UNIVERSITY OF LIFE SCIENCES
"KING MIHAI I" FROM Timisoara
Multidisciplinary Conference on Sustainable Development
30-31 May 2024

2024 MULTIDISCIPLINARY CONFERENCE ON SUSTAINABLE DEVELOPMENT

Study on lactation curve in Romanian buffalo using non-linear mixed models

L.T. Cziszter[1,2,*], S. Baul[1], S.E. Erina[1], R.I. Neamț[2], D.E. Ilie[2]

[1]Department of Animal Production Engineering, University of Life Sciences "King Michael I of Romania" from Timișoara, 300645, Timișoara, Calea Aradului 119, Romania
[2]Research Department, Research and Development Station for Bovine, 310059, Arad, Calea Bodrogului 32, Romania

• Introduction

Empirical mathematical models of lactation curves are regular functions y = f(t), defined for positive values of daily milk production (y) and time from parturition (t), used in the dairy cattle industry for breeding and management purposes (Macciotta et al., 2005). When fitted to milk test-day (TD) data, an empirical model must be able to disentangle the continuous component from temporary environmental perturbations and to make predictions on milk yields. Nonlinear models (NLM) are used to characterize and analyse lactation curves (Luna-Palomera et al., 2021), which can be useful in handling, feeding, and breeding programs. This study aimed to characterize the lactation curve type of the Romanian buffaloes using non-linear mixed equations (NLM) for the test-day milk in total lactation recorded.

• Material and method

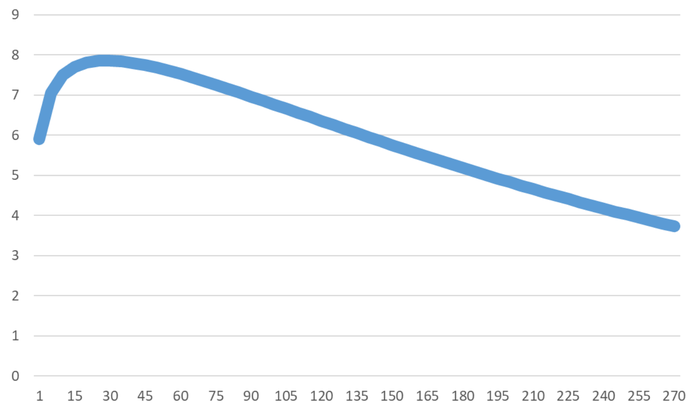
- Database: 2726 test-day milk records (kg)
- 311 buffalo cows, calving from 2021 to 2023 in a farm located in Arad County
- Data collected at irregular time intervals
- Five NLMs were tested:

- Brody et al., 1923 (BRO) $y_t = \beta1*(\exp(-\beta2*t))-\beta1*(\exp(-\beta3*t))$
- Sikka, 1950 (SIK) $y_t = \beta1*(\exp((\beta2*t)-(\beta3*t^2)))$
- Wood, 1967 (WOD) $y_t = \beta1*(t^{\beta2})*(\exp(-\beta3*t))$
- Cobby and Le Du, 1978 (COB) $y_t = \beta1-\beta2*t-\beta1*(\exp(-\beta3*t))$
- Wilmink, 1987 (WIL) $y_t = \beta1+\beta2*t+\beta3*(\exp(-.05*t))$

- The best fit model was selected using the R^2.

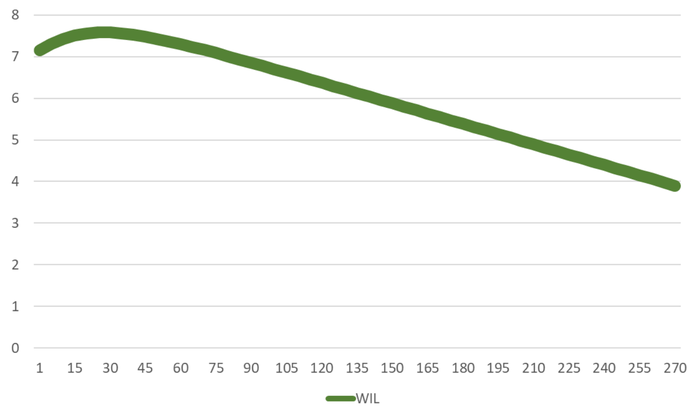
Abstract: *The aim of the study was to evaluate the lactation curve in Romanian buffalo cows using non-linear mixed equations (NLM) for the total lactation recorded. A database of 2726 daily milk records (kg) were analysed. The data was collected at irregular time intervals during lactation from 311 buffalo cows, calving from 2021 to 2023 in a farm located in Arad County. Five NLMs were tested: Brody et al., 1923 (BRO); Sikka, 1950 (SIK); Wood, 1967 (WOD); Cobby and Le Du, 1978 (COB); and Wilmink, 1987 (WIL). The best fit model was selected using the R2. All the parameters of the models were statistically significant (p≤0.05), while the percentage of variance explained by each model was only over 30%. The highest R2 was obtained by WOD (0,3399), followed by BRO (0,3355), SIK (0,3279), WIL (0,3267), and COB (0,3303). All five NLMs had three variables (b1, b2, and b3) which were very different from one model to another. This resulted in different lactation curve shapes depending on the model used, but we consider that the best model was WOD because it provided the highest R2 and produced the closest to the normal shape of the lactation curve.*

