Journal of Animal and Veterinary Advances 8 (11): 2383-2387, 2009
ISSN: 1680-5593

A Research on Reproductive Traits of Holstein Cattle Reared at Tahirova State Farm in Balikesir Province in Turkey

[1]Galip Bakir and [2]Suleyman Cilek
[1]Department of Animal Breeding, Faculty of Agriculture,
Yuzuncu Yil University, Van, Turkey
[2]Department of Animal Breeding, Faculty of Veterinary Medicine,
Kirikkale University, Yahsihan, 71451 Kirikkale, Turkey

Abstract: The aim of this study was to investigate environmental factors affecting reproductive traits of Holstein cows and heifers raised at the Tahirova state farm in province Balikesir in Turkey. Reproductive traits were investigated by using 1074 records between 2000 and 2008. The least square means of age of first breeding, age of first calving, service period, calving interval and gestation length were 523.90±6.71, 815.38±7.18, 387.69±1.60, 122.30±1.67 and 277.45±0.27 days, respectively. Effects of calving year, calving age, calving season on age of first breeding and age of first calving were statistically significant ($p<0.01$). The effects of calving age, calving year and calving season on calving interval were significant ($p<0.01$-0.05). Although, the effect of calving year on service period was non-significant ($p>0.05$), the effects of calving age and calving season on service period were significant ($p<0.01$-0.05). Effects of sex of calf, calving age, calving year and calving season on gestation length were statistically significant ($p<0.01$-0.05). According to these results, it can be concluded that reproductive performance of Holstein cattle reared at this farm in Balikesir province were raised more successful than state farms in other regions of Turkey. To obtain better reproductive performance, service period should be decreased, heifers should be bred at 15 months of age, oestrus detection and artificial insemination should be done at the right time and convenient manner, GnRH injections was done for cows with high milk yield.

Key words: Holstein, reproductive traits, age of first breeding, age of first calving, service period, environmental factors

INTRODUCTION

Reproduction in all animals is necessary for continuance of generation. Furthermore, reproduction of livestock animals is beginning for all economic yields (milk yield and meat yield). If reproduction of animals is absent, milk yield and meat yield (meat of young animal) of animals will be absent except for wool yield in sheep. If reproduction of animals is high, milk yield and meat yield of animals will be at high level. Profitable breeding of livestock, animals can be obtained with high reproductive performance. Therefore, environmental factors affecting on reproduction of livestock animals should be known. And some corrections in management of farm should be done to increase reproductive yields of animals.

As breeder can obtain lifelong high milk production from a cow, it should be obtained a calf from this cow in every year. It was known that calving interval >365 days causes economic loss at dairy cattle breeding. Therefore, dairy cows should be made pregnant again within 90 days after calving, as mean gestation duration is 280 days. Namely, service period should be >90 days. As getting longer of service period cause economic loss, farm management should be planned according to ideal value of service period carefully.

The gestation length of Holstein cows between 273.46 and 279.3 days has been reported by Bakir *et al.* (1994), Sehar and Ozbeyaz (2005), Erdem *et al.* (2007), Kopuzlu *et al.* (2008) and Cilek (2009). Gestation duration is affected by a lot of factors as age of cows, sex of calf, type of birth, feeding of cows etc. Effect of age of cows on gestation duration was found significant (Inal and Alpan, 1989; Ogan, 2000; Cilek and Tekin, 2005, 2007; Sehar and Ozbeyaz, 2007; Cilek, 2009). Although, it was reported that gestation duration increased parallel to calving age (Ogan, 2000; Sehar and Ozbeyaz, 2007). Inal and Alpan (1989) reported that gestation duration increased, until 6 years of age and then began to

Corresponding Author: Suleyman Cilek, Department of Animal Breeding, Faculty of Veterinary Medicine, Kirikkale University, Yahsihan, 71451 Kirikkale, Turkey

decrease. It was reported that effect of sex of calf on gestation duration was significant and gestation duration for male births was longer than for female births (Cilek and Tekin, 2005, 2007). Effect of calving season on gestation duration was reported significant by Cilek and Tekin (2005, 2007), Erdem *et al.* (2007) and Kopuzlu *et al.* (2008). Stevenson (1989) reported that gestation duration increased by 1.3 days for every 1 h decrease in day length from September to December.

