

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Nebraska Beef Cattle Reports

Animal Science Department

2010

Post Weaning Management of Heifer Calves Impacts ADG and Feed Efficiency as Pregnant Heifers

Daniel M. Larson

University of Nebraska-Lincoln

Tonya L. Meyer

University of Nebraska-Lincoln, tl.meyer@live.com

Leslie Aaron Stalker

University of Nebraska-Lincoln, stalkera@byui.edu

James R. Teichert

University of Nebraska-Lincoln, jteichert2@unl.edu

Richard N. Funston

University of Nebraska-Lincoln, rfunston2@unl.edu

Follow this and additional works at: <https://digitalcommons.unl.edu/animalscinbcr>



Part of the [Animal Sciences Commons](#)

Larson, Daniel M.; Meyer, Tonya L.; Stalker, Leslie Aaron; Teichert, James R.; and Funston, Richard N., "Post Weaning Management of Heifer Calves Impacts ADG and Feed Efficiency as Pregnant Heifers" (2010). *Nebraska Beef Cattle Reports*. 570.

<https://digitalcommons.unl.edu/animalscinbcr/570>

This Article is brought to you for free and open access by the Animal Science Department at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Nebraska Beef Cattle Reports by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Post Weaning Management of Heifer Calves Impacts ADG and Feed Efficiency as Pregnant Heifers

Daniel M. Larson
T.L. Meyer
L. Aaron Stalker
Jim Teichert
Rick N. Funston¹

Summary

Replacement heifers were developed on cornstalks (Exp. 1, 2, and 3), dry lot (Exp. 1 and 2), or winter range (Exp. 3). In Exp. 1, pregnant heifers were individually fed during mid to late gestation. Heifers developed on cornstalks were more feed efficient than heifers developed in a dry lot. In Exp. 2 and 3, pregnant heifers grazed cornstalks during mid to late gestation. Heifers developed on cornstalks gained more and were more efficient, especially compared to heifers developed in a dry lot. These data provide evidence of an adaptive response to grazing low quality forages and may be beneficial in the critical period leading up to the first calving season.

Introduction

Current recommendations indicate a heifer should reach approximately 65% of mature body weight (BW) by the first insemination for successful reproduction. However, recent data demonstrate heifers reaching less than 58% of mature BW by breeding do not display impaired reproductive performance (2008 *Nebraska Beef Report*, pp. 5-7). Heifers developed on an excessively high plane of nutrition have impaired milk production, which reduces productivity (Ferrell et al., *Journal of Animal Science*, 1976, 42:1477). Heifers developed on grazing corn residue (CR) gain less during winter grazing but compensate during the summer, yet are lighter prior to first calving (2008 *Nebraska Beef Report*, pp. 8-10). These findings suggest cows developed grazing CR are more efficient. Lighter cows may have smaller liver mass (Jenkins et al.,

Animal Production, 1986, 43:245), and a smaller liver mass is associated with improved feed efficiency (DiCostanzo et al., *Journal of Animal Science*, 1991, 69:1337). There also is anecdotal evidence of a learning curve associated with grazing CR. It may be cows grazing CR as virgin heifers are better adapted to graze CR prior to calving.

The objective of the current experiments was to evaluate the effect of replacement heifer development system on subsequent gain and efficiency of pregnant heifers.

Procedure

The University of Nebraska—Lincoln Institutional Animal Care and Use Committee approved the procedures and facilities used in these experiments.

Experiment 1

The effect of heifer development system on ADG and G:F during gestation was evaluated. Following weaning, predominately Angus-based heifers were transported to the West Central Research and Extension Center (WCREC), North Platte, Neb. After a receiving period, heifers were blocked by initial BW and randomly assigned to graze CR (n = 50) or consume a diet in a dry lot (DL; n = 50). The CR heifers grazed for approximately 88 days and were offered 1 lb/day of a 28% crude protein (CP; DM basis) supplement daily. Following CR grazing, heifers grazed dormant mixed grass upland range with 1 lb/day of a 28% CP (DM basis) supplement daily for 60 days. Heifers then entered the DL and were offered a common diet for 47 days until completion of artificial insemination (AI). Following weaning, heifers assigned to the DL grazed mixed upland winter range and were offered 1 lb/day of a 28% CP (DM basis) supplement daily for 45 days. Heifers then entered the

DL and were offered a common diet for 128 days until completion of AI. The DL diet was formulated to achieve an ADG that would allow heifers to reach approximately 65% of mature BW (1,320 lb) prior to AI (NRC, 1996). Estrus was synchronized using MGA/PGF followed by estrous detection and AI. After AI, heifers were exposed to fertile bulls for 60 days. Approximately 45 days after AI, first service conception was determined; final pregnancy rate was determined 45 days after bulls were removed. During the breeding season and until individual feeding began in October, heifers grazed mixed grass upland summer range in a single group.

