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Impact of Heifer Development System in Two Different Breeding Seasons

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Summary with Implications

Replacement heifers from March and May calving herds were offered ad libitum meadow hay and 4 lb/d supplement or grazed meadow and offered 1 lb/d supplement from mid-January to mid-April. Heifers fed hay gained more during the treatment; however, heifers grazing meadow experienced compensatory gain, resulting in similar body weight at pregnancy diagnosis in both calving herds. Pregnancy rates were similar between treatment groups in March and May heifers. A reduced input winter management system is a viable option to maintain pregnancy rates in early and late summer breeding seasons.

Introduction

Traditional recommendations suggest heifers reach 55 to 65% of mature body weight (BW) at the time of breeding. Due to the cost of retaining replacement heifers, more efforts have been made to devise economical methods of developing heifers. Previous studies have indicated heifers developed to lower target BW have comparable reproductive performance to heifers developed in higher input systems. Furthermore, it has been reported heifers fed to 51% vs. 57% mature BW showed no difference in puberty attainment. However, heifers developed on corn residue had a reduced percentage that reached puberty compared with winter range or drylot developed heifers. Therefore, the objective of the current study was to determine the impact of heifer development system on subsequent growth and reproductive performance in early and late summer breeding seasons.

Procedure

A 4-yr study was conducted at the Gudmundsen Sandhills Laboratory (GSL), Whitman, NE, that utilized replacement heifers from 2 calving seasons. March-born (n = 225) and May-born (n = 258), crossbred (5/8 Red Angus, 3/8 Continental) heifers were stratified by BW and randomly assigned to 1 of 2 post-weaning nutritional treatments (2 pastures·treatment^{-1}·year^{-1}) from mid-January to mid-April. Heifers were offered ad libitum meadow hay (HAY) and 4 lb/d (29% CP, DM) supplement or allowed to graze meadow (MDW) and offered 1 lb/d of the same supplement. Prior to and following treatment, heifers were managed together within their respective breeding group. Prior to each breeding season, 2 blood samples were collected 10 d apart to determine pubertal status. Heifers with plasma progesterone concentrations greater than 1 ng/mL at either collection were considered pubertal. Heifers were synchronized with a single $PGF_{2\alpha}$ injection 5 d after being placed with bulls for a 45 d breeding season. Pregnancy diagnosis was conducted via transrectal ultrasonography 40 d following bull removal.

Statistical Analysis

Data were analyzed using the GLIMMIX procedure of SAS (SAS Institute, Inc., Cary, N.C.), evaluating year, treatment, and year × treatment. The proportions of pubertal and pregnant heifers were analyzed using an odds ratio. Least squared means and SE of the proportion of pubertal and pregnant heifers by treatment were obtained using the ILINK function.

Results

March-born Gain and Reproductive Performance

March-born HAY heifers had greater ($P = 0.01$) ADG during the treatment period than MDW heifers (Table 1). However, following treatment, MDW heifers tended ($P = 0.07$) to have a greater ADG compared with HAY heifers. Summer ADG (May 22 to Sept. 10) was similar ($P = 0.12$) between treatments. Significant year effects are noted on summer ADG among heifers developed in 2012 compared with other development years, presumably due to the severe drought. Post-treatment and prebreeding BW was greater ($P = 0.02$) for HAY heifers. At pregnancy diagnosis, HAY heifers tended ($P = 0.06$) to have greater BW compared with MDW heifers. Percent of mature BW prior to the breeding season was greater ($P = 0.02$) for HAY compared with MDW. Pubertal status prior to breeding was not different ($P = 0.51$) between treatments. Furthermore, pregnancy rates were similar for HAY and MDW heifers ($P = 0.97$, 88 ± 4%). Calving rate and the proportion of heifers that calved within the first 21 d was also similar ($P \geq 0.54$) between treatments.

May-born Gain and Reproductive Performance

Data for BW gain and reproductive performance on May-born heifers are presented in Table 2. Similar to March-born heifers, May-born heifers on HAY had greater ($P = 0.01$) ADG during the treatment period. Spring and summer ADG was greater ($P = 0.03$) for MDW heifers, due to a compensatory gain effect. Post-treatment and pre-breeding BW was greater ($P = 0.02$) for HAY heifers compared with MDW heifers. At pregnancy diagnosis, BW was similar ($P = 0.16$) between treatments. Percent of mature BW prior to the breeding season was greater ($P = 0.02$) for

Table 1. Effect of over-winter treatment on developing March-born heifer gain and reproductive performance

