57TH ANNUAL MEETING OF THE EUROPEAN ASSOCIATION FOR ANIMAL PRODUCTION
17-20.September.2006, Antalya, TURKEY
Free Communications Cattle Production, Poster Presentation: Session C33.36, Abstract No: 480

RESEARCHES ON MILK YIELD AND COMPONENTS OF HOLSTEIN FRIESIAN CATTLE

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This study was summarized from the PhD thesis "*Researches on some production traits of Holstein-Friesian cattle under private farm condition in England*" of Nihal Topaloglu. (* : gunes@istanbul.edu.tr)

Summary: This study was conducted to determine the duration of lactation, lactation and 305 days milk yield, milk fat and protein percentage and somatic cell counts of Holstein-Friesian cattle selected randomly in five private farms in England and to investigate the effects of some environmental factors on these traits. In the statistical analysis of data, the GLM procedure in SAS programme package was used. Average of the duration of lactation, lactation and 305 days milk yield, fat and protein percentage and somatic cell counts were 324.32 days, 7715.23 kg, 7218.62 kg, 4.028%, 3.333% and 137.948 ('000 cell/ml) respectively. During the study, the farm where the animals were kept and the year in which lactation started made significant effects at P<0.001 level on all traits, also the lactations turn has made a P<0.05 level effect on these traits except the P<0.05 level effect on the duration of lactation. However season, like other factors made significant effects on the lactations duration, milk fat and protein rates at a level of P<0.001 and on 305 days milk yield at a level P<0.01. Results of study showed that the management conditions and the use of high yielding breeders accomplished the improvement in yields in different years. Two principle factors came forward in the study and highest determining factors were observed to be the farm and turn of lactation.

Key words: Holstein-Friesian, milk yield and components, somatic cell count.

Introduction

Animal breeding in agricultural production is one of the most important proportions in the economy and progress of developed countries. The first condition to increase milk yield and an economical production is to increase the yield per animal (4). This is possible by improving the environmental and managemental conditions and adding high yielding animals to the herd. The yielding ability of an animal is determined by its genotype and environment. In the countries where genetic improvement is achieved, selection and elimination is accomplished systematically and managed with good organisations, therefore, it is possible to use the animals more efficiently (5). Economy and industry of these type of countries are at high level (1, 2, 7, 8, 11).

This study was conducted to determine duration of lactation, milk yield (lactation and 305 days), milk fat and protein and milk somatic cell counts of Holstein Friesian cattle bred in England, and to calculate the effects of some environmental factors on these yields.

Materials and Methods

The study was carried out on randomly chosen ordinary Holstein-Friesian breeding farms at southern England. The milk yield records controlled by National Milk Record were the

material of the study. This study dealt with the effects of farm, turn of lactation, year and season on duration of lactation, lactation and 305 days milk yield, milk fat and protein percentage and somatic cell count in milk on some milk yield traits of Holstein-Friesian cattle in England. The following model was used for the statistical analysis of the study.

$$Y_{ijklm} = \mu + F_i + S_j + V_k + M_l + e_{ijklm}$$

The symbols in this model are:

Y_{ijklm} : Observed trait yield value of a random individual
μ : Expected mean
F_i : Farm effect (i = 1, 2, 3, 4 and 5)
S_j : Effect of the lactation turn (j = 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10)
V_k : Effect of the year (k = 1993, 1994, 1995, ... and 2003)
M_l : Effect of the season (l = winter, spring, summer and autumn)
e_{ijklm} : Random error.

In the study, to find the effect ratios of the factors showing classified variation and the ratios of environmental factors in general variation, tables of the material which were grouped in various classes were used. It was assumed that there was no significant interaction between factors under investigation and these effects of factors were determined by using least squares means method. The difference between the least squares means of effect proportions was determined statistically by using contrast-test. The data were analysed with the general linear models (GLM) procedure of the SAS programme package (3, 10).

Results

In this study, duration of lactation, real and 305 days milk yields general and corrected averages and effect proportions of sub-groups established according to the farm on which the animals were kept, lactation turn, year in which lactation started and season and the statistical control and determining degrees of the differences among them are presented in Table 1. Milk fat and protein levels relating the investigated factors and somatic cell count values are presented in Table 2.

Discussion and Conclusion

The lactation duration of Holstein cattle on five different farms in England was found close to the standard 305 days. The short difference was thought to be due to the late first insemination time of cattle after delivery, long open period duration and high milk yield. The lactation and 305 days milk yield values were higher then the general average of English cattle. This suggests that the examined farms have provided a better feeding and management environment to their animals. Milk fat and protein levels were higher than those reported for Holsteins. Somatic cell counts were quite lower then the level reported by international foundations. These findings reveal the high milking character of cattle together with the good health conditions on these farms (6, 9, 12).

