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 four-year period to ascertain the influence of grazing pressure on growth and development from the time of weaning until the heifer weaned its first calf. Under the low and medium low grazing pressures, heifer growth was positive and linear from early January until early October. Heifer growth was 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 lbs, and were about 670 lbs in early April, prior to grazing pressure assignments. The 4-year October weights were 938, 921, 879, and 780 lbs, 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 prior to calving. At initiation of the rebreeding season, first calf heifers weighed 868 (HI), 887 (MH), 930 (ML), and 940 (LO) lbs; whereas, weights at the time of weaning their first calves were 798 (HI), 898 (MH), 974 (ML), and 1029 (LO) lbs. 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 prior to calving.

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 U.S. in general and East Texas specifically, climatic conditions and improved forages are conducive to providing 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.

PROCEDURES

During each of four 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-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 4 treatment groups and exposed to Braford bulls	Apr. 15
4. Bulls removed from each of the 4 grazing pressure groups	Jul. 1
5. Heifers continued to graze in respective grazing pressure treatment groups until fall	Jul. 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 4 grazing pressure groups	Jul. 1
9. First-calf heifers continued to graze in respective grazing pressure treatment groups until fall	Jul. 1-Oct.
10. All calves weaned and moved to wheat pastures at Amarillo	Oct.

During the time the heifers were weaned until rye-ryegrass pastures were available for grazing, heifers received *ad libitum* Coastal bermudagrass hay and 3 lbs/da of a 4:1 (corn:CSM) ration. This ration was used for about a 30-45 day period. Heifers grazed rye-ryegrass pastures from early January to early April. In early April, heifers were assigned to each of four groups using stratified randomization based on 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, there were small differences in grazing pressures. This delay in the execution of differences in available forage among treatments was done intentionally 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 1000, 2000, 3000, and >4000 lbs/ac of dry matter forage when measured to ground level. Resultant grazing pressures (lb forage dry matter/100 lbs 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 impose a graded level of forage availability across the four animal groups to impose different levels of selective grazing and restricted *ad libitum* intake of bermudgrass. With restricted 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 due to 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 hrs/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 with 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 4 bulls were bred to each of the four treatment groups. Grazing pressures were gradually increased after about June 1 until July 1, at which time 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 two-year growth period. Pastures were sampled for forage availability and nutritive value on regular intervals throughout the grazing period.

RESULTS AND DISCUSSION

Grazing pressures were gradually increased during June of each year so that by July 1 there was a graded level of forage availability across the treatments. From late June to early October, forage available on HI, MH, ML, and LO grazing pressures averaged about 1500, 2750, 3750, and 5500 lbs/ac dry matter (DM), respectively, when harvested to ground level. The relationship of forage availability with 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 has 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 above-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 between 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 four years' body weight data is shown in Figures 1-4 for heifers born in 1984, 1985, 1986, and 1987, respectively. These respective figure depict gain in body weight of the weanling-yearling heifer and continue through the lactation stages of the two-year old heifer. The following similarities were apparent: (1) weanling heifers made little, if any, weight gains for the first 30-60 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-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 in the other 3 groups; (5) grazing pressures had dramatic effects on heifer body weight during lactation.

Figure 5 presents the 4-year average gain in body weight from each of the four grazing pressures. The average weight of the 7 to 8 month old weanling heifers was 555 lbs. In early January, heifers averaged 575 lbs when placed on full-time grazing of winter pastures, and weighed about 670 lbs 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 lbs, 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 lbs, respectively. Thus, when forage availability was not severely limiting intake, there was a positive, linear growth rate from early January to early October (330 days) which was accomplished on an exclusive forage diet. Heifers were removed from the graded grazing pressures from early October until the following June to allow heifers an opportunity to replenish body weight and an opportunity to rebreed as a first calf, 2-year old heifer. By the time of initiation of the rebreeding period of the first calf heifer, four-year average body weights were 868, 887, 930, and 940 lbs, 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 lbs, 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 was evident in the expression of body weight with maturity (time) (Figure 6). These coefficients were calculated from the mean heiferr weight at each date for each of the four years:

(1) High Grazing Pressure; Body Weight = $-13.71 + 2.10X - .001X^2$ ($r = .94$)

(2) Medium High Grazing Pressure; Body Weight = $-36.09 + 2.16X - .001X^2$ ($r = .95$)

(3) Medium Low Grazing Pressure; Body Weight = $-56.27 + 2.22X - .001X^2$ ($r = .97$)

(4) Low Grazing Pressure; Body Weight = $-31.63 + 2.10X - .001X^2$ ($r = .97$)

where X = time in days from Jan. 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 four-year test period.

