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Evaluation of prior grazing experience on reproductive performance in beef heifers

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ABSTRACT

An important part of any production system is the reproductive performance associated with replacement heifers. In the majority of beef operations, heifers are moved to a drylot for a period of time to be weaned and then must again be moved to a forage grazing situation. Therefore, experiments were conducted to determine whether previous grazing experience affected performance and conception rates. In Exp. 1, beef heifers were moved to a forage grazing situation after a 44-d weaning period in the drylot [EXPER (experienced); n = 33] or were moved to a forage grazing situation 27 d before the start of the breeding season [NIV (naïve); n = 32]. In Exp. 2, beef heifers were moved to a forage grazing situation before the breeding season (EXPER; n = 207) or were moved to a forage grazing situation immediately following AI (NIV; n = 214). In Exp. 1, after being moved, NIV heifers lost 1.6 ± 0.08 kg/d for the first week they were turned to grass compared with EXPER heifers that gained 0.88 ± 0.08 kg/d ($P < 0.0001$). This resulted in a linear ($P < 0.01$) BW gain among EXPER heifers and a quadratic ($P = 0.04$) BW gain among NIV heifers. In Exp. 2, EXPER heifers had increased ADG ($P < 0.01$; 0.58 ± 0.03 kg/d) from AI to pregnancy diagnosis and more ($P = 0.04$) became pregnant to AI (59.4%) compared with NIV heifers (0.21 ± 0.03 kg/d and 49.1%). In summary, transitioning naive heifers to pasture resulted in BW loss during the first week after movement, and if this transition occurred immediately following AI, pregnancy success to AI was reduced.

Key words: heifer development, conception rate

INTRODUCTION

An important part of any cow–calf operation is the reproductive performance of the developing heifers. Reproductive failure costs the US beef and dairy industry approximately $1 billion annually (Bellows et al., 2002), and the economic value of reproduction for commercial beef producers was reported to be 5 times greater than that of calf growth (Trenkle and Willham, 1977).

Heifer development often involves placing heifers into a confined feeding situation from weaning until the following breeding season. Development of heifers in a confined environment allows for increased management to ensure proper growth from weaning to the start of the breeding season. However, at the start of the breeding season, heifers are usually moved to a forage grazing situation. This change from a confined feeding situation to a grazing situation could have an effect on reproductive efficiency through changes in nutritional intake.

Nutritional intake may change the uterine environment through changes to the components in uterine secretions (see review by Foxcroft, 1997). More specifically, heifers fed only 85% maintenance requirements of energy and protein had reduced embryo development on d 3 and 8 after insemination compared with heifers fed 100% maintenance (Hill et al., 1970), indicating decreased embryonic growth. Therefore, undernutrition can have an effect on embryo survival and the ability to conceive or maintain a pregnancy during a defined breeding season (Randel, 1990; Leroy et al., 2008a,b).

Heifers that are developed from weaning to breeding in a drylot situation may experience a period of negative energy balance immediately following being moved to a grazing situation because grazing skills and dietary habits are learned early in life (Provenza and Balph, 1988). This learning resulted in the development of motor skills necessary to harvest and ingest forages (Provenza and Balph, 1987) and allow animals to

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increase their consumption of forage (Lyford, 1988). These skills learned between weaning and breeding have been reported to carry through to the next grazing season (Olson et al., 1992). However, following a conventional weaning situation in which heifers are moved to a drylot for a period of time to be weaned, all heifers must again be move to a forage grazing situation and these grazing skills will have to be learned. Therefore, moving heifers to a forage grazing situation immediately following insemination could affect embryonic survival. Therefore, the objectives of these projects were to determine how prior grazing experience affected performance and pregnancy success to AI.