It was determined that the environmental factors with measurable effects caused serious variations on examined yielding characteristics. The farm factor among the environmental factors affected the yielding of animals, as a result of the differences in the managements employed. Effect of the year factor was observed as the yearly increase of yields. Particularly high quality semen used for inseminations resulted with the higher yielding breeders entering the herd every year and therefore the year factor affected the yields significantly.

Table 1. General and corrected averages of the lactation and 305 days milk yield, effect proportions (EP) of the observed factors, comparison among the groups significance level (F-values) and determining degree (R^2) of Holstein-Friesian cattle.

Factors	n	Lactation duration (day)	Lactation milk yield (kg)	305 days milk yield (kg)
Overall means	2514	324.32±1.141	7715.23±40.971	7288.62±34.397
Expected means	2514	318.42±1.111	7076.35±33.907	6759.40±26.535
All factors	*F* (*R²*)	6.54*** (0.062)	47.25*** (0.322)	69.39*** (0.411)
Farm	*F* (*R²*)	18.96*** (0.028)	39.52*** (0.043)	57.79*** (0.055)
1	263	-0.62^{b}	-155.43^{c}	-163.62^{a}
2	396	19.68^{a}	-203.93^{c}	-370.09^{b}
3	527	-2.60^{b}	587.38^{a}	594.66^{a}
4	576	-11.89^{c}	-591.51^{d}	-433.38^{b}
5	752	-4.57^{b}	363.49^{b}	372.43^{a}
Lactation turn	*F* (*R²*)	2.00* (0.007)	44.29*** (0.109)	82.14*** (0.175)
1	722	5.80^{ab}	-1039.17^{d}	-1167.97^{f}
2	567	0.65^{bc}	-4.73^{c}	-72.41^{e}
3	420	2.71^{ab}	641.12^{ab}	547.44^{bc}
4	302	-5.56^{c}	719.28^{a}	771.04^{a}
5	200	-2.69^{bc}	623.04^{ab}	681.65^{ab}
6	126	-4.42^{bc}	200.34^{c}	300.31^{cd}
7	76	4.78^{abc}	151.37^{c}	72.99^{d}
8	50	17.13^{a}	170.27^{bc}	56.03^{de}
9	27	-13.66^{bc}	-512.24^{cd}	-324.78^{ef}
10	24	-4.74^{abc}	-949.28^{d}	-864.30^{f}
Year	*F* (*R²*)	6.36*** (0.021)	40.21*** (0.099)	47.63*** (0.102)
1994	39	-15.18^{c}	-1085.06^{e}	-883.96^{e}
1995	42	-10.24^{bc}	-1067.26^{e}	-905.32^{e}
1996	65	-5.02^{bc}	-463.67^{de}	-353.03^{cd}
1997	90	-10.24^{c}	-767.42^{e}	-599.52^{de}
1998	159	-2.52^{bc}	-182.29^{d}	-179.16^{c}
1999	218	-0.77^{bc}	190.22^{c}	203.53^{b}
2000	333	3.79^{b}	250.36^{c}	254.30^{b}
2001	441	17.43^{a}	497.82^{b}	237.58^{b}
2002	522	16.35^{a}	1337.83^{a}	1092.54^{a}
2003	605	6.39^{b}	1289.47^{a}	1133.04^{a}
Season	*F* (*R²*)	7.49*** (0.008)	$0.98^{N.S.}$ (0.001)	3.62** (0.003)
Winter	552	-2.82^{b}	-101.79^{a}	-34.85^{b}
Spring	285	-5.32^{b}	1.02^{a}	-86.61^{b}
Summer	378	11.75^{a}	69.18^{a}	-20.81^{b}
Autumn	1299	-3.61^{b}	31.59^{a}	142.27^{a}

^{a,b,c,d,e,f} : Differences between sub-groups with different superscripts are statistically significant (P<0.05).

***: P<0.001, **: P<0.01, *: P<0.05, $^{N.S.}$: P>0.05

Table 2. General and corrected averages of the milk fat, protein percentages and somatic cell count, effect proportions (EP) of the observed factors, comparison among the groups, significance level (F-values) and determining degree (R^2) of Holstein-Friesian cattle.