Pregnancy data of the yearling F-1 heifer are presented in Table 1 for each of the four years. The 4-year average indicated similar pregnancy rates of about 80-85% across all treatment groups. By and large, many of the heifers palpated 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 period to allow 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 three 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, there were no clear trends 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, that there are about 15% that may not breed as 15 to 18-month old heifers due to pre-puberal status, infantile reproductive tract, or other factors that restrict 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 the pregnancy status of the first-calf heifers averaged about 90 to 95% among all treatment groups. This similarity in pregnancy rates indicated that: (1) yearling heifers on the HI grazing pressure treatment made adequate compensating gains and body condition during the winter-spring period prior to calving to allow for acceptable rebreeding as a first-calf heifer; and (2) the impact of the grazing pressure treatments were not severely imposed, by design, until near the end of the breeding season (Apr. 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 of time (100 to 150 days) providing that a period of compensation is allowed prior to calving.

Certainly, absolute weight, body condition, and weight gain prior to 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 prior to 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 sub-optimum growth during the previous summer months.

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 four-year average weaning weights of calves from HI, MH, ML, and LO grazing pressures were 357, 411, 429, and 459 lbs, 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 four years:

(1) High Grazing Pressure; Body Weight = $-108.9 + 2.98X - .005X^2$ ($r = .99$)
(2) Medium High Grazing Pressure; Body Weight = $-59.6 + 2.26X - .002X^2$ ($r = .99$)
(3) Medium Low Grazing Pressure; Body Weight = $-24.3 + 1.67X$ ($r = .99$)
(4) Low Grazing Pressure; Body Weight = $-43.9 + 1.85X$ ($r = .98$)
where X = time in days from Jan. 1 of birth year

The rate of growth 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 enforce the impact of grazing pressure on the growth and development of the first calf heifer.

These initial summaries of this trial would suggest some of the following forage-animal management factors that may be considered: (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 winter-spring period masks the impact of restricted gains during the previous summer time; (4) forage utilization can be increased with higher levels of grazing pressure (stocking rate) for short periods (60-90 days) without dramatic impact on pregnancy of first-calf heifers; (5) weaning weights and growth rates of suckling calves may encourage continued ownership post-weaning, especially for cattle that have access to limited forage availability; (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.

TABLE 1. PREGNANCY STATUS OF YEARLING F-1 HEIFERS DURING EACH YEAR OF THE FOUR-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

TABLE 2. BODY WEIGHT AT THE INITIATION AND TERMINATION OF THE BREEDING SEASON FOR OPEN HEIFERS AND THE TREATMENT GROUP

Year	Number Open Heifers	Weight at Initiation of Breeding		Weight at Termination of Breeding	
		Open	Group	Open	Group
		----------lbs----------			
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

