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Growth and Development of F-1 (Brahman x Hereford) Heifers under Various Short-Term Grazing Pressures

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Summary

A total of 179 F-1 (Brahman x Hereford) heifers were used during a 4-year period to ascertain the influence of grazing pressure on growth and development from the time a heifer was weaned until she weaned her first calf. Under the low and medium low grazing pressures, heifer growth was positive and linear from early January until early October. Heifer growth slowed, and in some cases halted, on pastures that had high grazing pressures. The 4-year yearling heifer weights in early January were approximately 575 lb and were about 670 lb in early April before grazing pressure assignments. The 4-year October weights were 938, 921, 879, and 780 lb, respectively, for heifers assigned to low (LO), medium low (ML), medium high (MH), and high (HI) grazing pressures. Pregnancy rate of yearling heifers was 84% for the 4-year period and varied among years. Heifers on the high grazing pressure treatment made some compensatory gains during the winter-spring period before calving. At initiation of the rebreeding season, first-calf heifers weighed 868 (HI), 887 (MH), 930 (ML), and 940 (LO) lb, whereas weights at the time of weaning their first calves were 798 (HI), 898 (MH), 974 (ML), and 1,029 (LO) lb. Rebreeding status of the first-calf heifer was about 93% regardless of previous grazing pressure. These preliminary data suggest that short periods of slowed or no growth after the yearling breeding season may not deleteriously affect the rebreeding of first-calf heifers provided that adequate forage or supplemental feed are available during the winter-spring period before calving.

Keywords: heifer / growth / bermudagrass / ryegrass / stocking rate.

Introduction

The development, growth, and ownership of replacement heifers is costly. Management schemes have often involved significant quantities of supplemental energy and protein sources to ensure proper growth and pregnancy of the F-1 (Brahman x Hereford) heifer. In the humid southeastern United States in general and in East Texas specifically, climatic conditions and improved forages favor abundant, nutritious pastures for livestock production. The objectives of this study were to use forages exclusively to develop replacement F-1 heifers and to ascertain the influence of short-term grazing pressures on growth, development, and pregnancy of the yearling and first-calf heifer.

Procedure

During each of 4 years, 35 to 50 spring-born F-1 (Brahman x Hereford) heifers were purchased at weaning in the fall. Heifers were transported to the Texas A&M University Agricultural Research and Extension Center at Overton during October and November of each year and were brucellosis-vaccinated, dehorned, and branded. A companion set of heifers was sent to the Texas A&M University Agricultural Research and Extension Center at Uvalde, where they were exposed to analogous treatments to meet the overall objectives of ascertaining the influence of environmental conditions and grazing pressure on animal performance. Only the Overton data will be presented in this paper. The following schedule of events were common for each year:

Activity	Time of year
1. Received heifers	Oct.-Nov.
2. Heifers pastured as a common group on small grain - ryegrass	Jan.-Apr.
3. Heifers allotted to each of four treatment groups and exposed to Braford bulls	Apr. 15

4. Bulls removed from each of the four grazing pressure groups — July 1
5. Heifers continued to graze in respective grazing pressure treatment groups until fall — July 1-Oct.
6. Heifers wintered and calved in a common group — Oct.-Apr.
7. First-calf heifers separated into initial treatment groups and exposed to Braford bulls — Apr. 15
8. Bulls removed from each of the four grazing pressure groups — July 1
9. First-calf heifers continued to graze in respective grazing pressure treatment groups until fall — July 1-Oct.
10. All calves weaned and moved to wheat pastures at Amarillo — Oct.

From the heifer-weaning date until rye-ryegrass pastures were available for grazing, heifers received *ad libitum* 'Coastal' bermudagrass hay and 3 lb/day of a 4:1 (corn:CSM) ration. This ration was used for about a 30- to 45-day period. Heifers grazed rye-ryegrass pastures from early January to early April. In early April, heifers were assigned to each of four groups by stratified randomization according to weight and condition score. These groups were randomly allotted to high (HI), medium high (MH), medium low (ML), and low (LO) grazing pressure treatments and returned to rye-ryegrass-arrowleaf clover pastures.

From April 15, when Braford bulls were placed with the yearling heifers, until about June 1, differences in grazing pressures were small. This delay in the execution of differences in available forage among treatments was intentional to allow the young heifers an opportunity to have an estrus cycle and breed.

