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PERFORMANCE OF KENANA × FRIESIAN CROSS-BRED CATTLE IN CENTRAL SUDAN

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ABSTRACT: *A study to evaluate performance of Friesian crosses with Sudanese (Kenana × Friesian) dairy cattle was carried out in central Sudan conditions in tow herds at tow dairy farms (Kenana company, and ELbshaier dairy farms). A sample of 128 records (90+38 from Kenana and Elbashaier dairy farms respectively) were studied for the performance of different blood levels on milk production, days in milk, calving interval, age at lactation and lactation number. Analysis of variance, correlations, regressions and mean separation utilizing "Duncan" were done in version 9 (SPSS) computer program. The results showed that the overall mean lactation yield (kg), days in milk and calving interval were: 3603.4±127 kg, 317.3±8 days and 420.3±8 days respectively. Mean lactation milk yield was highest in 75% blood level (4724.1 kg).On the other hand, Mean milk yield for: 25%, 37.5%, 50%, 62.5%, 75%, 87.5% and 100% were: 2497.7, 3302.0, 3508.4, 2657.0, 4724.0, 4362.3 and 3507.5 kg respectively. There were significant (P≤0.01) differences between means of milk yield, days in milk, and calving interval in the tow farms Kenana and Elbashaier respectively. Blood level, herd, lactations and their interactions had a significant (P≤0.05) effect on milk production. Also blood level had a significant (P≤0.01) effect on days in milk, and the mean days in milk for 25%, 37.5%, 50%, 62.5%, 75%, 87.5%, and 100% were: 354.0, 291.0, 307.0, 298.6, 339.9, 302.5, and 377.0 days respectively. Milk yield was affected by: herd, lactation and blood level, but there was a positive significant (P≤0.05) correlation between milk yield and blood level. Mean calving interval for 25%, 37.5%, 50%, 62.5%, 75%, 87.5%, and 100% were: 466.0, 454.0, 395.7, 382.9, 445.7, 401.0, and 416.8 (days) respectively.*

Keywords: *Performance, Friesian crosses, central Sudan*

ORIGINAL ARTICLE

INTRODUCTION

Sudan is the home of large numbers of domestic animals. The total number of the cattle in 2001 was 38.325 million heads (Medani, 2003). In spite of this large number of cattle, there was a shortage in milk and milk products in many parts of the country, particularly in urban areas. The productivity of the Sudanese dairy cattle was generally low and the average annual milk yield did not exceed 2000 kg, (Osman and Ruseell, 1974). The best milk producing breeds in Sudan are Kenana and Butana, and they had shown production estimated to be about 1872 kg and 2254 kg per lactation respectively (Fangaly, 1980) On the other hand, Hamide (2004) reported that judged by international standards milk production potential of most indigenous Sudanese cattle was sub-optimal. Generally milk production in Sudan tends to be highly seasonal, and most production occurs during the rainy seasons at the time of relatively plentiful grass and other forages. This availability of feed continues into the winter season when agricultural byproducts are available. (Mohamed, 1987).Currently the demand for milk exceeds supply. To satisfy this shortage the government policy was to increase milk production by improvement of the genetic makeup of cattle by crossing with foreign blood. Cattle in the tropics have, on average, lower milk yield and shorter lactations than cattle in temperate zone countries. The difference is caused by both genetic and non-genetic factors. The level of foreign blood is one factor that affects milk yield and composition.

The main objectives of this study were to:

-Determine the effect of foreign blood levels on milk yield and the dairy characteristics.

-Determine the optimum foreign blood level that results in optimum performance

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MATERIALS AND METHODS

Data collection

Total sample of 128 (90+38 animal records from Kenana and El Bashaier dairy farms, respectively) were taken. All cows were (Kenana × Friesian) crosses at different foreign blood percentages (25 to 100%). Complete records representing, the period 1989 – 2005 were taken and analyzed.

