Estimation of breeding values of Anatolian population of Simmental cows using monthly test day milk yields

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SUMMARY

In this study, lactation records and monthly test day milk yields were obtained from Kazova State Farm, Tokat in Turkey (middle Anatolia), belonging to the Ministry of Agriculture, between 1993 and 2002. In this study, 611 first lactation records of daughter sired by 86 bulls that had at least 5 daughters were used. The aim of this study was to compare analysis results and to calculate genetic parameters of 305-day milk yield and breeding value estimation of Simmental Cattle reared on Kazova State Farm. From the first 10 test milk yield, 305-day milk yield was calculated by taking results of monthly test day milk yield in the farm by using Holland method. Additive genetic variance, error variance, permanent variance, environment variance, heritability, repeatability and breeding value were estimated using REML animal model. Heritability of test day milk yields (0, 14) was higher than the heritability of 305-day milk yield (0.22). Correlation between breeding values estimated using test day milk yields and breeding values of 305-day milk yield was found statistically significant and as 0.876. In estimation of breeding value for test day milk yields and 305-day milk yield, Spearman and Kendall correlations between rankings of bulls were found 0.906 and 0.906 and statistically significant. According to results of this study, test day milk yields should be used in genetic evaluation of dairy cows. Furthermore, in genetic evaluation of dairy cows at early stage of lactation, there are advantages for using test day milk yields. Among these advantages, there are decreases of generation interval, early culling of cows and bulls with low breeding value and decrease of expenses for milk yield records in late stages of lactation and feeding of cattle. In breeding dairy cattle, test day milk yields ought to be taken into consideration in early culling and selection of heifer for milk yield during lactation.

Keywords**:** breeding value, cattle, test day milk yields, Simmental

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INTRODUCTION

Genetic evaluations of dairy sires and dairy cows for milk production have been based on 305-day lactation yields, Whereas, 305-day lactation yields were by taking results of monthly test day milk yield tests during lactation and were compared to evaluations based on the corresponding test day yields from those lactations (Ptak and Schaeffer, 1993). Alternative approach for genetic evaluation is to evaluate test day milk yields. The models named milk yield models take into consideration directly test day milk yield (Firat, 2001). The genetic evaluation of dairy sires and cows for production traits for many years has been based on the analysis of 305-day lactation yields. The basis of every 305-day yield is a set of test day yields taken approximately every 30 days in milk. Incomplete lactation records are normally extended to a 305- day basis following a set of well-defined rules. The accuracy of 305-day measures varies depending on the number of tests that have been combined and the procedure being used (Danell, 1982; Swalve, 1995).

Genetic and environmental effects on 305-day milk yield have been taken into consideration as general effect during lactation (Kettunen et. al., 1998). However, various factors are acting on milk yield change during of lactation. Because of this reason, instead of calculation of 305-day milk yield, using of test day milk yield have been considered in world (Reents and Doop, 1996; Olori et. al., 1999; Kaya et. al., 2003; Jamrozik et. al., 1997; Swalve, 1995). Thus, as accurate genetic evaluations were estimated, genetic improvement speed had raised in breeding of dairy cattle (Akbaş, 1994).

At early stage of lactation, there are many advantage of using of test day milk yield of dairy heifer. Among these advantages, there are decreases of generation interval, early culling of low breeding value cows and bulls and decrease of expenses for milk yield records in late stages of lactation and feeding of cattle (Firat, 2001; Açikgöz et. al., 2006). Furthermore, heritability of test day milk yield records is similar to heritability of 305 day milk yield or slightly lower than heritability of 305-day milk yields (Meyer et. al., 1989; Danell, 1982).

The heritability estimates for test day yields for midlactation have been either the same or slightly lower than those for 305-day yields, although heritability estimates for test day yields were lower for the beginning and end of lactation than heritability of 305-day yields (Swalve, 1995; Danell, 1982; Pander et. al., 1992) It was reported that breeding values estimated according to 305-day milk yield and test day milk yield indicated only minor changes in sire and cows rankings (Kaya et. al., 2003; Swalve 1995).

As correlation between lactation milk yields and test day milk yields is high, test day milk yield can be used in genetic evaluation (Melo et. al., 2005; Ilatsia et. al., 2006, İlatsia et. al., 2007; El Faro and Albuquerque, 2003). Especially, test day milk yields at the middle of the lactation can be used instead of 305-day milk yield (Ferreira et. al., 2003; Shadparvar and Yazdanshenas, 2005; Dalal et al, 1999).

Genetic correlations between test day milk yields and 305-day milk yield were reported high and between 0.65 and 0.99 (Meyer et al., 1989; Meinert et al., 1989: Pander et al., 1992; Danell, 1982).

As there aren't differences between ranking of daughters sired by bulls for breeding values estimated according to 305 day milk yield and test day milk yields, test day milk yields potentially can be used for especially in genetic evaluation of bulls (Kaya et. al., 2003; Ptak and Zarnecki 1998; Swalve, 1995).

The purpose of the present study was to determine genetic parameters for test-day milk yield and 305-day milk yield, and to examine breeding value estimation procedures on the local population of cattle.

MATERIAL AND METHODS

In this study, test day milk yields for first lactation records of 1367 of Simmental cows reared between 1992 and 2002 on Kazova State Farm, which is owned by the Ministry of Agriculture, were used. In lactations tested monthly more than 10 times, milk yields were calculated from the first 10 test milk yields. Lactations tested monthly less than 7 times were not used in the calculation. Milk yield on normal lactation (305-days) was calculated by taking results of monthly test day milk yield tests in the farm by using Holland method (Cilek and Tekin, 2005). Estimation of heritability and breeding value of 305 day milk yield and test day milk yields were estimated by using REML method in DFREML 3.0 program (Meyer, 1997).