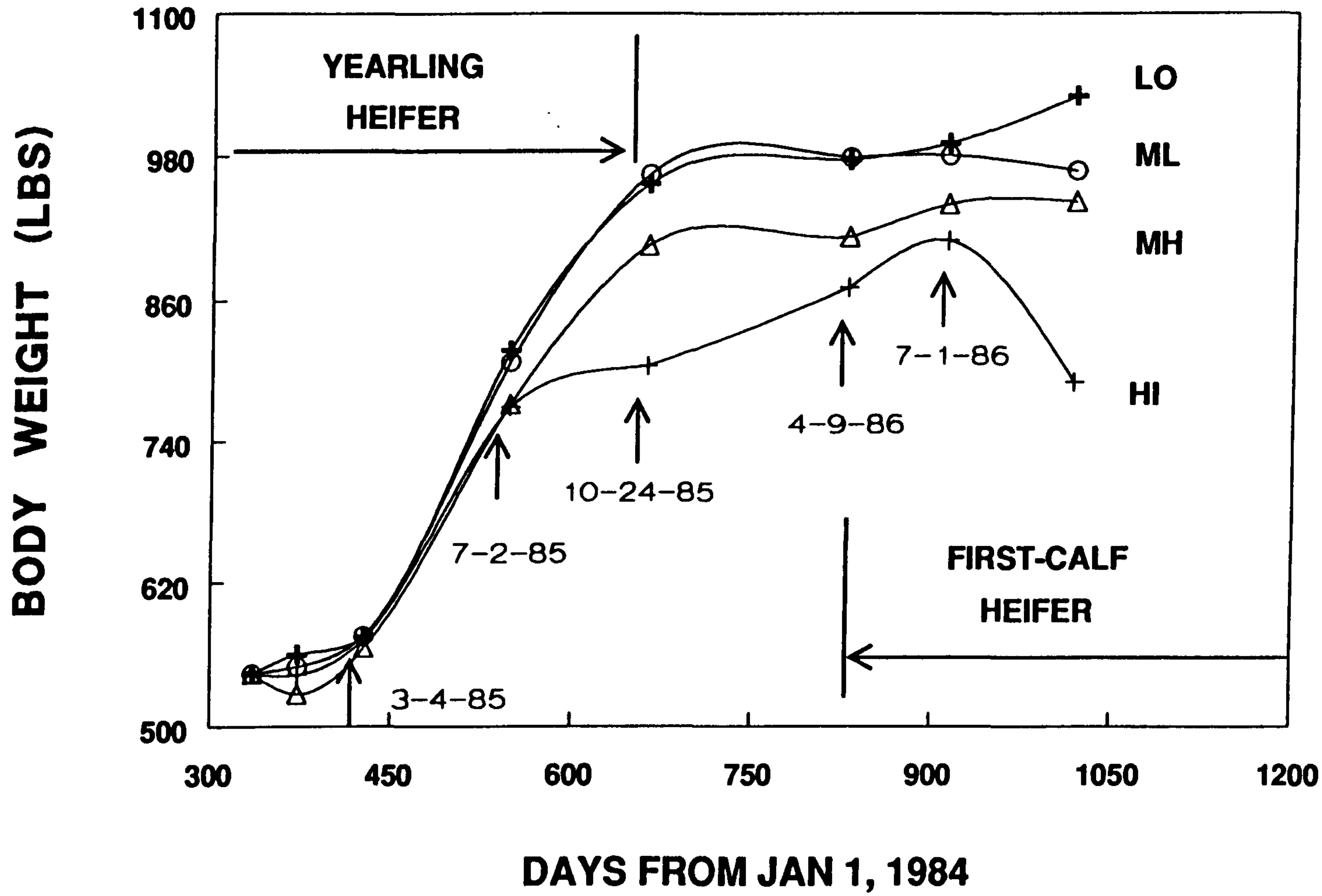

Figure 1. Gain in body weight of F-1 heifers born in winter-spring of 1984 and developed under various levels (HI, MH, ML, LO) of grazing pressure.

