Atatürk Üni. Zir.Fak.Der. 28 (2), 206- 211, 1997.

PREDICTION of 305-DAY MILK PRODUCTION FROM PARTIAL MILK YIELDS in BROWN-SWISS CATTLE REARED in THE RESEARCH FARM of ATATÜRK UNIVERSITY

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SUMMARY: *In this study, possibilities of predicting first lactation 305-day milk yield from various cumulative monthly partial milk yields of Brown Swiss cattle were investigated. Positive and highly significant correlation values between sequential cumulative monthly yields and 305-day yield were obtained. Also, regression equations and ratio factors were developed to predict the 305-day milk yield of Brown Swiss cows.*

It was concluded that regression equations number 4 and 5 involving partial yields upto 120 and 150 days respectively could be used confidently to estimate the 305-day milk yield. The regression equations were Y = 875.6 + 1.56 X4 and Y = 573.5 + 1.47 X5 respectively. Ratio factors were also calculated and presented for predicting 305-day yield.

ATATÜRK ÜNİVERSİTESİ ARAŞTIRMA ÇİFTLİĞİNDE YETİŞTİRİLEN ESMER SIĞIRLARDA KISMİ SÜT VERİMLERİNDEN 305-GÜNLÜK SÜT VERİMİNİN TAHMİNİ

ÖZET: *Bu çalışmada, esmer sığırların kümülatif aylık verimlerinden birinci laktasyonda, 305 günlük süt veriminin tahmin edilebilme olanakları araştırmıştır. Kümülatif aylık verimler ile 305-gün süt verimi arasında önemli derecede pozitif korelasyon değerleri tesbit edilmiştir. 305-günlük süt verimini tahmin etmek üzere regresyon eşitlikleri geliştirilmiştir.*

120 ve 150 günlük kısmi süt verimlerini kullanan 4 veya 5 numaralı regresyon eşitliklerinin toplam 305-gün süt veriminin tahmininde güvenle kullanılabileceği sonucuna varılmıştır. Bu regresyon eşitlikleri sırasıyla Y = 875.6 + 1.56 X4 and Y = 573.5 + 1.47 X5 dir. Ayrıca bu çalışmada 305 günlük süt verimini tahmin etmek amacıyla orantı faktörleri geliştirilerek sunulmuştur.

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INTRODUCTION

Milk production is the most significant economic trait of dairy cattle. But, knowing the worth of a dairy cow from it`s actual performance is a time consuming process (Raheja and Balaine, 1976; Khan and Johar, 1988). Hence, the prediction of complete first lactation milk production from partial milk yields will be useful for saving time in a herd culling programme. In addition, in dairy cattle, rate of genetic improvement can be hastened through early culling of poor cows and early selection of suitable young bulls based on their progeny performance (Sebastian and George, 1989). This can be accomplished by selecting cows and bulls on the basis of their partial yields, if full lactation yield can be accurately predicted from partial milk yields.

The possible use of partial lactation records in dairy cattle breeding programs has been studied on different breeds of cattle and buffaloes by many researchers (Khan and Johar, 1988; Sebastian and George, 1989; Katoch and Yadav, 1990; Bagherwal and Khan, 1991; Soysal, 1993; Roy et al. 1994).

The purpose of the present study was to investigate the possibilities of predicting first 305-day milk yield from various cumulative monthly partial milk yields in Brown Swiss cattle reared under Erzurum conditions of Erzurum.

MATERIAL and METHODS

Data from 117 cows which have been reared in the Research Farm of College of Agriculture at Atatürk University, were used in this study.

Two different methods (regression and ratio) for predicting 305-day milk production from incomplete lactation records were used as described by Sidher and Tuncel (1971) and Sundaresan (1973).

Once the monthly milk yields were determined, cumulative monthly milk yields at the first 30, 60, 90, 120, 150, 180, 210, 240, 270 and 300 days of lactation were obtained by adding the milk yields of the successive months. Also, 305-day milk yield in the first lactation was calculated by using Holland Method (Şekerden and Özkütük, 1990). Least squares analysis of the data were carried out to test the significance of various fixed non-genetic factors on partial yields of first lactation (Harvey, 1986). The original observations were adjusted for these significant fixed environmental effects such as years, calving ages, calving seasons by using a special computer program written in FORTRAN 4.

The adjusted data were used to obtain simple correlation coefficients, various simple linear regression equations with degree of determinations (R^2) and means of error used for assessing the regression equations (Neter et al., 1989). SAS statistics computer programme were employed for the statistical analysis (SAS, 1985).

RESULTS and DISCUSSION

Correlation values among cumulative monthly partial yields and total 305-day milk yield are presented in Table 1.