Repeatability of test day milk yields was calculated by dividing variance among cows to total variance. Variance components and REML estimations was calculation by Proc Varcomp procedure in SAS statistical program (SAS Institute 1987).

The models used were as follows:

For 305 day milk yield;

$$Y_{ijk} = HPS_{i} + b_1 X_{1ijk} + b_2 X_{2ijk} + a_j + e_{ijk}$$

where

Y_{ijk} = 305-day milk yield, HPS_i= effect of calving season, X_1 = effect of first calving age, X_2 = days in milk (DIM) at first TD, a_j = animal's random additive genetic effect, e_{ijk} = random residual effect.

For TD records (repeatability model),

$$Y_{ijk} = HPS_{i} + b_1 X_{1ijk} + b_2 X_{2ijk} + b_3 X_{3ijk} + b_4 X_{4ijk} + b_5 X_{5ijk} + a_j + p_{ej} + e_{ijk}$$

where

Y_{ijk} =test day milk yield, HPS_i = effect of calving season, X_1 = effect of first calving age, X_2 = DIM/c, (DIM= duration between calving and first test day, c = 305 day, X3 = $(DIM/c)^2$, X_4 = [(Ln (c/DIM)], X_5 = $[(Ln (c/DIM)]^2$, a_j = animal's random additive genetic effect, p_{ej} = effect of random permanent environment of the cow during lactation, e_{ijk} = = random residual effect (Ptak and Schaeffer, 1993; Swalve, 1995, Cilek and Kaygısız 2008).

RESULTS AND DISCUSSION

Standard errors and phenotypic means of 305 day milk yield and of the test days milk yields are shown in table 1. Means of duration between parturition and first test days was found as 18.44 ± 8.82. In beginning of lactation, mean of milk yield of cows was 10.48 kg. Maximum dairy milk yield of cows was 18.12 kg. Maximum daily milk yield of cows was in 49.79th day of lactation. This value calculated Brown Swiss cows is higher than 45 days reported by Kaya et al. (2003), 36.55 days reported by Kaygisiz (1999), and 54.75 by Cilek and Kaygisiz (2008) and 52.17 days reported by Yilmaz and Kaygisiz (2000) for Holstein cows.

Table 1. Standard errors and phenotypic means of 305 day milk yield and of the test days milk yields

Test Day (TD)	1st TD	2nd TD	3rd TD	4th TD	5th TD	6th TD	7th TD	8th TD	9th TD	10th TD	305 days
305 day milk yield	17.993	17.382	16.663	16.206	15.215	14.619	14.103	12.922	10.706	8.194	4519
Standard errors(Sx)	4.966	5.243	5.385	12.79	4.919	4.801	4.990	5.105	5.811	6.113	1281

Heritability of 305-day milk yield and test day milk yields were calculated as 0.14 and 0.22, respectively. As reported in previous researches (Meyer et. al., 1989; Danell, 1982), heritability of test day milk yields was slightly lower than the heritability of 305-day milk yield. Heritability of 305-day milk yield estimated as 0.22 is similar to reported values by other researchers (Wilmink, 1987; Swalve, 1995; Ali and Schaeffer, 1987; Pander and et. al. 1992; Meyer et. al. 1989; Strabel and Szwaczkowski, 1998; Kaya et. al. 2003, Cilek and Tekin 2005). Heritability of test day milk yield estimated as 0.14 is similar to reported value as 0.11 by Kaya et.al. (2003) and 0.10 by Cilek and Tekin (2008). However, this value is lower than 0.28-0.52 reported by Ilatsia et. al. (2007), 0.11-0.19 reported by Shadparvar and Yazdanshenas (2005) in second lactation, 0.15-0.27 reported by Ferreira et. al. (2003) and 0.27 reported by Costa et. al. (2005), 0.07-0.32 reported by Takma and Akbas (2007).

Correlations between breeding value estimated according to 305 day milk yield and test day milk yield of daughter sired by 86 bulls were estimated. Correlation between breeding values estimated using test day milk yields and breeding values of 305 day milk yield was found statistically significant and as 0.876. In estimation of breeding value for test day milk yields and 305 day milk yield, Spearman and Kendall correlations between rankings of bulls were found 0.906 and 0.906 and statistically significant. Correlations between both breeding values and correlations between rankings of bulls according to breeding value were found significant ($P<0.01$). Correlations estimated in this study are similar to previous researches (Danell, 1982, Meyer et al., 1989; Meinert et al., 1989; Pander et al., 1992; Akbaş and Takma 2007). However,

Correlations estimated in this study were found higher than 0.66, the value reported by Ptak and Zarnecki (1998).

CONCLUSIONS

Heritability of test day milk yield and heritability of 305-day milk yield were heritability at a middle level. Test day milk yields might be used to select dairy cows and heifer for milk yield. Furthermore, correlations between rankings on the breeding values estimated from the 305-day milk yield and test days milk yields of daughter sired by bulls were found high and statistically significant ($P<0.01$). According to these results, it can be stated that evaluation for daughter sired by bulls according to 305-day milk yield is more accurate and appropriate. In genetic evaluation of dairy cows at early stage of lactation, there are advantages for using test day milk yields. Among these advantages, there are decreases of generation interval, early culling of cows and bulls with low breeding value and decrease of expenses for milk yield records in late stages of lactation and feeding of cattle. In breeding dairy cows, test day milk yields ought to be taken into consideration in early culling and selection of heifer for milk yield.

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