Research Journal of Biological Sciences 3 (12): 1463-1467, 2008
ISSN: 1815-8846

The Association Between Production and Reproduction Traits in Some Iranian Holstein Herd

Reza Seyed Sharifi, Taher Yalchi, Raouf Seyed Sharifi and Bahram Fathi Achachlouei
Faculty of Agriculture, University of Mohaghegh Ardabil, Ardabil, Iran

Abstract: The objective of this study was to evaluate the relationship between reproductive performance and milk yield in some Iranian Holstein cattle that calved from 2000-2004. Results for current days open for the first lactation indicated a curvilinear relationship with milk yield. These results agree with the accepted management recommendation of a 60 days dry period. Most estimates of heritability of various measures of reproductive efficiency are less than 0.05. The reproductive trait with the highest heritability, 0.096, was previous days dry in the third lactation. Genetic correlations between milk production and reproduction traits were generally positive. Phenotypic correlations were larger than genetic correlations. Genetic correlations among cow fertility in second and third lactations were inclined to be lower than in first lactation, whereas the phenotypic correlations tended to be of the same magnitude and direction in all three lactations.

Key words: Days open, days dry, fertility, milk yield, holsteins

INTRODUCTION

Milk yield traditionally has been the single most important trait of dairy selection Programs. However, several studies have shown that reproductive efficiency declines with increased Milk yield. A negative association between fertility and milk yield has been consistently reported in dairy cattle (De Vries and Risco, 2005).

Adequate methods of selecting dairy cattle and of improving herd reproductive efficiency depend, among other things, on knowledge of how genetic progress for milk yield influences reproductive performance (Weigel, 2006).

Days open from parturition to the subsequent conception affects milk yield. With fewer current days open, nutrients consumed during late lactation are partitioned to gestational needs rather than to yield and often cows are dried off prior to 305 DIM.

With more days open, cows have more time to renew the body fat that is used for yield during the next lactation and the converse may be expected (Hansen *et al*., 1983).

A dry period, typically 40-60 days, between lactations is believed to be required to maximize milk yield in the subsequent lactation. Several hypotheses have been proposed to explain the requirement for the dry period, including: Replenishment of body reserves, Regeneration of mammary tissue and optimization of benefits from endocrine events near the time of parturition (Kuhn *et al*., 2006).

Conception at <100 days postpartum and short dry periods of <40 days depress milk yield during the subsequent lactation. High milk yield appears to be antagonistic to early conception because high yielding cows may not conceive as readily as low have less interference from pregnancy on lactational milk yield. Short dry periods significantly diminished milk production in the following lactation. Also, several studies have indicated that reducing the length of the dry period to <60 days has a more detrimental effect between the first and second lactation than between later lactations (Annen *et al*., 2004). However, other analyses have indicated no interaction between parity and optimal length for the dry period (Bachman and Schairer, 2003).

Funk *et al*. (1987) reported that maximum fertility in all first services at 80 days postpartum in cows producing 2000 kg or above in the first 100 days of lactation, whereas the time for cows of 1500 kg or lower production was under 40 days. The maximum conception rate of high producers was higher than that of lower producers.

Single measures of reproduction have low heritability. several estimates reported were lower than 0.10 the range of heritability estimates from the literature for various fertility traits (e.g., days open and calving interval) is from 0-15%. Repeatabilities range from 0-67%, which indicate that environmental influences are larger than genetic influences and thus, little change would be expected by selecting for fewer days open. However, heritability estimates of days dry have been in the range

Corresponding Author: Reza Seyed Sharifi, Faculty of Agriculture, University of Mohaghegh Ardabili, 56199-11367 Ardabil, Iran

of 0.25-0.40 implying a possible genetic correlation with milk production. This would make adjustment of lactation records for length of dry period undesirable. Genetic improvement of reproductive traits is slow and dose not reduce the need for appropriate management techniques (Kawashima *et al*., 2006; Nebel and Mcgilliard, 1993).

Objectives of the present research were to estimate genetic parameters of milk yield and reproductive traits and determine the effects of previous days dry, previous days open and current days open on milk yield of iranian Holstein cows.

MATERIALS AND METHODS

The initial data set contained data from 26175 randomly selected herds with cows calving from 2000-2004. Data were collected by Iran breeding genetic center first, second and third lactations were evaluated for the population. Culling of cows is the same as in commercial herds, except that healthy heifers with low yields during the early part of first lactation are culled a month or more after they would be in most commercial herds.

