1-1-2008

Effect of Pre-breeding Weight and MGA Supplementation on Heifer Performance

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Summary

Developing heifers to reach a target weight of 50% of mature body weight at the beginning of the breeding season is an effective method for reducing heifer development cost. Net costs to produce a bred yearling heifer and 2-year-old cow were lower when heifers were developed to 50% rather than 55% of mature body weight, regardless of breeding season length. Administration of oral progestin to heifers developed to 50% mature body weight prior to breeding did not affect reproductive performance during the first breeding season when heifers were exposed to bulls 13 days after the end of progestin treatment.

Introduction

It is commonly recommended heifers be developed to between 60% and 65% of mature body weight (MBW) prior to breeding. However, Funston and Deutscher (*Journal of Animal Science*, 2004, 82:3094-3099) reported similar pregnancy rates from the initial through fourth breeding season for heifers developed to reach either 53% or 58% of MBW prior to breeding as yearlings. Initial results and economic analyses from developing replacement heifers to 50% or 55% of MBW were reported previously (*2005 Nebraska Beef Report,* pp. 3-6). The majority of heifers that failed to become pregnant were acyclic at the beginning of the breeding season. Because the oral progestin, MGA, is known to induce cyclicity in prepubertal heifers, the objectives of this study were to: 1) determine the effects of developing heifers to a pre-breeding target weight of 50% or 55% of MBW, and 2) determine effects of supplementing heifers developed to 50% of MBW with progestin prior to breeding.

Procedure

Two experiments were conducted using crossbred MARC II (¼ each Angus, Hereford, Simmental, and Gelbvieh) x Husker Red (¾ Red Angus, ¼ Simmental or Gelbvieh) heifers at Gudmundsen Sandhills Laboratory (GSL), Whitman, Neb.

Experiment One

Two hundred sixty-one heifers (505 lb; n = 88, 90, and 83 in 2001, 2002, and 2003, respectively) were assigned randomly to development in intensive (INT; n = 119) or relaxed (RLX; n = 142) systems. Heifers in the INT system were developed to 55% of MBW before a 45-day breeding season. In the RLX system, heifers were developed to 50% MBW before a 60-day breeding season. An estimated MBW of 1,200 lb was used since the weight of mature cows (4 years old and up) in this herd the previous five years was 1,171 lb. In order to assure an adequate number of heifers would remain in the herd as 2 year olds, more heifers were developed and the breeding season extended for the RLX system because reduced heifer pregnancy rate was expected.

At the initiation of the trial each year, heifers were weighed two consecutive days, stratified by first day weight and birth date, and assigned randomly to treatment. Treatments were initiated Jan. 1, 2001, and Dec. 1 in 2002 and 2003. Heifers were placed in hay-feeding grounds, by treatment, for the winter feeding period and fed a diet consisting of meadow hay and protein supplement (*2005 Nebraska Beef Report,* pp. 3-6). Heifers were weighed monthly and feed amounts adjusted to obtain desired gains. At the end of the winter feeding period (May 15), heifers were weighed and body condition score (BCS) was determined. Blood samples were collected 10 days apart prior to initiation of the breeding season and progesterone concentration was analyzed to determine the number of heifers pubertal before the breeding season.

Heifers were maintained on native Sandhills upland range for breeding, beginning May 20 of each year. After 45 days of breeding season, INT heifers were removed from the breeding pasture while RLX heifers remained with bulls an additional 15 days. Sixty days after the end of the breeding season for RLX heifers (approximately Sept. 10), pregnancy diagnosis was performed via rectal palpation.

After pregnancy diagnosis, heifers were maintained as a single group on sub-irrigated meadow regrowth during fall (September through October). During the subsequent winter, bred heifers received 1.5 lb/head/day supplement and *ad libitum* access to meadow hay. Pre-calving BW and BCS were recorded approximately Feb. 15 each year and calving began approximately March 1. Calf birth BW was recorded within 24 hours of parturition.

