

Moderate prebreeding body condition improves reproductive efficiency and productivity in fall- and spring-lambing commercial Rambouillet ewes.

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A moderate prebreeding BCS of approximately 3.0 maximized reproductive efficiency and lamb production in commercial Rambouillet ewes. While prebreeding condition influenced flock-level productivity through improved conception and prolificacy, it had limited effects on late-gestation metabolism, lamb growth, or survival. Strategic management of ewe body condition before breeding provides a practical approach to improving flock efficiency and year-round lamb supply.

Summary

Body condition before breeding is an important management tool for improving ewe reproductive success and flock productivity. This study evaluated 327 fall-lambing and 219 spring-lambing commercial Rambouillet ewes to determine how prebreeding body condition score (BCS) influences reproduction, ewe productivity, late-gestation health and lamb outcomes. Ewe BCS was evaluated prior to breeding and throughout gestation, and reproductive performance, lamb survival, growth and health outcomes were monitored through weaning. Prebreeding BCS influenced conception, prolificacy and total pounds of lamb weaned per ewe, with the greatest productivity among exposed ewes occurring at a moderate BCS of approximately 3.0, regardless of season. Greater

prebreeding BCS further improved productivity among fall-lambing ewes that conceived but appeared to offer limited advantages for spring-lambing ewes. Prebreeding BCS had limited effects on late-gestation metabolism, lamb health, survival or growth in either season. These results indicate that maintaining ewes near a BCS of 3 before breeding can improve reproductive efficiency and flock productivity without negatively affecting ewe or lamb health and performance through weaning.

Introduction

Increasing U.S. lamb demand and seasonal limitations in domestic production create opportunities to improve out-of-season production systems (USDA-ERS, 2025). Fall-lambing systems can increase production flexibility but require breeding outside the natural reproductive season, which may challenge ewe reproductive performance (Lomet et al., 2020). Body condition scoring

is a practical tool for evaluating ewe nutritional status, which plays an important role in reproductive success by influencing energy availability, ovulation and pregnancy establishment (Muñoz et al., 2007). However, variation in prebreeding BCS is common in extensive production systems, and optimal BCS targets for maximizing productivity while maintaining downstream ewe and lamb outcomes remain unclear. Therefore, this study evaluated the relationship between prebreeding BCS thresholds and reproductive performance, ewe productivity, late-gestation metabolic status and lamb outcomes in commercial fall- and spring-lambing Rambouillet ewes.

Procedures

Data were collected from 327 fall-lambing and 219 spring-lambing multiparous commercial Rambouillet ewes (2-6 yr) managed at the NDSU Hettinger Research Extension Center under an approved NDSU Institutional Animal Care and Use Committee protocol. Ewes were managed under commercial flock conditions with uniform nutrition within each production season. Body condition was assessed before breeding, midgestation (~60-90 dGA), late-gestation (~135 dGA) and weaning, using a 1-5 scale in 0.5-point increments. A subset of ewes (fall: n = 78; spring: n = 36) was evaluated for metabolic status and lamb outcomes. Measurements included reproductive

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performance, lambing outcomes (birthing difficulty, lamb vigor, suckling assistance), lamb survival, adjusted weaning weights, ewe and lamb health, ewe metabolites, and lamb immune outcomes. Data were analyzed within each lambing season using SAS statistical software, with ewe age included in statistical models as a fixed effect.

Results and Discussion

Fall-lambing ewes entered the breeding season at a lower average BCS than spring-lambing ewes (2.74 vs. 3.23), while conception rates were

similar between seasons (72.5% and 74.4%). Body condition increased throughout gestation in both systems, with fall-lambing ewes maintaining condition from mid- to late gestation, while spring-lambing ewes continued increasing condition through late gestation. Greater prebreeding BCS was associated with greater body condition throughout gestation. Prebreeding BCS influenced reproductive efficiency and flock productivity, with optimal conception and lamb production occurring near a BCS of 3.0. Greater prebreeding BCS increased the likelihood of multiple

births and pounds of lamb weaned per productive ewe. However, prebreeding BCS had limited effects after pregnancy was established, with no major associations observed with lamb growth, mortality, lambing difficulty, ewe health, late-gestation metabolites or most lamb immune outcomes. Maintaining ewes at a moderate prebreeding BCS (~ 3.0) provides a practical strategy to improve reproductive performance and flock productivity without negatively affecting ewe or lamb health.

Table 1. Summary of experimental ewe cohorts and reproductive performance metrics.

	Fall (April 2025 – January 2026)	Spring (August 2025 – April 2026)
# Exposed ewes (n)	327	226
Average age	3.42 ± 0.06	3.25 ± 0.07
Average weight (lbs)	151.1 ± 1.19	155.1 ± 1.47
Average adjusted pre-breeding BCS	2.74 ± 0.03	3.23 ± 0.03
Conception rate (%)	72.5	74.4
# Productive ewes (n)	237	163

BCS = body condition score. Values are presented as mean ± standard error (SE) for continuous variables and percentages or counts for categorical variables. Exposed ewes represent all ewes participating in the breeding season, whereas productive ewes represent ewes that successfully conceived. Fall data was collected from April 2025 to January 2026, and spring data was collected from August 2025 to April 2026.