Grazing pressures were gradually increased on the sod-seeded bermudagrass pastures so that by the time the bulls were removed on July 1 of each year, the relationship between forage availability and animal performance could be ascertained. Targeted levels of forage availability for the four treatments were to be maintained as nearly as possible at 1,000, 2,000, 3,000, and >4,000 lb/A of dry matter forage when measured to ground level. Resultant grazing pressures (lb forage dry matter/100 lb body weight) were, therefore, planned to be less than 100 for two treatments (HI and MH) and more than 100 for two treatments (ML and LO). The primary objective was to prescribe a graded level of forage availability across the four animal groups to impose different levels of selective grazing and restricted *ad libitum* intake of bermudagrass. With restricted bermudagrass intake, different levels of gain would be expected from the yearling heifers.

The F-1 heifers remained in separate treatment groups of 8 to 14 heifers, depending upon the year, until October of each year. At that time, bermudagrass pastures were vacated because of reduced growth rate and forage availability as well as the need to overseed these pastures again with 'Yuchi' arrowleaf clover-'Elbon' rye-'Marshall' ryegrass. Heifers were palpated, and all pregnant heifers were placed in a common group for wintering and calving. The open heifers were removed from the experiment. All cattle received *ad libitum* bermudagrass hay and limit-grazing (2 hours/day) of winter pasture until calving was completed. Thereafter, all pairs were grazed full-time on winter pastures as a common group until early April. At this time, heifers and their calves were placed into their original grazing pressure treatment group and remained there until October when calves were weaned.

As during the yearling stage, one Braford bull was placed with each group on April 15 and removed on July 1. During the 4-year period, all four bulls were bred to each of the four treatment groups. Grazing pressures were gradually increased after about June 1 until July 1, when the desired grazing pressures were in place. Forage availability was regulated by the addition or removal of regulator cattle (put-and-take technique). Animals were weighed at approximate 28-day intervals through each test period of the 2-year growth period. Pastures were sampled for forage availability and nutritive value at regular intervals throughout the grazing period.

Results and Discussion

Grazing pressures were gradually increased during June of each year so that by July 1, a graded level of forage availability existed across the treatments. From late June to early October, forage available on HI, MH, ML, and LO stocked pastures averaged about 1,500, 2,750, 3,750, and 5,500 lb/A dry matter (DM), respectively, when harvested to ground level. The relationship of forage availability to animal body weight (DM/100 lb BW) is often used to define grazing pressure. Thus, the resultant average grazing pressure values for HI, MH, ML, and LO were approximately <50, 90, 200, and >300, respectively.

Previous research at the Overton Center indicated that grazing pressure values of approximately 100 or less restrict forage available for *ad libitum* intake and, thus, for maximum gain. The intent of this trial was to restrict forage availability to F-1 heifers by varying the grazing pressures. We accomplished this objective by using regulator animals to adjust the stocking rates. Although stocking rates were not set but were variable by design, the average stocking rates necessary to achieve the previously mentioned grazing pressures, based on a 750-lb equivalent equal to one heifer, were approximately 6.25, 3.50, 2.5, and 2.0 heifers per acre, respectively, for HI, MH, ML, and LO grazing pressures. Climatic conditions caused considerable variation within and among years on these improved bermudagrass pastures. During the winter pasture phase, when heifers were not assigned to treatment groups, a stocking rate of 1.5 to 2.0 heifer equivalents per acre was used. Grazing pressures during this period were usually >150 lb DM/100 lb BW.

Each of the 4-years' body weight data is shown in Figures 1 to 4 for heifers born in 1984, 1985, 1986, and 1987, respectively. These respective figures depict gain in body weight of the weanling-yearling heifer and continue through the lactation stages of the 2-year-old heifer. The following similarities are apparent: (1) weanling heifers made little, if any, weight gains in the first 30 to 60 days during the relocation process in which hay and supplement were offered; (2) a rapid growth rate occurred for approximately 90 days while yearling heifers grazed winter pasture during January through March; (3) body weight changes were sensitive to increased grazing pressures that were imposed after mid- to late June; (4) bred heifers assigned to the HI grazing pressure had higher rates of gain during the wintering period than heifers did in the other three groups; and (5) grazing pressures dramatically affected heifer body weight during lactation.

