

# Effect of Heifer Percent Mature Body Weight at Breeding on Heifer Performance, Calf Production, and Subsequent Pregnancy Rates

Josie N. Crouch  
 J. Travis Mulliniks  
 Jacki A. Musgrave  
 Kathy J. Hanford  
 Kacie L. McCarthy

## Summary with Implications

*A retrospective study was done utilizing 1,434 March- and May-calving Red Angus x Simmental crossbred cows and heifers from 2005 through 2019. Heifer weight at breeding was used to conduct a regression analysis from 50 to 70% of mature body weight to determine the impact of body weight at breeding on reproductive performance. Heifer pregnancy rates and second pregnancy rates as 2-year-olds were greater for heifers at 60, 65, and 70% of mature body weight at breeding than heifers at 50 and 55%. However, heifer percent mature body weight at breeding did not influence pregnancy rates as 3-, 4-, and 5-year-olds. As heifer percentage of mature body weight at breeding increased, calf birth weight and weaning weight increased. A greater percentage of heifers at a mature body weight of 50, 55, and 60% at breeding calved during the first 21d of the calving season than 65 and 70%. For producers, these results suggest that developing heifers at 60–70% of mature body weight at the time of breeding will likely have increased heifer pregnancy rates and as a 2-year-old. However, heifers below 60% of mature body weight at the time of breeding will likely have a higher percentage calve earlier in the first calving season, but calf weaning weights will not be increased. Although input costs would likely be reduced, the greatest challenge with developing heifers below 60% of mature body weight is rebreeding as 2-year-olds, however, there is no impact on subsequent pregnancy rates after 2-years of age.*

**Table 1. Mean, standard deviation (SD), minimum and maximum cow and heifer body weight (BW)**

Measurement	Mean	SD	Minimum	Maximum
Cow BW <sup>1</sup> , lb				
March	1,107	37	761	1,745
May	1,072	68	825	1,742
Heifer BW <sup>2</sup> , lb				
March	653	73	399	888
May	708	73	412	944

<sup>1</sup>Cow BW was adjusted to a common body condition score (BCS) of 5 for 5-, 6-, and 7-yr-old mature cows.

<sup>2</sup>Heifer BW was recorded at the time of breeding within each calving season.

## Introduction

Developing heifers as replacements accounts for a substantial amount of production costs with feed being a main contributor. Lower input costs can increase long-term profitability in the herd if overall performance is not jeopardized. Traditional recommendations suggest that a heifer should be at 65% of her mature body weight (BW) at the time of breeding to obtain optimal production efficiency and achieve the greatest pregnancy rates. Previous research has shown that heifers that do not reach that target of 65% of mature BW do not have negative impacts on reproduction or longevity within the herd. Conversely, developing heifers to a lighter mature BW percentage could serve as a management strategy to lowering input costs without sacrificing reproductive performance. Therefore, the objective of this study was to determine the impact of differing percentages of heifer mature BW at breeding on reproductive performance and calf production.

## Procedure

Data from Red Angus x Simmental crossbred cows and heifers (n = 1,434) were collected near Whitman, NE at the University of Nebraska, Gudmundsen Sandhills Laboratory (GSL) from 2005 through 2019.

Data were collected from both March- and May-calving herds. Heifer BW was collected at the time of breeding. The average herd mature BW within the March and May calving herds was calculated by averaging 5, 6, and 7-year-old cow adjusted BW at weaning within each calving season and are reported in Table 1. Using an equation from recent literature, cow BW at weaning was adjusted to a body condition score (BCS) of 5. Heifer weights at the time of breeding were divided by their respective average mature BW within each season to determine percent of mature BW achieved at the time of breeding. Within the March herd, percent mature BW at the time of breeding ranged from 42 to 85% with the average being 60%. Mature BW percent at the time of breeding in the May herd ranged from 46 to 92% with the average being 67%. A retrospective regression analysis was conducted on percentage of estimated mature BW heifers obtained by the time of breeding to determine the impact of varying mature BW percentages at the time of breeding on heifer performance, subsequent calf performance, and subsequent pregnancy rates.

All analyses were performed using the PROC GLIMMIX procedure of SAS 9.4 (SAS, Cary, NC). A similar initial model was used to analyze both the heifer and progeny data. To account for differences in calving season (March or May) and differences among years, a SEASONYR term