After calving, primiparous cows were maintained on meadow hay and supplement until May 10, at which point they were placed on sub-irrigated meadow until June 5. Native upland Sandhills range was grazed for the remainder of the trial. Two-year-old cows were exposed to bulls for 60 days beginning June 5. In early September, cow rebreeding pregnancy diagnosis was performed and calves were weaned. Calf weaning BW and cow BW and BCS were recorded at this time.

Experiment Two

One hundred eighty-four heifers (474 lb; n = 104 and 80 in 2004 and 2005, respectively) were developed to achieve 50% MBW before a 45-day breeding season and were assigned randomly to control (CON; n = 103) or progestin treatment (MGA; n = 81). Heifers were managed in a common

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group except during progestin treatment. After weaning in late September until approximately Jan. 1 each year, heifers grazed subirrigated meadow regrowth and were supplemented with 1 lb/day of a 28% CP cube containing 62% dried distillers grains. Beginning approximately Jan. 1 each year, heifers were maintained in drylot and fed meadow hay *ad libitum* and 1 lb/day supplement. Heifers fed MGA received 0.5 mg/head/day MGA in supplement for 14 days, beginning 27 days prior to initiation of a 45-day breeding season. The CON heifers received similar supplement without MGA during this time. Heifers were moved to upland range at the beginning of the breeding season and remained on upland range pasture through October.

After the summer grazing period, heifers grazed corn crop residue and received 1 lb/day supplement from Nov. 1 to Feb. 22 each year. During the pre-calving period, heifers were allowed *ad libitum* access to meadow hay. After calving until early May, 1 lb/day supplement was fed in addition to free-choice meadow hay. Primiparous cows and calves grazed subirrigated meadows from early May until beginning of the second (60 day) breeding season on June 12 each year. Cow/calf pairs remained on native range throughout the remainder of the study.

Table 1. Growth, reproductive, and calf performance of heifers developed in intensive (INT) or relaxed (RLX) systems from treatment initiation through rebreeding as 2 year old cows.[a]

	RLX	INT	SEM	*P*-value
Data through first breeding season				
n	142	119		
Beginning BW, lb	505	505	7	0.99
Winter ADG, lb/day	0.75	1.19	0.04	<0.001
Pre-breeding wt., lb	611	679	15	<0.001
Pre-breeding BCS	5.2	5.7	0.1	<0.001
Pre-breeding proportion MBW, %	50.9	56.5	—	<0.001
Cycling at beginning of breeding season, %[b]	34.9	52.1	—	0.39
Pregnancy check BW, lb	827	847	33	0.006
Pregnancy check BCS	5.6	5.9	0.1	<0.001
Pregnancy rate, %	87.2	89.8	—	0.51
Proportion of nonpregnant heifers pre-pubertal prior to breeding season, %	78.9	46.8	—	0.07
Data from initial calving season through second breeding season				
Pre-calving BW, lb	955	990	31	<0.001
Pre-calving BCS	5.3	5.4	0.1	0.06
Calf birth date, Julian d	77	70	1	<0.001
Calf birth BW, lb	73	73	2	0.95
Calving difficulty, %[c]	31.3	24.7	—	0.18
Calf weaning BW, lb	428	439	9	0.07
Pregnancy diagnosis BW, lb	919	950	22	0.005
Pregnancy check BCS	5.07	5.16	0.09	0.10
Pregnancy rate, %	92.4	93.8	—	0.61
2-year old retention, %[d]	75.6	79.1	—	0.72

[a]ADG = average daily gain; BCS = body condition score; MBW = mature body weight.
[b]Proportion of heifers determined to have reached puberty as indicated by serum progesterone concentration > 1ng/ml prior to the initial breeding season.
[c]Proportion of heifers requiring assistance during calving.
[d]Proportion of heifers exposed to bulls during the initial breeding season that became pregnant as 2-year-old cows.