Factors	n	Milk fat percentage (%)	Milk protein percentage (%)	Somatic cell count (‘000 cell/ml)
Overall means	2514	4.028±0.009	3.333±0.004	137.998±4.313
Expected means	2514	4.203±0.009	3.296±0.004	174.438±4.093
All factors	*F* (*R²*)	14.34*** (0.126)	13.126*** (0.118)	12.10*** (0.108)
Farm	*F* (*R²*)	38.25*** (0.054)	44.50*** (0.063)	19.49*** (0.028)
1	263	0.118^{a}	-0.065^{c}	39.661^{a}
2	396	0.115^{a}	0.012^{b}	9.790^{b}
3	527	-0.086^{b}	0.057^{a}	37.951^{a}
4	576	-0.182^{c}	-0.057^{c}	-49.013^{c}
5	752	0.035^{d}	0.053^{a}	-38.389^{c}
Lactation turn	*F* (*R²*)	6.71*** (0.021)	4.18*** (0.013)	10.57*** (0.034)
1	722	-0.153^{e}	-0.038^{b}	-84.476^{e}
2	567	-0.110^{de}	0.017^{a}	-71.868^{d}
3	420	-0.088^{cd}	0.004^{a}	-35.590^{c}
4	302	-0.056^{bcd}	0.003^{a}	-16.415^{bc}
5	200	0.020^{ab}	0.023^{a}	5.515^{ab}
6	126	0.070^{ab}	0.005^{a}	46.605^{a}
7	76	0.015^{abc}	0.017^{a}	-9.299^{abc}
8	50	0.056^{ab}	0.009^{ab}	64.403^{a}
9	27	0.042^{abcd}	-0.039^{ab}	32.030^{ab}
10	24	0.202^{a}	-0.001^{ab}	69.095^{a}
Year	*F* (*R²*)	13.01*** (0.041)	6.86*** (0.022)	8.17*** (0.026)
1994	39	0.349^{a}	-0.075^{c}	-8.632^{bc}
1995	42	0.141^{b}	-0.073^{c}	-9.001^{bc}
1996	65	0.088^{b}	0.009^{b}	0.461^{bc}
1997	90	-0.014^{bc}	-0.005^{b}	-34.737^{c}
1998	159	0.041^{b}	0.001^{b}	-34.632^{c}
1999	218	-0.148^{d}	-0.001^{bc}	-13.477^{c}
2000	333	-0.182^{d}	0.019^{b}	-14.344^{c}
2001	441	-0.050^{c}	0.030^{b}	-1.316^{c}
2002	522	-0.050^{c}	0.073^{a}	44.962^{b}
2003	605	-0.175^{d}	0.022^{b}	70.716^{a}
Season	*F* (*R²*)	11.83*** (0.012)	17.72*** (0.019)	$1.01^{N.S.}$ (0.001)
Winter	552	-0.042^{c}	-0.016^{c}	6.274^{a}
Spring	285	-0.086^{c}	-0.051^{d}	9.837^{a}
Summer	378	0.097^{a}	0.054^{a}	-7.425^{a}
Autumn	1299	0.031^{b}	0.013^{b}	-8.686^{a}

$^{a, b, c, d, e}$: Differences between sub-groups with different superscripts are statistically significant (P<0.05).

***: P<0.001, $^{N.S.}$: P>0.05

Acknowledgements

The authors of the study thank to Mannor Farm, Cote Lodge Farm, Field Farm Lower, Manor Farm and Common Farm, their employees and Dr. Serhat Alkan and Dr. Alper Yilmaz.

References

1. DEFRA. Animal Health and Welfare. Department for Environment, Food and Rural Affairs. http://www.defra.gov.uk, (17.05.2004).
2. FAO. Statistical Database. http://faostat.fao.org/faostat/collections?subset= agriculture (18.05.2004).
3. Goodnight JH, Harvey WR. Least-squares means in the fixed effects general linear model. SAS Technical Report (R-103), Cary, North Carolina: SAS Institute Incorporated, 1978.
4. Gunes H. Kumkale Tarım Isletmesi'nde 10 yillik Siyah-Alaca sigir yetistiriciligi uzerinde arastırmalar. II. Sut verim ozellikleri. [Studies on 10 years of Holstein-Friesian cattle breeding in Kumkale State Farm. II. Milk trait characteristics]. The Journal of the Faculty of Veterinary Medicine University of Istanbul, 1996; 22 (2), 225-240.
5. Haile-Mariam M, Bowman PJ, Goddard ME. Genetic and environmental relationship among calving interval, survival, persistency of milk yield and somatik cell count in dairy cattle. Livestock Production Science 2003; 80: 189-200.
6. Mantysaari P, Ojala M, Mantysaari EA. Measures of before and after breeding daily gains of dairy replacement heifers and their relationship with first lactation milk production traits. Livestock Production Science 2002; 75: 313-322.
7. NASS. Milk Production, disposition and income summary. US Department of Agriculture, National Agricultural Statistical Service. 2001; Online. Available: http://www.usda.gov/nass/.
8. NDC. Dairy Facts and Figures. National Dairy Council (Federation of United Kingdom Milk Marketing Board), London, 2001, 1-275.
9. Roughsedge T, Visscher PM, Brotherstone S. Effects of cow families on production traits in dairy cattle. Animal Science 2000; 71: 1, 49-57.