Lactation Curve Modelling for Dairy Cattle Genotypes in Different Agroclimatic Zones and Management Systems in Sri Lanka

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Lactation curve modelling allows for the estimation of individual cow's lactation yield over time, supporting improvements in herd management, genetic selection, and overall productivity and profitability. In local context, evaluating and comparing different lactation models is essential to identify the most appropriate one under varying genetic, environmental, and management conditions in Sri Lanka, as these factors significantly influence lactation performance. This study compared six non-linear lactation models namely Wood, Brody, Gaines, Dijkstra, Wilmink, and Rook, to select the best fit model for dairy cows. Data included 39,198 test-day milk records from 2,976 cows across five parity levels and six genotypes (Friesian, Jersey, Sahiwal, and their crosses), reared under intensive and semi-intensive systems across four agro-climatic zones of up-country wet zone, up country intermediate zone, low country intermediate zone and low country dry zone. In total, 24 genotype-management-environment combinations were analysed. Model parameters were estimated using non-linear regression (PROC NLIN in SAS software) for each group. The goodness of fit was assessed using coefficient-of-determination (R^2), mean-square-error (MSE), Akaike's-information-criterion (AIC), and Bayesian-information-criterion values (BIC). Wilmink and Rook had nearly linear curves, leading to unrealistic predictions and poor fit for all scenarios. Late-lactation yield was also underestimated consistently by Gaines, and unsuitable for long-term milk yield forecasting. Brody model demonstrated a moderate suitability for purebreds, while the Wood was performed well in early lactation but significantly overestimated peak yield, therefore, unsuitable for practical application. Due to the best fit provided, Dijkstra model can be recommended for all scenarios with further cross validations on other scenarios.

Keywords: Lactation curve model, Non-linear regression, Dijkstra model

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