

Effect of calving period on beef cow longevity and lifetime productivity in western Canada

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INTRODUCTION

The profitability and sustainability of a cow–calf operation are dependent on the longevity of each breeding female and the production of a live calf every year. If a heifer calves earlier in the calving season (first 21-day period), they have more time to heal and resume cycling before the next breeding season commences in order to maintain a 365-d calving interval. A limited number of reports are available regarding the relationship between cow calving time as a heifer and subsequent longevity and production as cows (Burriss and Priode, 1958; Wiltbank, 1970; Lesmeister et al., 1973; Sprott, 2000; Funston et al., 2012; Cushman et al., 2013). Burriss and Priode (1958) showed that cows calving late in 1 yr tended to continue that trend, calving late in the following year or coming up open. Similarly, Wiltbank (1970) stressed the importance of heifers conceiving early in their first breeding in order to have good lifetime production performance and was one of the first to suggest calving heifers earlier than the rest of the herd given their longer postpartum interval (80–100 d vs. 50–60 d for cows). Lesmeister et al. (1973) demonstrated the importance of breeding heifers to calve early to maintain calving period throughout their time

in the herd and that heifers that calve early will produce more kilograms of calf in their lifetime than heifers that calve later in their first calving. Sprott (2000) analyzed calving records from five Texan herds to show that average lifetime calf weight is highest for females whose first calf was born in the first 21 d of the calving season. Similarly, Funston et al. (2012) reviewed 13 years of production records from Gudmundsen Sandhills Laboratory and found calving period influenced a heifer's herd performance with heifers that were born in the first calving period having higher first conception rate, percentage calving in first 21 d, first calf weaning weight and second conception rate than heifers born in the second or third calving period. Furthermore, Cushman et al. (2013) showed that having heifers calve early in their first calving resulted in increased herd retention and the additional kilograms of calf weaned by an early-calving heifer equated to the production of an extra calf during her lifetime. The objective of this ongoing study is to investigate the influence of calving early as heifer on her lifetime reproductive performance and productivity using a western Canadian data set.

MATERIALS AND METHODS

Source of Data

Data were aggregated into a database from the Western Beef Development Centre's (WBDC;

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Saskatchewan, Canada) beef cattle research herd production records. The WBDC follows typical management practices of western Canada for beef heifer development, cow breeding, and nutrition, as described elsewhere (Krause et al., 2013; Lardner et al., 2014; Damiran et al., 2016). Data for the spring calving herd collected between 2001 and 2017 were used for this study. The breeding season at WBDC began approximately June 20 each year and lasted for ~65 days. Weaning occurred each year in late October (at ~160 d of age). Data were trimmed to remove heifers that produced a twin at any point during their life. Females sold or culled for non-breeding reasons (e.g., mothering, milk, conformation, temperament) were removed from the data set. Heifers were also eliminated from the data set if proper assignment to an initial calving group was not possible due to abortion, or birth of an abnormal or premature calf. The final data set for this study consisted of 211 Black Angus and Angus crossbred heifers born from 1999 to 2008.

Each female's calving date was assigned a number (Julian date) corresponding with calving span. Postpartum recovery period was estimated by subtracting 282 d (average gestation length) from the calving interval (Damiran et al., 2016). Two-year-old first-calf heifers were assigned to one of three 21-day calving periods based on the date their first calf was born. Each subsequent calf born to the cow was also assigned to a calving group (or period), but for analysis purposes the female remained in the group number assigned for her first parturition. For example, a cow that calved in period 2 as a heifer but then had her next three calves in period 3 was analyzed as a period 2 female. Average lifetime production was calculated as the mean production of all calves whose dams were classified in a particular calving group as heifers. Weaned calf revenue was calculated, \$/cow = Calf cumulative weaning BW, kg/cow \times WCP, \$/kg, where WCP = weaned 249.4 kg (550 lb) calf prices, over the last 9 years (2008–2017) in Saskatchewan, Canada, have averaged \$3.68/kg (CANFAX, 2017). All dollar values are in Canadian dollars.

