

## Milk Yield Traits of Holstein Cattle Reared at Tahirova State Farm in Balikesir Province in Turkey

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**Abstract:** In this study, effects of environmental factors on milk yield and milk yield characteristics of Holstein cows raised at Tahirova state farm in Balikesir province of Turkey have been investigated. A total of 1302 milk records obtained between 2000 and 2007 were used in this study. As milk yield traits, lactation duration, lactation milk yield, 305 days milk yield and dry period were investigated. Effect of environmental factors on milk yield traits was analyzed by using the least square means method. The least square means for the lactation duration, lactation milk yield, 305 days milk and dry period yield were 331.74±1.55 days, 7574.39±55.22 kg, 6810.14±56.38 kg and 79.47±0.90 days, respectively. The effects of calving year on lactation duration, lactation milk yield, 305 days milk yield and dry period were much significant ( $p<0.01$ ). Effect of calving season on lactation duration was significant ( $p<0.05$ ). Effect calving age on lactation duration and lactation milk yield was significant ( $p<0.05$ ,  $p<0.01$ ). The effects parity on lactation duration, lactation milk yield, 305 days milk yield and dry period were significant ( $p<0.01-0.05$ ). It can be said that Holstein cattle have quite well milk yield and are raised successfully on Tahirova state farm and under conditions of west Anatolia in Turkey. To obtain much higher milk yield in this farm, true selection for milk yield should be done and better feeding, care and management should be done.

**Key words:** Holstein, cattle, milk yield, effective factors, Turkey

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### INTRODUCTION

Basis aim of dairy cattle breeding is to obtain the highest yield more economically, like other livestock animal species. Yield level is determined by two components, which are genetic structure and environmental conditions. As maximum milk yield can be obtained from cows, these two basis components should take into consideration together. As all countries of world, dairy cattle's breeding in animal production of Turkey is the most important branch of animal production and decreasing of economic loss is accepted as obligatory to increase the milk yield level per cow. Especially in last years, improvements have done considerably in dairy cattle breeding in all regions in Turkey (Kutlu *et al.*, 2003; Akman *et al.*, 2005).

Ratio of native cattle breeds (Anatolian black breed, East Anatolian red breed, Southern Anatolian red breed and Turkish grey and other breeds) are constituted

34.52% of cattle population of Turkey. Ratio of crossbred cattle is constituted 43.11% of cattle population of Turkey and culture breed cattle as Holstein, Simmental, brown Swiss and other breeds is 22.37% of cattle population of Turkey (Anonymous, 2006). Crossbred of Holstein cattle with native breeds in Turkey are named Turkish black pied (Pelister *et al.*, 2000). In Turkey, ratios of culture breed cattle have increased gradually in last years. However, total milk production in Turkey has been increased.

Black pied or Holstein cattle are at more number as numerically among culture-breed cattle reared in Turkey. However, as other breeds, milk yield level of Holstein cattle is affected by genetic structure and also more significantly environmental condition. As a result, yield levels are various in different regions and different farm condition of Turkey. These various demonstrate partially different of milk yield level of regions and farms in subject of dairy cattle breeding (Kutlu *et al.*, 2003; Erdem *et al.*, 2007).

