

Evaluating Cyclical Bovine Growth Trajectories: A GAMLSS Approach for Hereford Cattle

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Abstract

Tracking the relationship between age and weight through growth trajectories is crucial for effective herd management and identifying cattle with superior mass accumulation. Because an animal's physical expansion is fundamentally linked to the quantity and quality of meat, accurately modeling this development is essential. Traditionally, researchers rely on standard non-linear equations to evaluate these patterns; however, achieving parameter convergence becomes highly challenging when growth exhibits cyclical fluctuations. To overcome this limitation, parametric quantile regression techniques offer a robust substitute. Specifically, Generalized Additive Models for Location, Scale and Shape (GAMLSS) allow for the fitting of percentile trajectories using various statistical distributions. This study introduces GAMLSS as an effective methodology for modeling bovine growth dynamics, analyzing a dataset comprised of 55 female Hereford cattle. Our GAMLSS-based findings reveal a distinct developmental pattern: the mean body mass increases steadily from birth until 200 days, experiences a gradual decline between 200 and 400 days, resumes an upward trend from 400 to 500 days, and subsequently plateaus until 615 days. These cyclical variations in the average growth profile are likely attributable to external environmental stressors, such as extreme precipitation events or nutritional deficits.

Index Terms

Bovine Growth Curves, Hereford Cattle, GAMLSS, Parametric Quantile Regression, Livestock Management, Environmental Stressors