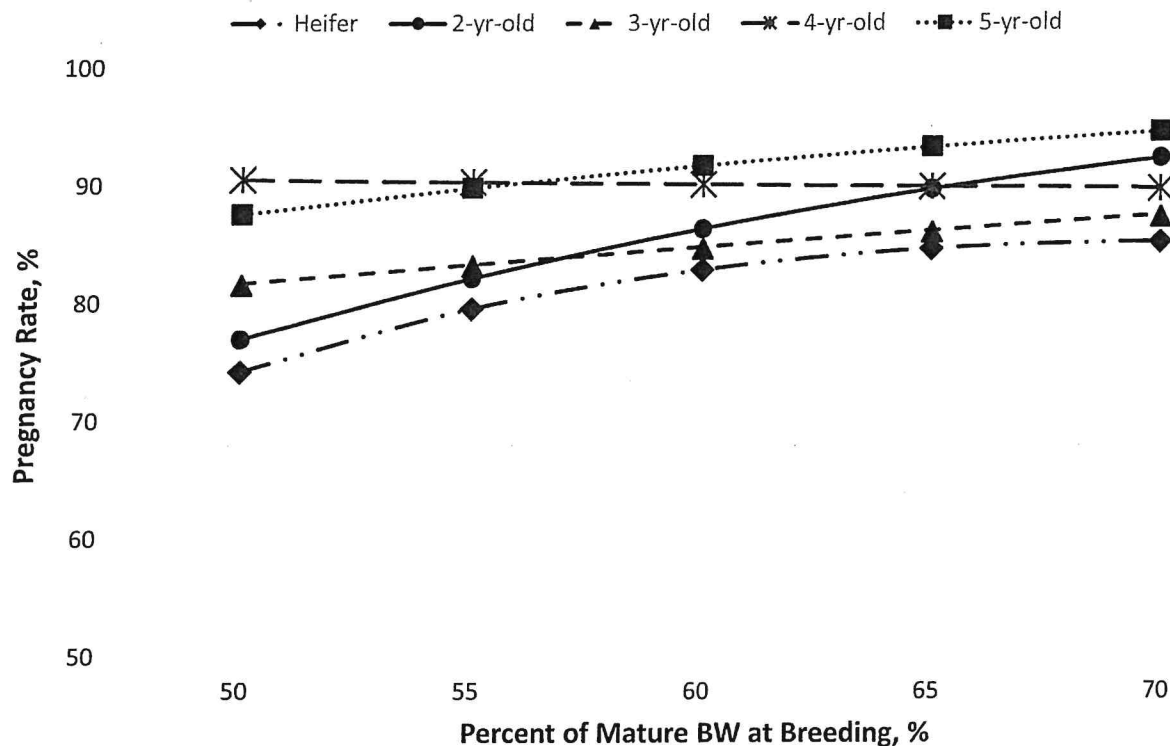


Fig. 1. The impact of percent of mature BW at breeding in replacement heifers on subsequent pregnancy rates as a heifer, 2-, 3-, 4- and 5-yr-old. Where yearling heifers is represented by a dashed and dotted line with diamonds ( $P < 0.001$ ), 2-yr-old a solid line with circles ( $P < 0.001$ ), 3-yr-old a dashed line with triangles ( $P = 0.19$ ), 4-yr-old a dotted line with squares ( $P = 0.85$ ), and a 5-yr-old a long-dashed line with stars ( $P = 0.15$ ).

was determined. To account for differences in birth date within calving season, days within calving season (CDAYSEAS) was determined. The initial model included fixed effects of calf gender, covariate CDAYSEAS, linear and quadratic percent mature weight (PCTMAT) and the random effects of SEASONYR by linear PCTMAT, SEASONYR by quadratic PCTMAT and residual error. To account for the differences between seasons and between years, the error term used for testing the linear PCTMAT was the SEASONYR by linear PCTMAT and for testing the quadratic PCTMAT was the SEASONYR by quadratic PCTMAT. All other effects were tested over the residual. Non-significant terms ( $P > 0.05$ ) were dropped to produce the final model. A normal distribution was assumed for all measures, except for heifer pregnancy rate and calving within first 21 days of calving season, where a binomial distribution was assumed. Binomial data were evaluated using the odds and odds ratio. Odds ( $o$ ) are the probability ( $p$ ) of the event occurring

over the event not occurring ( $1-p$ ). Odds ratio is the ratio of the odds for two different levels. Estimate statements were used to determine the predicted responses at different percent mature weights and differences between levels of percent mature weight. Significance was determined at  $P < 0.05$  and tendency was determined at  $0.05 < P < 0.10$ .

### Results

Initial pregnancy rates of heifers that were 60, 65, and 70% (83, 85, and 85%, respectively) of mature BW at the time of breeding were increased ( $P < 0.001$ ) compared to heifers at 50 and 55% (74 and 80%, respectively) of mature BW. Additionally, pregnancy rates as 2-year-olds were increased ( $P < 0.001$ ) for heifers that were 60, 65, and 70% of mature BW at breeding, with respective pregnancy rates from 50 to 70% being 75, 82, 87, 90, and 92%. However, mature BW percentage at breeding did not influence ( $P \geq 0.15$ ) pregnancy rates as 3-, 4-, and 5-year-old cows (Figure 1). A

greater percentage ( $P = 0.05$ ) of heifers at a mature BW percentage of 50, 55 and 60% at breeding calved during the first 21d of the calving season. Heifer first calf BW at birth was greater ( $P < 0.001$ ) as percent of mature body weight at breeding increased with calf birth weight rising 1.2 lbs. with every 5% increase in heifer mature BW at breeding. Additionally, as heifer percent mature BW increased 5% from 50 to 70%, subsequent year calf weaning weights were greater within each cow age ( $P = 0.007$ ).