**Table 1: Results for milk yield researches which were done in different state farms in Turkey**

Region of research	Lactation duration (day)	Lactation milk yield (kg)	305 days milk yield (kg)	Dry period (day)	References
Yalova	290.7	3935.8	3902.5	75.5	Tuncel and Eker (1972)
Sakarya	305± 2.2	2801±39.9	2766	-	Çetegen (1978)
Polatli	295.9	3459	-	75.1	Sekerden and Pekel (1981)
Malya	-	-	3102.52±63.52	114.22±10.2	Cengiz (1982)
Koças	-	-	3039.99±35.83	75.51±3.42	Cengiz (1982)
Ceylanpinar	303.7± 1.0	3553.0±19.1	3396±17.2	-	Cebeci and Özkütük (1987)
Dalaman	310.66±2.99	-	3843.66±106.31	90.60±3.06	Kumuk (1989)
Türkgeldi	296.96±2.73	-	5022.17±97.36	123.18±2.67	Kumuk (1989)
Sarmisakli	285.32±2.51	-	5763.53±90.06	118.47±2.44	Kumuk (1989)
Tahirova	313.21±2.37	-	4895±96.31	98.92±2.88	Kumuk (1989)
Karacabey	326	3322	3165	-	Yildiz and Sengonca (1990)
Gökçeada	299±9.7	4379.3±270.6	4413.5±548.5	-	Soysal and Özder (1992)
Tahirova	307	-	4822	-	Ipek (1993)
Sakarya	349.87	6111.16	5527.96	71.8	Özbeyaz and Altinel (1995)
Kumkale	313.43	5519.46	5289.87	82.72	Günes (1996)
Altindere	230	-	-	209	Kaygisiz (1996)
Polatli	284.7±2.5	4859.4±61.8	4597.3±64.1	-	Bilgiç and Yener (1999)
Malya	324.8	-	3298	69.1	Özbeyaz and Küçük (1999)
Tahirova	311.02±2.42	6311.68±74.91	6170.85±67.06	68.09±1.50	Özçakir and Bakir (2001)
Konuklar	303	-	6173	-	Zulkadir and Boztepe (2001)
Gelemen	322	4925	4564	-	Akman <i>et al.</i> (2001)
Koças	304	4966	4784	-	Duru and Tuncel (2002)
Reyhanli	313.08±41.63	6427.90±75.03	6208.42±69.39	61.22±5.00	Bakir and Çetin (2003)
Gökhöyük	301.7±3.8	6467.0±80.9	6273.0±100.4	82.0±4.0	Erdem <i>et al.</i> (2007)
Polatli	303.40±3.04	-	5606.92±75.49	98.15±2.25	Çilek (2009)

To determine milk yield level of Holstein cows, a lot of studies were done by Çetegen (1978), Tuncel and Eker (1972), Sekerden and Pekel (1981), Cengiz (1982), Cebeci and Özkütük (1987), Kumuk (1989), Günes (1996), Kaygisiz (1996), Bilgiç and Yener (1999), Özbeyaz and Küçük (1999), Pelister *et al.* (2000), Akman *et al.* (2001), Zulkadir and Boztepe (2001), Duru and Tuncel (2002), Bakir and Çetin (2003), Özçakir and Bakir (2003), Çilek and Tekin (2005, 2007), Türkyılmaz *et al.* (2005), Erdem *et al.* (2007) and Çilek (2009). However, different results in these researches were found. To determine milk yield level of Holstein cows, results found in some researches, which were done in Turkey were demonstrated in Table 1. This study was done to determine various, which were occurred together with years at milk yield traits of Holstein cows reared in Tahirova state farm. Furthermore, results, which were found in this study were compared with results in study. Also, it was aimed to determine management condition of farm viewpoint of milk yield traits.

**MATERIALS AND METHODS**

Material of study is a total of 1302 milk yield records of cows which are present in Tahirova state farm or culled from herd between 2000 and 2007 years. The lactation duration, lactation milk yield, 305 days milk yield and dry period were estimated from test milk yields collected once a month using the Holland method (Akman and Eliçin, 1984; Çilek and Tekin, 2006a; Çilek, 2009). In this study, 6 calving groups were formed beginning from 2 years and ending at 7 years. Four groups were formed for calving

season as winter, spring, summer and autumn. Six groups were formed for parity (lactation number). Eight groups for calving year were formed between 2000 and 2007. Lactations <180 days were not used for the calculation in this study.

