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RESEARCH ARTICLE

Genetic Parameters of 305-Day Milk Yield for Brown Swiss Reared in the Bahri Dağdaş International Agricultural Research Institute in Turkey

Muammer TİLKİ * Mehmet ÇOLAK ** Mehmet SARI *

* Kafkas University, Veterinary Faculty, Department of Animal Science, Kars -Turkey
** Bahri Dağdaş International Agricultural Research Institute, Konya -Turkey

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Summary

This study was conducted to estimate variance components, genetic parameters and breeding values of 298 Brown Swiss cows milk yield recorded between 1987 to 1999. Estimates of variance components, genetic parameters and estimates of breeding values of 305-day milk yield were obtained for each of animals using two different models. First lactation records were analysed in a model (Model 1) that included direct genetic effect as the only random factor. All lactation records were analysed in a model (Model 2) that was the same as Model 1 but permanent environmental effects associated with animal were also taken into account. The heritability of milk yield for first lactation and all lactations were 0.23 and 0.19 respectively. According to analyses among the years, there was no any constant trend for phenotypic and genetic values of 305 day milk yield. Generally an irregular fluctuation was observed. This irregular fluctuation may demonstrate that there was no any standard selection programme in the herd.

Keywords: *Breeding value, Genetic trend, Milk yield, Brown Swiss*

Bahri Dağdaş Uluslararası Tarımsal Araştırma Enstitüsünde Yetiştirilen Esmer Irk Sığırların 305 Günlük Süt Veriminin Genetik Parametreleri

Özet

Bu çalışma, 1987 ile 1999 yılları arasında kayıt altına alınan 298 Esmer ırk sığırın süt veriminin varyans unsurları, genetik parametreleri ve damızlık değerlerini tahmin etmek için yapılmıştır. Sığırlara ait 305 günlük süt veriminin genetik parametreleri, varyans bileşenleri ve damızlık değeri 2 farklı model kullanılarak elde edilmiştir. Birinci laktasyon kayıtları model 1 ile analiz edilmiş, tesadüfî faktör olarak yalnızca direkt genetik etki dâhil edilmiştir. Tüm laktasyon kayıtları model 2 ile analiz edilmiştir, model 1'den farklı olarak hayvan ile ilgili kalıcı çevresel etkiler de analize dâhil edilmiştir. Birinci laktasyon ve tüm laktasyon süt veriminin kalıtım dereceleri sırasıyla 0.23 ve 0.19 olarak bulunmuştur. 305 günlük süt veriminin fenotipik ve genetik değerlerinde yıllara göre devamlılık gösteren bir eğilim yoktur. Genellikle düzensiz dalgalanmalar gözlenmiştir. Bu düzensiz dalgalanmalar, sürüde herhangi bir standart seleksiyon programı uygulanmadığının göstergesi olabilir.

Anahtar sözcükler: *Damızlık değeri, Genetik eğilim, Süt verimi, İsviçre Esmeri*

INTRODUCTION

Brown Swiss cows are one of the most desirable breeds in Turkey. Nearly 65% of Turkey's cattle population is consisted of European originated cattle (Holstein, Brown Swiss, Simmental, Jersey) and their crosses. Brown Swiss has a special place among them with milk and meat yield capacity. Therefore many breeders and state farms prefer Brown Swiss. But very limited records for milk production were kept for the cattle reared in state and private farms. It is a reality that, recoding is essential to apply the latest techniques in modern animal husbandry. Insufficient recording practice in the industry restricts the application of new techniques, such as BLUP, on the animal population [1-4].

Variance components and genetic parameters are required to estimate breeding values and breeding values are needed to select animals. In order to obtain breeding values, with accurate prediction, good knowledge of the variance components for the tarits is necassary [1,5,6].

Correct estimates of genetic parameters are essential

İletişim (Correspondence)
☎ 90 474 2426807/1135
✉ mtilki@hotmail.com

for prediction of breeding values using mixed models [7]. In addition, animal breeders use breeding values to predict genetic progress [8]. Especially after the applications of new techniques in last years, selection with breeding values which were estimated by Best Linear Unbiased Prediction (BLUP), made better input on genetic values of dairy cows [9,10].

The aim of the study was to estimate variance components and breeding values of milk yield in Brown Swiss cows calved in Bahri Dağdaş International Agricultural Research Institute in Turkey between 1987 and 1999 years.