Statistical Analysis

Data (heifer age of birth, Julian day of calving, calf birth weights, calving interval, calf weaning age and weight, adjusted 205-d weaning weight of all calves that survived until weaning, and longevity of cows) were analyzed using the MIXED procedure of SAS 9.2 (SAS, 2003). The model used for the analysis was: $Y_{ij} = \mu + T_i + e_{ij}$; where Y_{ij} was an observation of the dependent variable ij ; μ was the population mean for the variable; T_i was the fixed effect of the

contemporary heifer calving group (period 1, period 2, and period 3); and e_{ij} was the random error associated with the observation ij . Heifer was considered an experimental unit. For all statistical analyses, significance was declared at $P < 0.05$.

RESULTS AND DISCUSSION

Cow Retention and Longevity

As indicated previously, in this study, cows were culled or sold from the herd if they failed to become pregnant (e.g., open). Figure 1 depicts percentages of cows remaining in the herd over time out to ninth calving based on retention data. Retaining percentage of period 1 cows was 6.5–18.3% and 2.9–24.1% units greater than those of period 2 and period 3 cows, respectively. Thus, heifers that calve later at their first calving fail to remain in the herd as long as heifers that calve earlier (first 21 days) at their first calving. The results of this study agree with the previous findings (Cushman et al., 2013) in that having heifers calve early in their first calving would increase their retention in the herd.

The longevity of a beef female is important to the sustainability and profitability of any beef operation (Cushman et al., 2013). Increasing longevity by improving retention of females can increase herd size. Figure 2 presents influence of calving period on beef cow average longevity from WBDC. In this study, heifers that had their first calf during the first 21-day period of the calving season had increased ($P < 0.05$) longevity compared with heifers that calved in the second and third 21-day periods (7.2 ± 0.3 , 6.5 ± 0.4 , and 6.2 ± 0.4 yr for period 1, period 2, and period 3, respectively). However, no difference ($P > 0.05$) was observed between period 2 and period 3 groups in longevity. The reason for the obtained results on cow retention time and longevity can be explained as Bridges (2013) noted, if a heifer conceives late and subsequently calves late, she has less time from calving until the start of the subsequent breeding season, so she is more likely to be anestrous, or not having estrous cycle, at the start of the breeding season and will likely conceive late again in the second breeding season; this cycle continues to repeat until eventually she fails to conceive in a confined breeding period and is culled from the herd.

Effect of Initial Calving Group on Cow Lifetime Productivity

Effects of first calving period on a beef cow's lifetime productivity are presented in Table 1. When

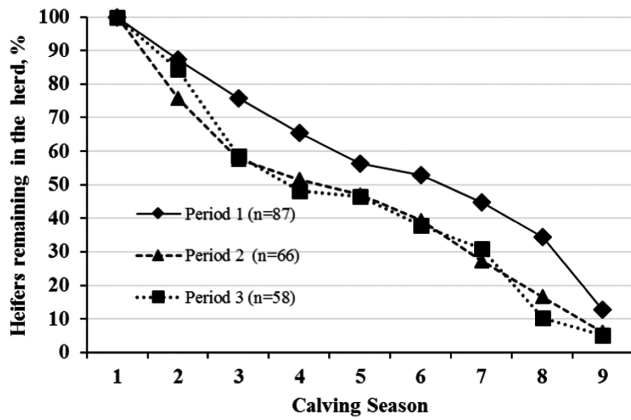


Figure 1. Analysis of the influence of calving period on herd survival from Western Beef Development Centre, Saskatchewan, Canada. Results from Angus and Angus crossbred heifers ($n = 211$) from WBDC. Period 1 = calved in the first 21 days; Period 2 = calved in the second 21 days; Period 3 = calved in the third 21 days and after as heifer.