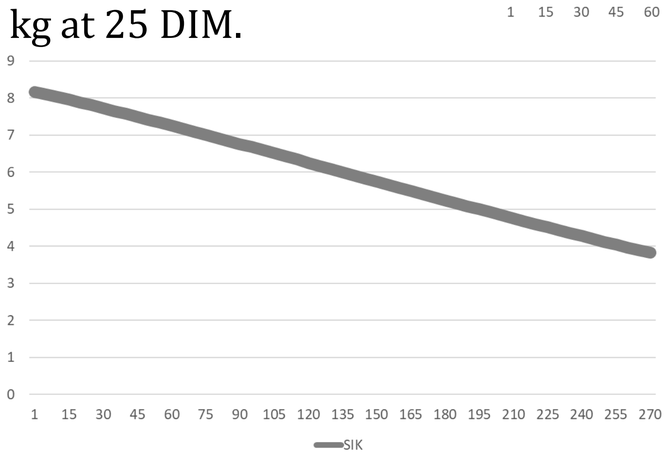
• Results and discussions



WOD explained 34% of the variance and provided the closest to a normal lactation curve. Started at 5.93 kg milk/day, reached the maximum of 7.86 kg at 28 DIM.

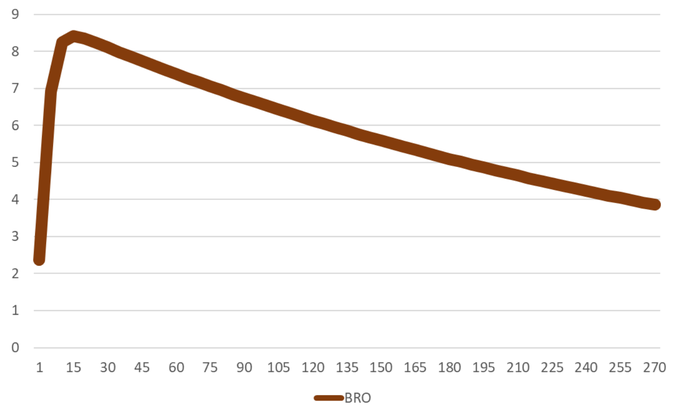
WIL explained 33% of the variance and the lactation curve had a similar shape with WOD. Started at 7.15 kg milk/day, reached the maximum of 7.58 kg at 25 DIM.

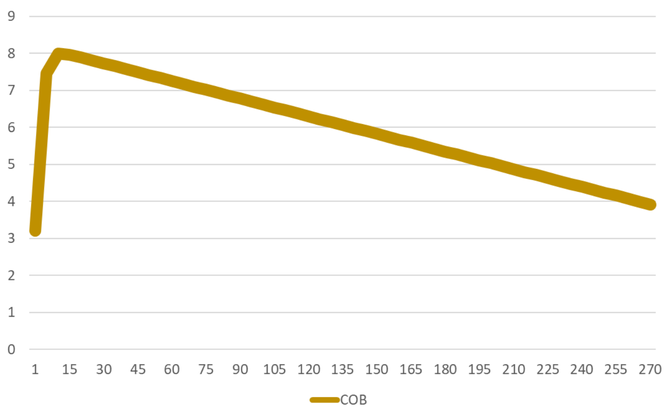




SIK explained 33% of the variance and the shape of lactation curve was quasi-linear. Started at 8.16 kg milk/day, then steadily decreasing

BRO explained 34% of the variance and produced a steep lactation curve. Started at 2.37 kg milk/day, reached the maximum of 8.42 kg at 15 DIM.





COB explained 33% of the variance and produced a lactation curve with a similar shape as **BRO**. Started at 3.21 kg milk/day, reached the maximum of 7.99 kg at 10 DIM.

• Conclusion

We consider that the best model was WOD because it provided the highest R^2 and produced the closest to the normal shape of the lactation curve