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Lactation Performance of Crossbred Dairy Cows in the Sudan

[1]Fadlelmoula, A.A., [2]Abu Nekheila, A.M. and [1]Yousif, I.A.

[1]Dept. of Genetics and Animal Breeding, University of Khartoum,
Faculty of Animal Production, Postal code: 13314, P.O.Box: 32, Shambat-Sudan.
[2]Dept. of Dairy Production, University of Khartoum,
Faculty of Animal Production, Postal code: 13314, P.O.Box: 32, Shambat-Sudan.

Abstract: This study was conducted to investigate the factors that have influence on the lactation traits of crossbred dairy cows in the Sudan; data comprising some productive traits such as milk yield/ lactation, average daily milk yield, lactation length and dry period were obtained from the University of Khartoum Farm and subjected to statistical analysis using the computer program (SAS[15]). The results revealed that parity had significant ($p<0.01$) effect on milk yield per lactation, average daily milk yield and dry period. While percentage total foreign blood and sire breed introduced variation on the productive traits namely: milk yield per lactation ($p<0.01$); average daily milk yield ($p<0.01$); lactation length ($p<0.05$) and dry period ($p<0.01$). Among the productive traits studied; only average daily milk yield was found to be affected by period of calving ($p<0.01$). However, lactation length was influenced by season x period of calving interaction.

Keywords: lactation length, lactation yield, daily milk yield, percentage foreign blood, sire breed).

INTRODUCTION

Indigenous breeds of cattle in the tropics and subtropics have been known for their low inheritance productivity; however in most cases they have been selected for their advantage of adaptation to extreme adverse environmental conditions.

Attempts to introduce exotic blood into the Sudanese local breeds have resulted in relative improvements of the overall average productivity. However, the difficulties to assess the relationship between phenotype and genotype rendered the estimate of the potential breeding worth of the cross bred animals for most quantitative traits, such as milk production less accurate. There for it is necessary to assess the environmental effects in order to obtain proper estimation of the genetic effects. Cunningham[2] had reported on the advantage of crossing European dairy cattle with indigenous breeds, never the less, the performance of different grades vary from one environment to the other. Osman[9] reported that the total life time yield had increased with percentage of European blood up to 75% at standard management; Ali[1] suggested that the 50% Friesian blood would be the grade of choice under the Sudan tropical condition. Philipsson[13] stated that in many parts of the developing countries the use of semen of the exotic breeds has greatly enhanced the production of milk, mainly by crossbreeding with indigenous cattle breeds; he also suggested that in the utilization of cross breeding systems the aim is to optimize the simultaneous use of both additive and non- additive (heterosis) sources of genetic variation. Animal factors such as breed, age, stage of lactation, parity and even milking frequency, have also been reported in other studies to affect milk production[17,5].

In this study crossing was performed between Friesian and Ayrshire bulls and the Sudanese indigenous cattle with the following objectives:

- To determine the over all average performance of the resulted cross bred stock.
- To study the effects of the percentage total foreign blood (Friesian and Ayrshire).
- The effects of season and period of calving and their interaction on the same lactation traits.

MATERIALS AND METHODS

Data on crossbred dairy cows was collected from the University of Khartoum data records, comprising 521 lactation records and included the following lactation traits:

1- Milk yield/lactation (kg).
2- Average daily milk yield (kg).
3- Lactation length (day).

The period of the study was divided into three seasons:

Corresponding Author: Fadlelmoula, A.A., Dept. of Genetics and Animal Breeding, University of Khartoum, Faculty of Animal Production, Postal code: 13314, P.O.Box: 32, Shambat-Sudan.
E-mail: abdelazizfadlelmoula@gmail.com

1- Dry summer (March-June).
2- Wet summer (July-October).
3- Winter (November-February).

Using the year of calving as a criterion, the data was also classified into four periods of five years each. Moreover, according to the breed of the sire, the data was classified into two groups, the first one sired by Friesian bulls and the second was sired by Ayrshire bulls. Four grades of total foreign blood were considered viz, 25%, 37.5%, 50% and 62.5%.

Statistical Analysis: Fixed effects multiple regression model incorporated in the computer program of SAS[15] was employed to analyze the data; according to the following model:

- $Y_{ijklmns} = \mu+c_i+a_j+b_k+d_i+x_m+f_n+e_{ijklmns}$

Where:

- $Y_{ijklmnps}$ = ijklmnpsth observation.
- μ = the over all mean.
- c_i = the effect of ith lactation number.
- a_j = the effect of jth percentage foreign blood.
- b_k = the effect kth sire breed.
- d_I = the effect of Ith season of calving.
- x_m = the effect of mth period of calving.
- f_n = the effect of nth season x period interaction.
- $e_{ijklmns}$ = residual effect.

