Performance Evaluation of Jersey Cattle at Islamabad

R. N. Khan*

Livestock Research Station, Animal Sciences Institute, National Agricultural Research Center, Islamabad, Pakistan

ABSTRACT : Performance data (from 1985 to 2000) of Jersey cattle imported from USA and maintained at Islamabad, Pakistan were evaluated. The purpose of this study was to assess the genetic merit of Jersey breed under Pakistani environment for further propagation. Cows with at least two calvings were considered for this study; records on 50 daughter-dam pairs were available on production and reproduction performance traits for genetic evaluation. The average age at first calving in parents was 25.2±2.4 m as compared to 23.9±6.6 m in progeny. Calving interval in parents and progeny was 416±74 and 446±105 d; lactation length 301±51 and 325±73 d; lactation milk yield 2,908±669 and 2,707±903 lit respectively. All these differences were found to be statistically significant except lactation length. The correlations between age at first calving and total lactation milk was -0.25, between calving interval and total lactation milk yield was 0.14, and between lactation length and total lactation milk yield was 0.79. The h^2 of these traits were low indicating important role of environment in expressing the genetic potential of animals. The S.E of h^2 of all the traits was high due to large variation in data. ***(Asian-Aust. J. Anim. Sci. 2002. Vol 15, No. 5 : 695-698)***

Key Words : Genetic Evaluation, Heritability, Correlations, Lactation Milk Yield.

INTRODUCTION

Pakistan has 20.4 million cattle (Livestock Census, 1996). Seventy five percent of these cattle are non-descript, poor producers and draught type. Poor genetic potential for milk production is a result of overriding emphasis on past selection for draught animals in Asia (Meyn, 1991).

Pakistan is in dire need of dairy type of animals to meet the needs of milk for faster growing human population. Efforts are made to crossbreed local cattle with dairy breeds of temperate regions for quick improvement in milk yield. Fifty Jersey cattle were imported from USA in 1985 to be maintained as nucleus herd at Islamabad, Pakistan. The males were sold to farmers for use as sires for crossbreeding their local nondescript cows. The crossbreds have shown promising results as compared to local cattle. Their milk production potential has increased by 100% and there is a marked decrease in their age at maturity/first calving. These are two most important and sought after dairy traits. However, there are reports of adaptability problems of these animals under local environments.

The study is based on genetic assessment of Jersey breed under local environmental conditions and its suitability in a crossbreeding program.

MATERIALS AND METHODS

The data used in this study were obtained from Livestock Research Station (LRS), National Agricultural Research Center (NARC) Islamabad, Pakistan, where Jersey cattle were maintained. The animals were imported from USA in 1985 and raised as a nucleus herd for use in a cattle crossbreeding program. Mean normal monthly temperature and rainfall of Islamabad, for the year 2000 are presented in table 1 (Pakistan Statistical Year Book 2000).

Jersey cattle in Islamabad showed considerable signs of distress during summer months (April-June) due to high temperature, low rainfall and non-availability of green fodder in required amount.

The animals were fed seasonal green fodders, oats and corn. Perennial grass was fed during a scarcity period in September to November. Oats and corn silage was also prepared to feed animals in December-January and April-May. Concentrate ration at 2-1/2 kg/head was fed throughout the year. The ration was prepared by NARC with brand name “PARC Feed”. Grazing was practiced as routine from 4 to 7 h daily.

Statistics

The data were recorded on 50 daughter-dam pairs completing at least two lactations for heritability and correlation estimates of the following traits.

- Age at first calving (AFC)
- Calving interval (CI)
- Lactation length (LL)
- Lactation milk yield (LMY)
- Average daily milk yield (ADMY)

The data were analyzed using the statistical model described by Dale Van Vleck (1979) and the computer statistical software MSTATC.

* Corresponding Author: R. N. Khan. Tel: 9255012/ ext. 3105, Fax: 9255221, E-mail: amazing_fortune@hotmail.com
Received November 2, 2001; Accepted January 28, 2002

Table 1. Mean normal monthly temperature and rainfall at Islamabad

Month	Mean of maximum (°C)	Mean of minimum (°C)	Mean of rainfall (mm)
January	17.7	2.6	56.1
February	19.1	5.1	73.5
March	23.9	9.9	89.8
April	30.1	15.0	61.8
May	35.3	19.7	39.2
June	38.7	23.7	62.2
July	35.0	24.3	267.0
August	33.4	23.5	309.9
September	33.5	20.6	98.2
October	30.9	13.9	29.3
November	25.4	7.5	17.9
December	19.7	3.4	37.3

Model:

$P_{xi}=\mu+G_{xi}+E_{xi}$

$P_{Yi}=\mu+G_{Yi}+E_{Yi}$

P_{xi} and P_{Yi} are records of dam X and progeny Y which have additive relationships:

