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Effect of Development System on Heifer Performance and Primiparous Heifer Grazing Behavior

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Summary

The effect of heifer development system on primiparous heifer performance grazing corn residue during late gestation was investigated. Weaned heifers grazing corn residue tended to have reduced final BW after corn residue grazing compared to heifers grazing winter range. However reproductive performance for the two treatments was similar. When grazing corn residue as pregnant heifers during late gestation, heifers developed on corn residue had improved ADG compared to drylot-developed heifers and tended to have increased ADG compared to winter range-developed heifers. Adaptation to corn residue grazing as a developing heifer improves primiparous heifer performance grazing corn residue during late gestation.

Introduction

The greatest cost of heifer development is feed. Reducing harvested forage use could decrease heifer development costs. However, previous reports indicate heifers developed on dormant forages have reduced BW through pregnancy diagnosis compared to drylot-developed heifers, although overall pregnancy rate is similar (*Journal of Animal Science*, 2011, 89:1595-1602). Larson et al. (*Journal of Animal Science*, 2011, 89:2365-2372) reported a trend for increased ADG for heifers developed on winter range (WR) compared to corn residue (CR) in one experiment, but no difference was reported in the second experiment. Variation in results were attributed to differences in location and winter precipitation in which CR heifers were offered hay during CR grazing due to snow cover.

Grazing habits can be developed through social interaction, with young or naïve animals learning what to eat from their contemporary groups (*Applied Animal Behaviour Science*, 1990, 25:25-33; *Journal of Chemical Ecology*, 1993, 19:313-323). Furthermore, it is suggested cattle naïve to corn residue grazing require an acclimation period (*1989 Nebraska Beef Cattle Report*, pp. 11-15; *1990 Nebraska Beef Cattle Report*, pp. 51-53). This study was conducted to evaluate the effect of heifer development systems on ADG and reproductive performance, and to determine the effects of winter development system on subsequent adaptation to corn residue in late gestation.

Procedure

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

Heifer Development Management

Over a four-year period, 382 weaned crossbred heifers (Red Angus × Simmental) were blocked by BW and randomly assigned to either graze WR throughout development or graze WR and CR. Winter-range heifers grazed upland Sandhills pastures continuously through the 221-day development period at the Gudmundsen Sandhills Laboratory (GSL), Whitman, Neb. Corn residue-developed heifers grazed WR 30 days prior to being shipped approximately 90 miles to graze CR for 82 days. Following CR grazing, heifers were returned to GSL and managed similarly with WR-developed heifers for approximately 109 days prior to the breeding season. All heifers received 1 lb/day of 28% CP supplement throughout development.

Prior to the breeding season, blood samples were collected 10 days apart via coccygeal venipuncture to determine plasma progesterone concentration. Heifers with plasma progesterone concentrations >1.0 ng/mL were considered pubertal. Estrus was synchronized with a single 5 mL injection of prostaglandin (PGF) administered 108 hours after bulls were exposed to heifers. Bulls remained with heifers for 45 days (1 bull to 25 heifers). Heifers remained on Sandhills upland range through final pregnancy diagnosis in September.

Additionally, heifers were developed at the West Central Research and Extension Center (WCREC), North Platte, Neb., and grazed WR and CR or WR and placed in the drylot (DL). Heifers were fed MGA for 14 days and administered a single injection of PGF 19 days after the end of MGA feeding. Estrus detection was performed for five days following PGF administration and AI performed approximately 12 hours after standing estrus. Approximately 10 days following the last day of AI, heifers were exposed to bulls (1 bull to 50 heifers) for 60 days.

Primiparous Heifer Management

A subset of pregnant heifers from GSL (n = 200) and WCREC (n = 214) were blocked by weight and assigned to one of three CR fields based on previous development system: 1) a naïve group composed of WR- and DL-developed heifers with no previous CR grazing exposure, 2) a group developed on CR, and 3) a mixture of WR-, DL-, and CR-developed heifers. Heifers were transported to corn fields and grazed approximately 82 and 79 days for GSL and WCREC heifers, respectively, based on CR availability over the four years. While grazing, all heifers received the equivalent of 1 lb/day of 28% CP supplement three times weekly.

Table 1. Effect of winter heifer development system on ADG and reproduction in beef replacement heifers[1].

Item	CR[2]	WR[3]	SEM	*P*-value
n	192	190		
Initial BW, lb	479	481	7	0.71
Final BW, lb	517	533	11	0.09
Pre-breeding BW, lb	631	639	5	0.27
Pregnancy diagnosis BW, lb	786	794	4	0.28
Pregnancy diagnosis BCS	5.9	5.9	0.1	0.45
ADG, lb/day				
Winter grazing[4]	0.43	0.60	0.10	0.11
Pre-breeding[5]	0.82	0.84	0.07	0.51
Summer[6]	1.64	1.64	0.11	0.97
Range[7]	1.41	1.35	0.05	0.17
Cycling[8], %	47	43	6	0.41
Pregnancy rate, %	82	86	3	0.29

[1]Heifers developed at Gudmundsen Sandhills Laboratory Whitman, Neb.
[2]CR= heifers were developed grazing winter range 30 days, then corn residue 82 days and upland range 109 days and offered the equivalent of 1 lb/day 28% CP supplement three times per week.
[3]WR= heifers were developed grazing winter range 221 days and offered the equivalent of 1 lb/day 28% CP supplement three times per week.
[4]ADG while heifers grazed CR or WR.
[5]ADG in the period between weaning and the beginning of the breeding season.
[6]ADG in the period between the beginning of the breeding season and pregnancy detection.
[7]ADG in the period between CR removal and pregnancy detection.
[8]Considered cycling if blood serum progesterone concentrations were >1 ng/mL.

