MEDWELL PUBLISHING
Journal of Animal and Veterinary Advances 8 (1): 6-10, 2009
ISSN: 1680-5593

Milk Yield Traits of Holstein Cows Raised at Polatli State Farm in Turkey

Süleyman Çilek
Department of Animal Breeding, Faculty of Veterinary Medicine,
University of Kirikkale, Yahsihan, 71451 Kirikkale, Turkey

Abstract: The present research was carried out to determine milk yield traits and effects of environmental factors on these traits in Holstein cows raised at Polatli State Farm located in Ankara province. A total of 3011 production records between 1993 and 2006 were constituted the research material. Environmental factors were analyzed by Least Squares Method. Effects of parity (lactation number) on 305 days milk yield, lactation duration and dry period were significant ($p<0.001$-$p<0.05$). Effect of calving year on 305 days milk yield was significant at the $p<0.001$ level, nevertheless, not significant on both lactation length and dry period. Effect of calving year was significant statisticaly for all milk yield traits ($p<0.001$). Effect of calving age on 305 days milk yield and dry period were significant ($p<0.001$), nevertheless, not significant for lactation length. The least square means of 305 dayss milk yield, lactation duration and dry period were 5606.92±75.49 kg, 303.40±3.04 days and 98.15±2.25 days, respectively. Under Turkish conditions and steppe climate of middle Anatolia, it can be concluded that Holstein cattle are raised successfully for milk yield on Polatli state farm.

Key words: Cattle, Holstein, milk yield, performance, Turkey

INTRODUCTION

Holstein cows were considered the most dairy cows in World. As number of Holstein cows in Turkey is more than other breeds, breeding of Hostein cows is very impotant in Turkey. In breeding of dairy cows, the most important aims are to obtain a calf in a year and high milk yield from cows. To obtain a calf in a year from cows dependents on some parameters in ideal limits (60 days dry period, 305 days lactation duration etc.). For these aims, good managment in herd of dairy cows is very important. Profitable breeding could be achieved by keeping lactation duration, dry period and service period between optimal limits (Alpan, 1994; Kumuk *et al*., 1999; Çilek and Takin, 2005; Koçak *et al*., 2007).

The yields of farm animals are the result of the combined effects of genotype and environmental conditions. In order to increase the yield level, it is necessary to optimise the environmental conditions and to improve the genetic structure of the animals. Environmental factors can be classified as factors with measurable effects (age, year, season, milking frequency, etc.) and factors with unmeasurable effects (infectious diseases, parasitic infestations, etc.). The measurable effects can be determined and used in the management of the farm (Yalçin, 1975; Yaylak and Kumlu, 2005; Çilek and Tekin, 2007b).

The 305 days milk yield of Holstein cows was between 4597 and 6464 kg in different studies in Turkey (Duru and Tuncel, 2002, 2004; Kaya *et al*., 2003; Bilgiç and Aliç, 2005; Erdem *et al*., 2007; Inci *et al*., 2007). Milk yields of Holstein cows were 5353 kg in Morocco (Boujenane, 2002) and 5905 kg in Tunisia (Ajili *et al*., 2007).

Many researchers reported that the effect of calving season on 305 days milk yield was as significant and indicated that milk yield was higher in autumn and winter (Kaya and Kaya, 2003; Yaylak and Kumlu, 2005; Çilek and Tekin, 2007; Erdem *et al*., 2007; Koçak *et al*., 2007). However, some authors reported that effect of calving season on 305 days milk yield was non-significant in commercial farm c onditions (Pelister *et al*., 2000b; Bilgiç and Aliç, 2005).

Although, effect of lactation number on 305 days milk yield was reported as significant (Özbeyaz and Küçük, 1999; Özçelik and Arpacik, 2000; Erdem *et al*., 2007; Inci *et al*., 20007). Some authors reported effect of lactation number on 305 days milk yield as non-significant (Bilgiç and Aliç, 2005; Koçak *et al*., 2007). Effects of calving age on 305 days milk yield have been reported as significant (Özbeyaz and Küçük, 1999; Pelister *et al*., 2000a; Çilek, 2002).