Primiparous heifers pregnant by AI (n = 40) were blocked by previous development system and BW. Only heifers pregnant by AI were used to remove variation due to period of gestation. Heifers were originally developed grazing CR (930 ± 11 lb; n = 20) or fed in a DL (983 ± 11 lb; n = 20) prior to first breeding. Heifers were individually fed once daily. Body weight was measured for three consecutive days at the beginning and end of the study to compute an average. The pregnant heifers consumed a diet composed of 90% grass hay (11.7% CP; DM basis) and 10% wet distillers grains plus solubles/straw mixture (21.8% CP; DM basis) during late gestation. Individual feed offered was recorded daily and individual feed refusal was recorded weekly. Data were analyzed using the MIXED procedure of SAS with development system as the fixed effect and pen as random effect.

Experiment 2

Pregnant heifers grazed CR prior to calving with a supplement (1 lb/day; 28% CP) to evaluate effect of heifer development system prior to first breeding on gain during late gestation.

(Continued on next page)

Heifers utilized in Exp. 2 were from the same herd as heifers in Exp. 1 and were developed following the same protocols through pregnancy diagnosis. However, heifers used in Exp. 2 were pregnant as a result of a combination of either AI or natural mating. Pregnant heifers (n = 55) were blocked by BW and mating type and sorted into three groups. The treatment groups included: heifers developed prior to breeding in a DL (981 ± 18 lb; n = 18); heifers developed prior to breeding grazing CR (963 ± 18 lb; n = 18); and a mixture of the two development systems (MIX; 959 ± 18 lb; n = 19). Heifers were transported to CR Dec. 1 and returned to WCREC Feb. 18, grazing CR for 80 days. While grazing CR during late gestation, heifers were offered the equivalent of 1 lb/day of a 28% CP (DM basis) supplement provided three times per week.

Experiment 3

The effect of development system prior to breeding on gain during late gestation while grazing CR was evaluated. Composite Red Angus x Simmental heifer calves (n = 90) from the Gudmundsen Sandhills Laboratory (GSL) near Whitman, Neb., were assigned randomly by initial BW (496 ± 4 lb) to graze CR or winter range (WR) between weaning and the breeding season. Grazing treatments were initiated approximately 30 days after weaning, beginning in mid-November, and continuing through mid-May. Heifers either grazed WR pastures at GSL or were transported to CR fields and grazed for 88 days. A daily supplement was offered (1 lb/day; 28% CP) while grazing. Subsequently, all heifers grazed WR for 100 days until breeding with a daily supplement (1 lb/day; 28% CP). Estrus was synchronized with a single i.m. injection of PGF_{2α} administered 108 hours after bulls were turned in with the heifers. Heifers were exposed to fertile bulls (1 bull to 25 heifers) for 45 days. Pregnancy diagnosis was performed approximately 45 days following completion of the breeding season. During the breeding

Table 1. Effect of heifer development system on ADG and feed efficiency of pregnant heifers, Exp. 1.

	Treatment ¹		SEM	P-value
	DL	CR		
n	20	20		
Initial BW, lb	984	930	11	0.002
Final BW, lb	1103	1059	14	0.03
DMI, lb	25.7	24.4	0.6	0.04
ADG, lb	1.66	1.79	0.09	0.29
G:F	0.065	0.073	0.0	0.08

¹DL = heifers developed in a dry lot; CR = heifers developed on corn residue.

Table 2. Effect of heifer development system on ADG of pregnant heifers grazing CR, Exp. 2.

	Treatment ¹			SEM	P-value
	DL	CR	MIX		
n	18	18	19		
Initial BW, lb	980	964	960	18	0.71
Final BW, lb	1028	1072	1033	20	0.27
ADG, lb	0.69 ^x	1.28 ^y	0.98 ^{xy}	0.15	0.04
BCS	5.14	5.47	5.47	0.14	0.08

¹DL = heifers developed in a dry lot; CR = heifers developed on corn residue; MIX = mixture of heifers from DL and CR treatments.

^{xy}Means without a common superscript differ (P < 0.05).

Table 3. Effect of heifer development system on ADG of pregnant heifers grazing CR, Exp. 3.

	Treatment ¹			SEM	P-value
	WR	CR	MIX		
n	17	17	15		
Initial BW, lb	883	873	872	17	0.86
Final BW, lb	956	974	946	18	0.54
ADG, lb	0.9 ^x	1.33 ^y	0.95 ^x	0.11	0.02
BCS	5.2	5.27	5.18	0.10	0.81

¹WR = heifers developed on winter range; CR = heifers developed on corn residue; MIX = mixture of heifers from WR and CR treatments.

^{xy}Means without a common superscript differ (P < 0.05).

season and until grazing CR, heifers grazed upland Sandhills range. A subset of the pregnant heifers (n = 49) was blocked by BW and sorted into three groups: heifers developed prior to breeding grazing WR (884 ± 15 lb; n = 17); heifers developed prior to breeding grazing CR (873 ± 15 lb; n = 17); and a mixture of the two development systems (MIX; 873 ± 18 lb; n = 15). Pregnant heifers grazed CR during late gestation with a supplement (1 lb/day; 28% CP) provided three times per week in late gestation. Heifers were transported to CR fields Dec. 1 and returned to GSL Feb. 18, grazing CR for 80 days. Heifer BW was measured at days 1, 51, and 80. In addition, heifer body condition score (BCS) was assessed at day 80.

