

STUDY OF LACTATION CURVE IN HOLSTEIN FRIESIAN CATTLE ON AN ORGANIZED FARM

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The production performance from 213 cows maintained at H.F Project, Anand Agricultural University, Anand over a period from 1992-2007 were studied. The gamma function was used to fit lactation curve for first to fifth parity in Holstein Friesian cows and the lactation curves were fitted based on daily milk production up to 43 weeks (300 days). The coefficient of determination (R^2) for gamma function of lactation curve was observe to be higher in all lactations indicating that the gamma function provided the best fit for lactation curve.

Keywords: Lactation curve, Gamma function of lactation curve, Coefficient of determination (R^2)

Cattle are the principal milk yielding livestock species of world. The lactation curve refers to graphical representation of milk production during lactation. The studies on lactation curve have found their own importance in understanding the pattern of production performance of animal and the nature of the lactation performance. The information on lactation curve will help the breeder to study lactation characteristics of Holstein Friesian cattle and identify various measures to be taken for achieving higher peak yield and sustain it for longer period so as to increase lactation yield.

MATERIAL AND METHODS

The lactation length up to 300 days (43 weeks) for first to fifth lactation of Holstein Friesian cattle were used to

estimate the coefficient of determination (R^2) and fitness of gamma function of lactation curve. The Statistical Package for Social Science (SPSS version 10.1) programme was used to calculate curve parameters 'a', 'b' and 'c' where in 'a' denotes initial value of milk production, 'b' denotes rate of increase to peak production and 'c' denotes rate of decline from peak production.

The lactation records were analyzed for the lactation curve using the Gamma function:

$$Y_t = a \cdot t^b \cdot e^{-ct} \text{ (Wood, 1967)}$$

Y_t = The average weekly yield at time t,

t = Week of lactation

'a', 'b', 'c' are constants

RESULTS AND DISCUSSION

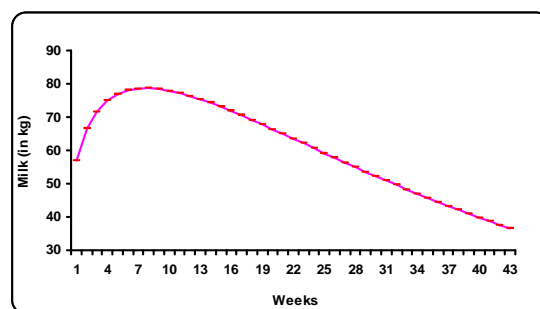
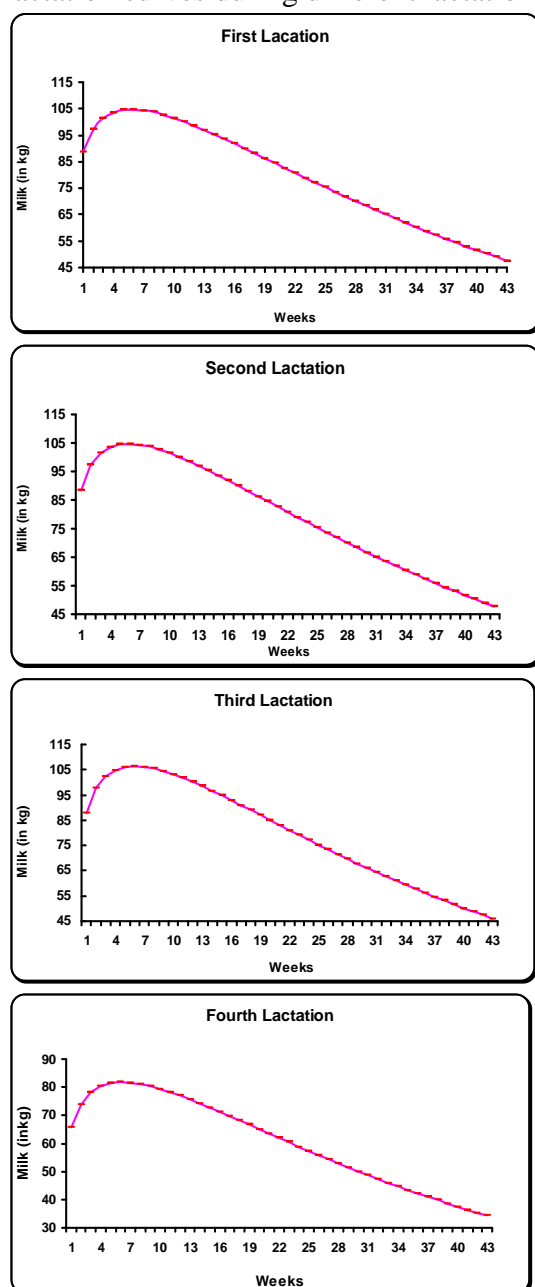
The lactation curve refers to graphical representation of milk production during lactation. The gamma function was used to fit lactation curve for first to fifth parity in Holstein Friesian cows. The lactation curves fitted based on daily milk production up to 43 weeks (300 days) are presented in Graphs I to V for first to fifth lactations.

Table I. The values of parameters 'a', 'b' and 'c' fitted in different lactations for Gamma function with their respective R^2 values

Lactation. Constants	I	II	III	IV	V
a	82.124	91.254	90.769	68.182	58.995
b	0.122	0.180	0.200	0.219	0.273
c	0.023	0.031	0.033	0.035	0.0351
R^2	0.957	0.973	0.976	0.966	0.875

The values of different constants and corresponding coefficients of determination (R^2) of gamma function for Holstein Friesian cows in five parities are presented in Table I. The coefficients of determination (R^2) for gamma function of lactation curve was observed to be higher in all lactations indicating that the gamma function provided the best fit for lactation curve. Sherchand *et al.* (1995) observed that the modified gamma function gave the best fit for the first lactation, the inverse polynomial function for the second lactation and the quadratic log function for the third lactation.

Graph I: Graphic representation of gamma lactation curves during different lactation



Wood (1969) also reported that a gamma model of lactation curve can give a good fit to the lactation curve in Holstein Friesian cattle in all lactation. Tekerli *et al.* (2000) also reported that the overall squared multiple correlation coefficients (R^2) of gamma function were 0.708 ± 0.08 and 0.609 ± 0.013 , 0.726 ± 0.015 and 0.743 ± 0.015 for first, second, third and fourth lactations, respectively in Turkish Holstein. The coefficients of determination (R^2) in present study were 0.957, 0.973, 0.976, 0.966 and 0.875 in first, second, third, fourth and fifth lactations, which were higher than R^2 reported by Tekerli *et al.* (2000) in Turkish Holstein. The present finding indicated that the gamma function is the best fit for lactation curve in Holstein Friesian cattle. Boer *et al.* (1989) reported the multiphasic function best fitted over the incomplete gamma function during first to third-parity for milk and fat yields of Israeli Holsteins.

CONCLUSION

The higher R^2 values (0.875 – 0.976) of gamma function of lactation curve indicated that it can be effectively used to fit lactation curve.

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