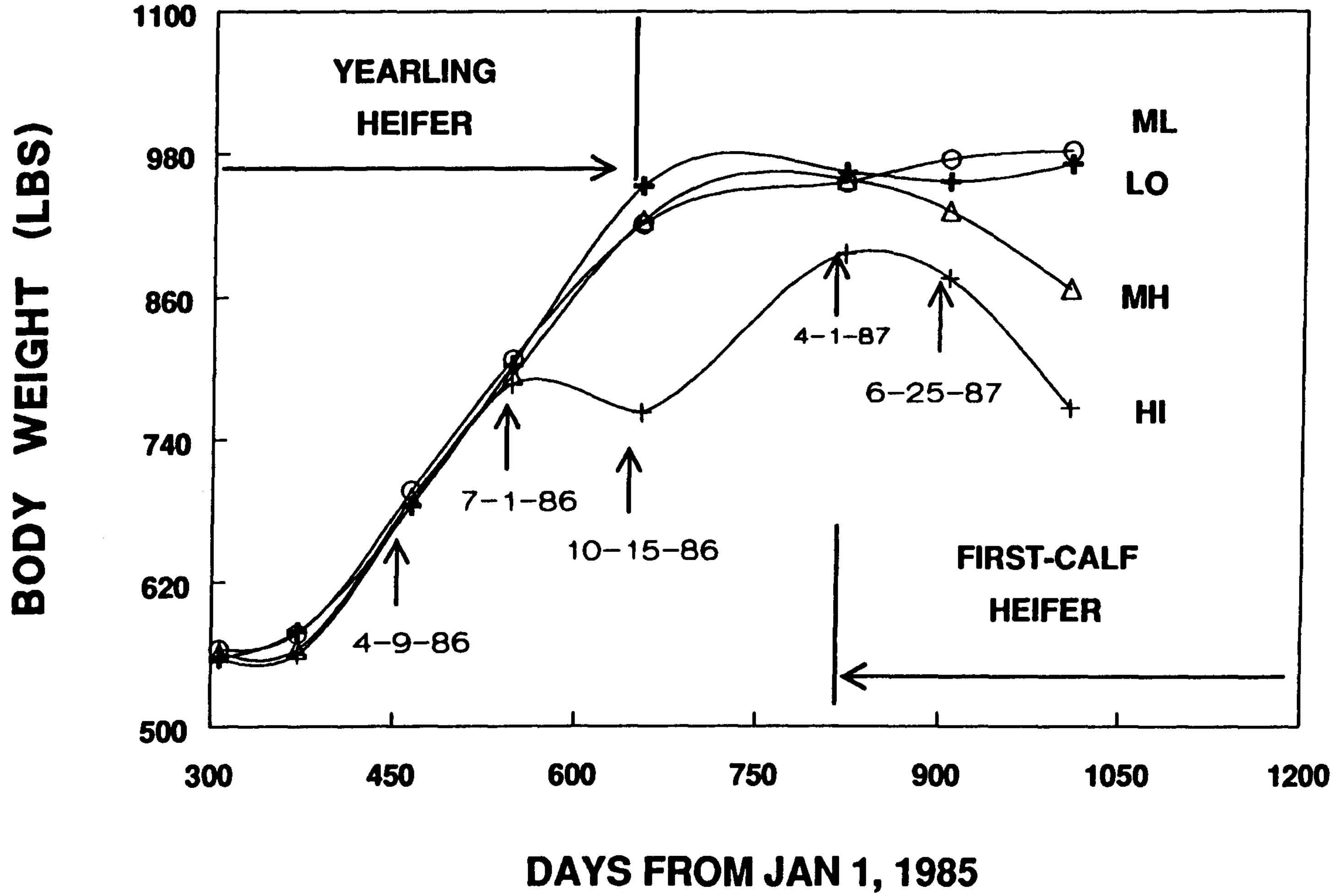

Figure 2. Gain in body weight of F-1 heifers born in winter-spring of 1985 and developed under various levels (HI, MH, ML, LO) of grazing pressure.

