

Relationship between actual vs. targeted weight at first calving and milk production in first and second lactation

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Introduction

First lactation milk production is affected by management during the raising period prior to first calving as well as during lactation. Genetics, feeding, breeding, health and other issues combine to determine the size and age at first calving. Commonly stated goals for raising replacement heifers include a first calving age of approximately 23-24 months and 82-85% of expected mature body weight. The objective was to quantify the relationship between differences in actual vs. targeted weight at first calving and subsequent 305d milk production.

Materials and methods

Data from birth through 3 lactations were obtained for all animals born during 2015 to early 2019 on a single Holstein dairy. This farm was chosen due to the availability of genomic outcomes and body weights taken on the day after calving for lactations 1 to 3. To be included in this project, animals had to calve at least once with body weights recorded at the time of calving along with genomic outcomes and milk production data during the first lactation. From an initial population of 3,333 heifers, 1,751 entered their third lactation and had a body weight recorded after calving. Since no true mature body weights (MBW) nor weights at the start of the fourth lactation were available, adjustments were made to the third lactation weights to estimate expected MBW. Cows were assumed to add an additional net gain of 2% in body weight from the start of third lactation until maturity. These estimated MBW were regressed against genomic body composite (BDC) resulting in the following equation: $MBW (lb) = 1768 + 80.2 * BDC$. Using this derived equation, a predicted MBW (pMBW) was created for each animal that calved at least once. The product of $0.85 * pMBW$ was used as the targeted weight at 1 DIM after first calving. Subtracting the targeted weight from the actual weight resulted in the first lactation weight difference (L1 Wt Diff). From this L1 Wt Diff, 3 groups were created: "Light" (L1 Wt Diff = -400 to -76 lb, n = 2,549), "Targeted" (-75 to 75 lb, n = 631) or "Heavy" (76 to 300 lb, n = 163) animals at 1 DIM after first calving. Linear mixed models were used to evaluate first lactation 305d milk within group using genomic milk, DIM, DIM², age at first calving, and age at first calving² as fixed effects, and month and year of calving as random effects. For second lactation 305d milk, age at second calving and age at second calving² were added to the variables used for first lactation milk.

Results

In the Light group, regression results showed that each additional pound, L1 Wt Diff at first calving was associated with 7.4 lb more 305d milk in lactation 1 ($P < 0.01$). For example, if an animal with a -300 L1 Wt Diff had calved with 100 lb greater weight (-200 L1 Wt Diff), she was predicted to have produced 740 lb more 305-d milk. There were no significant effects of L1 Wt Diff in the Targeted or Heavy Groups for lactation = 1 ($P = 0.38$ and $P = 0.47$). Age at first calving was not significant. Each additional point of gPTA milk was associated with 3.3 lb more 305d milk ($P < 0.01$). In the second lactation, each additional pound L1 Wt Diff at first calving was associated with 2.6 lb more milk for the Light group ($P < 0.01$) but no significant effect in Targeted or Heavy cows ($P = 0.44$ and $P = 0.82$).

Significance

The results of this project demonstrated that appropriate size at first calving relative to projected mature body weight is critical for achieving greater milk production, both in the first and second lactation. Age at first calving was not an important predictor of milk production when size was considered. Efforts aimed at optimizing production in first and second lactation and overall profitability of replacements should focus on timely calving of heifers that are of high genetic potential and have achieved adequate body mass prior to calving. Failure to adequately grow heifers prior to calving represents a large lost economic opportunity.