Figure 5 presents the 4-year average gain in body weight at each of the four grazing pressures. The average weight of the 7- to 8-month-old weanling heifers was 555 lb. In early January, heifers

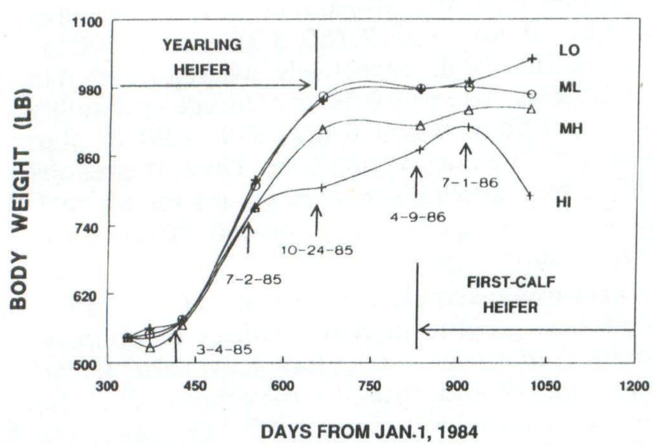

Figure 1. Gain in body weight of F-1 heifers born in winter-spring of 1984 and developed under various levels (HI, MH, ML, LO) of grazing pressure.

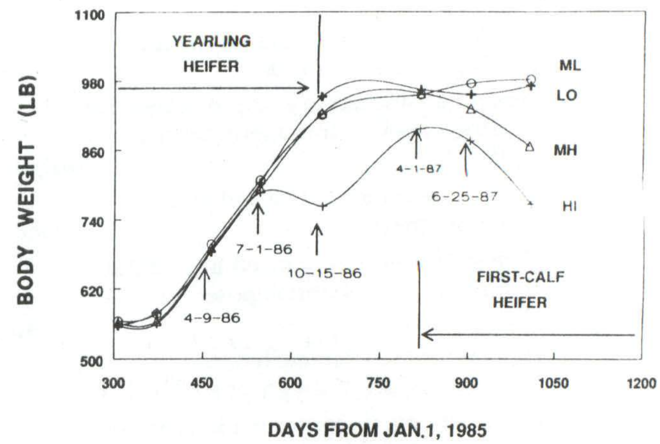

Figure 2. Gain in body weight of F-1 heifers born in winter-spring of 1985 and developed under various levels (HI, MH, ML, LO) of grazing pressure.

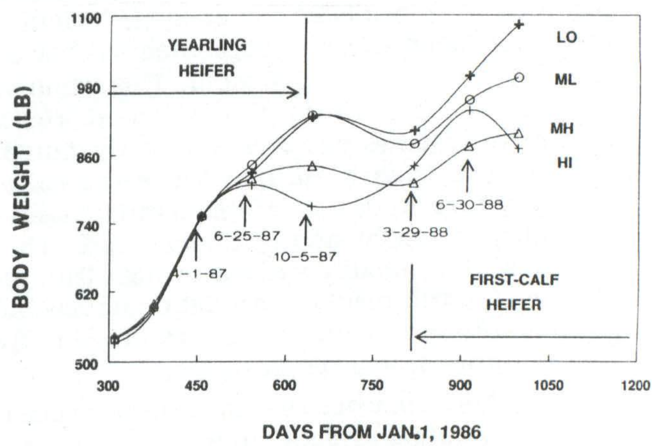

Figure 3. Gain in body weight of F-1 heifers born in winter-spring of 1986 and developed under various levels (HI, MH, ML, LO) of grazing pressure.