Historical background

Kenana dairy farm was established in 1985.The farm was situated at Kenana Town on the Eastern bank of the White Nile, 300 km south Khartoum, latitude 13˚–10˚ N and longitude 32˚–40˚ East, in a heavy clay soil. The climate is hot, semi-arid with mean maximum temperature of 36.4˚C and corresponding mean minimum temperature of 20.2˚C and the mean annual rainfall of 278 mm for the period 1977 to 2002. The foundation stock of Kenana farm consisted of Kenana cattle type and some of the cows were crosses (Kenana × Friesian) from University of Gezira Research Farm, and Kafoury Dairy Farm (Khatroum North). Cross breeding was started in 1985 at Kenana Dairy Farm.

El Bashaier dairy farm is a private small scale dairy farm, located at Elshokaba 10 km south of Wad Medani Town (Gezira Steate). The farm was established in 1990 as a dairy production enterprise. At El Bashaier farm, the foundation stock was (Kenana × Friesian) crosses with different foreign blood levels.

Herd management

Animals were housed in open fenced pens in Kenana farm. There were three large units, A, B and C, with total capacity of 2200 heads of different ages (64x220) meters for every unit. Every unit was divided into many pens i.e (a1, a2, a3 … ect.) with total capacity of 85heads/pen. Also there were 16 sections for calf housing with 900 heads/unit. The total animal number of Kenana farm herd was about 900 heads, with (4–7) breeding bulls. Lactating cows were around 500 cows throughout the year. Artificial insemination (AI) system was used many years ago by using 100% Friesian semen. Cows were machine milked in two parlours with full capacity of 32 cows. Cattle feed was offered in the pens, consisting of: (Dolecus, lablab), Clitoria, Rhodes grass (Glories, gayana), Maize and Abu 70 (sorghum spp) and other grasses, concentrate feed was composed of groundnut cakes, wheat bran, and Maize forage, while molasses was fed adlib, cows were grouped into: three feeding groups according to the level of production (high, medium and low, yielders), dry cows and young stock. Calves were also kept in three separate units. Cows were milked twice a day and the total weekly milk yield for each cow was entered into a computer recording program.

In El Bashaier farm, cows were housed in open system, and partially grazed on Abu 70 (sorghum spp.) during the day. Concentrate was composed of sorghum, groundnut cakes, wheat bran and molasses, offered during milking. Dairy cows were supplemented with minerals and they were hand – milked twice a day and the daily milk yield was recorded for each cow.

Statistical analysis

The data extracted from the record sheets were transferred to a computer coding sheets prepared for statistical analysis in version 9 (SPSS). According to Harvey (1977). Means and standard deviations for: overall milk yield (kg), days in milk and mean calving interval (days) were computed. Mean separation utilizing Duncan's multiple range test (DMRT) was used to compare the different means. Milk performance was studied to determine any significant effect of factors affecting milk yield to compare the performance of different crosses together. And the mathematical model used was:

$$Yijklmnopq = \mu + Ai + Bj + HL + ABm + BHo + eijklmnopq$$

Where:

Yijklmnopq= Milk yield of nth cow of i^{th} age, and j^{th} blood level, on L^{th} herd, of m^{th} age x blood interaction, of o^{th} blood×herd interactions.

μ = Overall mean of lactation milk yield, days in milk and calving interval.

Ai = Effect of animal age.

Bj = Effect of blood level (j x 1, 2 … 7 groups).

HL = Effect of herd (1, 2).

ABm = Interaction of J^{th} age with j^{th} blood level (1 …7).

BHo = Interaction of j^{th} blood (1, 2…7) with herd (1, 2).

Eijklmnopq = (ijklmnopq) the random error term.

Regression was obtained on blood level groups for total lactation milk yield, days in milk, herd and age at lactation. Correlation of milk yield with blood level, age, herd, lactations and blood with, herd age and lactations were also computed.