To determine effects of age of cow, calving years, lactation number (parity) and calving season on milk yield traits, variance analyze was done by using SAS program (SAS, 1998). Duncan's (1955) multiple range tests was used for multiple comparisons in important subgroups. The model used to analyze effective factors on milk yield was:

$$Y_{ijkl} = \mu + a_i + b_j + c_k + d_l + e_{ijklm}$$

Where:

- $\mu$  = Mean milk yield of cow population
- $a_i$  = Parity (lactation number)
- $b_j$  = Calving years
- $c_k$  = Calving season
- $d_l$  = Effect of calving age
- $e_{ijklm}$  = Error

**RESULTS AND DISCUSSION**

The least square means of lactation duration, lactation milk yield, 305 days milk yield, dry period were 331.74±1.55 days, 7574.39±55.22 kg, 6810.14±56.38 kg and 79.47±0.90, respectively as shown in Table 2. According to variance analyze for milk yield traits, effects of parity and calving years on all milk yield traits (lactation duration, lactation milk yield, 305 days milk yield, dry period) were found statistically significant ( $p < 0.05$ ,  $p < 0.01$ ).

Table 2: Standard error and least square means values for milk yield traits

Factors	Lactation duration (days)		Lactation milk yield (kg) ( $\bar{x} \pm S_e$ )	305 days milk yield (kg) ( $\bar{x} \pm S_e$ )	Dry period (days)	
	N	$\bar{x} \pm S_e$			N	$\bar{x} \pm S_e$
<b>Parity</b>	-	**	**	*	-	**
1	475	347.54±7.775a	8007.75±275.15a	7115.56±280.96a	413	68.16±4.85c
2	327	342.93±5.76ab	7953.88±204.35a	7192.35±208.67a	274	78.32±3.68bc
3	221	326.36±5.69b	7374.75±201.93a	6727.19±206.20a	177	81.52±3.47bc
4	137	311.80±7.00b	6880.11±248.23a	6162.75±253.47a	111	96.77±4.30a
5	81	306.31±10.17b	5728.59±360.78b	5373.34±368.40b	55	86.30±7.07bc
6	61	311.39±12.21b	5792.32±433.10b	5819.85±442.24b	47	95.16±8.73ab
<b>Calving year</b>	-	**	**	**	-	**
2000	62	314.84±8.27d	5763.70±293.28d	5424.94±299.47d	51	89.12±4.75ab
2001	75	351.36±7.32a	6939.31±259.91b	6373.93±265.39bc	70	89.25±4.10ab
2002	144	332.12±5.38b	6292.78±191.05d	5802.54±195.09cd	142	90.55±3.02ab
2003	174	310.38±5.22d	6938.39±185.40b	6601.41±189.31ab	163	89.39±3.00a
2004	165	311.09±5.23d	7289.70±185.79ab	6897.78±189.72a	146	86.07±3.10ab
2005	268	326.14±4.47bc	7361.76±158.66ab	6268.08±162.01c	220	79.89±2.65abc
2006	255	328.95±4.20bc	7845.39±149.23a	7235.05±152.39a	215	78.20±2.55bc
2007	159	320.22±5.24bcd	7218.81±186.05b	6584.33±189.98bc	68	72.49±4.26c
<b>Calving age</b>	-	**	*	NS	-	NS
2	420	317.66±9.13a	6365.93±323.84a	5953.77±330.68a	368	89.96±5.87c
3	262	309.62±7.26bc	6407.95±257.46a	6049.93±262.90a	225	84.47±4.78bc
4	221	321.84±6.76bc	6708.87±239.85a	6188.85±244.91a	177	85.08±4.41bc
5	163	322.13±6.59c	7046.23±233.97a	6559.53±238.91a	126	83.51±4.20ab
6	109	340.52±7.45b	7564.27±264.52a	7042.80±270.10a	91	82.53±4.56a
7	127	334.54±8.92c	7644.13±316.50b	6596.16±323.19b	90	80.68±6.55ab
<b>Calving season</b>	-	*	NS	NS	-	NS
Winter	426	315.58±3.93b	6979.00±139.58a	6568.25±142.53a	346	81.27±2.38a
Spring	372	340.70±4.53a	7162.70±160.75a	6332.66±164.15a	302	87.93±2.71a
Summer	255	321.15±4.57b	6768.06±162.07a	6270.60±165.49a	209	84.19±2.86a
Autumn	249	320.11±4.28b	6915.17±151.97a	6422.51±155.18a	220	84.10±2.71a
Year×season	-	**	*	NS	-	*
Overall mean	-	331.74±1.55	7574.39±55.22	6810.14±56.38	-	79.47±0.90