Table 2. Effects of heifer development system on ADG while grazing corn residue during late gestation[1].

Item	CR[2]	WR[3]	SEM	*P*-value
n	99	101		
Initial BW, lb	862	867	13	0.68
Final BW, lb	932	921	14	0.40
Initial BCS	5.4	5.4	0.1	0.16
Final BCS	5.3	5.2	0.1	0.24
BCS change	-0.17	-0.16	0.13	0.84
ADG, lb/day	0.95	0.74	0.17	0.07

[1]Heifers developed at Gudmundsen Sandhills Laboratory Whitman, Neb.
[2]CR= heifers were developed grazing winter range 30 days, then corn residue 82 days and upland range 109 days and offered the equivalent of 1 lb/day 28% CP supplement three times per week.
[3]WR= heifers were developed grazing winter range 221 days and offered the equivalent of 1 lb/day 28% CP supplement three times per week.

Statistical Analysis

Data were analyzed utilizing the MIXED and GLIMMIX procedures of SAS. Heifers were developed at two locations and treatments repeated four years. Year was considered the experimental unit, with development treatment the fixed effect. Year was also included as a random effect in the model. A *P*-value ≤ 0.05 was considered significant.

Results

Heifer Development Performance

Performance data for heifers developed at GSL are reported in Table 1. Final BW tended ($P = 0.09$) to be greater for WR-developed heifers compared to CR-developed heifers (533 vs. 517 ± 11 lb) after the 89 day CR grazing period. However, pre-breeding BW was similar for CR and WR heifers. Larson et al. (*Journal of Animal Science*, 2011, 89:2365-2372) reported similar findings, utilizing the same cow herd, with increased final BW after the CR grazing period for WR compared to CR-grazed heifers. Furthermore, WR heifer pre-breeding BW tended to be greater compared to CR-developed heifers, whereas in the current study pre-breeding BW did not differ. It has been reported that cattle grazing CR require an adaptation period (*1989 Nebraska Beef Cattle Report*, pp. 11-15; *1990 Nebraska Beef Cattle Report*, pp. 51-53). Winter range-developed heifers remained at GSL throughout the development period and did not need to adapt to new forages and grazing behaviors. These factors likely contributed to heavier BW in WR-developed heifers compared to CR heifers.

Although there was a tendency ($P = 0.11$) for ADG to be greater for WR heifers developed at GSL while CR heifers grazed CR, there were no differences in ADG while both WR and CR grazed WR prior to the beginning of the breeding season. Furthermore, the proportion of heifers attaining puberty prior to the breeding season and overall pregnancy rates were similar between WR and CR heifers. Heifer development data for WCREC heifers are reported in the *2013 Nebraska Beef Cattle Report*, pp. 5-7.

Primiparous Heifer Performance

There were no differences in primiparous heifer performance based on CR grazing groups from GSL or WCREC, thus data are reported based on heifer development system (WR vs. CR and CR vs. DL, respectively). There was no difference in initial or final BW between CR- and WR-developed heifers from GSL grazing CR during late pregnancy (Table 2). However, initial BW was 59 lb (± 8 lb) greater ($P = 0.01$) for DL compared to CR heifers developed at WCREC and final BW tended to be

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greater (1,033 vs. 1,000 ± 26 lb; P = 0.06) for DL compared to CR heifers (Table 3). Average daily gain was two times greater (P = 0.03) for CR compared to DL heifers while grazing CR as pregnant heifers (Table 3). Similarly, there was a trend (P = 0.07) for increased ADG for CR-compared to WR-developed heifers grazing CR (Table 3). Both DL- and WR-developed heifers were naïve to CR grazing as pregnant heifers, whereas CR heifers grazed CR during development. Reduced ADG in DL- and WR-developed heifers is likely due to increased adaptation time to grazing CR required by naïve cattle placed on CR (*1989 Nebraska Beef Cattle Report*, pp. 11-15, *1990 Nebraska Beef Cattle Report*, pp. 51-53).

Developing heifers on CR tended to reduce BW at the end of the grazing period compared to WR-developed heifers developed at GSL; however, reproductive performance was similar between treatments. Furthermore, grazing heifers on CR during development improves ADG of primiparous heifers placed on CR during late gestation compared to DL-developed heifers, and it tends to improve ADG of CR-developed heifers compared to WR-developed heifers supporting the hypothesis of a learned effect for grazing CR.

Table 3. Effect of heifer development system on ADG while grazing corn residue during late gestation[1].

Item	CR[2]	DL[3]	SEM	*P*-value
n	107	107		
Initial BW, lb	945	1004	8	0.01
Final BW, lb	1000	1033	26	0.06
ADG, lb/day	0.66	0.32	0.29	0.03

[1]Heifers developed at West Central Research and Extension Center North Platte, Neb.
[2]CR= heifers were developed grazing dormant pastures 33 days, corn residue 79 days, dormant winter pastures 66 days and were offered the equivalent of 1 lb/day 28% CP supplement three times per week prior to entering the drylot 40 days before AI.
[3]DL= heifers were developed grazing dormant pastures 98 days and were offered the equivalent of 1 lb/day 28% CP supplement three times per week prior to entering the drylot 112 days before AI.

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