RESULTS and DISCUSSION:

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Level of foreign blood and milk yield

A comparison of milk yield between the different levles of foreign blood groups was presented in Table 2 There were significant (P<0.01) differences between different foreign blood level groups(25, 37.5, 50, 62.5, 75, 87.5, and 100 %).Cows with 75% foreign blood produced the highest milk yield (4724.1 kg) followed by 87.5% (4362.3 kg) ,while there was no significant (P<0.01) difference between pure Friesian and 50% crosses in milk production (3507.5and 3508.4 kg); However, the lowest milk yield was obtained from 25% (2497.7 kg). The reason why 100% and 50% blood group cows produced the same volume of milk per lactation might be attributed to the very harsh environmental temperature that cows with this blood could not tolerate. Normally pure temperate zone cattle reared in the tropics show decreased production due to decreased feed intake, low energy metabolism and at the same time direct most of the energy intake to vaporization of sweat to keep the body cool. The highest milk production obtained from the 75% blood level might be due to acclimatization process gained during upgrading. While the lowest milk production obtained from 25%, foreign blood level cows might be due to the low performance cams from there high local blood level. This result was closely similar to that reported by Osman (1970) who found that total milk yield increased with the increasing percentage of foreign blood to a maximum at 75%; and also it was in agreement with Ageeb and Hillers (1991) who found that more the Kenana blood in the crossbreed the lower the yields. The current result for milk yield was also closely similar to that reported by El-Faki (1988) who revealed that cows with more than 50% foreign blood gave significantly higher daily milk yield as compared with those with less than 50% foreign blood. This however, was not in agreement with Kale et al. (1984) who concluded that there was no significant advantage in increasing the Holstein-Friesian inheritance more than 50%. Differences in milk yield between results obtained by different authors might be attributed to years and location effects. On the other hand, the mean milk yield of 37.5, 50, 75 and 100% foreign blood (3181.2+211.2, 2400.4+108.8, 4109.8+271.6 and 3548.4+506.7 respectively) was not in agreement with that obtained by Ibrahim (1983) who reported that milk yield of 37.5, 50 and 75% was 2324, 2347 and 2457 kg respectively, these differences may be due to age and locations. The low production in milk yield from the 62.5% foreign blood level was not expected. This was in contrast with most studies. Mc Dowell (1985) reported that crossbred with 62.5% European inheritance had performed well. Also Chacko and George (1984) reported same results for 62.5% Friesian X Sahiwal. Ali, et al. (1988) found that the average milk yield was better at 62.5% (5733 lb) and lower at 50% (4136 lb) in Sudan for crossbred dairy cattle.

This study indicated that, the Interaction between: (lactation xHerd), (Herd x lactation x blood level) and (lactation x blood level) had a significant effect on milk yield (Appendix II).

Lactation period (days in milk)

Dairy cows need to express good production characteristics by producing more milk and prolonging their productive period. Table 3 shows that blood level had significant (P<0.01) effect on days in milk. Pure Friesian cows were milked for longer period (377 days) followed by 25% (354 days), then 75%, while there was no significant difference between 50%, 62.5 and 87.5%. Shorter days in milk was obtained at 37.5% foreign blood level (291 days); there was a moderate correlation (r=0.57) between milk yield and days in milk (Table 1).

The difference between days in milk and calving intervals obtained between different blood levels may be due to management variation (i.e.) reproductive disorders, health control and environmental stress. This result was different from the Findings of Ali et al. (1988), Kale et al. (1984) Ibrahim (1983) and Khalifa (1964). The lowest milk production from 25% blood level was attributed to the low performance due to the high percent of the local blood, though they were adapted to the environmental stresses; this may be explained by longer productive period (354 days). Pure Friesian cows and those with 87.5 % blood level, lost their high genetic potentials by the interaction with the environment, although they produced for longer periods (377, 339.9 days respectively). The current result was similar to the findings of Ali, et al. (1988) who reported 306 days for 50% crossbred in Sudan, and also similar to that obtained by Madalena et al. (1990) for 50, and 75% foreign blood level. But their finding for 62.5% (191) was less than in this study. On the other hand Fadlelmoula (1989) revealed different result, indicating that lactation length was similar in cows with 37.5 and 50% foreign blood levels.