production data for each year were pooled, cow groups were different from each other ($P < 0.05$) in calving date; and were $107 (\pm 0.9)$, $110 (\pm 1.1)$, and $119 (\pm 1.3)$ d for period 1, period 2, and period 3 cows, respectively. This result indicated that the females that calved early as heifers tended to calve earlier throughout the remainder of their productive lives than the females that calved later in their first calving. The interval between postpartum estrus and beginning of pregnancy is the other component of the reproductive cycle. In this study, period 1 (95 d) and period 2 (90 d) cows were similar ($P > 0.05$) in the length of estimated postpartum interval; both groups were greater ($P < 0.01$) than period 3 cows (76 d). A shorter calving interval was also observed for period 3 (late calving) females. These two results may seem counter intuitive at first, but can be explained by fall out with a defined 65 d breeding season. Only the most reproductive females from period 3 remained in the study (the ones with short postpartum intervals), while females in periods 1 and 2 had the leeway to not conceive in their first (and even second) cycle of the breeding season and still end up pregnant at the end of the breeding season. As cows (2nd through 9th calving), estimated postpartum interval did not differ ($P > 0.05$; data not shown) by heifer calving group and averaged ~ 81 d (period 3 group) to 87 d (period 1 group).

In beef cattle, prolonged postpartum intervals can decrease the proportion of cows that are cycling at the start of the breeding season thereby decreasing pregnancy rates and kilogram of calf weaned per cow exposed during a breeding season. Postpartum interval length is influenced by several factors, including suckling, nutrition, age, dystocia, genetic variation, stress, and disease (Short et al.,

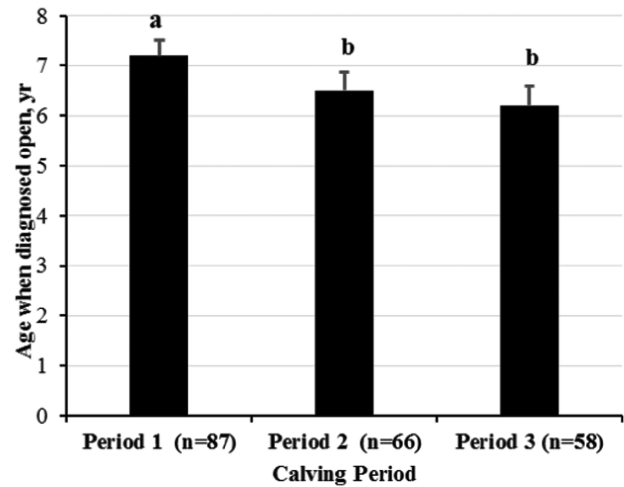


Figure 2. Influence of calving period on average lifetime in herd from Western Beef Development Centre, Saskatchewan, Canada. Period 1 = calved in the first 21 days; Period 2 = calved between day 22 and 43; Period 3 = calved after day 44. ^{a,b}Bars with different superscripts are different at $P < 0.05$.

1990; Yavas and Walton, 2000). In addition, postpartum interval to first behavioral estrus decreases as cows calve later in the calving season and varies with breed (Short et al., 1990; Cushman et al., 2007), but averages ~ 62 d (Cushman et al., 2007). When lifetime productivity for each animal was pooled, calf actual average weaning weights were 15 kg heavier ($P < 0.01$) and average adjusted 205-d weaning weights were 9 kg heavier ($P < 0.01$) for period 1 and 2 cows (Table 1) than period 3 cows. Calf gain to weaning (ADG) was lower ($P < 0.05$) for the calves from period 3 cows (1.05 kg/d) than for the calves born to period 1 (1.08 kg/d) and period 2 cows (1.09 kg/d) (Table 1).

Reproductive performance is one of the biggest factors affecting beef cow production efficiency and profitability. Reproduction has been estimated to be three to nine times more influential on profitability than other production traits (Melton, 1995). Average lifetime calves weaned for WBDC cows that calved in the first, second, and third 21-day periods was 5.4 ± 0.32 , 4.5 ± 0.37 , and 4.2 ± 0.39 /cow, respectively (Table 1). Due to combined effects of greater average number of calves weaned over lifetime and actual calf weaning weights, cows that had their first calf during the first 21-day period had ($P < 0.01$) greater total weight weaned (1157.1 ± 70.0 kg) compared with heifers that calved in the second (946.6 ± 82.1 kg) or third (841.4 ± 87.6 kg) 21-d period (Table 1).

