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Summary with Implications

Cattle records were gathered and evaluated over a 12-yr period to investigate how cow age impacts heifer progeny growth and reproductive performance. Cow records from March and May calving herds, were categorized into young, moderate, and old groups based on their age at calving each year in the herd. Heifer calves born to young cows had lighter body weight at birth and adjusted 205-d BW than heifers from moderate and old cows. Heifer pre-breeding BW and pregnancy determination BW were not influenced by dam age. However, age of dam does impact the percentage of heifers to reach puberty prior to the start of breeding with no differences in percentage of heifers who calved within the first 21 d of calving in the subsequent calving season and pregnancy rates. Average number of calf crops from heifer progeny was different among all age of dam groups with young dams having more calves. Results from this study suggest older cows have a positive influence on growth and prebreeding puberty status in female progeny during heifer development. Heifer progeny from young dams, however, had increased calf crops and longevity within the cowherd.

Introduction

Selection and development of heifers can have long-term impacts on production and profitability. Developing females to replace cull cows is costly and one of the most expensive management decisions for cow-calf producers. Therefore, producers selecting replacement females place emphasis on both reproduction and growth value.

However, younger females are thought to be genetically superior to older cow due to the rate of genetic progress. Age of dam is considerably varied within a herd and compounded with an array of effects on progeny performance, little is known regarding optimal dam age for selecting replacement females. Thus, it was hypothesized heifer progeny from moderate and mature cows would have increased growth during development, reproductive performance, and longevity in the cow herd. The objective of this study was to evaluate age of dam on female progeny performance and herd longevity.

Procedure

Cow and calf performance data were collected from 2005 through 2017 at the University of Nebraska, Gudmundsen Sandhills Laboratory (GSL) near Whitman, NE. Cow and calf performance data were obtained from both March and May calving herds at GSL to determine the impact of dam age on subsequent heifer progeny performance and longevity. Cows ($n = 1,059$) utilized in this study were Red Angus \times Simmental and ranged from 2 to 11 yr of age. To determine the effect of age of dam on subsequent heifer progeny's growth development and reproductive efficiency, cows were also classified by age groups as young (2 to 3 yr old), moderate (4 to 6 yr old), and old (≥ 7 yr old). Heifer calves were weighed at birth and weaning each year. Weaning weights were adjusted for a 205-d weaning weight with no adjustments for sex of calf or age of dam.

Each year, all heifers were managed together within their respective breeding group. March-born heifers grazed meadow until early June then moved to upland native range, and May-born heifers continuously grazed upland native range. In each year, heifers were weighed at prebreeding and at pregnancy diagnosis. Prior to each breeding season, 2 blood samples were collected via coccygeal venipuncture 10 d apart to determine pubertal status (May for

March-born heifers and early July for May-born heifers). Blood samples were placed on ice following collection and centrifuged at $2,500 \times g$ for 20 min at 4°C . Following serum removal, plasma samples were stored at -20°C for pending progesterone analysis. Plasma progesterone concentration was determined via direct solid phase RIA (Coat-A-Count, Diagnostics Products Corp., Los Angeles, CA). Heifers with serum progesterone concentrations greater than 1.0 ng/mL at either collection were considered pubertal. Heifers were synchronized with a single PGF_{2a} (Lutalyse, Zoetis, Parsippany, NJ) injection 5 d after bull placement (1:20 bull to heifer ratio) for a 45-d breeding season. All heifers grazed Sandhills upland range through final pregnancy diagnosis. Pregnancy diagnosis was conducted via transrectal ultrasonography (ReproScan, Beaverton, OR) 40 d from bull removal. Calving distribution in 21-d intervals was calculated with the start of the calving season coinciding with the first day 2 or more heifers calved.

Data were analyzed using the GLIMMIX procedure of SAS (SAS Inst. Inc., Cary, NC). For reproduction and growth performance of heifer progeny, the linear model included fixed covariates of dam at the weaning (DAWW), and heifer progeny birthdate (BDATE), and fixed classification effects of age of the dam (young, moderate, and old; AGEDAM). Due to having data from 2 seasons of calving (March or May) nested within each year, year and season are not independent (YRSEAS), additional random effects were included for testing of the fixed effects. Error terms used for testing DAWW, BDATE, and AGEDAM were DAWW*YRSEAS, BDATE*YRSEAS, and AGEDAM*YRSEAS, respectively. Puberty diagnosis, pregnancy rate, and calving within first 21 d of the subsequent calving season were analyzed using a binomial distribution. All other response variables were considered normally distributed. Data are presented as LSMEANS and P -values ≤ 0.05 were considered significant and tendencies were considered at a $P > 0.05$ and $P \leq 0.10$.

Table 1. Effect of age of dam on growth performance of female progeny

Items	Dam Age ¹			SE ²	P-Value
	Young	Moderate	Old		
Heifer BW, lb					
Birth	70 ^a	75 ^b	73 ^b	0.9	< 0.01
205 d	438 ^a	455 ^b	453 ^b	7	0.01
Prebreeding	612	625	621	9	0.21
Pregnancy diagnosis	820	820	809	9	0.17

^{a,b}Means with different superscripts differ $P \leq 0.05$.

¹Age of dam = age of dam at time of calving, Young (2 to 3 yr of age), Moderate (4 to 6 yr of age), Old (≥ 7 yr of age)

²SE is the SE of the difference between LSMs.

Table 2. Effect of age of dam on reproductive performance of female progeny

Items	Dam Age ¹			SE ²	P-Value
	Young	Moderate	Old		
Puberty, %	51.55 ^a	69.64 ^b	74.06 ^b	9.7	< 0.01
Pregnancy, %	80.44	84.08	85.89	2.5	0.15
Calved in first 21 d, %	73.34	77.88	78.94	3.0	0.28
Calf Crop ³ , n	3.1	2.8	2.2	0.7	< 0.01

^{a,b}Means with different superscripts differ $P \leq 0.05$.

¹Age of dam = age of dam at time of calving, Young (2 to 3 yr of age), Moderate (4 to 6 yr of age), Old (≥ 7 yr of age).

²SE is the SE of the LSMs.

³Number of calf crops produced within age of dam groups.

Results

Heifer calves born to young cows had lighter ($P \leq 0.01$; Table 1) birth BW and 205-d BW than heifer calves born to moderate and old cows. Although pre-weaning BW differences occurred, heifer prebreeding and pregnancy determination BW were not different ($P \geq 0.17$) among dam age groups. Female progeny born to moderate and old cows had a greater ($P < 0.01$, Table 2) percentage reach puberty prior to breeding compared with heifers born to young cows. Age of dam did not influence ($P = 0.15$) heifer progeny pregnancy rates. This could be attributed to post-weaning growth, as no BW differences were observed among the groups suggesting heifer post-weaning intake and plane of nutrition impacted reproduction success. In the subsequent calving season, there were no differences ($P = 0.28$) among age groups for percentage of heifers who calved within first 21 d of calving. Average number of calf crops from progeny within dam age was different among all groups ($P < 0.01$), with heifer progeny from young and moderate dams having more calves than and old dams. These findings suggest as age of dam increases retention and productivity of female progeny tend to decrease.

Conclusion

Results from this study suggest age of dam will impact growth and reproductive performance of female progeny. Female progeny from moderate and older dams tended to have increased performance up to first calving. Female progeny from young dams, however, had increased calf crops and productivity compared with their older counterparts. Depending on production goals, age of dam may need to be considered for selecting replacement females with the goal of increased productivity and long-term profitability.

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