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Breeding Value Estimation of Dairy Cattle Using Test Day Milk Yields for Brown Swiss Cows Reared at Ulaş State Farm

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Abstract: In this study, it was aimed to calculate genetic parameters of 305 day milk yield and breeding value estimation of Brown Swiss Cattle reared on Ulaş State Farm. Later, analysis results were compared. In this study, 830 first lactation records of daughter sired by 58 bulls that had at least 5 daughters were used. 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, 10) was higher than the heritability of 305 day milk yield (0, 02) Correlation between breeding values estimated using test day milk yields and breeding value of 305 day milk yield was found statistically significant (p<0.01) and high level (0.862). 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 0.853 and 0.662 and statistically significant (p<0.01). According to results of this study, in genetic evaluation of dairy cows, test day milk yields should be used instead of 305 day milk yield. Furthermore, in genetic evaluation of dairy cows, there are advantages for using test day milk yields. Test day milk yields ought to be taken into consideration in early culling and selection of cows for milk yield.

Key words: Breeding value, cattle, test day milk yields, brown Swiss

INTRODUCTION

Genetic evaluations of dairy sires and cows for milk production based on 305 day lactation yields 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 has for many years 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 beeen taken into consideration as general effect (Kettunen *et al*., 1998). However, Factors affecting on milk yield change on duration of lactation. Due to this reason, instead of calculation of 305 day milk yield, using of test day milk yield have been considered (Reents and Doop, 1996; Olori *et al*., 1999; Kaya *et al*., 2003; Jamrozik *et al*., 1997; Swalve, 1995). Thus, as accurate genetic evaluations were done, genetic improvement speed had raised (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*., 2007). 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 mid-lactation have been either the same or slightly lower than those for 305 day yields, although estimates were

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lower for the beginning and end of lactation (Swalve, 1995; Danell, 1982; Pander *et al*., 1992) I 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, El Faro and Albuquerque, 2003, 2007). 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*., 1939; 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 for Brown Swiss Cattle reared on Ulaş State Farm.

MATERIALS AND METHODS

In this study, test day milk yields for first lactation records of 830 between 1989 and 2001 of Brown Swiss cows reared on Ulaş 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 with Holland method (Çilek and Tekin, 2006). Lactations tested monthly less than 7 times were not used in the calculation. Estimation of heritability and repeatability of 305 day milk yield and test day milk yields and breeding value 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 programe in SAS statistical program.

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).
X_3 = $(DIM/c)^2$.
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).

RESULTS AND DISCUSSION

Lactation curve was presented in Fig. 1. Regression equation of milk yield was estimated as:

$$Y = 2.41311 + 0.20368 X_1 - 0.00372 X_2.$$

Where,

Y = 305 day milk yield.
X_1 = Increase of milk yield before maximum milk yield
X_2 = Decrease of milk yield after maximum milk yield.

In beginning of lactation, mean of milk yield of cows was 11.13 kg. Maximum dairy milk yield of cows was 20.50 kg. Maximum daily milk yield of cows was in 54.75th day of lactation.

Phenotypic means for 305 day milk yield and standard errors were presented in Table 1. Means of duration between parturition and first test days was found as 17, 86±9, 18. Maximum daily milk yield of cows was in 54.75th 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 Kaygısız (1999) and 52.17 days reported by Yılmaz and Kaygısız (2000) for Holstein cows.

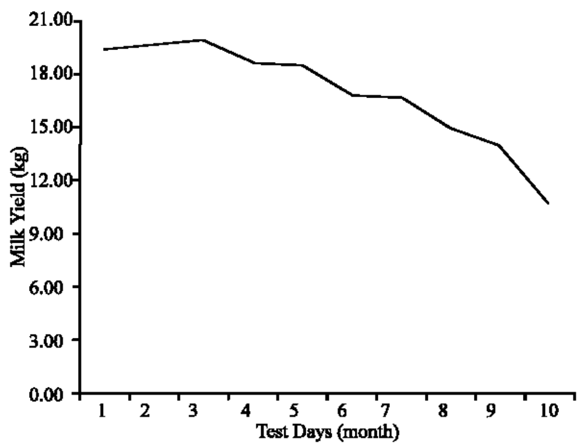

Fig. 1: Lacation curve of brown swiss cows

Table 1: Standard errors and means of 305 day milk yield and test day milk yield

	n	X	Sx
305	830	5158.69	1331.38
TD 1	830	19.41	5.18
TD 2	830	19.62	5.33
TD 3	830	19.92	5.52
TD 4	830	18.65	5.26
TD 5	830	18.50	5.54
TD 6	830	16.85	5.61
TD 7	830	16.70	5.77
TD 8	830	14.99	5.80
TD 9	830	13.98	6.10
TD 10	830	10.64	6.74