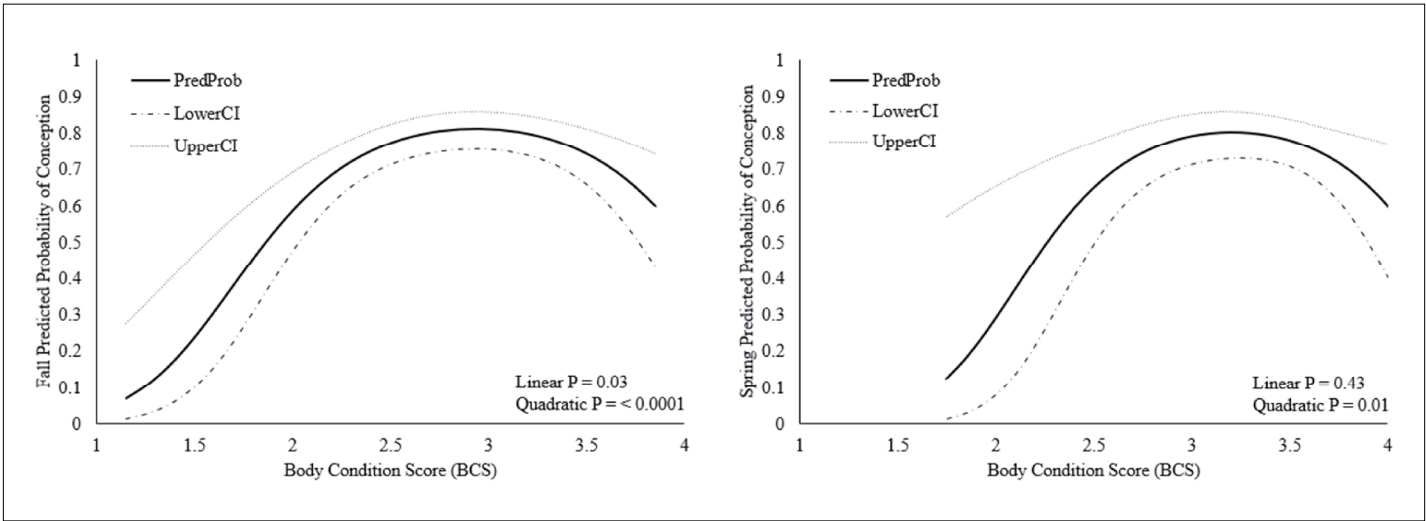


Figure 1. Predicted probability of conception as a function of ewe pre-breeding body condition score (BCS) in (a) fall- and (b) spring-lambing ewes. Lines represent predicted values (solid) ± 95% confidence intervals (dashed), restricted to the observed BCS ranges (fall: 1.15 - 3.85; spring: 1.64 - 4.05). Conception probability was quadratically associated with pre-breeding BCS in both fall- ($P < 0.001$) and spring-lambing ewes ($P = 0.01$), with a maximum at approximately BCS 2.9 and 3.2, respectively.

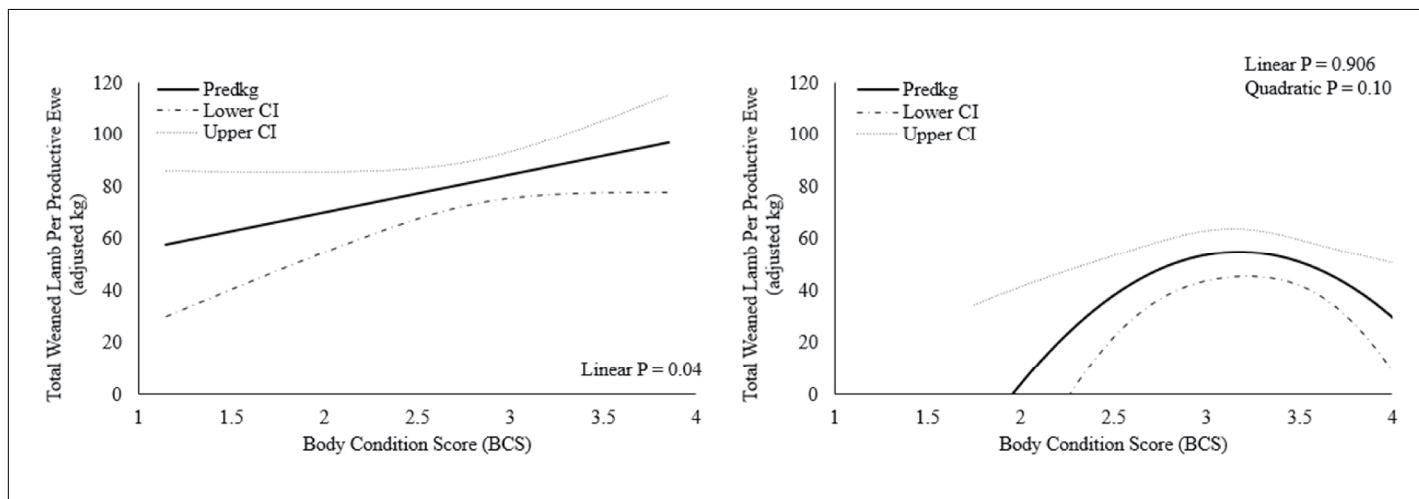


Figure 2. Total adjusted lamb weight weaned per productive ewe as a function of pre-breeding body condition score (BCS) in (a) fall- and (b) spring-lambing ewes. Lines represent predicted values (solid) $\pm$ 95% confidence interval (dashed), restricted to the observed BCS range (fall: 1.15 - 3.85; spring: 1.64 - 4.05). Total adjusted lamb weight weaned increased linearly with pre-breeding BCS in fall-lambing ewes ($P < 0.05$), whereas spring-lambing ewes exhibited a tendency for a quadratic relationship ($P = 0.10$), maximizing at approximately 3.2.

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