THE COMPARISON OF LACTATION CURVE WITH DIFFERENT MODELS IN ANATOLIAN WATER BUFFALO

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ABSTRACT

In this study, biometry of lactation was investigated to use daily milk yield records of Anatolian water buffalo. Wood and Wilmink models were used at the present study. All animals raised a private farm in Istanbul and grouped according to number of lactation. The lactation period and total lactation milk yield averages were found 244 days and 1567.3 kg for all animals respectively. The highest determination coefficients were founded at third lactation for Wood and Wilmink models as 0.77 and 0.75 respectively. At the same time, persistency (S), maximum milk yields (Y_{max}) and the time of obtaining the milk yield (T_{max}) values were calculated for Wood model. Persistency (S), Y_{max} and T_{max} values were found as 7.07, 7.44 (kg) and 67.26 (day) for general groups, respectively. As a result, Wood and Wilmink models were acceptable similarly and whole lactation curves were found as standard lactation curve type according to sign of the parameters in the model.

Keywords: Anatolian Water Buffalo, lactation curve, Wood model, Wilmink model.

INTRODUCTION

Water buffalo number is 117.591, female water buffalo number is 51.940 and total water buffalo milk production is 51.947 tones (Anonim 2014). Water buffalo milk has averagely 7-8% fat and is much fatty than cattle milk, also the cattle milk is used making cream, yoghurt, cheese, ice cream, the water buffalo milk used making sausage. With decreasing of milk yield unto lactation end, fat content percentage rises and even it might rise 12,5-15% degree. (Soysal 2009; Duzgunes 1960; Kreul and Sarican 1993).

As well as the other farm animal which are milking, also in water buffalos, shape of lactation curve is an important criterion. Lactation curve can be flat or vertical shaped. Practically, animals which has flat lactation curve are preferred rather that animals which has vertical lactation curve (Akbulut and et al. 1994). Gürcan and et al. (2011) compared water buffalos' lactation curve in second lactation with quadratic logaritmic linear, logaritmic quadratic, linear hyperbolic, inverse polinomial and Wilmink models. The highest adjusted coefficient of determination is found 0.97 in logaritmic quadratic model. It is stated that adjusted coefficient of determination of Wilmink model is 0.86, 77% of lactations are found typical 23% is found atypical lactation curve. Sahin and et al., (2014) used Wood, exponential, parabolic exponential, quadratic, reverse polinomial, logaritmic quadratic, logaritmic linear models. Logaritmic quadratic and quadratic models which imparting highest R^2 and lowest KSS, are the best fitting models.

As to this study, it is studied specifying the best fit model and modelling the lactation curve by using Wood and Wilmink models on water buffalos and benefiting from daily milk yield records, for 2,3,4th lactation number.

MATERIALS AND METHODS

Animal material is totally constituted 20 water buffalo which recoding milk yield records daily on a special firm constructed the study. Water buffaloes grouped as 2,3 and 4th lactation according to lactation number and modelling is realized for each lactation number, separately. In the study, Wood and Wilmink models and milk yield modelled according to time. (Wood, 1967). On comparing used models, benefited from summation of coefficient of determination and sum square error. In Table 1, used models were given. Modelling and parameter estimations belonging to models is realized by Statistica packaged software (Statistica 1994). In addition, by looking the parameters placing in Wood and Wilmink models, typical and atypical lactations are specified. Accordingly, as to Wilmink model, negatively valued curves of both of b and c parameters, together, are typical curves Ozyurt and Ozkan, 2009). In Wood model, (A,b and c negative) is specified as atypical lactation curves (Kaygısız, 1999). Persistance value for Wood model is calculated as S=-(1+b).lnc, as to T_{max} ve Y_{max} values are T_{max}=b/c ve Y_{max}=a(b/c)^{b}e^{-b}, respectively. (Soysal and Gurcan, 2000)

Figure 1. Models used in study

Model	Function
Wood	$Y_{(t)}=at^{b}\ e^{-ct}$
Wilmink	$Y_{(t)}=a+be^{-kt}+ct$

Meaning of the parameters placing in these models is that. Y= milk yield of lactation in t day, t= what number of lactation day, e= base of natural logarithm, a= point of curve's interrupting to axis y (beginning milk yield), b= coefficient of amplification at start point of lactation, c= coefficient of recession after peak, k coefficient is used as 0,05 in Wilmink model.

RESULTS AND DISCUSSION

According to lactation numbers of animals' daily milk yield records, lactation times and average lactation milk yield represented in Table 2. Accordingly, 2,3 and 4th lactation numbers considered, average lactation time is found 244 days and average milk yield is found 1567,3 kg. Garcia et al., (2013) found 244 day-old average milk yield and lactation length on water buffalos as 864 kg and 240 day, respectively. Malhado and et al., (2013) found milk yield and lactation time on crossbreed water buffalos as 1546 kg and 252,3 day, respectively.

Table 2. Parameter estimations according to Wood and Wilmink models as to lactation number

Lactation Number	Models	a	b	c	r	R^2	SSE
2	Wood	3,14	0.27	0.0044	0.67	0.45	255,66
	Wilmink	8,81	-4,67	-0,016	0,65	0,43	264,80
3	Wood	2,14	0,41	0,0060	0,88	0,77	139,07
	Wilmink	9,88	-6,95	-0,020	0,86	0,75	152,83
4	Wood	2,58	0,31	0,0043	0,77	0,59	126,35
	Wilmink	8,40	-4,93	-0,013	0,73	0,53	144,33

R^2: Coefficient of Determination, r: Coefficient of Correlation, SSE: Sum Square Error

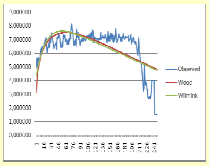

Figure 1. Lactation curves drawn according to estimated values as to Wood and Wilmink models for second lactation.

Figure 4. Residual value diagram representing difference between Wood and Wilmink models' estimated values for second lactation

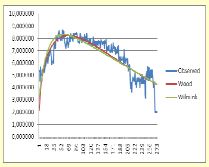

Figure 2. Lactation curves drawn according to estimated values as to Wood and Wilmink models for third lactation

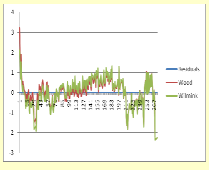

Figure 5. Residual value diagram representing difference between Wood and Wilmink models' estimated values for third lactation.

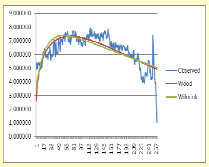

Figure 3. Lactation curves drawn according to estimated values as to Wood and Wilmink models for fourth lactation.

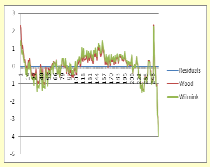

Figure 6. Residual value diagram representing difference between Wood and Wilmink models' estimated values for fourth lactation.

CONCLUSION

In the study practised with daily milk yield records, it is occurred that in the comparison according to Wood and Wilmink models, the chosen models' coefficient of determination and error sum of squares are close to each other.