Cows with missing birth data, calving date, age at first calving, or sire and dam identification were deleted. Also, editing excluded records with <250 DIM because of the possibility that the cows did not go dry naturally but were denied an opportunity to complete their records and because the effects of days open occur mostly in the last part of lactation.

Lengths of dry period were computed by subtracting the reported dry date from the calving date of the following lactation. Negative days dry or missing dry dates caused that record to be rejected. the open period was the difference between a 280 days gestation period from calving interval. Days dry and previous days open were studied only for second and third lactations. Similarly, adjustment for previous milk yield was only for second and third lactations.

The model (1) assumed:

$$Y_{ijkl} = u + HYS_i + G_j + S_{jk} + e_{ijkl}$$

where,

Y_{ijkl} = Observation of ith daughter of the kth sire in the jth genetic group in the ith herd-year-season of calving.

u = Overall mean.

HYS_i = Fixed effect of ith herd-year-season of first lactation calving.

G_j = Fixed effect of jth genetic group.

S_{jk} = Rrandom effect of the kth sire in the jth genetic group.

e_{ijkl} = Random error.

Model 2 (animal model) included the overall mean, herd-year of calving of cow, month of calving, age at calving in months, days dry, previous days open, current days open and the partial linear regressions of unadjusted actual milk yield on DIM and previous milk yield when applicable. Identical models were fitted data using a Derivative-Free (DF) REML algorithm.

RESULTS AND DISCUSSION

The means and standard deviations for milk yield, current days open, previous days open, days dry, DIM and age at calving for the Holstein cows by lactation are in Table 1. In the first lactation, the cows produced average 5750 kg of milk An increase in production in the 2nd lactation was 13.1%. In the third lactation, a slight increase in production was 5.6% for milk (Table 1).

For milk yield heritabilities were 0.42 our estimates for reproductive traits and most estimates of other researchers were very low. The reproductive trait with the highest heritability, 0.096 was previous days dry in the third lactation. The heritabilities for change in milk yield (Table 2) are for changes from 1st-2nd and 2nd-3rd

Table 1: Mean and standard deviations for traits by source of data and lactation

Trait	$\bar{x}$	S.D.
Lactation 1		
Records, no	7746	
Actual milk yield, kg	5750	1625
Current days open	147	93
DIM	296	8
Age at calving, mo	32	5
Lactation 2		
Records, no	4350	
Actual milk yield, kg	6509	1868
Current days open	145	90
Previous days open	148	93
Previous days dry	71	33
DIM	294	9
Age at calving, mo	42	8
Lactation 3		
Records, no	3956	
Actual milk yield, kg	6875	1857
Current days open	153	93
Previous days open	142	90
Previous days dry	78	34
DIM	291	9
Age at calving, mo	56	9

Table 2: Heritabilities and standard deviations for milk yield and fertility traits (days) of Holsteins by lactation and source of data

	Standard deviation		
Trait	Additive	Phenotypic	h^2
Milk yield (lact 1)	1030.0	606.0	0.420
Current days open (lact 1)	8.4	74.4	0.012
Current days open (lact 2)	73.2	8.4	0.012
Previous days open (lact 2)	7.2	67.2	0.012
Previous days dry (lact 2)	37.2	8.4	0.060
Current days open (lact 3)	79.2	12.0	0.024
Previous days open (lact 3)	52.8	9.6	0.048
Previous days dry (lact 3)	30.0	8.4	0.096

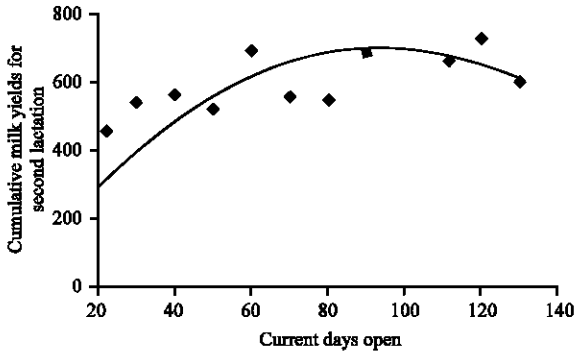

Fig. 1: The effects of current days open lengths on cumulative milk yield in second lactation

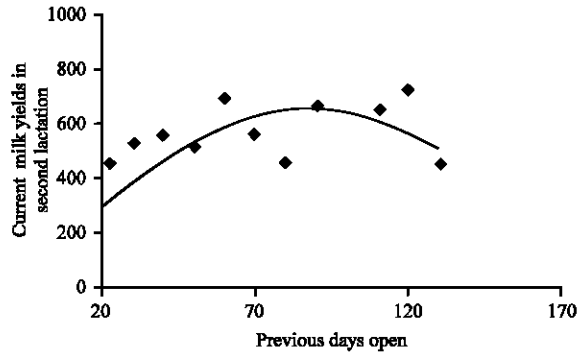

Fig. 2: The effects of previous days open lengths on cumulative milk yield in second lactation days dry

lactations. Current milk yield were more highly correlated with current days open than with previous days open and days dry.