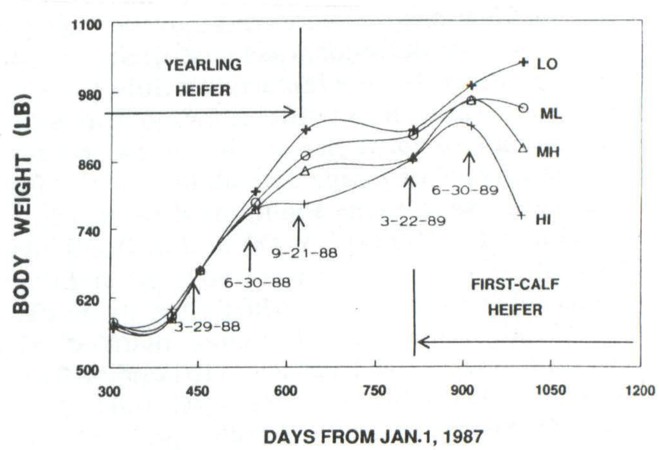

Figure 4. Gain in body weight of F-1 heifers born in winter-spring of 1987 and developed under various levels (HI, MH, ML, LO) of grazing pressure.

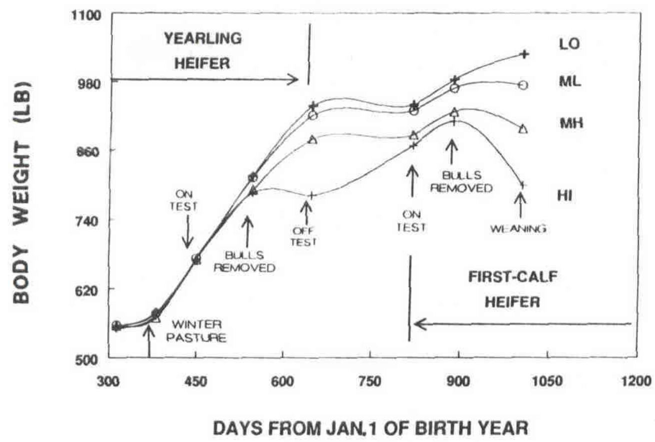

Figure 5. Four-year average growth of F-1 heifers from the weanling-yearling stage through the time of weaning their first calf at various levels (HI, MH, ML, LO) of grazing pressure.

averaged 575 lb when placed on full-time grazing of winter pastures and weighed about 670 lb in late March when treatments were assigned. At the time the bulls were removed on July 1, the average weight of yearling heifers was 785, 790, 811, and 814 lb, respectively, for HI, MH, ML, and LO grazing pressures. By the end of the bermudagrass-grazing period in early October, heifers assigned to HI, MH, ML, and LO grazing pressures weighed 780, 879, 921, and 938 lb, respectively. Thus, when forage availability was not severely limiting intake, linear growth rate was positive from early January to early October (330 days), which was accomplished on an exclusively forage diet.

Heifers were removed from the graded grazing pressures from early October until the following June to allow them an opportunity to replenish body weight and an opportunity to rebreed as first-calf, 2-year-old heifers. At initiation of the rebreeding period of the first-calf heifer, 4-year average body weights were 868, 887, 930, and 940 lb, respectively, for heifers assigned to HI, MH, ML, and LO grazing pressures. Thus, from the time yearling heifers were removed from treatments the previous October, the net weight gain after calving and upon reentering the experiment was 2, 9, 8, and 88 lb, respectively, for heifers assigned to LO, ML, MH, and HI grazing pressures. Figure 5 illustrates this maintenance of body weight from the LO, ML, and MH heifers vs. the near 100-lb gain for the heifers assigned to HI grazing pressure.

A curvilinear relationship is evident in the expression of body weight with maturity (time) (Fig. 6). These coefficients were calculated from the mean heifer weight at each date for each of the 4 years:

(1) High grazing pressure: body weight = $-13.71 + 2.10X - 0.001X^2$ ($r = 0.94$)

(2) Medium high grazing pressure: body weight = $-36.09 + 2.16X - 0.001X^2$ ($r = 0.95$)

(3) Medium low grazing pressure: body weight = $-56.27 + 2.22X - 0.001X^2$ ($r = 0.97$)

(4) Low grazing pressure: body weight = $-31.63 + 2.10X - 0.001X^2$ ($r = 0.97$)

where X = time in days from January 1 of birth year

The forage availability data will be included in these relationships in a future publication. The regression equations for estimating growth are unique for humid environments with warm-season perennial grasses such as bermudagrass and small-grain - ryegrass pastures during the winter. Development of heifers from the weanling stage to the time of calving as a 2-year-old and subsequent weaning of the first calf was affected by grazing pressure and was similar among the 4-year test periods.