Results

Experiment One

Performance results from heifers from treatment initiation through second-calf conception are reported in Table 1. There was no difference (P = 0.99) in beginning weight (505 lb) between the two systems. There was a 68 lb difference in pre-breeding weight (P < 0.001) and 0.5 unit difference in pre-breeding BCS ($P <$ 0.001) between systems, due to the difference (0.44 lb/day; P < 0.001) in winter ADG. Targeted pre-breeding weight for both systems was based on expected MBW of 1,200 lb. Heifers in both systems exceeded their targeted pre-breeding weight, which resulted in RLX heifers averaging 51% and INT averaging 57% MBW prior to the initial breeding season.

The proportion of heifers pubertal prior to breeding did not differ (Table 1; $P = 0.39$) between the two systems. However, of heifers that failed to become pregnant, a greater proportion of ($P = 0.07$) RLX than INT heifers were pre-pubertal when the breeding season began. Interestingly, further characterization of nonpregnant heifers within each system revealed 79% (14 of 17) of nonpregnant RLX heifers (after a 60-day breeding season) but only 45% (5 of 11) of nonpregnant INT heifers (after a 45-day breeding season) were pre-pubertal at the start of the breeding season.

Weight at pregnancy diagnosis was still greater ($P = 0.006$) for INT heifers compared to RLX heifers; however, the difference was less than one-third seen at initiation of breeding (68 vs. 20 lb difference at beginning of breeding and pregnancy diagnosis, respectively). This indicates RLX heifers were able to compensate during summer grazing for some of the weight difference created by winter development system. A similar pattern was observed for BCS, with RLX heifers having lower ($P <$ 0.001) pre-breeding and pregnancy diagnosis BCS but gaining more condition throughout the summer than INT heifers. Pregnancy rate following the initial breeding season was not different ($P = 0.51$) between INT and RLX heifers and averaged 89% across systems.

Weight differences created by winter development system were maintained over the second wintering period; therefore, pre-calving weight was greater ($P < 0.001$) for INT than RLX heifers. Pre-calving weight difference was 35 lb, compared to 20 lb weight difference at pregnancy diagnosis. Pre-calving BCS was also greater ($P = 0.06$) for INT than RLX heifers. Average calving date was 7 days later ($P < 0.001$) for RLX than INT heifers, primarily due to the 15-day longer breeding season for RLX heifers. Neither calf birth weight ($P = 0.61$) nor the proportion of heifers requiring assistance at calving ($P = 0.31$) were different between systems. Calving rate during the initial calving season, based on the number of heifers exposed to bulls, was not affected ($P = 0.68$; data not shown) by development system.

In this study, RLX heifers calved 7

Table 2. **Growth, reproductive, and calf performance of heifers developed to 50% MBW with or without prebreeding progestin exposure.[a]**

	CON	MGA	SEM	*P*-value
Data through first breeding season				
n	103	81		
Pre-breeding wt., lb	617	619	42	0.55
Cycling at beginning of breeding season, %[b]	71.8	77.8	—	0.69
Pregnancy check BW, lb	833	840	49	0.47
Pregnancy check BCS	5.8	5.9	0.2	0.13
Pregnancy rate, %	91.3	88.9	—	0.69
Data from initial calving season through second breeding season				
Pre-calving BW, lb	926	939	15	0.22
Pre-calving BCS	5.3	5.3	0.1	0.34
Calf birth date, Julian d	66	66	1	0.69
Calf birth BW, lb	71	73	2	0.52
Calving difficulty, %[c]	38.4	32.0	—	0.56
Calf weaning BW, lb	425	434	15	0.28
Pregnancy diagnosis BW, lb	939	944	9	0.78
Pregnancy check BCS	5.2	5.2	0.1	0.44
Pregnancy rate, %	93.3	88.0	—	0.03

[a]ADG = average daily gain; BCS = body condition score; MBW = mature body weight.
[b]Proportion of heifers determined to have reached puberty as indicated by serum progesterone concentration > 1ng/ml prior to the initial breeding season.
[c]Proportion of heifers requiring assistance during calving.

days later than INT heifers. Funston and Deutscher (*Journal of Animal Science*, 2004 82:3094-3099) reported no difference in calving date following a 45-day breeding season between heifers developed to 53% or 58% MBW prior to breeding. Retrospective analysis considering only RLX heifers bred within the first 45 days of the breeding season, based on days pregnant at pregnancy diagnosis, revealed similar ($P = 0.20$; data not shown) 45-day pregnancy rates for INT (90%) and RLX (78%) systems. During the extended 15 day breeding period (from 45 to 60 days) for the RLX heifers, an additional 9% of heifers became pregnant.