Current days open: Results for current days open for the first lactation indicated a curvilinear relationship with milk yield (Raheja *et al*., 1989). Current days open for the second and later lactations of this study meansured the pregnancy effect on milk yield during that lactation because of adjustment fror both previous days open and DIM as well as permanent environmental effects of the cow.

Current days open and previous days open were lowly but positively correlated because the trait was the same but from different parities. Age at calving did not influence days open, while month of calving did affect days open. Open periods were longer for cows that freshened during the summer months han for winter and spring fresheners. Year effects were significant. Figure 1 shows the effects current days open on milk yield in second lactation.

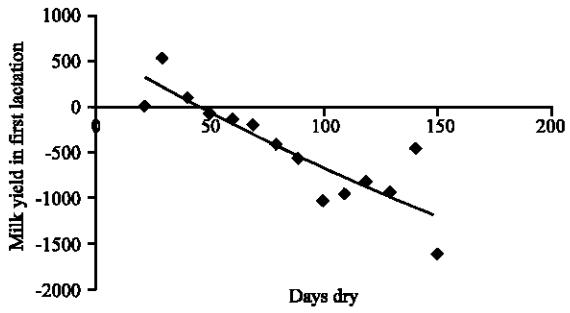

Fig. 3: The effects of days dry lengths on milk yield in first lactation

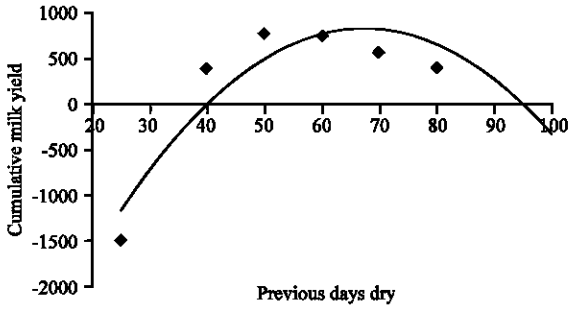

Fig. 4: The effects of previous days dry lengths on cumulative milk yield in current period

Previous days open: Increased days open, both current and previous resulted in greater milk yield. Dairy producers tend to keep nonpregnant cows for longer periods if and only if, they do not have health problems and are persistently good milkers. Figure 2 shows The effects of previous days open lengths on cumulative milk yield in second lactation.

A dry period, typically 40-60 days, between lactations is believed to be required to maximize milk yield in the subsequent lactation. These results agree with the accepted management recommendation of a 60 days dry period. Beyond 60 days, our data suggest that additional days dry probably do not result in enough extra milk yield to compensate for the extra costs of feeding cows with longer dry periods. Similarly, more dry days probably do not maximize milk yield per day of herd life. Figure 3 and 4, respectively shows the effect of days dry lengths on milk yield in first lactation and effects of previous days dry lengths on cumulative milk yield in current period.

Part of the impact of previous days dry and previous days open on the current lactation resulted from the milk yield of the previous lactation (Macmillan *et al*., 1996). This relationship was clearly shown in the preliminary analyses, because the solutions for days dry

Table 3: Genetic correlations (above diagonal) and phenotypic correlations (below diagonal) among fertility and production traits for the first three lactations (lact)

	Lact.	DCFI	DO	NICC	BCA-M
DCFI	1	-----	0.24	-0.04	0.04
	2	-----	0.17	-0.02	0.02
	3	-------	0.08	-0.01	0.02
DO	1	0.62	---------	0.17	0.07
	2	0.58	----------	0.11	0.03
	3	0.60	----------	0.08	0.03
NICC	1	0.03	0.75	----------	-0.02
	2	-0.16	0.70	----------	-0.02
	3	-0.09	0.78	----------	0.03
BCA-M	1	0.04	0.03	0.03	----------
	2	0.04	0.05	0.05	----------
	3	0.07	0.05	0.03	----------

DCFI = Days between Calving and First Insemination; DO = Days Open; NICC = Number of Inseminations per Conception Cow; BCA-M = Breed Class Average-Milk

and previous days open decreased when previous milk yield was included simultaneously as a covariable. Current milk yields were more highly correlated with current days open than with previous days open and days dry. Subsequent lactation yields were positively associated, milk yield increased independently of previous yield and previous days open.

