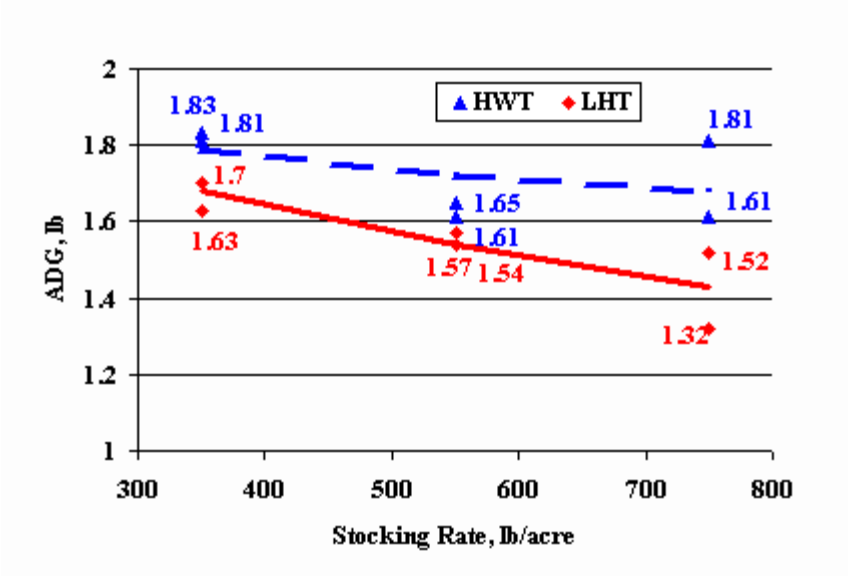

Figure 2. Relationship between average daily gain and stocking rate for light and heavy steers during 1998.

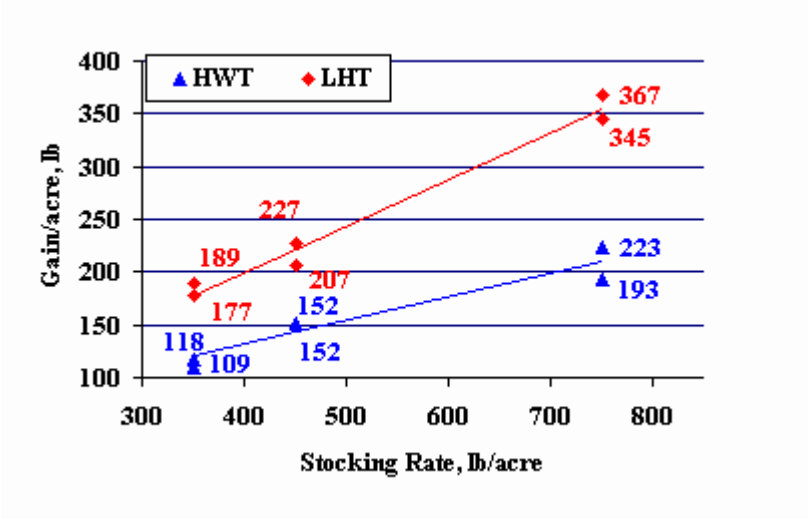

Figure 3. Relationship between gain per acre and stocking rate for light and heavy steers during 1997.