The lactation duration of Holstein cows was between 284.7 and 333.9 days in previous studies (Pelister *et al*., 2000a; Duru and Tuncel, 2002, 2004; Kaya *et al*., 2003; Bilgiç and Aliç 2005; Erdem *et al*., 2007; Inci *et al*., 2007). The effect of calving season on lactation duration was reported as non-significant (Pelister *et al*., 2000a;

Bilgiç and Aliç, 2005; Koçak *et al*., 2007). The effect of lactation number on lactation duration was reported as non-significant (Özçelik and Arpacik, 2000; Bilgiç and Aliç, 2005; Erdem *et al*., 2007). However, the effect of calving age on lactation duration was reported as significant (Pelister *et al*., 2000a; Inci *et al*., 2007). Zambrano *et al*. (2006) reported that the effect of calving year on lactation duration was significant.

The dry period of Holstein cows was between 73.34 and 82.1 days in previous studies (Pelister *et al*., 2000a; Kaya *et al*., 2003; Erdem *et al*., 2007; Inci *et al*., 2007). The effect of calving season on dry period was reported as non-significant (Pelister *et al*., 2000a; Koçak *et al*., 2007). However, the effect of calving age on lactation duration was reported as significant (Erdem *et al*., 2007). The effect of lactation number on dry period was reported as non-significant (Erdem *et al*., 2007; Inci *et al*., 2007). However, the effect of calving age on lactation duration was reported as significant (Özçelik and Arpacik, 2000). Effects of calving age on dry period have been reported as significant (Pelister *et al*., 2000a).

Many researchers were found that effect of calving year on all milk yield traits (305 days milk yield, lactation duration, dry period) was significant (Pelister *et al*., 2000a; Bilgiç and Aliç, 2005; Zambarano *et al*., 2006; Erdem *et al*., 2007). Inci *et al*. (2007) reported that effects of calving year on 305 days milk yield and lactation duration were significant but non-significant on dry period.

This study was conducted to investigate the environmental factors affecting milk yield traits of Holstein cows raised betwen 1993 and 2006 at the Polatli state farm.

MATERIALS AND METHODS

At the Polatli state farm located in Ankara province, a total of 3011 milk yield records of Holstein cows raised between 1993 and 2006 were used. Seven age groups were formed beginning from 2 years and ending at 8 years and older for calving age; 4 groups for calving season (Spring, Summer, Autumn and Winter), 5 groups for parity (lactation number) and 14 groups for calving year, between 1993 and 2006. The 305 dayss milk yield was estimated from test milk yields collected once a month during all lactation periods using the Holland method (Çilek, 2002; Çilek and Tekin, 2006a, b). Lactations with less than 7 tests were not used in calculation. Milk yields were standardized to 305 days by using adjustment factors estimated by Çilek (2008) for this herd. Environmental factors, which influenced lactation milk yield, lactation duration and dry period were investigated. The General Linear Model (GLM) was used for variance analyses of milk yield traits. Duncan's multiple range test was used for multiple comparisons.

The statistical model was:

$$Y_{ijkl} = \mu + A_i + B_j + C_k + D_l + E_{ijkl}$$

where:

Y_{ijkl} = Observed milk yield values at lactation number i, calving season j, calving year k and calving age l
μ = Mean of total observed values
A_i = Effects of lactation number (i = 1, 2, 3, 4, 5)
B_j = Seasonal effects (j = spring, summer, autumn and winter)
C_k = Effect of calving year (k = years between 1993 and 2006)
D_l = Effect of calving age (l= 2, 3, 4, 5, 6, 7 and 8 and older)
E_{ijk} = Random sampling effects

RESULTS AND DISCUSSION

Least square means for milk yield traits are presented in Table 1. Effects of all factors (calving year, calving age, parity and calving season) on 305 days milk yield were significant ($p<0.001$). The average 305 dayss milk yield was estimated as 5606.92±75.49 kg; 305 days milk yields were lowest in 1995 at 4216 kg and highest in 2004 at 7280 kg. The highest level in cows calving in winter was 5890 kg and the lowest level in cattle calving in summer was 5506 kg. Total 305 days milk yields were lowest in 2 years of age at 5278 kg and highest in 7 years of age at 5961 kg.

Average lactation duration was estimated as 303.40±3.04 days. The effects of parity and calving year on lactation duration were statistically significant ($p<0.001$-$p<0.05$). However, the effect of calving age and calving season were non-significant ($p>0.05$). Lactation duration was shortest in 2006 at 252.9 days and longest in 2004 at 363.2 days. Lactation duration was longest in 1st lactation at 315.3 days and shortest in 5th lactation at 285.1 days. Lactation duration decreased with increase of lactation number.