Table (4) shows the results concerning the data of the two farms, Kenana and El Bashaier. There was a significant ($P \leq 0.01$) difference between the two farms in means of milk yield (3147.8, 3805.4), days in milk (296.9, 346.6), and calving interval (429.1, 407.8) respectively. Overall mean of total milk yield (kg), calving interval (day), and days in milk were: (3603.4$\pm$127.3, 420.4$\pm$8 and 317.3$\pm$8) for Kenana and El Bashaier respectively. The herd had also significant ($P \leq 0.05$) effect on days in milk (296.9$\pm$9, and 346.6$\pm$14.5) for Kenana and Elbashaier respectively.

It was obvious from Table (1), that there was a positive significant ($P \leq 0.01$) correlation between: milk yield x days in milk (r=0.10), and milk yield x Herd, (r=0.15); but no significant correlation between milk yield x calving interval (r=0.03). Correlation between milk yield x Age of the animal (r=0.10). Blood level had a positive significant ($P \leq 0.05$) correlation for milk yield (r=0.08), and significant ($P \leq 0.01$) correlation for herd (r=0.20) and days in milk (r=0.01); But negative significant ($P \leq 0.01$) correlation (r=-0.20) with lactation (year). Regression of blood level, age at lactation (year), herd and lactations on milk production (kg) were presented on (Appendix III). According to (t) value milk yield was dependant upon herd (1.87) followed by lactation (1.52) and then blood level (0.82).

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Table 1 - Correlation between age at lactation groups, blood level, calving interval, days in milk, herd, lactation, and milk yield

	Age at lactation (year)	Blood %	Calving interval (days)	Days in milk	Herd	Lactations	Milk yield (kg/Lactation)
Age at lactation	1.0	- 0.007	-0.139	- 0.005	-0. 56**	0.088**	0.122
N	218	218	128	155	217	218	155
Blood %		1.0	- 0.034	0.0134**	0.241**	- 0.16**	0.084*
N		706	544	621	705	706	619
Calving inter (days)			1.0	0.041	- 0.060	- 0.035	0.034
N			544	467	544	544	465
Days in milk				1.0	0.025*	- 0.059	0.567**
N				621	620	621	619
Herd					1.0	- 0.060	0.146**
N					705	705	618
Lactations (kg)						1.0	0.101*
N						706	619
Milk yield (kg/Lac)							1.0
N							619

*Correlation is significant at the (0.05) level, **Correlation is significant at the (0.01) level, N = Number of observations.

Table 2 - Milk yield (kg/lactations) of different blood level groups

Blood %	Mean milk yield (kg)	SE ±	N
25	2497.667^{f}	893.60	4
37.5	3302.122^{d}	259.035	74
50	3508.413^{c}	114.919	334
62.5	2656.994^{e}	293.771	93
75	4724.069^{a}	321.338	92
87.5	4362.250^{b}	947.848	10
100	3507.500^{c}	557.282	11

Means with different letters differ significantly ($P \leq 0.01$). N=Number of lactations.

Table 3 - Days in milk of different blood level groups

Blood %	Mean days in milk	SE +
25	354.00^{b}	56.70
37.5	291.04^{e}	16.43
50	307.25^{d}	7.29
62.5	298.62^{d}	18.63
75	339.89^{c}	20.38
87.5	302.50^{de}	60.12
100	377.00^{a}	35.35

Means with different letters differ significantly ($P \leq 0.01$).