Table 2: Estimation of genetic parameters for 305 day milk yield and test day milk yields

	h^2	r
305	0.02	
TD	0.10	0.20

Table 3: Correlations between breeding values estimated according to 305- day milk yield and test day milk yields

N	Pearson	Kendall rank correlation	Sperman
58	0.862**	0.662**	0.853**

** = p<0.01

Estimations of heritability of 305 day milk yield and heritability of test day milk yields and repeatability of test day milk yields were presented in Table 2. Heritability of 305 day milk yield and heritability of test day milk yields were found as 0.02 and 0.10, respectively. Repeatability of test day milk yield was found as 0.20. Heritability of 305 day milk yield estimated as 0.02 is lower than 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).

Heritability of test day milk yield estimated as 0.10 is similar to reported value as 0.11 by Kaya *et al*. (2003) 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)

As Heritability of test day milk yields was higher found than heritability of 305 day milk yield, selection of Brown Swiss cows may be conducted using test day milk yield.

Correlations between breeding value estimated according to 305 day milk yield and test day milk yield of daughter sired by bulls were presented Table 3. Correlations between both breeding values and correlations between rankings of bulls according to breeding value were found statistically ($p<0.01$). Correlations estimated in this study are lower than reported values by Ptak and Schaeffer (1993) and Kaya *et al*. (2003), However, Correlations estimated in this study were found more higher than 0.66 reported by Ptak and Zarnecki (1998).

CONCLUSION

Heritability of test day milk yield was estimated as higher than heritability of 305 day milk yield. Furthermore, correlations between rankings according to breeding values estimated according to 305 day milk yield and test day milk yield of daughter sired by bulls were found high and statistically significant. According to these results, it may be said that evaluation for daughter sired by bulls according to 305 day milk yield is more accurate and appropriate. However, test day milk yields ought to be taken into consideration early culling and selection of cows for milk yield. As Heritability of test day milk yields was higher found than heritability of 305 day milk yield, selection of Brown Swiss cows may be conducted using test day milk yield. Early selection and culling of cows and heifer can be used test day milk yield.

REFERENCES

Açıkgöz, A., A. Kaygısız and M. Şahin, 2006. Siyah Alaca Sığırlarında Kısmi Süt Verimlerinden Yararlanılarak 305 Günlük Süt Verimini Tahmin Etme Imkanları. Ankara Üniv. Tarım Bil. Derg., 12: 307-312.

Akbas, Y., 1994. Damızlık degerin en iyi sapmasız tahminleyicisi BLUP yöntemi. Hay. Üretim Derg., 35: 13-22.

Ali, T.E. and L.R. Schaeffer, 1987. Accounting for covariances among test day milk yields in dairy cows. Can. J. Anim. Sci., 67: 637-644.

Costa, C.N., C.M.R. de Melo, C.H.C. Machado, A.F. de Freitas, I.U. Packer, Cobuci and J. de A., 2005. Estimation of genetic parameters for test day milk records of first lactation Gyr cows using repeatability and random regression animal models. Rev Bras. de Zootecn., 34: 1519-1530.

Çilek, S. and M.E. Tekin, 2006. Estimation of factors for standardizing lactations to mature equivalent and 305 day basis for Brown Swiss cattle reared at Ulaş State Farm. Indian J. Anim. Sci., 76: 621-624.

Dalal, D.S., S.S. Rathi and K.L. Raheja, 1999. Genetic evaluation of Hariana sires for test day milk records and first lactation milk yield. Indıan. J. Anim. Sci., 69: 1042-1043.

Danell, B., 1982. Studies on lactation yield and individual test-day-yields of Swedish dairy cows. IV. Extension of part lactation records for use in sire evaluation. Acta. Agric. Scand., 32: 65-81.

El-Faro L. and L.G.De. Albuquerque, 2003. Estimation of genetic parameters for first lactation test-day records and total milk yield for Caracu cows. Rev. Bras. de Zootecn., 32: 284-294.

Ferreira, W.J., N.M. Teixeira, R.F. Euclydes, R. da S. Verneque, P.S. Lopes, R. de A. Torres, A.A. Wenceslau, M. V. G. B. da Silva and M.N. Magalhaes Junior, 2003. Genetic evaluation of Holstein cattle using test day milk yield. Rev. Bras. de Zootecn., 32: 295-303.

