BEEF CATTLE RESEARCH UPDATE

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Beef Heifer Growth and Reproductive Performance following Two Levels of Pasture Allowance

Management of beef replacement heifers from weaning to breeding is critical to their lifetime productivity. Historically, replacement heifers have been fed a diet to achieve 60 to 65% of mature body weight (BW) by breeding at 14 months of age.[1] This practice was based on research conducted during the late 1960s through the early 1980s. However, research conducted over the last 10 years has found that feeding beef heifers to 50 to 55% of mature BW reduced body size and development costs without compromising pregnancy rate.

Recent West Virginia University research evaluated the effect of allocating two different levels of stockpiled pasture (cool-season grass-legume mixture) during the fall on beef heifer growth, puberty, and pregnancy rate.[2] In this study (replicated over three years: 2009, 2010, and 2011), spring-born heifers of primarily Angus background (average age of 232 days and average weight of 542 lb) were allocated to the following fall grazing treatments: daily pasture dry matter (DM) allowance of 3.5% of body weight (BW: LO) or daily pasture DM allowance of 7.0% of BW (HI) under strip-grazing management. In each year, fall grazing treatments began in early November and continued until snow conditions prevented grazing or pastures had been fully consumed (late December to early January). At the end of the fall grazing period, the winter feeding period began and round bale mixed-grass/legume haylage and soybean hulls were fed on the same pastures. In early to mid-April, haylage and soybean hull feeding ended and fences between pasture allowance treatments were removed and pastures were continuously stocked through late May (spring grazing period). Following spring grazing, the heifers were combined into one group that rotated among pastures until early August (summer grazing period). In all years, heifers were synchronized and artificially inseminated (AI) in mid-May and a cleanup bull was turned out with the heifers in early-June and used for 35 days. Pregnancy status (either AI or bull) was determined via rectal palpation in August of each year.

The effects of fall grazing treatment on heifer growth and reproductive performance are shown in Table 1. Heifers in the LO group gained less than heifers in the HI group during the fall grazing period (0.26 vs. 0.0.88 lb/day; $P < 0.0001$) and were 34 lb lighter at the end of fall grazing (average of 54 days grazing). During winter feeding (average of 101 days), the LO heifers continued to gain slower than the HI heifers (0.66 vs. 0.86 lb/day; $P = 0.0008$) resulting in the HI heifers being 50 lb heavier at the end of winter feeding. During the spring grazing period (average of 38 days), LO heifers had numerically greater average daily gain (ADG) than HI heifers (3.06 vs. 2.89 lb/day; $P = 0.66$). This difference in ADG persisted during summer grazing (average of 75 days) with LO heifers gaining faster than HI heifers (1.63 vs. 1.48 lb/day; $P = 0.03$). Heifer ADG over the entire development period (fall grazing through pregnancy diagnosis was greater for HI than LO heifers (1.35 vs. 1.21 lb/day; $P < 0.001$). As a result, even though heifers on the LO treatment gained more during spring and summer, their BW at the end of the summer grazing period (time of pregnancy diagnosis) was less than the BW of heifers on the HI treatment (886 vs. 915 lb; $P = 0.0055$).

Fall pasture allowance had no effect no effect on the percentage of heifers reaching puberty by the time of AI (34% for both groups). Heifers in the LO treatment group weighed less at breeding (end of spring grazing) than heifers in the HI treatment group (739 vs. 785 lb; $P < 0.0001$) and were approximately 63% of mature BW, whereas those in the HI group were 66% of mature BW (1220lb) at breeding. The percentage of heifers becoming pregnant to AI tended ($P = 0.13$) to be greater for the HI heifers than for the LO heifers (44 vs. 32%). However, the percentage pregnant by natural service was similar (61% for LO vs. 59% for HI; P = 0.80) between the 2 groups. Likewise, final pregnancy rate was also not different among LO (74%) and HI heifers 77%).

Table 1. Effects of fall forage allowance (HI[1] vs. LO[2]) on heifer growth and reproduction.

Item	LO	HI	P-value
Growth Performance:			
Initial weight, lb	542	540	0.93
Fall grazing ADG, lb	0.26	0.88	<0.0001
BW at end of fall grazing, lb	553	587	0.0004
Winter feeding ADG, lb	0.66	0.86	0.0008
BW at end of winter feeding, lb	620	670	<0.0001
Spring grazing ADG, lb	3.06	2.89	0.66
BW at end of spring grazing, lb[3]	739	785	<0.0001
Summer grazing ADG, lb	1.63	1.48	0.03
BW at pregnancy check, lb	886	915	0.0055
Total ADG, lb	1.21	1.35	<0.001
Reproductive Performance:			
Pubertal by time of AI, %	34	34	0.93
Pregnant to AI, %	32	44	0.13
Pregnant to bull, %	61	59	0.80
Final pregnancy rate, %	74	77	0.61

[1]HI = daily pasture DM allowance of 7.0% of BW.
[2]LO = daily pasture DM allowance of 3.5% of BW
[3]BW at breeding
Adapted from Bailey et al., 2014.