Fertility relationships within lactation: Genetic and phenotypic correlations among fertility and production in the first three lactations are in Table 3. Genetic correlations were generally positive. These estimates were forced positive because of a part-whole relationship among the measures of fertility; for example, days open contains days from calving to first breeding. Phenotypic correlations were larger than genetic correlations. The low negative genetic correlations between days from calving to first breeding and number of inseminations per conception indicate that all cows may require the same number of services to conceive irrespective of large or small intervals between calving and first insemination. Genetic correlations among cow fertility in second and third lactations were inclined to be lower than in first lactation, whereas the phenotypic correlations tended to be of the same magnitude and direction in all three lactations. Genetic correlations were lower than some literature values, but phenotypic correlations of days open with number of inseminations per conception and days from calving to first insemination were consistent with values reported by Veerkamp and Beerda (2007), Watters *et al.* (2008) and Olds *et al.* (1979).

CONCLUSION

Heritabilities of fertility measures were low, Current days open and previous days open were lowly but positively correlated because the trait was the same but from different parities. A dry period, typically 40-60 days, between lactations is believed to be required to maximize milk yield in the subsequent lactation. Genetic correlations between fertility and production traits for different lactations suggest that production and fertility in different lactations may partially be determined by different sets of additive genes. Phenotypic correlations were larger than genetic correlations.

REFERENCES

Annen, E.L., R.J. Collier, M.A. McGuire, J.L. Vicini, J.M. Ballam and M.J. Lormore, 2004. Effect of modified dry period lengths and bovine somatotropin on yield and composition of milk from dairy cows. J. Dairy Sci., 87: 3746-3761.

Bachman, K.C. and M.L. Schairer, 2003. Invited review: Bovine studies on optimal lengths of dry periods. J. Dairy Sci., 86: 3027-3037.

De Vries, A. and C.A. Risco, 2005. Trends and seasonality of reproductive performance in Florida and Georgia dairy herds from 1976-2002. J. Dairy Sci., 88: 3155-3165.

Funk, D.A., A.E. Freeman and P.J. Berger, 1987. Effects of previous days open, previous days dry and present days open on lactation yield. J. Dairy Sci., 70: 2366-2373.

Hansen, L.B., A.E. Freeman and P.J. Berger, 1983. Association of heifer fertility with cow fertility and yield in dairy cattle. J. Dairy Sci., 66: 306-314.

Kawashima, C., E. Kaneko, C. Amaya Montoya, M. Matsui, N. Yamagishi, N. Matsunaga, M. Ishii, K. Kida, Y. Miyake and A. Miyamoto, 2006. Relationship between the first ovulation within 3 weeks postpartum and subsequent ovarian cycles and fertility in high producing dairy cows. J. Reprod. Dev., 52: 479-486.

Kuhn, M.T., J.L. Hutchison and H.D. Norman, 2006. Dry period length to maximize production across adjacent lactations and lifetime production. J. Dairy Sci., 89: 1713-1722.

Macmillan, K.L., I.J. Lean and C.T. Westwood, 1996. The effects of lactation on the fertility of dairy cows. J. Aus. Vet., 73: 141-147.

Nebel, R.L. and M.L. McGilliard, 1993. Interactions of high milk yield and reproductive performance in dairy cows. J. Dairy Sci., 76: 3257-3268.

Olds, D., T. Cooper and F.A. Thrift, 1979. Relationship between milk yield and fertility in dairy cattle. J. Dairy Sci., 62: 1140-1144.

Raheja, K.L., E.B. Burnside and L.R. Schaeffer, 1989. Relationships between fertility and production in Holstein dairy cattle in different lactations. J. Dairy Sci., 72: 2670-2678.

Veerkamp, R.F. and B. Beerda, 2007. Genetics and genomics to improve fertility in high producing dairy cows. Theriogenology, 11: 266-273.

Watters, R.D., J.N. Guenther, A.E. Brickner, R.R. Rastani, P.M. Crump, P.W. Clark and R.R. Grummer, 2008. Effects of dry period length on milk production and health of dairy cattle. J. Dairy Sci., 91: 2595-2603.

Weigel, K.A., 2006. Prospects for Improving the reproductive efficiency of dairy cattle through genetic selection. Anim. Reprod. Sci., 96: 323-330.