MATERIALS AND METHODS

Exp. 1

Experimental Design. All procedures were approved by the South Dakota State University Animal Care and Use Committee. Sixty-five nulliparous, predominately Angus crossbred beef heifers at the Antelope Range and Livestock Research Station, located near Buffalo, South Dakota, were blocked by age and randomly allotted to treatment. Treatments were movement to a forage grazing situation following a 44-d weaning period [**EXPER** (experienced); n = 33] or movement to a forage grazing situation 27 d (167 d after the weaning period) before the start of the breeding season [**NIV** (naïve); n = 32]. During the weaning period heifers were fed a weaning ration in the drylot consisting of ad libitum grass and alfalfa hay (consumption was approximately 2.26 kg/d of DM of each per animal) and 1.6 kg (DM) of a conventional supplement for 44 d (Table 1). Following the weaning period EXPER heifers were moved to native range and supplemented with dried distillers grains plus solubles (loose meal; Table 1). The dried distillers grains plus solubles were fed daily in feed bunks at a rate of 0.82 to 2.9 kg/d per animal (DM basis). The feeding rate was adjusted over the winter to account for heifer size, weather conditions, expected forage quality, and observed interim performance. The feeding rate was established to result in heifers weighing approximately 65% of mature BW at the start of the breeding season. The NIV heifers remained in the drylot and were placed on a diet consisting of ad libitum access to hay (grass–alfalfa mix; 8.1% CP, 66% NDF; DM basis) and a conventional supplement based on wheat middlings and sunflower meal (Table 1) fed at a rate of 1.2 to 1.6 kg/d per animal (DM basis). The supplement was fed at a rate to achieve approximately 65% of mature BW at the start of breeding. Supplementation was terminated in both treatments on May 18 (d 0) when all the heifers were moved to native range as a single group.

Heifer Performance. Heifers were weighed at the end of the weaning period, when moved to forage as a single group (d 0), 7 d after being moved to spring forage (d 7), at the initiation of the breeding season (d 27), and at time of pregnancy determination (d 88 and 176). All weights were measured after removal from feed and water for 12 h.

Reproductive Efficiency. All heifers were exposed to bulls as a single group beginning on June 14 (d 27) for a 60-d breeding season. Five days after bulls were placed with the heifers (d 32), all heifers received an injection of $PGF_{2\alpha}$ (25 mg i.m. ProstaMate, Teva Animal Health, Saint Joseph, MO) to synchronize estrus. Bulls were removed 5 d later (d 37) for a 14-d period so that synchronized conception rates could be determined. Synchronized conception rates were determined by transrectal ultrasonography 51 d after the synchronization period (d 88). Overall pregnancy was determined by rectal palpation 99 d after the breeding season.

Blood Samples and RIA. Two blood samples were collected 14 d apart before the start of estrous synchronization to determine pubertal status (d 13 and 27). Blood was allowed to coagulate at room temperature for 1 h, stored at 4°C for 24 h, and centrifuged at 1,200 × *g* for 30 min at 4°C. Serum was harvested and stored at −20°C until analysis was performed by RIA. Circulating concentrations of progesterone were analyzed in all serum samples by RIA using methodology described by Engel et al. (2008). Intra- and interassay coefficients of variation for progesterone assays were 5.5 and 6.86%, respectively, and assay sensitivity was 0.4 ng/mL. Heifers were considered prepubertal if serum concentrations of progesterone were <1 ng/mL in both of the blood samples and pubertal if serum concentrations of progesterone were >1 ng/mL in either or both of the blood samples.

Exp. 2

Experimental Design. This experiment was conducted in 5 replicates on 421 heifers. In replicates 1,

Table 1. Exp. 1. Nutrient analysis (DM basis) in dried distillers grains plus solubles (DDGS) and conventional supplement

Item	DDGS	Conventional supplement
CP, %	29.7	31.0
Fat, %	11.6	3.28
TDN, %	84.6	69.59
Calcium, %	0.06	0.37
Phosphorus, %	0.79	1.11
Potassium, %	1.09	1.31
Magnesium, %	0.34	0.45
Copper, mg/kg	6	61
Zinc, mg/kg	99	112
Manganese, mg/kg	18	56