All effects were considered to be fixed except for the residual effect which was considered to have zero mean and α^2 variance

The following parameters were computed:

- The over all averages of milk yield/lactation, daily milk yield lactation length and dry period.
- The averages of milk yield, lactation length and dry period by lactation number, percentage total foreign blood, sire breed, season of calving and period of calving.

Duncan's multiple range test (DMRT) was used to compare the different means.

RESULTS AND DISCUSSIONS

The Average Milk Yield/lactation and Daily Milk Yield: Table (2) presented the overall averages of the two traits (2729.85 ± 1014 kg and 7.94 ± 2.40 kg respectively). The higher value of C.V% could be due to variation in lactation length beside the genetic and environmental factors. These results were comparable with the findings of Epaphras[3] who found 7.1±0.6 average daily yield for crossbred Ayrshire cows reared under coastal tropical climate in Tanzania. Ishaq[4] who reported 8.5kg mean daily milk yield for crossbred Swedish red and white x Sahiwal cows. Ali[1] obtained mean lactation yield and mean daily milk yield for 50%, 62.5% and 75% foreign blood as 4306, 5733 and 4136 lbs for the former and 13.23, 15.53 and 13.03 lbs for the latter trait respectively. Patel[11] obtained overall mean lactation yield as 2798.33 ± 51.63 kg for Jersey x Kankrej cows.

Significant variation ($p<0.01$) in the two traits was encountered (Table 1) due to the effect of lactation number. Such variation was further explained in (Table 3) in which the maximum yield was attained in the fifth lactation, this result was consistent with those suggested by Sid Ahmed[16] and Ali[1] for Sudanese crossbred cows; the variation reported could be due to the improvement in milk let down with increasing age [6], also the level of feeding and management effecting one or more of the physiological functions related to milk yield might provide comfort or stress to the animals; in addition to the genetic difference among groups constituting the herd.

Percentage total foreign blood was shown to exert significant effect on milk yield per lactation ($p<0.01$) and average daily milk yield ($p<0.01$), (Table 4), the results exhibited the performance of cows with 50% foreign blood was significantly ($p<0.01$) higher than the other levels (Table 4); the same findings was obtained by Ali[1] for crossbred Zebu cattle with different levels of Friesian blood. This may suggest that 50% foreign blood is the most suitable level to the tropical conditions.

Table 5 showed that cows sired by Friesian bulls obtained the highest yield than those sired by Ayrshie bulls; with the difference being significant ($p<0.01$). Beside the genetic differences, this result may also, indicate a higher degree of adaptability of Friesian to tropical environment than other foreign breeds.

Lactation yield was not affected by season or year of calving indicating the lack of seasonal or yearly trend (Table 1); however, average daily yield was significantly ($p<0.01$) affected by period of calving (Table 7); which could be due to change in management and feeding regime through the years. Payne[12], Msanga[7] reported that a number of factors have been reported to affect milk production in the tropics including year of calving. Msanga[8] and Ali[1]obtained the same results for Tanzanian and Sudanese crossbred cows respectively.

Lactation Length: The overall average lactation length of the pooled unadjusted data was shown in (Table 2). The result exhibited a longer lactation which may indicate the presence of managerial problems that resulted from irregular drying off-system. The trait was

Table 1: Mean squares (M.S.) for the effect of lactation number, percentage foreign blood, sire breed, season of calving, period of calving and season x period interaction on some productive traits

Source of variation	D.F.	MY/LM.S.	DMY M.S.	L.L. M.S.	DP M.S.
Lactation number	6	448223.8*	57.3**	7534.4 N.S.	4777.2 N.S.
Percentage foreign blood	3	311242665.3*	160.2**	57043.2**	15657.2**
Sire breed	1	13380392.3*	31.9**	41245.5*	48843.0 N.S.
Season of calving	2	665020.7 N.S.	5.5N.S.	5611.7 N.S.	5583.7 N.S.
Period of calving	3	382723.3 N.S.	24.4**	1385.1N.S.	2036.6N.S.
Season x Period interaction	6	151606.4 N.S.	2.9 N.S.	37617.5**	1968.7 N.S.