Calving interval

Breeding efficiency of the dairy cows is dependent upon the good management in reproductive program, by reducing calving interval, and other reproductive problems. Results of calving intervals (days) are illustrated in Table 5 from this Table it could be seen that, there was a significant ($P<0.01$) difference between blood level groups. Highest interval was found in cows with 25 % foreign blood (466 days) followed by 37.5% (454 days) and then 75% (445 days). While shorter calving interval was obtained at 62.5 % (382.9 days). There was a positive correlation ($r=0.03$) between milk yield and calving interval (Table 3.1). Calving interval had no significant effect on milk yield (Appendix I). Overall mean calving interval in this study was 420.4+84 days which had no significant effect on milk yield. This result was closely similar to that obtained by Mohammed (1995) who reported 411 days for calving intervals for (Friesian x local Zebu breeds) in Sudan. However longer interval (than 420.4 days) was obtained by Magzoub (1993) who found overall calving interval of the first four calvings was 450 days in Sudanese crossbred cows. The longer interval at 25 % foreign blood level may be due to the high local blood level.Reducing calving interval is needed to increase the productive life of the cow, since the local dairy cattle are characterized by longer calving interval as it was reported by Saeed et al. (1987) with average calving interval of 485+5 days for Kenana type at Um Banien animal production research Farm. On studying the Sudanese dairy cattle, Osman (1971) reported 441+8 days which was higher than the overall mean calving interval in the present study (420.4+8) (Table 5).This indicated that there was a reduction in calving interval (day) by upgrading the local dairy breeds and it had a significant effect on milk yield. Calving interval tended to decrease by increasing the foreign blood up to 75% and it

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was negatively correlated with, blood level (r=-0.034) and negatively with herd (r=-0.06) (Table 1). This means that there was no direct relation between the two herds.

Table 4 - Means of milk yield, days in milk, and calving interval in Kenana and EL Bashaier dairy farms

Factor	Milk yield (kg/lactation)		Days in milk		Calving interval	
	Mean	SE ±	Mean	SE ±	Mean	SE ±
Overall	3603.40	127.30	317.30	8.08	420.40	8.40
Herd						
Kenana	3147.76 a	136.70	296.90 a	9.20	429.10a	9.60
El Bashaier	3805.38 b	201.42	346.60 b	14.50	407.80b	15.10

Means with different letters differ significantly (P≤ 0.01).

Table 5 - Calving intervals (days) of different blood level groups

Blood %	N	Means of calving Interval	SE ±
25	4	466.00[a]	58.74
37.5	74	454.10[b]	17.03
50	334	395.69[f]	7.55
62.5	93	382.94[g]	19.31
75	92	445.68[c]	21.12
87.5	10	401.00[e]	62.30
100	11	416.83[d]	36.63

Means with different letters differ significantly (P≤ 0.01). N=Number of observations.

CONCLUSION

The effect of foreign blood level, herd, lactations, and there interaction had significant (P<0.05) effect on milk production. The compartmental performance at the crossbred cows with different blood level showed that the overall mean: lactation milk yield (kg), days in milk and calving interval were 3603.4 kg, 317.3 days, and 420.4 days respectively. While the mean lactation milk yield for different blood levels 25, 37.5, 50, 62.5, 75, 86.5 and 100% were 2497.7, 3302.1, 3508.4, 2656.9, 4727.1, 4362.3 and 3507.5 kg respectively. Highest milk was reached at the 7th lactation. Mean days in milk for different blood levels 25, 37.5, 50, 62.5, 75, 86.5 and 100% were: 354.0, 291.0, 307.0, 298.6, 339.9, 302.5, and 377.0 days respectively. Mean calving interval (day) for different blood levels 25, 37.5, 50, 62.5, 75, 86.5 and 100% were: 466.0, 454.0, 395.7, 382.9, 445.8, 401.0 and, 416.0 respectively.

RECOMMENDATION

1) From this study, it has been established that dairy cattle managers at Kenana and El Bashaier dairy farms, should be advised to keep crossbred dairy cows of the intermediate exotic blood (62.5–75%, Friesian inheritance) for higher production.

2) From this study it could finally recommended that management improvement is a target and a decisive factor for any production system in dairy cattle.

3) More work in evaluation crosses with the intermediate blood level with large number of records and for longer period was so needed at the two farms.

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