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Impact of Post-Weaning Beef Heifer Development System on Average Daily Gain, Reproduction, and Feed Efficiency

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Summary

This experiment evaluated the impact of post-weaning heifer development system on ADG, reproduction, and subsequent feed efficiency during late gestation. Shortly after weaning, heifers were developed on one of two winter grazing systems: corn residue (CR) followed by winter range, or winter range followed by drylot (DL). Heifer BW was greater for DL heifers prior to breeding, at breeding, and prior to first parturition. There were no differences in reproductive performance despite CR heifers having lower BW at breeding. Feed efficiency was similar during late gestation between CR and DL heifers. Extending winter grazing decreased BW without impacting reproductive performance.

Introduction

Increasing harvested feed costs have producers seeking alternative resources for heifer development. Heifers developed on corn residue exhibited lower percentage cycling before breeding, compared to drylot (Funston, et al., *Journal of Animal Science*, 2011, 89:1595-1602). Heifers grazing corn residue gain less during winter months but compensate during the summer months (*2008 Nebraska Beef Cattle Report*, pp. 8-10). Jenkins et al. (*Animal Production*, 1986, 43:245-254) suggested that lighter cows have reduced liver mass, and cows with improved G:F were reported to have smaller liver mass (DiCostanzo, et al., *Journal of Animal Science*, 1991, 69:1337-1348). The objective of the current study was to evaluate effects of winter development system on reproductive performance and feed efficiency in beef heifers.

Procedure

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

The effect of post-weaning heifer development system on reproductive performance and feed efficiency was evaluated in a three-year study conducted at the University of Nebraska–Lincoln West Central Research and Extension Center (WCREC), North Platte, Neb. After a receiving period, weaned heifers (n = 299) were blocked by weight and randomly assigned to one of two developmental treatments: (1) graze corn residue (CR) followed by winter range (WR); or (2) graze WR and then fed in drylot (DL). Heifers assigned to CR initially grazed WR for 40 days, and then grazed CR for 75 days, followed by grazing WR for 65 days. Heifers received 1 lb/day protein cube (28% CP) for the duration of CR and WR grazing. Heifers developed in DL grazed WR for 95 days, with the same daily supplement as CR heifers, then entered the DL for 85 days and were offered a diet formulated to allow heifers to reach 65% of mature BW (1,250 lb) at start of breeding. Prior to breeding, CR and DL heifers were managed together 40 days in DL with a common diet. Preceding estrus synchronization, individual blood samples were collected 10 days apart to determine pubertal status. Melengestrol acetate/prostaglandin was used to synchronize estrus followed by 5 day heat detection and AI. Heifers were exposed to bulls (1 bull to 50 heifers) 10 days following the last AI for 60 days. Transrectal ultrasonography was used to determined both AI conception rate 45 days after AI. Final pregnancy rate was determined 45 days after bull removal. Heifers were managed together during and after breeding on mixed upland grasses for the summer months.

A subset of pregnant heifers (n = 118) were used to measure individual ADG and DMI, to determine feed efficiency during late gestation. Only heifers that conceived AI were utilized to reduce variation in stage of gestation. Each year (Year 1 = 40; Year 2 = 38, Year 3 = 40) heifers were stratified by weight and winter development system (CR (959 ± 6 lb) or DL (985 ± 6 lb)) into pens and individually fed in a Calan Broadbent feeding system. In Year 1, heifer diets contained 90% grass hay (11 % CP; DM) and 10% supplement composed of wet distillers grains plus solubles/straw mixture (21.8 % CP; DM). Years 2 and 3, heifers received *ad libitum* grass hay and: no supplement; a distillers grain based supplement; or a dried corn gluten feed supplement. Supplements were formulated to be isonitrogenous (29% CP, DM) and isocaloric, but differed in undegradable intake protein. Individual feeding started with a 25-day training period, followed by an approximately 80-day trial. Feed offered was recorded daily and feed refusals were measured and recorded weekly, with BW recorded every 14 days. Data were analyzed using the MIXED and GLIMMIX procedures of SAS (SAS Inst., Inc., Cary, N.C.) with development system as the fixed effect and year as the random effect.

Results

Winter development system did not affect BW ($P = 0.38$) or ADG ($P = 0.47$) during winter treatment (Table 1). However, DL heifer BW was greater ($P < 0.01$) after the DL period, compared to CR heifers beginning in

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April and continued to be greater ($P = 0.05$) until final pregnancy was determined. Heifers developed on CR had lower ($P = 0.02$) BW at time of breeding with similar ($P \geq 0.43$) percent cycling, AI conception, AI pregnancy, and overall pregnancy rates compared to DL heifers. These findings agree with research conducted by Freetly et al. (*Journal of Animal Science*, 2001, 79:819-826) indicating reduction of harvested feeds can impact ADG without impacting subsequent reproductive performance. Heifers developed on CR had similar ($P \geq 0.32$) DMI, ADG, G:F, and residual feed intake compared to DL heifers, during individual 80 day feeding trial (Table 2). Heifers developed on CR had lower ($P = 0.03$) BW prior to calving. Although heifers developed on CR had reduced BW at the start of the breeding season and prior to calving, CR heifers had similar reproductive performance, feed efficiency, and ADG during late gestation.

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Table 1. Effect of winter heifer development on ADG and reproductive performance.

	Treatment[1]			
	DL	CR	SEM	*P*-value
n	150	149		
Initial BW, lb	546	543	10	0.81
Dec – Feb ADG[2], lb	0.42	0.22	0.28	0.47
BW after winter grazing, lb	590	566	32	0.38
Prebreeding BW, lb	737	640	23	< 0.01
Feb – April ADG[3], lb	2.27	1.14	0.23	0.07
Breeding BW, lb	773	691	20	0.02
April – May ADG[4], lb	1.09	1.54	0.22	0.29
First ultrasound BW, lb	824	772	26	0.04
June – July ADG[5], lb	1.04	1.67	0.19	0.08
Final pregnancy BW, lb	940	897	17	0.05
July – Sept ADG[6], lb	1.68	1.83	0.19	0.08
Cycling %	68	52	12	0.43
Synchronization %	89	91	3	0.60
Conceived to AI %	67	71	6	0.66
Pregnant to AI %	60	65	6	0.58
Pregnant %	93	93	2	0.86

[1]DL = heifers grazed winter range then fed in drylot; CR = heifers grazed corn residue then grazed winter range.
[2]ADG while grazing CR or grazing WR.
[3]ADG between winter development and prebreeding.
[4]ADG between prebreeding and breeding.
[5] ADG between breeding and first ultrasound.
[6]ADG between first ultrasound and final pregnancy diagnosis.

Table 2. Effect of winter heifer development on ADG and feed efficiency during late gestation.

	Treatment[1]			
	DL	CR	SEM	*P*-value
n	58	60		
Initial BW, lb	986	959	6	< 0.01
Final BW, lb	1107	1085	7	0.03
ADG, lb	1.5	1.6	0.05	0.52
DMI, lb	23.0	22.7	0.24	0.42
RFI[2], lb	-0.64	-0.59	0.08	0.76
G:F	0.069	0.072	0.00	0.32

[1]DL = heifers grazed winter range then fed in drylot; CR = heifers grazed corn residue then grazed winter range.
[2]Residual Feed Intake = predicted DMI – actual DMI.