	Development Year						Treatment			
Item	2012	2013	2014	2015	SEM	*P*-value	Hay[1]	MDW[2]	SEM	*P*-value
n	50	50	101	24			113	112		
ADG										
Treatment ADG,[3] lb/d	1.37	1.43	1.57	1.28	0.11	0.42	1.70	1.12	0.07	0.01
Spring ADG,[4] lb/d	2.03^{x}	0.66^{xy}	0.33^{y}	0.31^{y}	0.31	0.06	0.46	1.21	0.20	0.07
Summer ADG,[5] lb/d	0.60^{b}	1.37^{a}	1.23^{a}	1.48^{a}	0.06	<0.01	1.12	1.21	0.03	0.12
Body Weight										
Weaning BW, lb	425^{b}	412^{b}	467^{a}	463^{ab}	9	0.01	443	441	4	0.86
Post-treatment BW, lb	644^{yz}	639^{z}	697^{x}	648^{xz}	13	0.07	683	631	8	0.02
Pre-breeding BW,[6] lb	701^{ab}	664^{b}	712^{a}	677^{ab}	11	0.049	705	672	7	0.02
Percent of Mature BW,[7] %	57^{ab}	54^{b}	58^{a}	55^{ab}	1	0.049	58	55	1	0.02
Pregnancy Diagnosis BW, lb	767^{b}	816^{ab}	847^{a}	851^{a}	12	0.02	831	809	6	0.06
Pubertal,[8] %	66^{a}	30^{b}	68^{a}	54^{ab}	7	<0.01	53	57	5	0.51
Pregnancy Rate, %	92	82	84	96	7	0.21	88	88	4	0.97
Calving rate, %	90	80	82	—	6	0.36	86	83	4	0.54
Calved in first 21 d, %	80	75	78	—	7	0.83	78	78	5	0.98

[1]HAY = heifers received ad libitum hay and 4 lb/d supplement from Jan. 15 to April 15.
[2]MDW = heifers grazed meadow and received 1 lb/d supplement from Jan. 15 to April 15.
[3]Treatment ADG from Jan. 16 to April 22 (96 d), includes the treatment period.
[4]Spring ADG from April 22 to May 22 (30 d).
[5]Summer ADG from May 22 to Sept 10 (111 d).
[6]Pre-breeding BW determined May 22.
[7]Percent of mature BW at breeding based on mature cow size of 1,218 lb.
[8]Considered pubertal if blood serum progesterone concentration > 1 ng/mL.
[a,b,c] For Development Year, means in a row with different superscripts are different ($P \leq 0.05$).
[x,y,z] For Development Year, means in a row with different superscripts are different ($0.05 \leq P < 0.1$).

Table 2. Effect of over-winter treatment on developing May-born heifer gain and reproductive performance

	Development Year						Treatment			
Item	2012	2013	2014	2015	SEM	*P*-value	HAY[1]	MDW[2]	SEM	*P*-value
n	66	65	68	59			128	130		
ADG										
Treatment ADG,[3] lb/d	1.17^{xz}	0.86^{yz}	1.10^{xz}	1.41^{x}	0.09	0.09	1.39	0.86	0.07	0.01
Spring ADG,[4] lb/d	1.92^{b}	2.43^{a}	2.56^{a}	1.90^{b}	0.07	0.01	2.07	2.34	0.04	0.03
Summer ADG,[5] lb/d	0.68^{c}	0.84^{c}	1.76^{a}	1.34^{b}	0.07	<0.01	1.06	1.26	0.04	0.03
Body Weight										
Weaning BW, lb	434^{x}	434^{x}	406^{xy}	397^{y}	11	0.05	417	419	4	0.90
Post-Treatment BW, lb	580	522	527	540	13	0.13	575	514	9	0.02
Pre-breeding BW,[6] lb	697	672	686	666	11	0.32	703	657	7	0.02
Percent Mature BW,[7] %	57	55	56	55	1	0.32	58	54	1	0.02
Pregnancy Diagnosis BW, lb	765^{b}	772^{ab}	866^{a}	787^{ab}	13	0.05	811	785	11	0.16
Pubertal,[8] %	78^{a}	37^{b}	96^{a}	54^{b}	5	<0.01	72	60	4	0.02
Pregnancy Rate, %	71	62	70	76	6	0.38	72	68	4	0.44
Calving Rate, %	68	57	67	—	6	0.35	65	63	5	0.77
Calved in 1st 21 d, %	75	74	60	—	8	0.27	60	78	6	0.03

[1]HAY = heifers received ad libitum hay and 4 lb/d supplement from Jan. 15 to April 15.
[2]MDW = heifers grazed meadow and received 1 lb/d supplement from Jan. 15 to April 15.
[3]Treatment ADG from Jan. 5 to May 10 (125 d), includes the treatment period.
[4]Spring ADG from May 10 to July 9 (30 d).
[5]Summer ADG from July 9 to Sept 10 (63 d).
[6]Pre-breeding BW determined July 9.
[7]Percent of mature BW at breeding based on mature cow size of 1,218 lb.
[8]Considered pubertal if blood serum progesterone concentration > 1 ng/mL.
[a,b,c] For Development Year, means in a row with different superscripts are different ($P \leq 0.05$).
[x,y,z] For Development Year, means in a row with different superscripts are different ($0.05 \leq P < 0.1$).

HAY (58%) compared with MDW (54%). May-born heifers on HAY had greater (P = 0.02) pubertal status prior to breeding than MDW. Significant development year effects are noted for spring and summer ADG due to the severe drought year in 2012. Pregnancy and calving rates were similar ($P \geq 0.44$) between treatments, although, the proportion of heifers that calved in the first 21 d was greater ($P = 0.03$) for MDW compared with HAY.

Heifer development system did not impact pregnancy rate in the March or May replacement heifers; however, March heifer pregnancy rate was greater ($P < 0.01$) than in May (87 vs. 70 ± 3%). The lower pregnancy rate in May heifers may be due to declining forage quality and quantity during the breeding season.

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