Statistical Analysis (Exp. 2 and 3)

The corn residue fields were of differing acreage and corn yield. According to the 2004 *Nebraska Beef Report* (pp.13-15), corn yield influences the carrying capacity of a corn residue field. The relationship between yield and carrying capacity is mass of leaf and husk per acre = ([bushels/acre corn yield x 38.2] + 429) x 0.39. Assuming corn residue mass (88% DM) to support 1 AUM was equal to 686 lb of biomass and a 50% utilization rate, the carrying capacity of a corn residue field was calculated. The number of AU represented by each individual heifer and the number of AUM supported by the acreage of the field was utilized to adjust the gain data. Subsequently, data were ana-

lyzed with the MIXED procedure of SAS. The model included the fixed effects of previous winter development treatment and AUM per field per animal.

Results

Heifer gain data for Exp. 1 are summarized in Table 1. In Exp. 1, pregnant heifers developed prior to breeding in the DL had a greater ($P = 0.04$) dry matter intake (DMI) than heifers developed grazing CR; however ADG was not different ($P = 0.29$). Thus, pregnant heifers developed in the DL had a lower ($P = 0.08$) G:F than heifers developed grazing CR. Previous data indicated that heifers developed to a greater weight prior to breeding had a greater liver mass at 72 months of age (Arnett et al., *Journal of Animal Science*, 1971, 33:1129). Cows with a greater liver mass consume more DM and are less efficient than cows with less liver mass (DiCostanzo et al., *Journal of Animal Science*, 1991, 69:1337). Heifers developed grazing CR were lighter prior to calving than heifers developed in the DL (2008 *Nebraska Beef Report*, pp. 8-10). Perhaps these lower BW heifers were more efficient due to differences in metabolism. The CR-developed heifers also may have experienced compensatory gain linked to alterations in metabolic hormones such as IGF-1 and T3/T4 (Yambayamba et al., *Journal of Animal Science*, 1996, 74:57).

Heifer gain data for Exp. 2 are summarized in Table 2. Pregnant heifers grazing CR during late gestation that also grazed CR during development gained more ($P = 0.04$), and tended to maintain a greater ($P = 0.08$) body condition score (BCS) prior to calving, than heifers devel-

oped in the DL. The mixture of CR- and DL-developed pregnant heifers had an intermediate ADG but were not different from heifers developed grazing CR or in the DL. Heifer gain data for Exp. 3 are summarized in Table 3. In Exp. 3, pregnant heifers grazing CR during late gestation that also grazed CR during development gained more ($P = 0.02$) than heifers grazing WR or the combination of WR- or CR-developed heifers. Heifer BCS prior to calving was similar ($P = 0.81$) in Exp. 3.

Heifers that previously grazed CR were more efficient (DiCostanzo et al., *Journal of Animal Science*, 1991, 69:1337) or experienced more compensatory gain (Yambayamba et al., 1996) than heifers developed in the DL. Heifers developed grazing CR also gained more than heifers developed grazing WR, although precalving BW was not different (2008 *Nebraska Beef Report*, pp. 8-10). It seems likely a mechanism other than a change in efficiency is partially responsible for the difference in gain.

Previous data (1989 *Nebraska Beef Report*, pp. 11-15; 1990 *Nebraska Beef Report*, pp. 51-53) have suggested cattle require an acclimation period to grazing corn residue. Other research (Fernandez-Rivera et al., *Journal of Animal Science*, 1989, 67:574; Fernandez-Rivera and Klopfenstein, *Journal of Animal Science*, 1989, 67:590) has determined that naïve cattle require a learning period when grazing corn residue. Dietary starch content indicated younger cattle consumed less starch in the first 3 weeks of grazing compared to older, experienced cattle (Fernandez-Rivera and Klopfenstein, 1989). Thus, naïve cattle gained less weight early in the grazing season and may lose

weight early in the grazing season (Fernandez-Rivera and Klopfenstein, 1989). Possibly, heifers originally grazing CR during development were better prepared to graze as pregnant heifers, leading to selection of higher quality nutrients and greater gain. Moreover, heifers developed in the DL grazing CR during the first pregnancy, combined with heifers developed grazing CR, gained more than DL-developed heifers grazing separately. Although heifers developed grazing CR had a greater BCS prior to calving than heifers developed in the DL, there was no pre-calving BCS difference between WR- and CR-developed heifers. Thus, it appears exposing heifers to low quality forage during development better prepares them for grazing CR during the first pregnancy.

Implications

These data provide evidence of an adaptive response to grazing low quality forages and may be beneficial in the critical period leading up to the first calving season. Not only does grazing CR during development improve feed efficiency, it also prepares heifers for grazing CR during pregnancy. Grazing low quality forage during development may produce a heifer better adapted to a lifelong grazing system.

¹Daniel M. Larson, former graduate student, T.L. Meyer, research technician, L. Aaron Stalker, assistant professor, Animal Science, University of Nebraska, Lincoln; Jim Teichert, beef herdsman, Rick N. Funston, associate professor, Animal Science, West Central Research and Extension Center, North Platte, Neb.