Pregnancy data of the yearling F-1 heifer are presented in Table 1 for each of the 4 years. The 4-year average indicates similar pregnancy rates of about 80 to 85% across all treatment groups. Many of the heifers palpated as being open as yearling heifers were noted as "pre-puberal" or "not cycling." Although heifers were bred in the grazing pressure treatment groups, the restriction of forage availability was not severe until the last 25% of the breeding

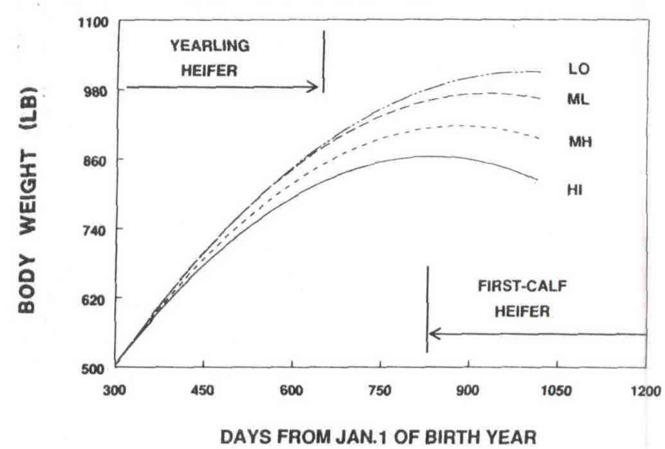

Figure 6. Curvilinear relationship of growth of F-1 heifer to time when exposed to various levels (HI, MH, ML, LO) of grazing pressure.

Table 1. Pregnancy status of yearling F-1 heifers during each year of the 4-year study.

Year	Heifer ID	Heifers exposed	Pregnant heifers	Pregnancy rate
		.... number		...... % ......
1984	4200	33	26	79
1985	5000	44	40	91
1986	6100	47	40	85
1987	7100	55	44	80
Four-year totals		179	150	84

period, which allowed all heifers at least two estrus cycles before forage was limiting to daily intake and gain. Table 2 shows the weight of the open heifers and the entire group of heifers at the initiation and termination of the breeding season. Only in 1984 (Year 1) did weight of the heifer indicate that the body weight may be responsible for the open status. In the other 3 years of the study, the weight of the open heifers was similar to the group at both the initiation and termination of the breeding season.

From this preliminary summary of pregnancy status of yearling F-1 (Brahman x Hereford) heifers, no clear trends are evident with respect to weight of heifers at the initiation and termination of the breeding season. The data do suggest, however, that within the genetic base of F-1 heifers used, about 15% may not breed as 15- to 18-month old heifers because of pre-puberal status, infantile reproductive tract, or other restrictions on estrus cycling and conception.

Heifers that were open at the end of the first year's grazing season were removed from the experiment. Thus, only pregnant heifers remained in the respective treatment groups as first-calf heifers. Table 3 shows that the pregnancy status of the first-calf heifers averaged about 90 to 95% among all treatment groups. This similarity in pregnancy rates indicates that (1) yearling heifers on the HI grazing pressure treatment had adequate compensating gains and body condition during the winter-spring period before calving to allow for acceptable rebreeding as first-calf heifers, and (2) the impact of the grazing pressure treatments was not severely imposed, by design, until near the end of the breeding season (April 15 to July 1). Thus, from a management perspective, these data indicate that heifers may be developed under selectively high stocking rates or grazing pressures for short periods (100 to 150 days) providing that a period of compensation is allowed before calving.

Certainly, absolute weight, body condition, and weight gain before and during the breeding season are of paramount importance for yearling and first-calf heifers that have not attained mature body size. These preliminary growth and development data also suggest that those heifers that breed to calve first as a 2-year-old are excellent candidates to rebreed and calve as 3-year-olds. In our opinion, an important period for obtaining this more than 90% rebreeding status is the winter-spring period before calving. The winter-spring period is a time of "high cost" rations with the need for winter pasture, hay, and/or supplemental feed. Pregnancy rates of 50, 60, or even 70% for the first-calf heifer may also be considered as a "high cost" to pay. Figure 5 shows the compensating growth that may occur after a period of suboptimum growth during the previous summer months.

Table 2. Body weight of open heifers and the treatment group at the initiation and termination of the breeding season.