Table 1. The Correlation Coefficients Among Sequential Cumulative Monthly Yields and 305-Day Milk Yield.

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
X_2	0.93									
X_3	0.87	0.97								
X_4	0.83	0.93	0.98							
X_5	0.79	0.87	0.92	0.97						
X_6	0.78	0.83	0.78	0.93	0.98					
X_7	0.77	0.80	0.83	0.89	0.95	0.98				
X_8	0.76	0.80	0.83	0.88	0.94	0.97	0.99			
X_9	0.73	0.78	0.82	0.87	0.92	0.95	0.97	0.98		
X_{10}	0.68	0.74	0.78	0.84	0.89	0.92	0.94	0.97	0.98	
UCY	0.71	0.77	0.80	0.85	0.90	0.92	0.94	0.96	0.97	0.97

X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10} : Cumulative milk yields at first 30, 60, 90, 120, 150, 180, 210, 240, 270, 300 days of first lactation respectively.

UCY : 305-day milk yield of first lactation

All correlation values are statistically highly significant ($P<0.01$).

The correlation coefficients of cumulative monthly yields with 305-day yield raised gradually by adding each month production. The correlation values ranged from 0.71 to 0.97. The findings conclude that early part of lactation can safely guide about first lactation 305-day milk yield. This is in close agreement with those reported by Sidher and Sundaresan (1973), Raheja and Balaine (1976), Katoch and Yadav (1990).

The linear regression equations developed for predicting total 305-day yield using various independent variables are presented in Table 2. The "F" values of regression analysis showed that there were highly significant ($P<0.01$) dependence of total yield on various independent variables.

Table 2. Regression Equations with Their Means Squares of Error, F Values and Degree of Determination for Estimating Total First Lactation 305-Day Milk Yield from Cumulative Partial Yields of Brown Swiss Cows

Equation Number	Regression Equations		Means Squares of Error	F Values	R^2
1	Y = 1385.1 + 4.03	X_1	105794	242.7	51.6
2	Y = 1209.6 + 2.40	X_2	89343	346.4	59.1
3	Y = 1064.3 + 1.83	X_3	77223	497.2	64.7
4	Y = 875.6 + 1.56	X_4	44531	731.8	77.1
5	Y = 573.5 + 1.47	X_5	32021	1188.3	83.4
6	Y = 276.7 + 1.42	X_6	31770	1864.8	85.5
7	Y = 140.0 + 1.31	X_7	25143	2846.3	88.5
8	Y = 9.86 + 1.23	X_8	15643	5403.6	92.8
9	Y = -38.8 + 1.14	X_9	10241	1078.1	95.3
10	Y = -17.7 + 1.05	X_{10}	9510	11598.9	96.8

Y : Total milk yield (kg) upto 305-days,

X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10} : Cumulative milk yields at first 30, 60, 90, 120, 150, 180, 210, 240, 270, 300 days of first lactation respectively.

R^2 : Coefficient of determination.

The magnitude of coefficient of determination (R^2) increased from first to tenth equation. The R^2 values varied from 51.6 to 96.8. Also, mean squares of error decreased as long as number of equations advanced. The mean squares of error ranged from 105794 to 9510. Prediction of first lactation 305-day milk yield based upon cumulative partial yields up to 7th to 10th would be the most accurate since R^2 values were between 88.5 and 96.8 (Table 2). However, it will take more time for selection to be exercised and thus will increase the generation interval. It is evident from Table 2 that the equation number 4 and 5 which contained partial milk yields upto 120 and 150 days respectively had considerably high values of coefficient of determination and low values of mean squares of error. They also had highly significant correlation values with total 305-day milk yield.Therefore, first 4 or 5 months could be considered as the best period to save time, labour and money in predicting the first lactation 305-day milk yield. The result was in agreement with findings of Venkateswara et al. (1980), Khan et al. (1982), Khan et al. (1989), Katoch and Yadav (1990).

Besides of the regression equations, ratio factors were calculated in order to predict total 305-day milk yield from partial cumulative yields. The ratio factors obtained are presented in Table 3. Madden et al. (1959), Mc Gilliard (1967), lamb and Appleman et al. (1969), Tuncel (1971) also determined ratio factors for different cattle breeds. Their results were similar to the findings of the present study.

Table 3. Ratio Factors with Their Standard Errors for Brown Swiss Cows.

Cumulative Monthly Yields	RF ± SEM
1	8.09 ±0.130
2	4.31 ± 0.060
3	2.99 ± 0.036
4	2.30 ± 0.023
5	1.87 ± 0.014
6	1.58 ± 0.009
7	1.37 ± 0.007
8	1.23 ± 0.005
9	1.12 ± 0.004
10	1.04 ± 0.003

RF ± SEM = Ratio Factors ± Standard Errors of Means

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