NS: Non-Significant, \* $p < 0.05$ , \*\* $p < 0.01$ ,  $\bar{x}$  : means,  $S_e$ : Standard error; a-d: Differences between groups with same letter in subgroups of a factor is non-significant, differences between groups with different letter are significant ( $p < 0.01-0.05$ )

Effects of calving age on lactation duration and lactation milk yield were statistically significant ( $p < 0.05$ ,  $p < 0.01$ ). Although, effect of calving season on lactation duration was significant ( $p < 0.05$ ), effect of calving season on other milk yield traits was non-significant ( $p > 0.05$ ).

According to the results of variance analyze for milk yield traits, effects of all factors (lactation number (parity), year, age, season) on lactation duration were significant ( $p < 0.01$ ,  $p < 0.05$ ). The means of lactation duration was found as 331.74±1.55 days. In dairy cattle breeding, it is wanted a cow is milked ten months and dried 2 month. Lactation duration was found as higher than wanted value (305 days). It can be said that farm management was not willing to dry cows. While, value estimated for lactation duration in this study was similar to results of previous researches in other farms (Güven, 1977; Yildiz and Sengonca, 1990; Yener *et al.*, 1994), it was the higher than results of a lot of studies (Çetegen, 1978; Tuncel and Eker, 1972; Sekerden and Pekel, 1981; Cengiz, 1982; Cebeci and Özkütük, 1987; Kumuk, 1989; Günes, 1996; Kaygisiz, 1996; Bilgiç and Yener, 1999; Özbeyaz and Küçük, 1999; Akman *et al.*, 2001; Zülkadir and Boztepe, 2001; Duru and Tuncel, 2002; Bakir and Çetin, 2003; Özçakir and Bakir, 2003, Çilek and Tekin, 2005, 2007; Erdem *et al.*, 2007;

Çilek, 2009) and is the lower than results of some studies (Atay *et al.*, 1995; Özcan and Altinel, 1995; Türkyılmaz *et al.*, 2005).

Although, the highest lactation duration was found as 347.54 at first lactation, the lower lactation duration was found as 306.31 days at 5th lactation. It can be said that lactation duration decreased with lactation number's increasing. Lactation duration was the highest in 6 years old cows and the lower in 3 years old cows. According this, it can be said that lactation duration increased with increasing of age of cow. As milk yields of cows, increase with age, cows might have been dried at late time of lactation by manager of farm. As milk yield of younger cows was low, younger cows were dried at early time of lactation by manager of farm. Thus, lactation duration of aged cows may be longer than lactation duration of young cows.

Although, effects of parity, calving year and calving age on lactation milk yield were significant ( $p < 0.01$ ,  $p < 0.05$ ), effect of season was non-significant ( $p > 0.05$ ). Means of lactation milk yield was found 7574.39±55.22 kg. This milk yield value quite higher than other state farm in Turkey's condition. This value was close to values informed as 7164 kg by Yener *et al.* (1994), but is lower

than all studies in other farms (Akman *et al.*, 2001; Zülkadir and Boztepe, 2001; Duru and Tuncel, 2002; Bakir and Çetin, 2003; Özçakir and Bakir, 2003; Erdem *et al.*, 2007; Çilek, 2009).

According to variance analyze for 305 days milk yield, effects of lactation number (parity) and calving year on 305 days milk yield were statistically significant ( $p < 0.01-0.05$ ).

Means of lactation 305 days milk yield was found  $6810.14 \pm 56.38$  kg. This milk yield value was quite higher than (Güven, 1977; Cengiz, 1982; Cebeci and Özkütük, 1987; Kumuk, 1989; Yildiz and Sengonca, 1990; Soysal and Özder, 1992; Ipek, 1993; Atay *et al.*, 1995; Özcan and Altinel, 1995, 1995; Günes, 1996; Kaygisiz, 1996; Bilgiç and Yener, 1999; Özbeyaz and Küçük, 1999; Akman *et al.*, 2001; Zülkadir and Boztepe, 2001; Duru and Tuncel, 2002; Bakir and Çetin, 2003; Erdem *et al.*, 2007) in other state farms in Turkey's condition. This value is very close to value informed as 6776.9 kg by Yener *et al.* (1994).