$ax_iY_i=a_{xy}$ for all i and

$ax_iY_i=0$ for all $i\neq i'$

The esimate of h^2 respectively from regression (i) and correlation (ii) were as follows:-

i) $h^2_{bxy}=(1/a_{xy})b_{Y.X}$

where $b_{Y.X}=\sigma_{XY}/\sigma^2_X$

$1/a_{xy}=2$ (relationship coefficient)

ii) $h^2_{rxy}=(1/a_{xy})r_{Y.X}$

where:

$$r_{Y.X}=\frac{\sigma_{XY}}{\sqrt{\sigma^2_X.\ \sigma^2_Y}}$$

The S.E. of h^2 is :

$$\sigma h^2_b=(1/a_{xy})\sigma_b=1/a_{xy}[(\sigma^2_Y/\sigma^2_x - b^2/n-2)]^{0.5}$$

Seasons were defined as follows (Shahid and Afzal, 1996):

1. Cold winter: December-March
2. Hot summer: April-June
3. Monsoon: July-September
4. Fall: October-November

RESULTS AND DISCUSSION

Arithmetic means, standard deviations and range of the traits are presented in table 2. Means for AFC in parents and progeny were 25.2±2.4 m and 23.9±6.6 m respectively. The difference was statistically significant ($p<0.05$). Nawaz et al. (1993) reported AFC for these cows as 25.6 and 22 m respectively. The lower AFC in progeny may be due to the persistent hot and humid climate of Islamabad, causing earlier maturity than parents.

Jersey parents had CI of 416±74 d as compared to 446±105 d of progeny. The difference was found statistically significant ($p<0.01$). Higher CI of progeny was also reported by Nawaz et al. (1993), for the same herd. The higher CI over the years indicated that CI was adversely affected in the new environment. Similar results were reported in India by Sadana and Basu (1983).

The LL observed in parents and progeny was 301±51 and 325±75 d respectively. The difference of LL in parents and progeny was found non-significant. The new environment did not alter this trait significantly. Average LMY in parents was 2,908±669 lit as compared to 2,707±903 lit in progeny. The large S.D. in both parent and progeny suggests high variation in animal's individual performance. This indicates decrease in LMY over a period of time due to unfavorable environments. Nawaz et al. (1993) reported that parents of these animals had recorded LMY of 5,858±141 kg in USA. The continuous decrease in the LMY illustrates the important role of environment in suppressing genetic potential.

Madsen (1976) and Menzi et al. (1982), also reported that the milk production of locally born cattle was significantly lower than that of their imported mothers in India and Thailand respectively.

The results showing ADMY were similar to LMY. The parents produced 9.4±1.3 lit of milk as compared to

Table 2. Means standard deviations and range of various traits

Traits	Parent			Progeny		
	Means	SD	Range	Means	S.D	Range
Age at first calving (m)	25.2[a]	2.4	19-30	23.9[b]	6.6	16-54
Calving interval (d)	416[a]	74	339-637	446[b]	105	240-826
Lactation length (m)	301	51	210-479	325.0	73	218-462
Lactation milk yield (l)	2,908[a]	669.4	1,865-5,211	2,707[b]	903.2	1,351-4,679
Avg. daily milk yield (l)	9.4[a]	1.4	6.3-13	8.8[b]	1.7	5.0-11.6

Note: the values with different superscripts are significantly different ($p<0.05$).

8.8+1.7 lit by the progeny. Consistent downward trend in milk production by the progeny gives indication of deterioration of the breed in the new environment.

Calving Season

Season effect on LMY was similar to ADMY. However other traits were not evaluated for season effect due to absence of their direct relationship. The season of calving had not significantly affected ADMY as indicated in table 3. The progeny had lower ADMY as compared to parent in all seasons. Juarrez et al. (1998) reported similar results on environment interaction of mature equivalent milk yield (MY) of Holstein cows. Nawaz et al. (1993) reported similar effects of season for the same herd.

Heritability

Estimated h^2 of various traits are given in table 4. For AFC the h^2 was found to be -0.25 as measured by regression and correlation method. The negative h^2 estimates were due to consistent decline of AFC in progeny as compared to parents under the new environments. The S.E. of h^2 was 0.26, due to large variation in the records. The estimates of h^2 for CI were also low and negative in Jersey breed. The S.E of h^2 was 0.31. Compos et al. (1994) reported h^2 of CI as 0.021±0.061 in Jersey cattle from phenotypic and estimated breeding values. The results indicated that CI was influenced more by environment than genetic causes. The results were similar to this study showing low h^2 for CI and higher SE of h^2 estimates. The h^2 of LL was similar to CI and indicated higher influence of environments on this trait. The estimated h^2 of LMY was 0.20±0.27 and 0.15 respectively measured through regression and correlation methods. The lower h^2 for LMY was also reported by other scientists, Campos et al. (1994) reported 327±0.075, Juarez (1988) 0.23, Dematawewa and Berger (1998) 0.14, and Strabel and Misztal (1999) 0.14 to 0.19.