Average dry period was estimated as 98.15±2.25 days. Effects of parity, calving age and calving year on dry period were statistically significant ($p<0.001$), but the effect of calving season was non-significant ($p>0.05$). The dry period was lowest in 1998 at 75.46 days and highest in D1999 at 141.06 days. Dry period increased with increase of calving age. The lowest dry period was found in 2 years old age at 84.48 days and highest in 7 years old age at 101.97 days. Dry period was longest in 3rd lactation at 85.69 days and shortest in 5th lactation at 127.95 days.

Table 1: Least square means of milk yield traits

	305 days milk yield (kg)		Lactation duration (day)		Dry period (day)	
Factors	n	Mean±SE	n	Mean±SE	n	Mean±SE
Calving age		***		ns		***
2	846	5278±80.36c	846	309.3±5.12	637	84.48±3.355c
3	637	5487±75.91b	637	299.4±4.84	459	95.10±3.254b
4	511	5839±75.57a	511	305.5±4.82	342	96.84±3.315b
5	417	5849±78.25a	417	300.3±4.99	278	100.24±3.402ab
6	289	5939±84.50a	289	299.4±5.39	175	107.44±3.760a
7	167	5961±104.87a	167	304.5±6.69	84	101.97±5.082ab
8 and older	144	5758±111.80a	144	305.4±7.13	75	100.97±5.251ab
Calving season		***		ns		ns
Spring	805	5737±62.67b	805	299.4±3.99	525	102.26±2.81
Summer	572	5506±67.81c	572	309.4±4.32	377	96.78±3.04
Autumn	814	5787±63.85ab	814	304.3±4.07	584	97.96±2.83
Winter	820	5890±64.42a		820 300.5±4.11		564 95.59±2.89
Calving year		***		***		***
1993	156	5253±119.74 f	156	277.8±7.64de	109	117.29±4.97b
1994	54	5357±189.89ef	54	269.3±12.11ef	44	113.23±7.27bc
1995	206	4216±104.40 I	206	288.4±6.66d	166	105.88±4.18cd
1996	177	4391±109.49hi	177	292.4±6.98d	140	102.42±4.35d
1997	99	4760±140.29g	99	289.7±8.95d	84	100.51±5.34de
1998	274	4622±89.31gh	274	309.6±5.70c	195	75.46±3.76i
1999	182	5481±105.88e	182	254.4±6.75fg	62	141.06±5.98a
2000	226	5561±96.40e	226	325.3±6.15bc	164	88.88±4.01gh
2001	374	6488±78.10c	374	319.8±4.98bc	273	82.65±3.36gh
2002	257	6880±90.71b	257	322.8±5.78bc	148	90.32±4.27efg
2003	223	6972±96.35b	223	327.8±6.14b	156	89.29±4.11fgh
2004	345	7280±80.78a	345	363.2±5.15a	267	98.66±3.35def
2005	286	6771±85.35b	286	354.2±5.44a	177	90.08±3.87efg
2006	152	6190±113.55d	152	252.9±7.24g	65	78.33±5.83hi
Lactation No.		***		*		***
1	1592	5885±48.03bc	1592	315.3±3.06a	1171	93.07±2.004bc
2	839	6096±54.62a	839	303.7±3.48b	557	88.93±2.325bc
3	380	5952±74.55ab	380	302.3±4.75b	217	85.69±3.280c
4	139	5758±116.65c	139	310.6±7.44ab	78	95.11±5.227b
5	61	4960±174.78d	61	285.1±11.15c	27	127.95±8.739a
Mean	3011	5606.92±75.49	3011	303.4±3.04	2050	98.15±2.25

*p<0.05; **p<0.01; ***p<0.001; ns: non-significant; a, b, c: Means without a common superscript within each variable and each factor differ (p<0.05)