Effects of calving season on service period and calving interval were reported significant (Koc *et al.*, 2004; Ozkan and Gunes, 2007; Tuna *et al.*, 2007; Kopuzlu *et al.*, 2008; Cilek, 2009). Although, Cilek (2009) reported that effects of calving age on service period and calving interval reported significant, effects of calving age on service period and calving interval were reported non-significant by Cilek and Tekin (2005) and Sehar and Ozbeyaz (2007). Although, effects of calving year on service period and calving interval as significant were reported by Koc *et al.* (1994), Pelister *et al.* (2000), Cilek and Tekin (2005), Topaloglu and Gunes (2005), Ozkan and Gunes (2007), Tuna *et al.* (2007), Kopuzlu *et al.* (2008) and Cilek (2009), effects of calving year on service period and calving interval were reported as non-significant (Inci *et al.*, 2007; Sehar and Ozbeyaz, 2007).

Age of first breeding for Holstein heifers between 538.4 and 664 days was reported by Erdem *et al.* (2007), Inci *et al.* (2007), Ozkan and Gunes (2007), Sehar and Ozbeyaz (2007), Tuna *et al.* (2007) and Kopuzlu *et al.* (2008). Effect of calving year on age of first breeding was reported by Inci *et al.* (2007), Sehar and Ozbeyaz (2007), and Tuna *et al.* (2007). Effect of calving season on age of first breeding was statistically reported by Erdem *et al.* (2007).

In dairy cattle breeding, it is desired that cows give fist calf at 2 years of age. Age of first calving for Holstein heifer was reported between 799 and 936 days (Pelister *et al.*, 2000; Koc *et al.*, 2004; Galic *et al.*, 2005; Topaloglu and Gunes, 2005; Erdem *et al.*, 2007; Inci *et al.*, 2007; Ozkan and Gunes, 2007; Sehar and Ozbeyaz, 2007; Tuna *et al.*, 2007; Kopuzlu *et al.*, 2008).

Effect of calving year on age of first calving was statistically reported by Bakir *et al.* (1994), Topaloglu and Gunes (2005), Ozkan and Gunes (2007), Sehar and Ozbeyaz (2007) and Tuna *et al.* (2007). Although, effect of calving season on age of first calving was reported as significant previously by Koc *et al.* (2004), Topaloglu and Gunes (2005) and Erdem *et al.* (2007). Ozkan and Gunes (2007) reported that effect of calving season on age of first calving was non-significant.

This study was conducted to investigate the environmental factors affecting reproductive traits of Holstein cows and heifers raised at the Tahirova state farm in Balikesir province in Turkey.

MATERIALS AND METHODS

In this study, a total of 1074 reproductive records of cows which are present in Tahirova state farm or culled from herd between 2000 years and 2008 years were used. As Reproductive traits, age of first breeding, age at first calving, calving interval, service period and gestation duration were investigated. The gestation length, service period, calving interval, age at first breeding and age at first calving were calculated by using records. In this study, six 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. Two groups were formed for sex of calf. Nine groups for calving year were formed between 2000 and 2008.

Variance analyze was done by using SAS program (SAS, 1998) for aim of determining effects of age of cow, calving years, sex of calf and calving season on reproductive traits. For multiple comparisons in significant subgroups, Duncan (1955) multiple range tests was used in comparisons among groups. The model was used to analyze effective factors on reproductive traits as:

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

μ = Mean gestation duration of cow population
a_i = Effect of calving age of cows
b_j = Effect of calving years
c_k = Effect of calving season
d_l = Effect of sex of calf
e_{ijklm} = Error