Fırat, M.Z., 2001. Sürü-Yıl-Ay Etkilerini Þansa Bağlı Varsayan Dengesiz Karıþık Bir Modelde Kontrol Günü Süt Verimlerinin Bayesian Analizi. Turk. J. Vet. Anim. Sci., 25: 327-333.

Ilatsia, E.D., T.K. Muasya, W.B. Muhuyi, A.K. Kahi, 2006. Use of test day milk yield records for genetic evaluation in Sahiwal cattle. Proceedings of the 8th World Congress on Genetics Applied to Livestock Production, Belo Horizonte, Minas Gerais, Brazil.

Ilatsia, E.D., T.K. Muasya, W.B. Muhuyi and A.K. Kahi, 2007. Genetic and phenotypic parameters for test day milk yield of Sahiwal cattle in the semi-arid tropics. Anim., 1 : 185-192.

Jamrozik, J., L.R. Schaeffer and J.C.M. Dekkers, 1997. Genetic Evaluation of Dairy Cattle Using Test Day Yields and Random Regression Model. J. Dairy Sci., 80: 1217-1226.

Kaya, I., Y. Akbaþ and C. Uzmay, 2003. Estimation of Breeding Values for Dairy Cattle Using Test-Day Milk Yields. Turk. J. Vet. Anim. Sci., 27: 459-464.

Kaygısız, A., 1999. Sarı Alaca Sığırların Laktasyon Eğrisi Özellikleri Türk. Vet. Hay. Derg., 23 (Ek-1): 15-23.

Kettunen, A., E.A. Mantysaari, I. Strandén, J. Pösö and M. Lidauer, 1998. Estimation of genetic parameters for first lactation test day milk production using random regression models. 6th WGCALP, Armidale, NSW2351, Australia, 23: 307-310.

Meinert, T.R., S. Korver and J.A.M. VanArendonk, 1939. Parameter estimation of milk yield and composition for 303 days and peak production. J. Dairy Sci., 72: 1534-1539.

Melo, C.M.R. de, I.U. Packer, C.N. Costa and P.F. Machado, 2005. Genetic parameters for test day and lactation milk yields of first lactation Holstein cows. Rev. Bras. de Zootecn, 34: 796-806.

Meyer, K., H.U. Graser and K. Hammond, 1989. Estimates of genetic parameters for first lactation test day production of Australian black and white cows. Livest. Prod. Sci., 21: 177-199.

Meyer, K., 1997. DFREML Version 3.0. User Notes. 1997. (http://agbu.une.edu.au/~kmeyer/dfreml.html)

Olori, V.E., W.G. Hill and B.J. Mcguirk, S. Brotherstone, 1999. Estimating variance components for test day milk records by restricted maximum likelihood with a random regression animal model. Livest. Prod. Sci., 61: 53-63.

Pander, B.L., W.G. Hill and R. Thompson, 1992. Genetic Parameters of Test Day Records of British Holstein-Friesian Heifers. Anim. Prod., 55: 11-21.

Ptak, E. and L.R. Schaeffer, 1993. Use of test day yields for genetic evaluation of dairy sires and cows. Livest. Prod. Sci., 34: 23-34.

Ptak, E. and A. Zarnecki, 1998. Estimation of breeding values of Polish Black-and-White cattle using test day yields. Proceedings of the 6th World Congress on Genetics Applied to Livestock Production, Armidale, NSW, Australia, 11-16 January, 1998. Vol. 23: Opening: plenary; technology; transfer; beef cattle; dairy cattle; pigs., pp: 335-338.

Reents, R. and L. Doop, 1996. Genetic evaluation for dairy production traits with a test day model for multiple lactations. Inter. Bullet., 14: 113-117.

Shadparvar, A.A. and M.S. Yazdanshenas, 2005. Genetic parameters of milk yield and milk fat percentage test day records of Iranian Holstein cows. Asian-Australian J. Anim. Sci., 18: 1231-1236.

Strabel, T. and T. Szwaczkowski, 1998. Genetic Evaluations of Test Day Data with Small Size of Contemporary Groups. J. Dairy Sci., 81 (Suppl. 1): 86 (Abstr.).

Swalve, H.H., 1995. The Effect of Test Day Models on the Estimation of Genetic Parameters and Breeding Values for Dairy Yield Traits. J. Dairy Sci., 78: 929-938.

Wilmink, J.B.M., 1987. Comparison of different methods of predicting 305 day milk yield using means calculated from within herd lactation curves. Livest. Prod. Sci., 17: 1-17.

Yılmaz, I. and A. Kaygısız, 2000. Siyah Alaca Sığırların Laktasyon Eğrisi Özellikleri Ankara Üniv. Tarım Bil. Derg., 6: 1-10.