Calf weaning weights were greater (Table 1; $P = 0.07$) for INT than RLX heifers; however, pre-weaning calf weight per day of age (WDA) was not affected ($P = 0.38$; data not shown) by heifer development system. Weaning rate, as a proportion of heifers exposed for breeding, was similar ($P = 0.67$; data not shown) between treatments. Cow body weights and BCS at weaning (Table 1; $P = 0.005$) and second pregnancy diagnosis ($P = 0.10$) were greater for INT than RLX cows. However, second-calf pregnancy rates were similar ($P = 0.61$) between treatments (91% vs. 92% for RLX and INT, respectively). Additionally, the proportion of heifers exposed for breeding as yearlings remaining in the herd as pregnant 2 year olds was similar ($P = 0.72$) between systems averaging 76% and 79% for the RLX and INT systems, respectively.

Experiment Two

Target pre-breeding weight for heifers in Experiment 2 was 600 lb, or 50% predicted MBW. Pre-breeding weights were similar (Table 2; P = 0.55) for CON and MGA heifers, and averaged 617 lb, slightly greater than target breeding weight. As a result, heifers in Experiment 2 were developed to 52% MBW at the time of breeding, based on an expected MBW of 1,200 lb. Weight and BCS at pregnancy diagnosis were similar ($P = 0.47$ and $P = 0.13$, respectively) for CON and MGA heifers.

Pregnancy rates were 91% for CON and 89% for MGA ($P = 0.69$). Pre-breeding treatment with the oral progestin MGA did not affect the proportion of heifers achieving puberty prior to breeding or becoming pregnant within a 45 day breeding season in Experiment 2. These results were surprising because a greater proportion of nonpregnant RLX heifers than INT heifers were pre-pubertal in Experiment 1. In Experiment 2, heifers were exposed to bulls beginning 13 days after completion of MGA feeding. Due to estrous synchronization, heifers fed MGA should not have displayed estrus until approximately 5 to 10 days after beginning of breeding. Therefore, no differences were observed in pregnancy rate, calving date, or calf weaning weight in heifers developed to 52% MBW and administered MGA because a high percentage of CON heifers were pubertal before the breeding season and due to timing of MGA withdrawal relative to beginning of the breeding season.

Pre-calving weight (Table 2; $P = 0.22$) and BCS ($P = 0.34$) were similar between treatments. Heifer development treatment did not affect ($P > 0.50$) calf birth date, birth weight, or the proportion of heifers requiring assistance during calving. At weaning, similar calf weights ($P = 0.28$) were achieved by calves from CON and MGA cows. Furthermore, cow weight ($P = 0.28$) and BCS ($P = 0.78$) at second pregnancy diagnosis were similar for CON and MGA cows. However, second breeding season pregnancy rates were greater ($P = 0.03$; 93% vs. 88 %) for CON than MGA cows.

Conclusions

Developing heifers to reach a target weight of 50% MBW is an effective method for reducing heifer development cost (*2005 Nebraska Beef Report,* pp. 3-6), and extending the breeding season beyond 45 days for lighter weight heifers allows first-calf pregnancy rates to equal those of heifers heavier at the initiation of breeding. Cost per pregnant 2-year-old cow is also reduced, despite later average calving date and lighter weaning weights. The later calving date does not affect the ability of heifers to re-breed during the second breeding season. Administration of oral progestin to heifers developed to 52% MBW prior to breeding did not affect reproductive performance during the first breeding season when a high percentage of heifers were pubertal and when MGA-fed heifers were exposed to bulls 13 days after the end of progestin treatment.

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