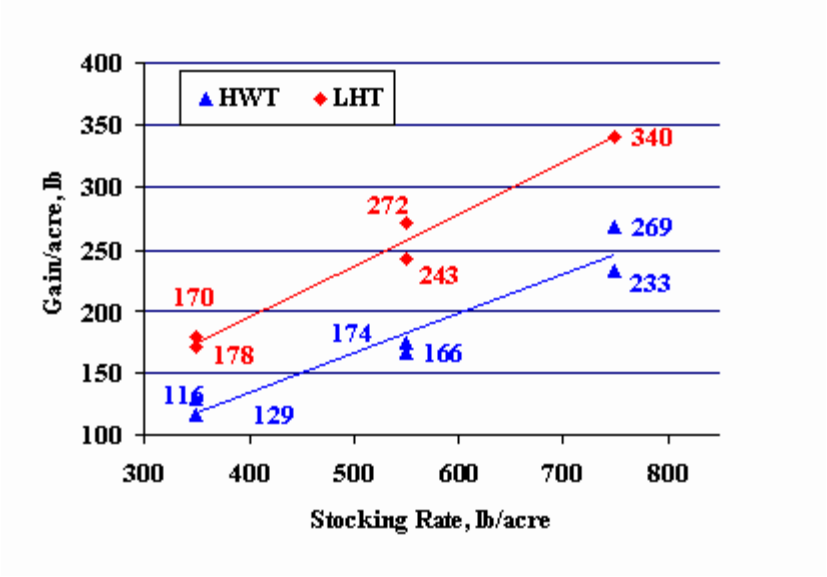

Figure 4. Relationship between gain per acre and stocking rate for light and heavy steers during 1998.

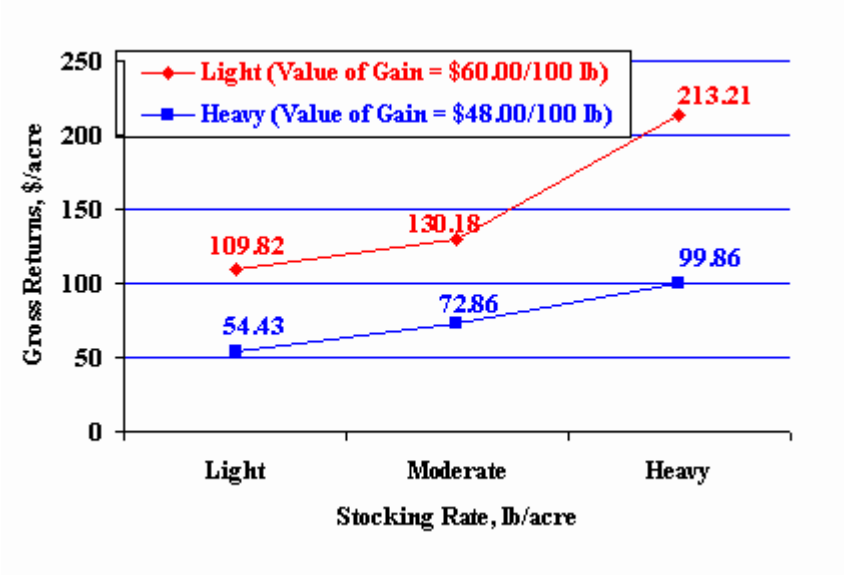

Figure 5. Gross returns ($/acre) of light vs heavy steers during 1997.

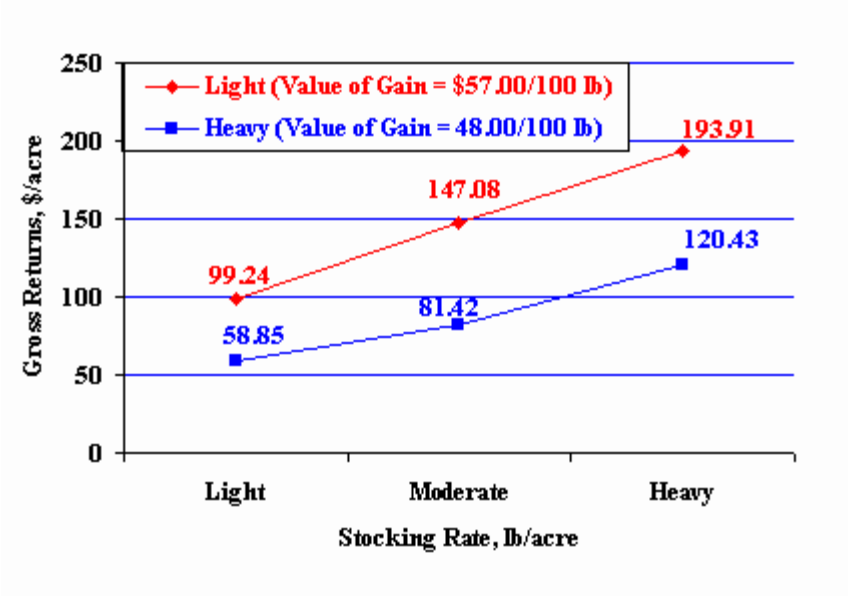

Figure 6. **Gross returns ($/acre) of light vs heavy steers during 1998.**

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