While, the lowest lactation milk yield and 305 days milk yield was seen in 2000 years, the highest milk yield was seen in 2006. According to this, it can be thought that increasing of milk yield with advanced years may have been performed with improvement of environmental conditions and true selection of daughter. It was reported milk yields of cows increase until 6 years old, which accepted as mature age (Çilek, 2002, 2009; Çilek and Tekin, 2005, 2006b). Similarly, it can be said milk yield increased with age up to maturity and decreased later in this study. Although, effects of calving season on 305 days milk yield and lactation milk yield were non-significant, it was reported that calving season affected on 305 days milk yield, also the highest 305 days milk yield was in cows in calved at winter, the lowest milk yield was in cows in calved at summer (Alpan and Arpacik, 1998; Çilek, 2009).

Milk yield of cows calved at winter was higher than cows calved at summer because of improvement of feeding level (Alpan and Arpacik, 1998; Çilek, 2009). Çilek and Tekin (2005) reported that cow calving in winter have high milk yield, due to good feeding levels in the first 3 or 4 months of lactation and increase milk yield due to feed with green grass and during the period when milk yield begins to decrease. Tahirhova state farm in Balikesir province in Aegean region of Turkey have mild climate. Temperature differences in among seasons are small in Tahirhova state farm. Furthermore, differences of feeding among seasons are small because of available of green grass in every season. This climatic trait may be reason that effect of season on milk yield was non significant.

Though effects of lactation number and calving year on dry period were statistically significant ( $p < 0.01$ ), effects of calving season and calving age were non-significant ( $p > 0.05$ ). Means of dry period was  $79.47 \pm 0.90$  days. Dry period was higher than wanted value (60 days) for dairy cattle breeding. It should be paid attention when cows were dry in state farm. The dry period was found lowest as  $68.16 \pm 4.85$  days for cows in first lactation and highest as  $96.77 \pm 4.30$  days for cows in 4th lactation.

The dry period was found highest as  $89.96 \pm 5.87$  days for in 2 years old cows and lowest as  $80.68 \pm 6.55$  days for in 7 years old cows. It can be said that dry period decreased with increasing of calving age. As older cows with high yield in herd keep at lactation in long time, lactation duration is longer and thus, dry period is shorter. While value of dry period is lower than values found between 114 days and 209 days in previous researches in other state farm (Cengiz, 1982; Kumuk, 1989; Kaygisiz, 1996), this value is similar to values found between 81 and 82 by Çilek and Tekin (2005) and Erdem *et al.* (2007).

## CONCLUSION

When results about milk production characteristics of Holstein cows raised in Tahirova state farm were compared with other state farms in Turkey. It can be said that milk yield of Holstein cows reared at Tahirova state farm (Aegean region of Turkey) is very good and important for Turkey. Milk yield of Holstein cows at Polatli state farm in Middle Anatolia with steppe climate conditions was reported 5606.92 kg in previous study (Çilek, 2009). As it was expected, milk yield of Holstein cows in Tahirhova state farm with mild climate was higher than Polatli state farm with steppe climate. Higher milk yield in Tahirhova state farm with mild climate can be obtained with improvement of feeding and genetic structure of cows. In this state farm, milk yield value was higher than value of previous study by Özçakir and Bakir (2003). Increasing of milk yield level in Tahirova state farm can be result of improvement of methods of feeding and attention and doing true selection according to milk yield. However, milk level of Holstein cows reared at Tahirova state farm is lower than yields of cows reared at countries of European Union. Milk yield level should be increased in this state farm. To increase milk yield level, feeding and care of cows should be done appropriately and selection of heifers and culling of cows according to milk yield should be done with more true selection methods.

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