MY/L = Milk yield per lactation
** = Significant at p<0.01
DMY = Average daily milk yield
* = Significant at p<0.05
L.L. = Lactation length
N.S. = Not significant p>0.05
DP = Dry period

Table 2: The overall means, standard deviation (S.D.) and coefficient of variation (C.V. %) of the productive traits measured

Trait	No. of records	Mean	S.D.	C.V.%
Milk yield per lactation (Kg)	471	2729.85	1014	31
Average daily milk yield (Kg)	464	7.94	2.40	24
Lactation length (Day)	372	344	94	25
Dry period (Day)	382	93	60	65

Table 3: Average milk yield per lactation, daily milk yield, lactation length and dry period by lactation number

Lactation number	Milk yield per lactation (Kg)	Daily yield per lactation (Kg)	Lactation length (Day)	Dry period(Day)
First	2374.50^{c}	6.60^{d}	359^{a}	-
Second	2588.20^{bc}	7.35^{cd}	358^{a}	96^{a}
Third	2948.70^{a}	8.38^{ab}	351^{a}	92^{a}
Fourth	2776.20^{ab}	8.68^{a}	337^{a}	92^{a}
Fifth	3005.50^{a}	8.94^{a}	336^{a}	112^{a}
Sixth	2995.50^{a}	8.77^{a}	343^{a}	87^{a}
Seventh	2490.10^{bc}	7.75^{bc}	322^{a}	110^{a}

N.B.: Means with the same letter are not significantly different (p>0.05).

Table 4: Average milk yield per lactation, daily milk yield, lactation length and dry period by percentage total foreign blood

Percentage total foreign blood	Milk yield per Lactation (Kg)	Daily milk yield (Kg)	Lactation length (Day)	Dry period (Day)
25	2343.9^{c}	7.3^{c}	321^{b}	107^{a}
37.5	2495.3^{c}	7.1^{c}	359^{a}	100^{b}
50	3521.5^{a}	10.0^{a}	357^{a}	84^{b}
62.5	3174.0^{b}	8.8^{b}	371^{a}	81^{b}

N.B.: Means with the same letter are not significantly different (p>0.05).

Table 5: Average milk yield per lactation, daily milk yield, lactation length and dry period by sire breed

Sire breed	Milk yield per Lactation (Kg)	Daily milk yield (Kg)	Lactation length (Day)	Dry period (Day)
Friesian	2808.9^{a}	8.1^{a}	351^{a}	94^{a}
Ayrshire	2370.0^{b}	7.4^{b}	323^{b}	106^{a}

N.B.: Means with the same letter are not significantly different (p>0.05).

Table 6: Average milk yield per lactation, daily milk yield, lactation length and dry period by season of calving

Season of calving	Milk yield per Lactation (Kg)	Daily milk yield (Kg)	Lactation length (Day)	Dry period (Day)
Dry summer	2800.9a	7.9a	354a	104a
Wet summer	2677.1a	7.7a	347a	94a
Winter	2707.4a	8.1a	334a	91a

N.B.: Means with the same letter are not significantly different (p>0.05).

Table 7: Average milk yield per lactation, daily milk yield, lactation length and dry period by period of calving

Period of calving	Milk yield per Lactation (Kg)	Daily milk yield (Kg)	Lactation length (Day)	Dry period (Day)
First	2489.1[a]	7.5[b]	332[a]	63[a]
Second	2684.3[a]	7.9[b]	340[a]	99[a]
Third	2740.7[a]	8.3[a]	330[a]	97[a]
Fourth	2790.8[a]	7.2[b]	387[a]	92[a]

N.B.: Means with the same letter are not significantly different (p>0.05).

not affected by parity number (Table 1), however, percentage total foreign blood and sire breed exerted significant effect on lactation length (p<0.01 and 0.05 respectively). Regarding DMRT, (Table 4) revealed that cows having 25% foreign blood had been lactating for a shorter period (321 days) than other grades, in addition to this, cows sired by Friesian bulls continued to give milk for a longer time than those sired by Ayrshire bulls (Table 5), such variation might be due to differences in the genetic groups.

Tables 6 and 7 indicated no significant (p>0.05) difference in lactation length among season and period of calving. This is comparable to the result obtained by Ali[1]. The result may reveal that introduction of foreign blood keep the regularity of yielding period irrespective of season or year of calving. On the other hand, season x period of calving interaction exerted a significant (p<0.01) effect on lactation length (Table 1) which could largely be attributed to change in management between season and periods of calving.

Dry Period: In order to express the maximum yielding potential of a lactating cow, it is of paramount importance to be given a period of rest after completing a determined period of yield. This study found that the overall average dry period (Table 2) was beyond the optimum (60 days); which was economically not feasible. The trait was significantly influenced by percentage total foreign blood (p<0.01), as shown in (Table 1) however, results in Table 4 revealed that 62.5% foreign blood was closer to the optimum dry period than other grades. This result supported by Pandy[10] and Prabhu[14], they found significant variation in dry period among different genetic groups. However, neither Friesian nor Ayrshire bulls were effective in causing variation in dry period. Generally the encountered variation in dry period might be attributed to change in management and inconsistent drying-off system.