In this study, means of 305 days milk yield was 5606.92 kg. This value is agreement with values in other countries (Boujenane, 2002; Ajili *et al*., 2007) and in Turkey (Duru and Tuncel, 2002, 2004; Kaya *et al*., 2003; Bilgiç and Aliç, 2005; Erdem *et al*., 2007; Inci *et al*., 2007). As reported previously (Çilek, 2002; Çilek and Tekin, 2005), the effect of calving season on milk yield was significant and milk yield was the highest in cows calving in winter. Cows calving in winter have high milk yields, due probably to good feeding levels in the first 3 or 4 months of lactation and increase milk yield due to feed containing alfalfa being given during the period when milk yield begins to decrease. On the other hand, cows calving in summer have low milk yields due to their being subject to high environmental temperatures in the first 3 or 4 months of lactation. The lowest milk yield was obtained from cows calving at 2 years of age and the highest from those calving at 7 years of age. Milk yield decreased after 7 years of age. As reported in the literature (Çilek, 2002; Çilek and Tekin, 2005), this confirms that milk yield increases with age up to maturity and decreases thereafter.

In this farm, the lowest milk yield was obtained in 1995. After 1995, milk yield increased up to 2004. The reasons for this increase could be the use of bulls with high genetic capacity, selection for milk yield and culling in the herd and especially improvement in management and feeding conditions. Uniform feeding was started with the importation of silage machine in 1995. This caused the cattle to reflect their genetic capability better. Lower milk yield in 2006 may result from incomplete lactation when data were collected and mastitis infectious observed in herd. Between 1993 and 1999, short lactation duration and consequently low milk yield may result from the deficiency of attention and feeding conditions.

In this study, average lactation duration was 303.40 days. This was very close to the ideal value (305 days). The shorter lactation duration as 252.9 days in may be related to some incomplete lactations when this study was started and data were collected. Lactation

duration decreased with increase of lactation number. Short lactation duration in the oldest cows (5th lactation number) may be related to incomplete lactations because of culling.

The average dry period was 98.15±2.25 days. Dry period was higher than the ideal value (80 days). However, the dry period increased with calving age, as a result of increase of milk yield level with age in the herd. It can be said that if milk yield icreases with calving age, dry period would decrease. Effect of calving year on all milk yield traits was significant. Differences among years may be related to managment. It can be said that differences of managment among years was the most important factor affecting milk yield traits.

CONCLUSION

In this study, there was increase of milk yield level according to previous research (Bilgiç and Aliç, 2005) in this farm. This may result from improvement in breeding, feeding and management conditions (selection for milk yield and culling in the herd etc.). Although, lactation duration was found almost at ideal value, dry period was estimated as higher than the ideal value. In order to make animals more profitable, it is essential they be made pregnant as soon as possible during the service period in order to shorten the dry period. Under Turkish conditions and steppe climate of middle Anatolia. It can be concluded that Holstein cattle are raised successfully for milk yield on Polatli state farm.

REFRENCES

Alpan, O., 1994. Breding and feeding of cattle. Medisan Yayinevi, Ankara.

Ajili, N., B. Rekik, A.B. Gara and R. Bouraoui, 2007. Relationships among milk production, reproductive traits and herd life for Tunisian Holstein-Friesian cows. Afr. J. Agric. Res., 2 (2): 047-051.

Bilgiç, N. and D. Aliç, 2005. Milk yield traits of holstein friesian cows raised in polatli state farm. IN: Ziraat Fakültesi, S.Ü. Dergisi, 19 (36): 116-119.

Boujenane, I., 2002. Estimates of genetic and phenotypic parameters for milk production in moroccan holstein-friesian cows. Revue Élev. Méd. Vét. Pays Trop., 55 (1): 63-67.

Çilek, S., 2002. Estimation of factors for standardizing lactations to mature age and 305 days and heritabilty and repeatability of milk yield for Brown Swiss cattle reared at Ulas State Farm. Ph. D. Thesis. Selçuk University the Institute for Health Sciences, Konya, Turkey, pp: 5-57.

Çilek, S. and M. E., Tekin, 2005. The environmental factors effecting milk yield and fertility traits of Simmental cattle raised at Kazova State Farm and phenotypic correlations between these traits. Turk. J. Vet. Anim. Sci., 29: 987-993.

Çilek, S. and M.E. Tekin, 2006a. Calculation of adjustment factors for standardizing lactations to mature age and 305 days and estimation of heritability and repeatability of standardized milk yield of simmental cattle reared on Kazova State Farm. Turk. J. Vet. Anim. Sci., 30: 283-289.