One of the most important findings of this study was females that calve early when they are heifers can produce more cumulative kilograms of weaned calf in their lifetime than females that calved later (after

Table 1. Effect of first calving period on beef cow lifetime productivity

Item	Calving period ¹			SEM ²	P value
	Period 1	Period 2	Period 3		
Initial heifer, <i>n</i>	87	66	58		
Age at first calving, d	731 ^a	751 ^b	778 ^c	3.6	<0.01
Calving interval, d	376 ^a	372 ^a	358 ^b	1.8	<0.01
Postpartum interval, ³ d	95 ^a	90 ^a	76 ^b	2.1	<0.01
Calf birth date, Julian day	107 ^b	110 ^b	119 ^a	1.1	<0.01
Calf birth BW, kg	40	40	40	0.5	0.80
Calf age at weaning, Julian day	167 ^a	164 ^a	149 ^b	2.0	<0.01
Calf weaning BW, kg	218 ^a	217 ^a	202 ^b	2.5	<0.01
Pre-weaning ADG, kg/d	1.1 ^{ab}	1.1 ^a	1.0 ^b	0.02	0.06
Calf adjusted 205-d weaning BW, kg/cow	264 ^a	264 ^a	255 ^b	2.1	<0.02
Calf cumulative weaning BW, kg/cow	1157 ^a	947 ^{ab}	841 ^b	84.5	0.04
Calf cumulative adjusted 205-d weaning BW, kg/cow	1401 ^a	1156 ^{ab}	1064 ^b	97.4	0.03
Total produced calves, <i>n</i> /cow	5.4 ^a	4.5 ^b	4.2 ^b	0.36	0.03
Weaned calves revenue, \$/cow	4251 ^a	3478 ^{ab}	3091 ^b	294.7	0.01

¹Period 1 = calved in the first 21 days, Period 2 = calved between day 22 and 43, Period 3 = calved day 44 or later.

²SEM, pooled standard error of means.

³Estimated postpartum interval from calving to conception based on consecutive calving dates and assuming a 282-d gestation length.

^{abc}Means without a common superscript differ ($P \leq 0.05$).

first 21 days) as heifers (i.e., cumulative kilograms of calf was 18.2% and 27.3% greater than that of period 2 and period 3 cows, respectively), which agrees with others' findings (Lesmeister et al., 1973). Period 1 cows were either numerically or significantly greater than period 2 ($P > 0.05$) and period 3 cows ($P < 0.01$); this generated an additional \$773 to \$1160 in weaned calf revenues over their lifetime. This represents a large financial advantage for cow-calf producers.

The differences in average lifetime production between cow groups in this study were likely associated with differences in total number of calves weaned over lifetime, but some differences were associated with calf weaning weight. In general, in western Canada, where cost of production has been measured at just under \$962 per cow wintered (AAF, 2016) a heifer will need to wean a minimum of five consecutive calves to recoup her development costs (K. Larson, Western Beef Development Centre, Humboldt, SK, Canada, personal communication). This economic threshold of needing to wean five calves was only reached by the females that calved early as heifers. Thus, the findings of this study demonstrate why it is so important for cow-calf producers to ensure that their replacement heifers conceive as early as possible in their first breeding exposure.

CONCLUSIONS AND IMPLICATIONS

As evidenced by the findings of this study, heifers that calved early in their first calving season had increased longevity (pregnancy rates) and weaned

more calves, compared with heifers that calved later in the calving season. Moreover, in her lifetime, heifers that calved during the first 21-day period of their first calving season weaned approximately one more calf compared with heifers that calved later in the calving season. Therefore, developing heifers so that they conceive early in the breeding season and subsequently calve early in the calving season is critical for heifer longevity in the herd as well as the performance of her progeny in subsequent generations.

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