RESULTS AND DISCUSSION

Results of least square means for reproductive traits were shown in Table 1. The average age of first breeding was estimated as 523.90±6.71 days. Age of first breeding was lowest in 2001 at 499.15 days and highest in 2003 at 552.61 days. Age of first breeding was lowest in spring at 519.54 days and highest in autumn at 551.85 days. The average age of first calving was estimated as 815.38±7.18 days; age of first breeding were lowest in 2001 at 777.93 days and highest in 2000 at 838.83 days. Age of first breeding was lowest in winter at 800.39 and highest in autumn at 839.92 days. Effects of calving year, calving age, calving season on age of first breeding and age of first calving were statistically significant ($p<0.01$).

Table 1: Least square means and standard error values for reproductive traits

	Age of first breeding (days)		Age at first calving (days)		Calving interval (days)		Service period (days)		Gestation duration (days)	
Factors	N	$\bar{x} \pm S_x$	N	$\bar{x} \pm S_x$	N	$\bar{x} \pm S_x$	N	$\bar{x} \pm S_x$	N	$\bar{x} \pm S_x$
Calving year	**		**		**		NS		*	
2000	20	542.41±16.88a	26	838.83±19.27a	34	342.26± 9.18c		-		-
2001	49	499.15±15.74	49	777.93±17.94d	22	389.32±11.16ab	65	133.45±6.90a	76	276.32±0.98c
2002	87	532.53±14.78ab	85	822.37±16.81abc	49	396.88± 7.70a	118	124.31±5.19a	120	275.40±0.78bc
2003	55	552.61±15.75a	59	835.94±17.77ab	114	373.95± 5.42b	163	122.52±4.43a	165	276.09±0.68abc
2004	38	529.31±16.22bc	37	810.30±18.39cd	140	379.33± 4.89ab	150	120.43±4.56a	132	276.79±0.73ab
2005	97	502.87±15.02d	104	798.67±17.05cd	188	376.64± 4.19ab	219	120.41±3.76a	202	277.48±0.59abc
2006	61	544.82±15.50a	79	820.11±17.37abcd	227	383.24± 4.08ab	96	117.26±5.71a	106	277.80±0.84a
2007	21	538.03±16.62ab	40	805.75±17.44bcd	220	374.40± 4.06ab	91	127.46±5.78a	40	279.05±1.29a
2008		-		-	80	376.18±6.17bcd	53	125.16±7.50a		-
Calving age	**		**		**		*		**	
2	21	467.09±11.31a	21	741.06±12.78a		-	89	104.12±5.85b	121	272.11±0.74b
3	408	532.60±2.69b	458	823.22±3.86b	21	330.22±11.37b	295	126.57±3.36a	295	277.80±0.50a
4		-		-	366	387.97±3.01a	252	125.54±3.49a	201	279.05±0.60a
5		-		-	256	388.17± 3.53a	168	125.26±4.28a	121	277.99±0.77a
6		-		-	178	391.04±4.17a	91	130.04±5.74a	57	276.53±1.11a
7		-		-	253	387.16±3.75a	60	131.71±7.03a	46	278.46±1.20a
Calving season	**		**		*		**		**	
Winter	132	521.99±14.43b	155	800.39±16.78b	347	372.86±3.74b	341	115.89±3.19c	306	278.42±0.54a
Spring	145	519.54±14.79b	160	804.60±17.03b	284	379.58±4.15ab	250	126.10±3.81ab	236	277.67±0.60a
Summer	78	527.48±15.11b	88	809.96±17.41b	223	382.79±4.41a	179	133.85±4.22a	135	274.29±0.73b
Autumn	73	551.85±15.08a	76	839.92±17.41a	220	372.42±4.18b	185	119.66±4.18bc	164	277.58±0.67a
Sex of calf				-					*	
Male		-		-	-	-		-	404	277.47±0.48a
Female		-		-	-	-		-	437	276.51±0.47b
Overall mean	429	523.90±6.71	479	815.38±7.18	1074	387.69±1.60	955	122.30±1.67	841	277.45±0.27

NS: Non-Significant, *p<0.05, **p<0.01, $\bar{x}$: Means, S_x: 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)

The effects of calving age, calving year and calving season on calving interval were significant (p<0.01-p<0.05). The average calving interval was estimated as 387.69±1.60 days. The calving interval was lowest in 2000 at 342.26 days and highest in 2002 at 396.88 days. The calving interval was lowest in 3 years old cows at 330.22 days and highest in 6 years old cows at 391.04 days. The calving interval was lowest in autumn at 372.42 days and highest in summer at 382.79 days.