### Conclusion

A mature BW percentage of 60, 65, and 70% at the time of breeding increased pregnancy rates as heifers and 2-year-olds. Furthermore, with every 5% increase in percentage of mature BW at the time of breeding, calf birth weights increased by 1.2 lbs. At the time of weaning, as heifer mature BW percent increased 5%, calf weaning weights increased 5 lbs. However, heifers at a lower percentage of mature BW calved at

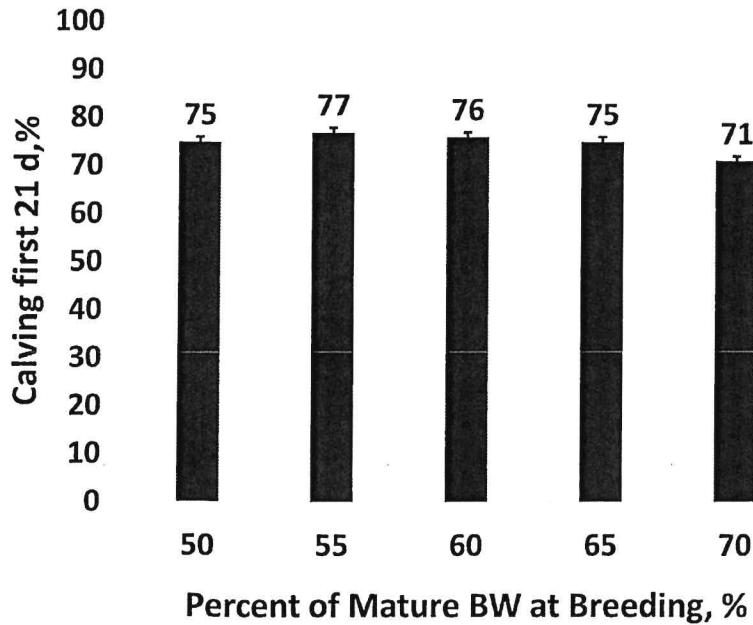


Fig. 2. The impact of percent of mature body weight of replacement heifers at breeding on heifers that calved in the first 21-d of the calving season ( $P = 0.05$ ).

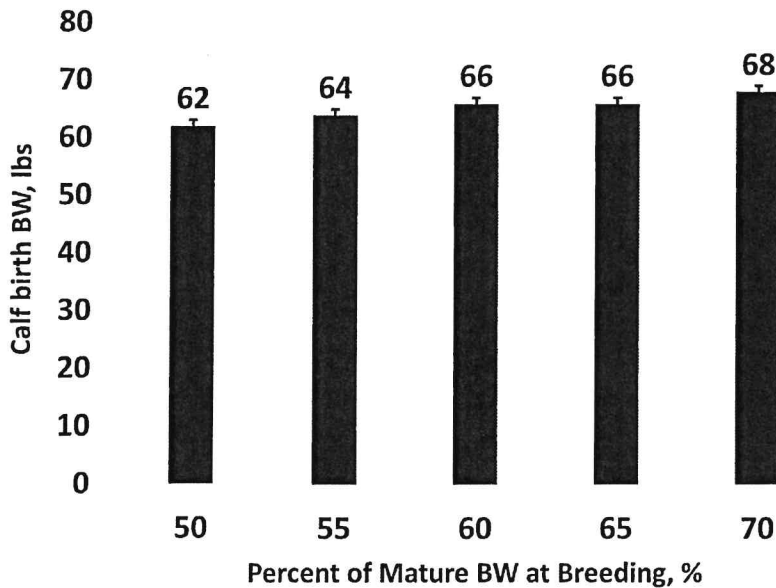


Fig. 3. The impact of percent of mature body weight of replacement heifers at breeding on calf body weight at birth ( $P < 0.01$ ).

a greater percentage during the first 21 d of the subsequent calving season. Additionally, pregnancy rates at 3-, 4-, and 5-year-olds in the cowherd was not influenced by heifer BW at the time of breeding. These results indicate that producers developing heifers below 60% of mature body weight at the time of breeding may have increased challenges in rebreeding 2-yr-old cows; however, subsequent pregnancy rates as a 3-yr-old and older are not impaired by percent of mature BW at breeding as a heifer.

.....  
 Josie N. Crouch, graduate student.

J. Travis Mulliniks, associate professor, animal science, University of Nebraska-Lincoln West Central Research and Extension Center, North Platte, NE.

Jacki A. Musgrave, research technician.

Kathy J. Hanford, professor, statistics, University of Nebraska- Lincoln , Lincoln, NE.

Kacie L. McCarthy, assistant professor, animal science, University of Nebraska-Lincoln, Lincoln, NE.