Çilek, S. and M.E. Tekin, 2006b. Estimation of factors for standardizing lactations to mature equivalent and 305 days basis for Brown Swiss cattle reared at Ulas State Farm. Indian J. Anim. Sci., 76 (8): 621-624.

Çilek, S. and M.E. Tekin, 2007. Environmental factors effecting milk yield traits of brown swiss cows raised at ulas state farm and phenotypic correlations between milk yield and fertility traits. Indian J. Anim. Sci., 77 (2): 154-157.

Çilek, S., 2008. Estimation of adjustment factors for standardizing lactations to Mature age and 305 days of milk yield of holstein cattle reared at polatli state farm in Turkey. J. Vet. Anim. Adv., 7 (9): 1056-1060.

Duru, S. and E. Tuncel, 2002. An investigation on milk yield and reproductive performance of holstein friesian cows in kocas state farm, 1. Milk Yield Traits. Turk. J. Vet. Anim. Sci., 26: 97-101.

Duru, S. and E. Tuncel, 2004. The correlations between dry period, service period and age at first calving with some milk yield traits in Holstein Friesian cattle. Uludag Üniv. Zir. Fak. Derg., 18 (1): 69-79.

Erdem, H., S. Atasever and E. Kul, 2007. Milk yield and fertility traits of holstein cows raised at Gokhoyuk State farm, 1. Milk Yield Traits. J. Fac. Agric., Omu, 22 (1): 41-46.

Inci, S., A., Kaygisiz, E. Efe and S. Bas, 2007. Milk yield and reproductive traits in brown swiss cattle raised at Altinova State Farm. Ankara Üniv. Tarim. Bilimleri. Derg., 13 (3): 203-212.

Kaya, I. and A. Kaya, 2003. Parameter estimates for persistency of lactation and relationship of persistency with milk yield in Holstein cattle. I. Factors Affecting Persistency of Lactation. Hayvansal. Üretim., 44 (1): 76-94.

Kaya, I., C. Uzmay, A. Kaya and Y. Akbas, 2003. Comparative analysis of milk yield and reproductive traits of Holstein-Friesian cows born in Turkey or imported from Italy and kept on farms under the Turkish-ANAFI Project. Ital. J. Anim. Sci., 2: 141-150.

Koçak, S., B. Yüceer, M. Ugurlu and C. Özbeyaz, 2007. Some production traits of holstein cows reared in Bala State Farm. Lalahan Hay. Arast. Enst. Derg., 47 (1): 9-14.

Kumuk, T., Y. Akbas and L. Türkmut, 1999. Economic loss in fertility parameters of dairy cattle and knowledge and technology needs of breeders Hayvansal Üretim., 39-40: 1-12.

Özbeyaz, C. and M. Küçük, 1999. Milk yield traits in Brown Swiss herd at Malya State farm. J. Lalahan Livest. Res. Instit., 39: 7-16.

Özçelik, M. and R. Arpacik, 2000. The effect of lactation number on milk production and reproduction in Holstein Cows. Turk. J. Vet. Anim. Sci., 24: 39-44.

Pelister, B., A. Altinel and H. Günes, 2000a. An investigation on the milk yield characteristics of black pied cattle of different origin in commercial farm conditions. Istanbul Üniv. Veteriner Fak. Derg., 26 (1): 201-214.

Pelister, B., A. Altinel and H. Günes, 2000b. Özel isletme kosullarinda yetistirilen degisik orijinli siyah alaca sigirlarin döl ve süt verim özellikleri üzerinde bazi çevresel faktörlerin Etkileri, Istanbul Üniversitesi Veteriner Fakültesi Dergisi, 26 (2): 543-556.

Yalçin, B.C., 1975. Bazi çevre faktörlerinin verim özellikleri üzerindeki etkilerinin Istatistiksel Eliminasyonu. Istanbul Üniversitesi Veteriner Fakültesi Dergisi, 1 (1): 82-102.

Yaylak, E. and S. Kumlu, 2005. The effects of body condition score and some environmental factors on 305 days milk yield of Holstein cows. Ege. Üniv. Ziraat. Fak. Derg., 42 (3): 55-66.

Zambrano, S., G. Contreras, M. Pirela, H. Cañas, T. Olson and A. Landaeta-Hernández, 2006. Milk yield and reproductive performance of crossbred Holstein × Criollo Limonero cows. Revista Científica, Fcv-Luz, XVI (2): 155-164.