Although, the effect of calving year on service period was non-significant, the effects of calving age and calving season on service period were significant (p<0.01-0.05). Average service period was estimated as 122.30±1.67 days. The service period was lowest in 2 years old cows at 104.12 days and highest in 7 years old cows at 131.71 days. The service period was lowest in winter at 115.89 days and highest in summer at 133.85 days.

Average gestation duration was 277.45±0.27 days. Effects of sex of calf, calving age, calving year and calving season on gestation duration were statistically significant (p<0.01-0.05). The gestation duration was lowest in 2 years old cows at 272.11 days and highest in 4 years old cows at 279.05 days. The gestation duration was highest in winter at 278.42 days and lowest in summer at 274.29 days. The gestation duration was lowest in 2002 years at 275.40 and the highest at 279.05 in 2007 years.

The main concern relative to when heifers should be inseminated for the first time is size. The size at the time of breeding is important because it affects the size of animal at first parturition. The significance of size at parturition relates to both uncomplicated parturitions and productivity of female. Heifers of dairy breeds should be reach desired first breeding weight at an average of 15 months so that heifers calve at approximately, 24 months of age. Heifers calved at 24 months on average will have a higher lifetime production than those calving later (Bearden *et al*., 2004). In this study, age of first breeding was found as 523.90±6.71 days. This value is lower than value in study (Erdem *et al*., 2007; Inci *et al*., 2007; Sehar and Ozbeyaz, 2007; Ozkan and Gunes, 2007; Tuna *et al*., 2007; Kopuzlu *et al*., 2008). Although, age of first breeding was higher than ideal value (450-480 days), it can be said that heifers were bred at convenient time by using good management in this state farm. It is desired that cows give fist calf at 2 years of age. As cows give fist calf at 2 years of age, heifers should be bred at 15 months of age in this farm.

Age of first calving was 815.38±7.18 days. This value was lower than values in study (Pelister *et al*., 2000; Koc *et al*., 2004; Galic *et al*., 2005; Erdem *et al*., 2007; Inci *et al*., 2007; Ozkan and Gunes 2007; Sehar and Ozbeyaz, 2007; Tuna *et al*., 2007; Kopuzlu *et al*., 2008) was higher than value reported by Topaloglu and Gunes

(2005) for Holstein cows reared in England. This value is the best value and the lowest for Holstein cows reared in Turkey. Age of first breeding was shorter in cows calving at spring, which is appropriate time of the year for birth of calves. Similarly, age of first calving was shorter in cows calving at winter and spring.

Calving interval in different state farms was reported between 383.1 and 427.88 days (Koc *et al*., 2004; Topaloglu and Gunes, 2005; Erdem *et al*., 2007; Inci *et al*., 2007; Sehar and Ozbeyaz, 2007; Tuna *et al*., 2007; Kopuzlu *et al*., 2008; Cilek, 2009). Service period for Holstein cows was reported between 99.5 and 149.6 days (Bakir *et al*., 1994; Topaloglu and Gunes, 2005; Erdem *et al*., 2007; Inci *et al*., 2007; Sehar and Ozbeyaz, 2007; Kopuzlu *et al*., 2008; Cilek, 2009).