These researchers concluded that altering fall pasture allowance may delay the majority of BW gain until late in heifer development without negatively affecting overall pregnancy rates. However, since the percentage of heifers becoming pregnant to AI tended to be greater for HI heifers than LO heifers, the HI heifers would presumably calve earlier and wean older, heavier calves. Research has also shown that heifers that calve early in the calving season with their first calf have increased longevity and pounds weaned compared with heifers that calve later in the calving season.[3] These authors also suggested that this study “suggest that delaying selection of replacement heifers until pregnancy evaluation may be a potential management strategy that would provide producers the opportunity to select heifers capable of achieving acceptable reproductive performance under restricted conditions”. They noted that the goal of heifer development programs should not be to produce heifers with the greatest BW gain but instead to produce a functional, pregnant heifer with the ability to have a live calf and rebreed the following breeding season using low-cost methods.

Effects of Beef Production System (Conventional vs. Natural) on Cattle Performance
Recent Oklahoma State University research evaluated the effects of conventional (CONV) and natural (NAT) beef production systems on feedlot performance and carcass characteristics during an annual pasture phase and feedlot finishing phase.[4] In this study, 180 black-hided yearling steers (551 lb initial weight; consisting of primarily Angus and Red Angus genetics) were assigned to two treatments in the pasture phase where steers grazed wheat or cereal rye for 109 days. CONV steers were implanted with a trenbolone acetate/estradiol combination implant (Component TE-G, Elanco Animal Health) and natural steers were not implanted. Following the pasture phase, 160 of the steers were used in the feedlot phase (CONV and NAT treatments were maintained). During finishing, CONV steers were given a combination implant (Component TE-S with Tylan, Elanco Animal Health) at processing, fed monensin (33 g/ton of DM) and tylosin (9 g/ton of DM), and fed Zilmax (Merck Animal Health) at 90 mg/steer/day for the last 20 days of the experiment followed by a 3 day Zilmax withdrawal period.

During the pasture phase, CONV steers gained 18.5% faster than NAT steers (2.69 vs. 2.27 lb/day; P < 0.01), resulting in in a 42 lb greater final weight at the end of grazing (849 vs. 807 lb; P < 0.01).

The effects of the treatments on feedlot performance and carcass characteristics are shown in Table 2. During finishing, CONV steers ate 6.9% more dry matter (DM), gained 28.4% faster, and were 24.2% more efficient than NAT steers. Hot carcass weight was increased by 137 lb and rib-eye area was increased by 2.63 square inches. Even though both groups of cattle carried the same amount of fat thickness, the reduced rib-eye area for the NAT cattle resulted in a greater USDA yield grade (YG) for these cattle (3.54 vs. 3.09; P < 0.01). Natural steers had a greater percentage of carcasses in the upper 2/3 of USDA Choice grade (48.7 vs. 18.7%; P<0.01), a greater percentage of YG 4 and 5 carcasses (25.4 vs. 9.3%; P<0.01), and a greater percentage of abscessed livers (39.6 vs. 10.5%, P < 0.01) compared with CONV steers. These researchers concluded that these data show that conventional production resulted in more rapid and efficient production that resulted in heavier carcasses with superior YG while still maintaining desirable quality grades as compared to natural production. A 2013 economic analysis of this data showed that net returns per steer were $203.69 greater for conventional cattle vs. natural cattle.[5]

Table 2. Effects of treatment on feedlot performance and carcass characteristics.

Item	NAT	CONV	P-value
Feedlot Performance:			
Days on feed	135	135	---
Initial weight, lb	822	869	<0.01
Final weight, lb	1274	1385	<0.01
DMI, lb/day	24.28	25.95	0.01
ADG, lb/day	3.26	4.19	<0.01
Gain/Feed	0.132	0.164	<0.01
Carcass Characteristics:			
Hot carcass weight, lb	798	935	<0.01
Dressing percentage	63.31	64.89	<0.01
Fat thickness, in.	0.685	0.705	0.53
Rib-eye area, sq. in.	13.01	15.64	<0.01
USDA Yield Grade	3.54	3.09	<0.01
USDA YG 2, %	17.6	37.5	0.01
USDA UG 4-5, %	25.4	9.3	0.02
Premium choice, %	48.7	18.7	<0.01
Low choice, %	36.9	54.1	0.05
Choice, %	86.0	73.1	0.06
Select, %	14.1	26.9	0.06
Liver abscesses, %	39.6	10.5	<0.01

Adapted from Maxwell et al., 2014.

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