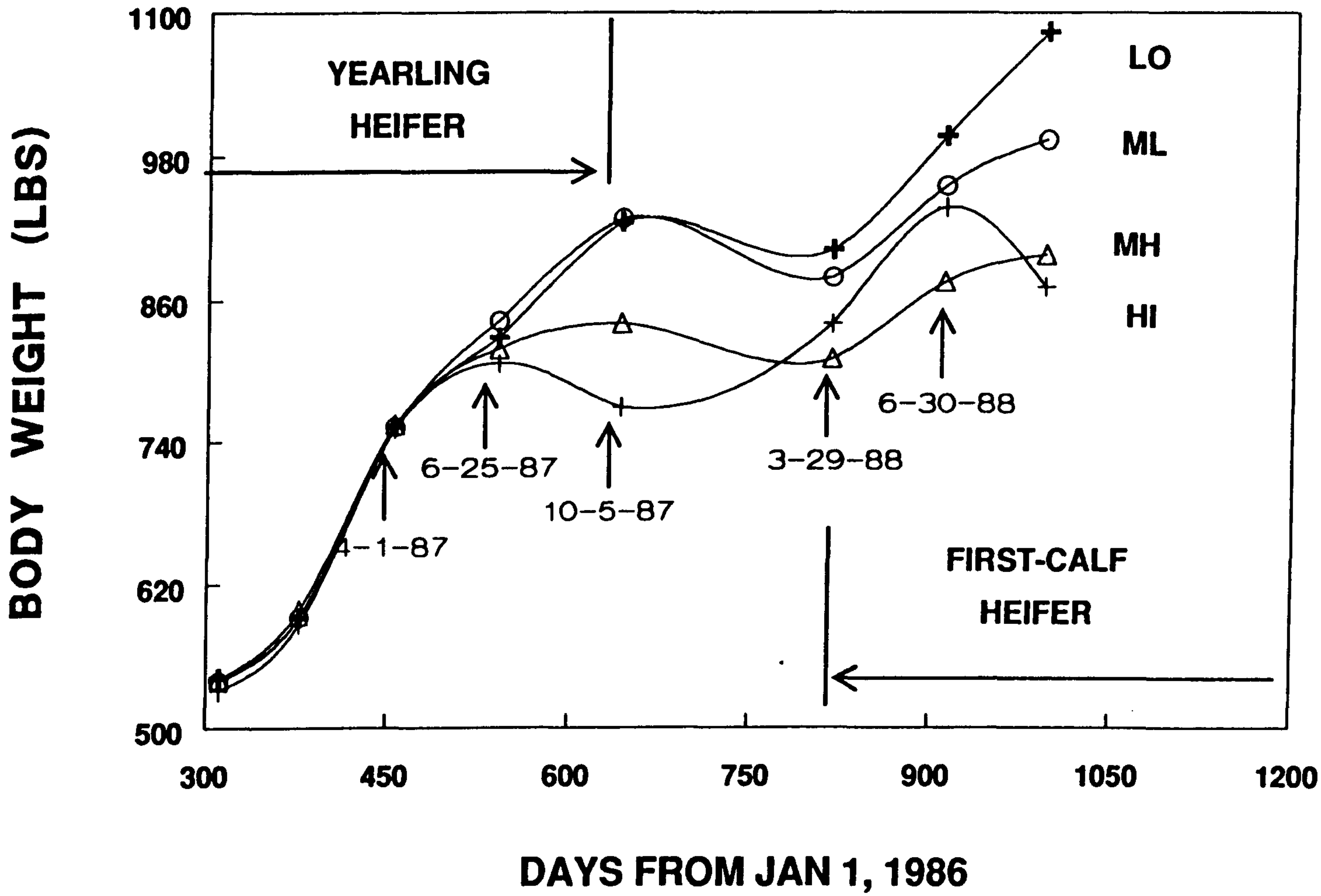

Figure 3. Gain in body weight of F-1 heifers born in winter-spring of 1986 and developed under various levels (HI, MH, ML, LO) of grazing pressure.