In this study, calving interval was estimated as 387.69±1.60 days. This value was lower than values in study by Koc *et al*. (2004), Topaloglu and Gunes (2005), Erdem *et al*. (2007), Sehar and Ozbeyaz (2007), Tuna *et al*. (2007), Kopuzlu *et al*. (2008) and Cilek (2009). However, this value was higher than value reported by Inci *et al*. (2007). High value of service period performs that it was not done artificial insemination at the right time and convenient manner by operators. Phillips (2006) reported that reproductive traits usually have a heritability of <0.10 and again there is an antagonist genetic relationship with milk yield. Similarly, Cilek (2009) reported that cows with high milk yield have long service period because of postpartum anoestrus. Calving interval or service period of Holstein cows with high milk yield may be reduced by the use of GnRH injections in this state farm.

Service period was found as 122.3±1.67 days. This value of service period was lower than values (Bakir *et al*., 1994; Topaloglu and Gunes, 2005; Inci *et al*., 2007; Sehar and Ozbeyaz, 2007; Kopuzlu *et al*., 2008) and was higher than value of one study (Inci *et al*., 2007). This value was found higher than the ideal value (60-90 days). Therefore, it may be said that it was not done oestrus detection accurately and artificial insemination at the right time and manner. As reported by Cilek and Tekin (2005), cattle calving in winter are inseminated in at spring and shorter service period in cattle calving in winter may result from the effects of temperature and humidity and the availability of green fodder during the spring, which might favour the physiological functioning of different systems. Although, Cilek and Tekin (2005) reported that service period and calving age increased up to 6 years of age and then decreased thereafter, service period and calving interval values increased with age in this study. However, there were not older cows than 7 years old in this study. As older cows have longer service period, cows at approximately, 10 years age after mature age were culled from herd. In this study, calving interval in some years may be shorter than other years because of differences of management and operators for artificial insemination among years. After 2000 years, it can be said that it was not done artificial insemination at the right time and convenient manner.

Average gestation duration was 277.45±0.27 days and between the limits reported by Bakir *et al*. (1994), Sehar and Ozbeyaz (2005), Erdem *et al*. (2007), Kopuzlu *et al*. (2008) and Cilek (2009). As reported by Stevenson (1989) and Cilek and Tekin (2005), the longest gestation duration was found in winter when daylight is short. On the contrary, gestation length was shortest in summer, when daylight is long. As reported by Inal and Alpan (1989) and Cilek and Tekin (2005), it can be said that gestation length increased with age and the shortest in 2 years old cows. As reported in earlier studies Cilek and Tekin (2005) and Erdem *et al*. (2007), the gestation duration for female calf of births was shorter than that male calf of births. Thus, estimating of day calf will be born, breeders can control cows will give birth at night and breeders can help cows in hard birth at night. Increasing service period with age may be reason of increasing of milk yield with age of cows. Service period of cows with high milk yield may be long because of postpartum anoestrus. To decrease service period of Holstein cows with high milk yield should be use GnRH injections in this state farm.

CONCLUSION

In Tahirova state farm, age of first breeding and age of first calving were rather well than values reported for Turkey. As it is desired that cows give first calf at 2 years of age, heifers in this state farm should be breed at 15 months of age. Similarly, it is desired that service period is between 60 and 90 days. It is desired that cows gave a calf every year or calving interval is 365 days.

However, in this study, service period and calving interval were higher than ideal values. As reported by Bearden *et al*. (2004), the problem related to detection of oestrus in cows is more critical than other species because of shorter and more variable length of oestrus period of cow's oestrus detection should be done accurately and artificial insemination should be done at the right time and at appropriate manner. Cows should be made pregnant within 90 days after calving by detecting oestrus carefully. Postpartum anoestrus may be reason of high service period in Holstein cows with high milk yield. In this farm, high service period of Holstein cows with high milk yield may be reduced by the use of GnRH injections. Profitable breeding for dairy cows can be

obtained with reaching to ideal values of some parameters of reproduction as service period, calving age, age of first breeding and age of first calving. Management of dairy cow farms should be planned according to arriving ideal values for reproduction parameters.

REFERENCES

Bakir, G., A. Kaygisiz and S.M. Yener, 1994. Reproduction characteristics of Holstein cows raised at Ankara sugar factory farm. Turk. J. Vet. Anim. Sci., 18 (2): 107-111.