In this study dry period was insignificantly (p>0.05) affected by lactation number, season and period of calving and their interaction, indicating that dry period is of managerial nature and could be controlled by proper management.

Generally it can be concluded that the productive traits were influenced by many environmental factors that can be monitored by establishing stable systems of management and feeding plan that also should fulfill the needs of the crossbred herds. On the other hand, introduction of foreign blood up to 50% was revealed to be most suitable for tropical conditions, unless stable and standard system of management is adopted; in such a case the level above 50% can be used.

REFERENCES

1. Ali, T.E., F.A. Ahmed and Y.A. Ombabi, 1988. Productivity of crossbred Zebu cattle with different levels of Friesian blood. Sudan J. Anim. Prod. 1(2): 69-79.
2. Cunningham, E.P. and O. Syrstad, 1987. Crossbreeding *Bos indicus* and *Bos taurus* for milk production in the tropics. FAO Animal Production and Health Paper 68. FAO Rome .
3. Epaphras, A., E.D. Karimuribo and S.N. Msellem, 2004. Effect of season and parity on lactation of crossbred Ayrshire cows reared under coastal tropical climate in Tanzania. Livestock Research for Rural Development, 16(6).
4. Ishaq, S.M., M.A. Khan and S.K. Shah, 1981. Experimental cross-breeding of Sahiwal cows for improved production performance. Pakistan Vet. J., 1(4): 154-160.

5. Johnson, C. R., D.L. Lalman, A. Appeddu-Lisa, A. Brown-Michael, R.P. Wetteman and D.S. Buchanan, 2002. Effect of parity and milk production potential on forage intake of beef cows during late gestation. TEKRAN United States Department of Agriculture, Agricultural Research Service.
6. Mahadevan, P., 1966. Breeding for milk production in tropical cattle. Technical Communication No. 17 of the Commonwealth Bureau of Anim. Breed. and Genetics, Edinburgh.
7. Msanga, Y.N., M.J. Bryant, I.B. Rutam, F.N. Minja and L. Zylstra, 2000. Effect of environmental factors and of the proportion of Holstein blood on the milk yield and lactation length of crossbred dairy cattle on smallholder farms in north-east Tanzania. Tropical Animal Health and Production, 32: 23-31.
8. Msanga, Y.N., 1994. Some environmental limitations on lactation performance of crossbred cattle on the coast of Tanzania. Tropical Animal Health and Production, 26(2): 127-128.
9. Osman, A.H. and W.S. Russell, 1974. Comparative performance of different grades of European-Zebu crossbred cattle at Ghurashi dairy farm, Sudan. Tropic. Agric. (Trinidad), 51(4): 549-558.
10. Pandy, H.N., R.C. Garg and S.N. Kaushik, 1983. First lactation milk yield, lactation length and dry period in Haryana-exotic crosses. Indian J. Dairy. Sci., 53(3): 307-309.
11. Patel, J.M. and M.M. Trivedi, 1989. Production profile of Jersey x Kankrej halfbreds. Indian J. Anim. Sci., 59(6).
12. Payne, W.J.A. and T.R. Wilson, 1999. An introduction to animal husbandry in the tropics. 5th ed. Blackwell Publishing Ltd, Iowa State University Press, U.S., pp: 826.
13. Philipsson, J., 1992. Practical; issues for the conservation and improvement of priority breeds with global reviews of species, Proceedings of an FAO Expert Consultation,Rome, Italy, April 1992.
14. Prabhu Kumar, V., Harinadha C. Rao, A. Venkartromaiah and K. NaraSaiah Naidu, 1990. Genetic group differences in the performance of the various crosses of Ongole with Friesian, Brown-Swiss and Jersey breeds. Indian J. Dairy Sci., 43(1): 46-50.
15. SAS, 1999. SAS Institute Inc., SAS/STAT User's Guide, Release 8.02 edition. Cary, NC, USA.
16. Sid Ahmed, S.E., 1986. Performance of crossbred dairy cattle in the Sudan. M.Sc. thesis, University of Khartoum, Sudan.
17. Tekerli, M., Z. Akinci, I. Dogan and A. Akcan, 2000. Factors affecting the shape of lactation curves of Holstein cows from the Balikesir Province of Turkey. J. of Dairy Sci., 83: 1381-1386.