MATERIAL and METHODS

Data

Data on 298 records of Brown Swiss cows were collected from the Bahri Dağdaş International Agricultural Research Institute in Turkey. Calving year ranged from 1987 to 1999. The calving months were ranged into four seasons: Winter, Spring, Summer, and Autumn. Characteristics of the data set are given in *Table 1*.

Table 1. *Characteristics of the data set used for genetic parameter estimates*

Tablo 1. *Genetik parametrelerin tahmini için kullanılan verilerin özellikleri*

Description	Total
Records in data	807
Cows in data	298
Sires in data	35
Dams in data	246
Animals in pedigree	461
Years (1987-1999)	13
Seasons	4
Lactation classes	7

Statistical analyses

Preliminary analyses were conducted for 305-day milk yield to define the significant fixed effects ($P<0.05$) using a General Linear Model (Minitab 12.1). The final model included the fixed effects of calving year, calving season and lactation number.

Genetic parameters, variance components and breeding values were estimated by MTDFREML using two different animal models [11]. For the first lactation records an animal model was used with animal as the only random effect *(Model 1)*. For all lactations the animal model included the permanent environmental effect due to the cows itself, fitted as additional random effect *(Model 2)*. Genetic trend was examined with estimated breeding values according to birth years. Fixed effects in the models were as follows:

Model 1 (First lactation): $Y_{ijklm} = F_{ijk}+a_l+e_{ijklm}$

Model 2 (All lactations): $Y_{ijklm} = F_{ijk}+a_l+p_l+e_{ijklm}$

Y_{ijklm}: is the observation of cow milk yield

a_l: the direct additive genetic effect of lth animal

p_l: permanent environmental effect lth animal (Model 2 only)

e_{ijklm}: the random residual error pertaining to Y_{ijklm}

F_{ijk} (fixed effects); $bm_i + by_j + ln_k$

Where;

bm_i: the effects of birth season (1-4)

by_J: the effects of birth year (1987-1999)

ln_k : the effects of lactation number (1-7)

RESULTS

The estimates of variance components and genetic parameters for milk yield were shown in *Table 2*. Similiar additive genetic variation was observed for first lactation records and all lactation records. The heritability of milk yield for first lactation and all lactations were 0.23 and 0.19 respectively.

Table 2. *Estimates of variance components and genetic parameters for milk yield*

Tablo 2. *Süt veriminin varyans unsurları ve genetik parametrelerinin tahmini*

Parameter	First lactation	All lactations
σ^2_A	59.475	32.000
σ^2_C	-	0.866
σ^2_E	197.925	136.666
σ^2_P	257.400	159.533
h^2	0.23	0.19
(s.e)	(0.003)	(0.001)
C^2	-	0.006

σ^2_A= direct additive genetic variance; σ^2_C= maternal environmental variance; σ^2_E= error variance; σ^2_P= phenotypic variance; h^2= direct heritability; C^2= the permanent environmental variance due to the dam as a proportion of the phenotypic variance σ^2C/σ^2P; s.e = Standard error