Bearden, H.J., J.W. Fuquay and S.T. Willard, 2004. Applied Animal Reproduction. 6th Edn. Reproductive Management. Pearson Education, pp: 291-317.

Cilek, 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.

Cilek, S. and M.E. Tekin, 2007. Environmental factors affecting fertility in cows. Indian J. Anim. Sci., 77 (3): 236-238.

Cilek, S., 2009. Reproductive traits of Holstein cows raised at Polatli state farm in Turkey. J. Anim. Vet. Adv., 8 (1): 1-5.

Duncan, W.R., 1955. Multiple range and multiple F-tests. Biometrics, 11: 1-42.

Erdem, H., S. Atasever and E. Kul, 2007. Milk yield and fertility traits of Holstein cows raised at Gokhoyuk State farm. 2. Fertility traits. J. Fac. Agric., OMU, 22 (1): 47-54.

Galic, A., H. Sekeroglu and S. Kumlu, 2005. First calving age in Holstein cattle raised in Izmir province and its effect on milk yield. J. Fac. Agric., Akdeniz Univ., 18 (1): 87-93.

Inal, S. and O. Alpan, 1989. Konya merkez hayvancilik enstitusundeki esmer irk sigirlarin dol verimi performansi. J. Lalahan Livest. Central Res. Inst., 29: 1-20.

Inci, S., A. Kaygisiz, E. Efe and S. Bas, 2007. Milk yield and reproductive traits in brown Swiss cattle raised at altinova state farm. Tarim Bilimleri Dergisi, 13 (3): 203-212.

Koc, A., M. Ilaslan and O. Karaca, 2004. Genetic and phenotypic parameter estimation of reproductive and milk production traits of holstein-friesian cattle raised at Dalaman State farm: Reproduction. J. Adnan Menderes Agric. Fac., 1 (2): 43-49.

Kopuzlu, S., H. Emsen, A. Ozluturk and A. Kucukozdemir, 2008. Reproductive traits of brown Swiss and holstein cattle under conditions of east Anatolia research institute. J. Lalahan Livest. Central Res. Inst., 48 (1): 13-24.

Ogan, M., 2000. Esmer irki ineklerin dol verimi ozellikleri ve bu ozelliklere etki eden bazi cevre faktorleri. J. Fac. Vet. Med., Uludag Univ., 19: 7-18.

Ozkan, M. and H. Gunes, 2007. Researches on the reproductive characteristics of Simmental cattle in commercial farms in Kayseri. J. Fac. Vet. Med. Istanbul Univ., 33 (3): 1-16.

Pelister, B., A. Altinel and H. Gunes, 2000. Environmental effects on Reproductive efficiencies and milk productions of Holstein Friesian cattle of different origin in commercial farm conditions. J. Fac. Vet. Med., Istanbul Univ., 26 (2): 543-559.

Phillips, C.J.C., 2006. Principles of cattle production. CABI Publishing, pp: 122-141.

Sehar, O. and C. Ozbeyaz, 2005. Some production traits of Holstein cows at a state farm in middle Anatolian conditions. J. Lalahan Livest. Central Res. Inst., 45 (1): 9-19.

SAS, 1998. SAS Users Guide: Statistics, Inc.

Stevenson, J.S., 1989. Relationship among climatological variables and hourly distribution of calving in Holsteins fed during the late afternoon. J. Dairy Sci., 72: 2712-2717.

Topaloglu, N. and H. Gunes, 2005. Studies on reproductive traits of Holstein-Friesian cattle in England. J. Fac. Vet. Med., Istanbul Univ., 31 (1): 99-118.

Tuna, Y.T., E.K. Gurcan and T. Savas, 2007. Genetic and phenotypic parameter estimation of reproductive and milk production traits of Holstein-Friesian cattle raised at Dalaman State Farm: Reproduction. J. Tekirdag Agric. Fac., 4 (3): 347-357.