Table 3. Season effect on average daily milk yield

Season	Parent			Progeny		
	Mean	SE	N	Mean	SE	N
1.	8.34	1.86	15	8.58	2.43	75
2.	9.72	2.41	58	7.55	2.22	44
3.	9.74	2.78	26	7.73	2.28	61
4.	9.26	2.51	8	7.66	2.23	37

Correlations

The genetic correlations of various traits with LMY and ADMY are given in table 5. The correlation of AFC with LMY and ADMY was found to be -0.25 and -0.26 respectively. Since ADMY is the function of LMY, the similarity in this correlation was expected. Negative correlations of AFC with these traits were also reported by Dematawewa and Berger (1988). They reported that genetic and phenotypic correlations between yield traits were high and positive and correlations between yields and reproductive traits were high and antagonistic.

The correlation between CI and yield traits was found to be very low, indicative of higher influence of environments in determining these traits. The correlation of LL with LMY was found to be high (0.79) however, it was low for ADMY. This indicated that the LL beyond 300 days caused a decrease in the daily milk yield. The results are similar to those reported by Campos et al. (1994).

CONCLUSION

The Jersey breed imported from USA and maintained at Islamabad, Pakistan did not perform up to its genetic potential due to severe climatic conditions, especially in summer. The genetic and phenotypic estimates however, gave results similar to those reported by other scientists for this breed under similar conditions. The lower estimates of h^2 for all the traits studied indicated great influence of environment on production and reproduction traits.

Table 4. Estimates of heritabilities of various traits by daughter-dam regression and correlation method

Traits	a	b	r	h^2_b	h^2_r	SE of h^2
Age at first calving (m)	32.6	-0.34	-.12	-0.25	-0.25	0.26
Calving interval (d)	479	-0.08	-0.06	-0.16	-0.11	0.31
Lactation length (d)	345	-0.07	-0.05	-0.13	-0.09	0.31
Lactation milk yield (l)	2,415	0.10	0.07	0.20	0.15	0.27
Avg. daily milk yield (l)	8.08	0.01	0.01	0.0	0.02	0.25

a=Y- Intercept, b=slope (regression coefficient), r=correlation coefficient.

h^2_b=heritability estimates derived by daughter-dam regression, h^2_r=heritability estimates derived by correlation.

Table 5. Correlations among the traits

Traits	Lactation milk yield	Average daily milk yield
Age at first calving (m)	-0.25	-0.26
Calving interval (d)	0.14	-0.05
Lactation length (d)	0.79	0.14

REFERENCES

Compos, C. J., M. S. Wilcox, C. M. Becerril and A. Diz. 1994. Genetic parameters for yield and reproductive traits of Holstein and Jersey cattle in Florida. J. Dairy Sci. 77:867-883.

Dematawewa, C. M. B. and P. J. Berger. 1998. Genetic and phenotypic parameters for 305-day yield, fertility and survival in Holsteins. J. Dairy Sci. 81:2700-2709.

Juarez, H. C., P. A. Oltenaeu, R. W. Blake, C. E. McCullock and E. G. Cienfuegos-Rivas. 1998. Effect of herd environment level on the genetic and phenotypic relationship among milk yield, somatic cell score and fertility. J. Anim. Sci. 76, Suppl. 61.

Lee, J. K., P. M. Van Raden, H. D. Norman, G. R. Wiggans and T. R. Meinert. 1977. Relationship of yield during early lactation and days open during current lactation with 305-day yield. J. Dairy Sci. 80:771-776.

Livestock Census 1996. Agricultural Census Organization, Statistic Division, Government of Pakistan, Gulberg, Lahore.

Madsen, O. 1976. Red Danish cattle in the tropics. Wld. Anim. Rev. 32:25-32.

Menzi, M., W. Kropt and W. V. Sieben Thal. 1982. An exotic population under a tropical environment. Wld. Anim. Rev. 44: 24-29.

Meyn, K. 1991. The contribution of European cattle breeding to cattle production in the third world. Anim. Res. Dev. 34:89-99.

Nawaz M., M. Anwar, M. A. Mirza and R. Nawaz. 1993. Study of comparative milk production and reproduction of Jersey cattle under USA and Pakistan conditions. Asian-Aus. J. Anim. Sci. 6:549-553.

Pakistan Statistical Year Book 2000. Federal Bureau of Statistic, Statistic Division Government of Pakistan, April, 2000.

Sadana, D. K. and S. B. Basu. 1983. Reproductive performance of exotic breeds in India. Indian J. Dairy Sci. 36(2):121-124.

Strabel, T. and I. MisZtal. 1999. Genetic parameters for first and second lactation milk yield of Polish Black and White cattle with random regression test-day models J. Dairy Sci. 82:2805-2810.

Vleck, V. D. 1979. Summary of methods for estimating genetic parameters using simple statistical models. Dep. of Anim. Sci. Cornell Univ, USA.