Year	Number open heifers	Weight at initiation of breeding		Weight at termination of breeding	
		Open	Group	Open	Group
		lb			
1984	7	558	629	719	792
1985	4	685	686	790	797
1986	8	768	752	845	825
1987	11	647	667	757	787

Table 3. Pregnancy status of first-calf F-1 heifers assigned to different levels of grazing pressure.

Year	Heifer ID	Grazing pressure				
		HI	MH	ML	LO	AVG.
		%				
1985	4200	83	100	100	100	96
1986	5000	100	90	89	73	88
1987	6100	80	91	91	100	91
1988	7200	100	100	92	92	96
Four-year avg.	91	95	93	91		93

During the grazing pressure treatment phase of the lactation period, the influence of forage availability and possibly milk production had profound effects on the suckling calves. The 4-year average weaning weights of calves from HI, MH, ML, and LO grazing pressures were 357, 411, 429, and 459 lb, respectively. Figure 7 shows the immediate response to increased grazing pressures, which were imposed in mid- to late June each year of the 4-year trial. Thus, by the time bulls were removed on July 1 of each year, calf daily gains were restricted on the various treatments. The following relationships show the mean calf body weight for each weigh period for each of the 4 years:

(1) High grazing pressure:
body weight = $-108.9 + 2.98X - 0.005X^2$ ($r = 0.99$)

(2) Medium high grazing pressure:
body weight = $-59.6 + 2.26X - 0.002X^2$ ($r = 0.99$)

(3) Medium low grazing pressure:
body weight = $-24.3 + 1.67X$ ($r = 0.99$)

(4) Low grazing pressure:
body weight = $-43.9 + 1.85X$ ($r = 0.98$)

where X = time in days from January 1 of birth year

The growth rate of these Braford-sired calves nursing first-calf F-1 (Brahman x Hereford) heifers may be predicted when pastures consist of overseeded bermudagrass in humid environments. A more detailed explanation of the relationship of calf growth rate with level of forage availability will be summarized in another publication. This preliminary calf data presentation serves to empha-

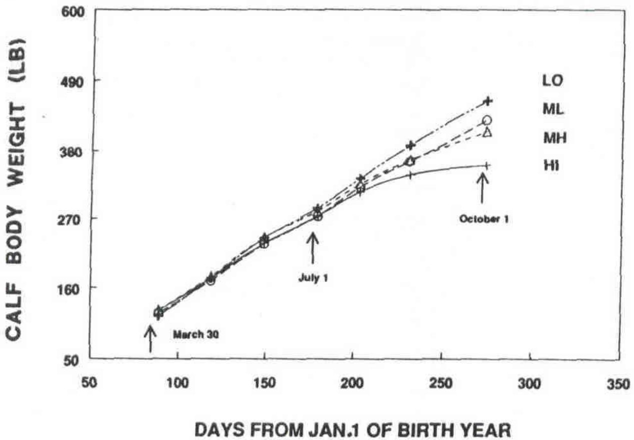

Figure 7. Relationship of calf gain in body weight to time on various levels (HI, MH, ML, LO) of grazing pressure.

size the impact of grazing pressure on the growth and development of the first-calf heifer.

These initial summaries of this trial suggest some of the following forage-animal management factors: (1) acceptable growth rates of yearling F-1 heifers may be obtained with exclusive forage rations that include a bermudagrass sod overseeded with winter-annual forages such as small grain, ryegrass, and clover; (2) grazing pressures that are sufficiently severe to restrict animal growth rates do not diminish the stand of bermudagrass pastures that receive some periodic (6 to 8 weeks) nitrogen fertilization; (3) forage or supplement that allows for compensating weight gain during the winter-spring period masks the impact of restricted gains during the previous summer; (4) forage utilization can be increased with higher levels of grazing pressure (stocking rate) for short periods (60 to 90 days) without dramatic impact on pregnancy of first-calf heifers; (5) weaning weights and growth rates of suckling calves may encourage continued ownership after weaning, especially for cattle that have access to limited forage; (6) estimates of production costs and projected cash-flow alternatives associated with forage management and utilization, first and second pregnancy status of replacement heifers, and post-weaning ownership of offspring are important considerations in optimizing forage-animal production.