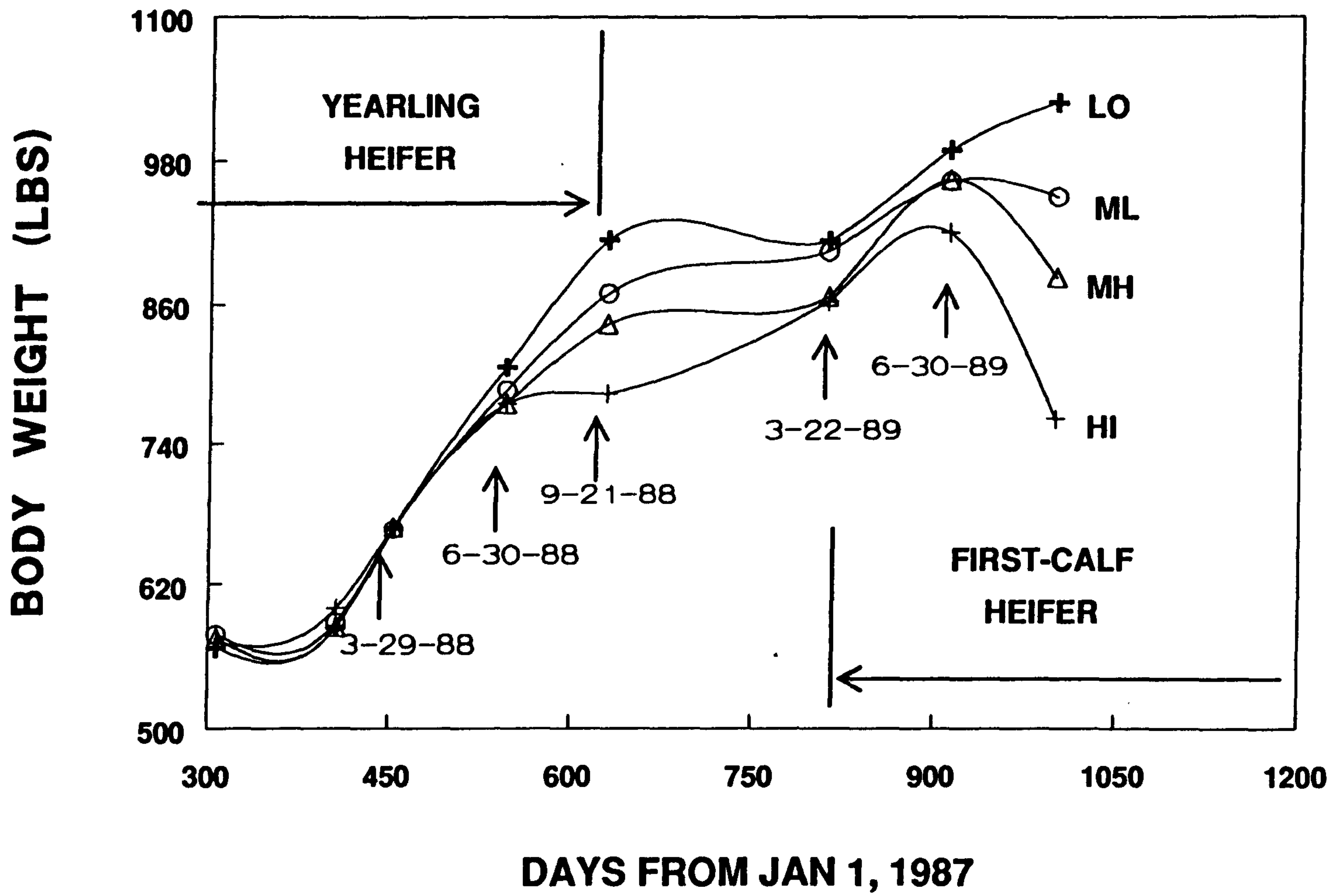

Figure 4. Gain in body weight of F-1 heifers born in winter-spring of 1987 and developed under various levels (HI, MH, ML, LO) of grazing pressure.