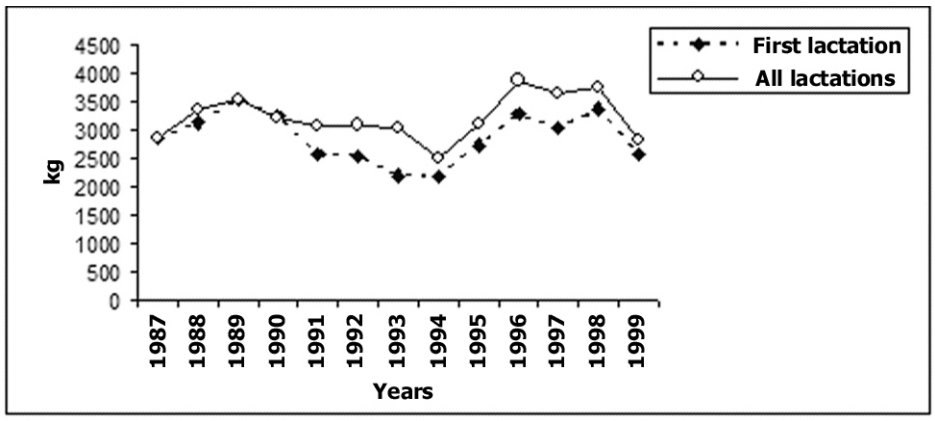

Fig 1. 305 day milk yields according to years

Şekil 1. Yıllara göre 305 günlük süt verimleri

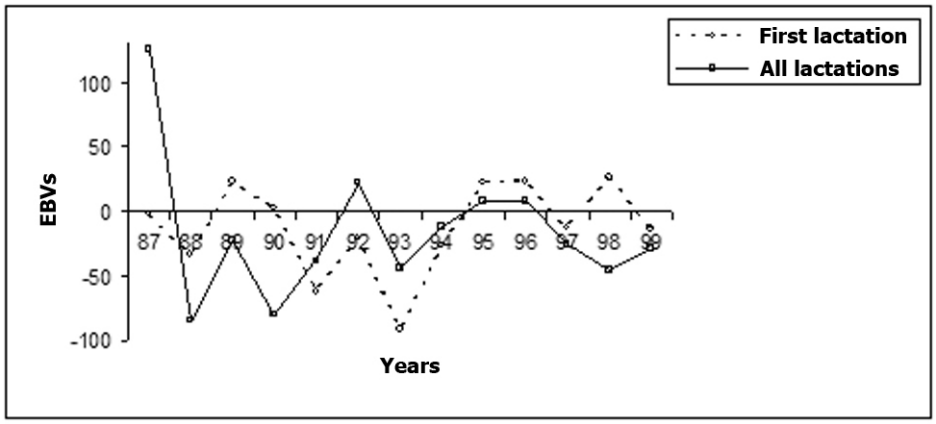

Fig 2. Breeding values for first and all lactations (the year values are represented as 1987-1999)

Şekil 2. İlk ve tüm laktasyonlar için damızlık değerleri (yıl değerleri 1987-1999 olarak ifade edilmiştir)

305 day milk yields according to years were shown in *Figure 1*. According to phenotypic values of 305 day milk yield, a fluctation trend was observed during the period. This trend might be accepted as a reflection of the management system and the characteristics of the herd.

Figure 2 shows the mean cow breeding values according to birth year. Genetic trend has not shown a trend among the years, generally a fluctuation was dedected.

DISCUSSION

First lactation records had a slightly higher heritability than all lactations records with h^2 of 0.23 and 0.19 respectively. These results were similar to those reported by Bakır et al.[12], and lower than those reported by Renno et al.[13].

According to phenotypic values of 305 day milk yield, a fluctation trend was observed during the period. This trend might be accepted as a reflection of the management system and the characteristics of the herd. Similar non-constant trends for milk production were also reported by many authors [14-16]. For all lactation records minimum milk yield was observed in 1994 and the maximum was in 1996 years. Little differences of milk yield in the observed years may also show that any selection was not applied on the animals to increase the milk yield. Because, amounts for milk yield in this study was less than the average milk yields of Brown Swiss cows [13,17-19]. Therefore it can be said that milk yield of the studied Brown Swiss herd can be improved with management applications.

Genetic trend has not shown a tendency among the years, generally a fluctuation was dedected. Same instability was reported in the estimates breeding values (EBVs) of milk yield for different cattle breeds by Saatcı et al.[3], Ulutaş et al.[4] and Lidauer et al.[20]. This situation in the mean EBVs may be observed in several herd and it can be a reflection of applying management system which was not contain the systematic selection.

Annual average EBVs of first calving records were less variable than those obtained for all lactations. But estimated breeding values for both calculations (first and all lactations) suggested that there was no any trend among the years, some years having low and some high values. This might be explained by the

fact that a defined selection programme based on BLUP was not carried out for the herd. It also indicates that management system was not steady for the herd during the trail period.

Parameters estimated from corresponding study gave an opportunity to compare the phenotypic and genetic parts of the studied herd.

It was defined from the trend analyses that there was no any standard selection programme in the evaluated Brown Swiss herd. This decision was agreed with the irregular trends among the examined years. Additionally study showed that recording systems are important for the livestock breeding, as reliable decisions can not be made without the records of animals. Therefore livestock breeders can be supported to keep the records of their animals and only with this situation they can apply the latest techniques, such as BLUP and selection based on EBV, on animals.

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