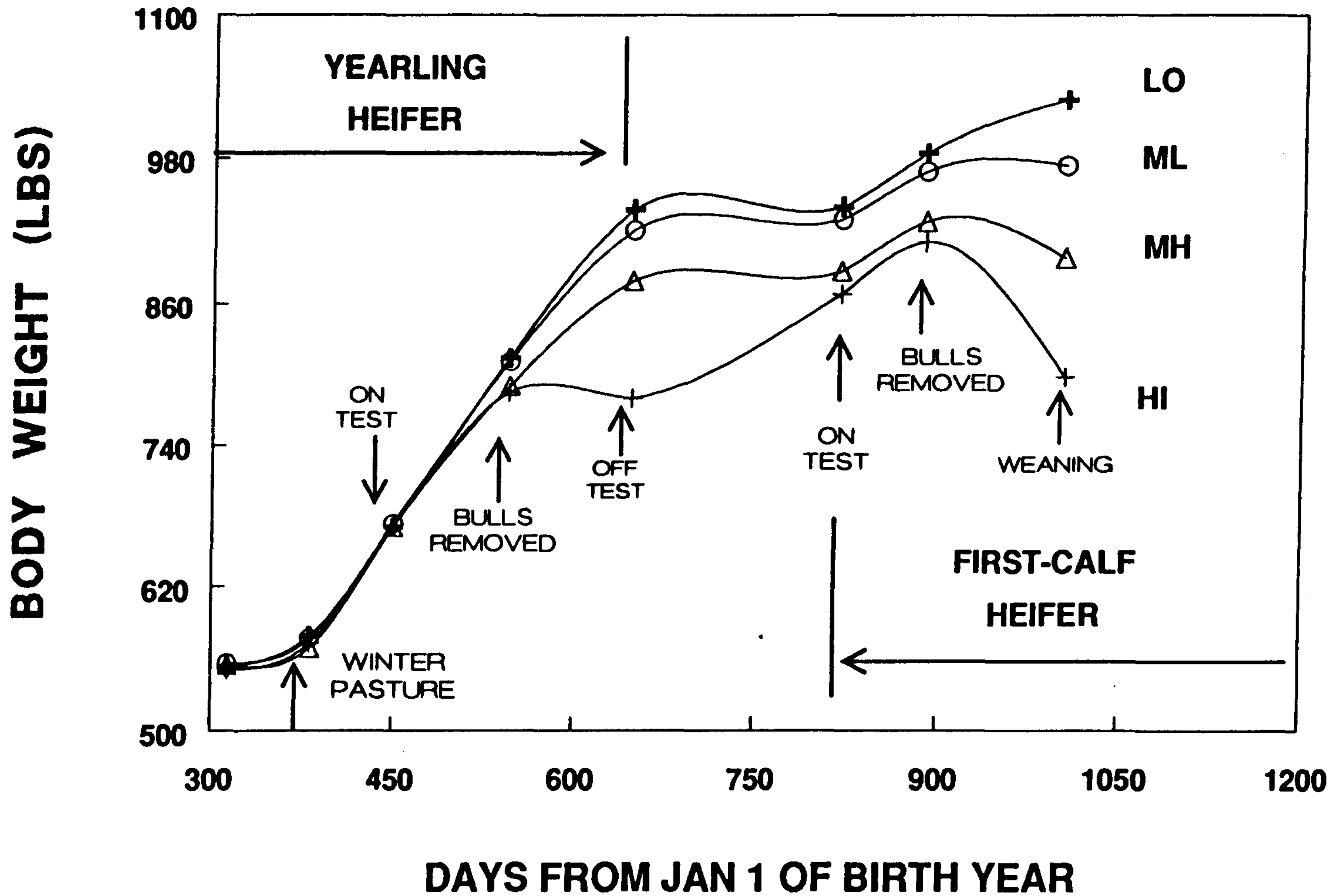

Figure 5. Four-year average growth of F-1 heifers from the weanling-yearling stage through the time of weaning their first calf at various levels (HI, MH, ML, LO) of grazing pressure.

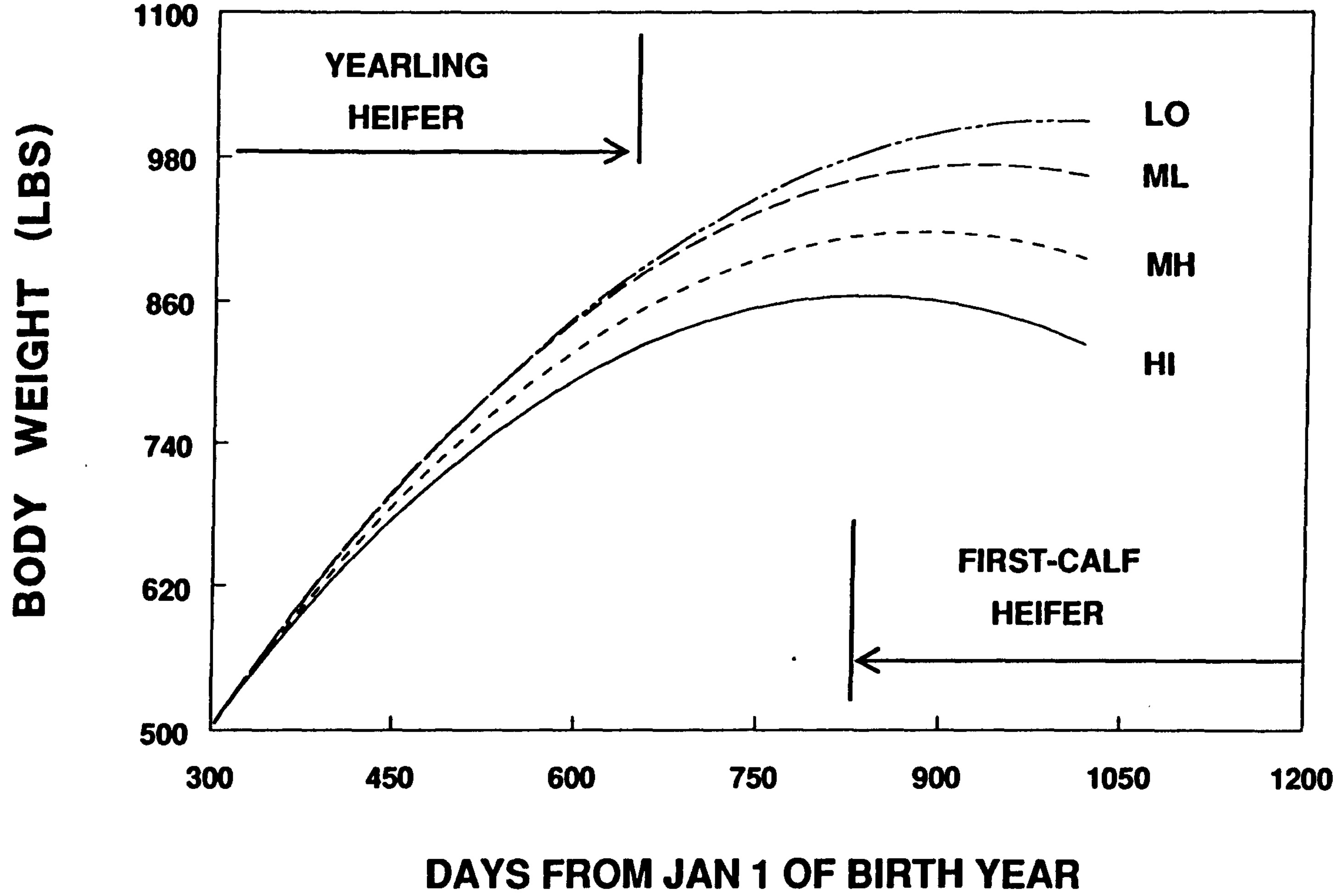

Figure 6. Curvilinear relationship of growth of F-1 heifer with time when exposed to various levels (HI, MH, ML, LO) of grazing pressure.

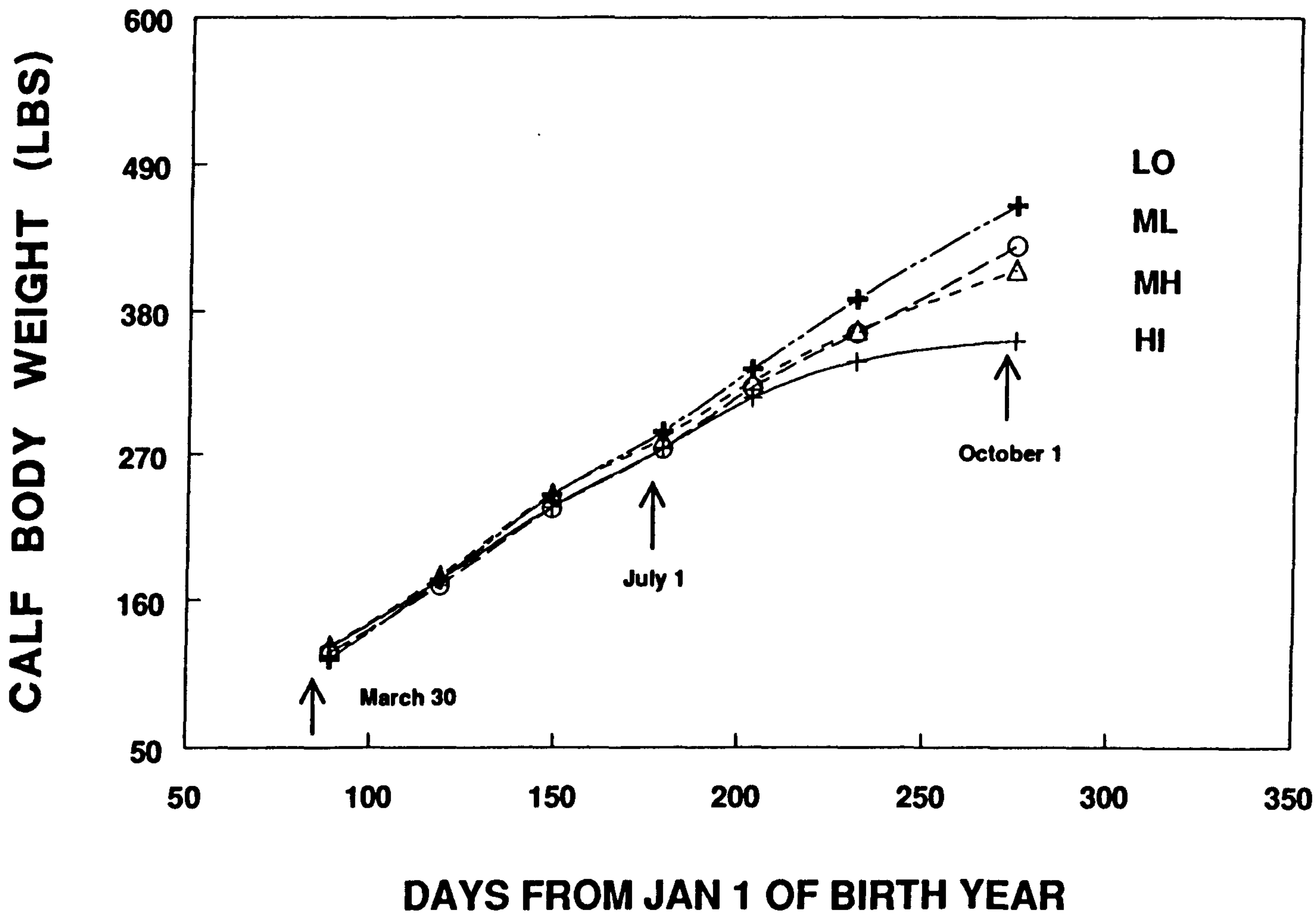

Figure 7. Relationship of calf gain in body weight with time on various levels (HI, MH, ML, LO) of grazing pressure.