

Milk Production and Reproductive Efficiency in Friesian and Friesian X Sharabi Cows

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Abstract

The reproductive efficiency was estimated from records of 104 Friesian and 48 crossbreed [Friesian X Sharabi (native breed)] cows. Functional traits interm of reproductive efficiency as well as age at first calving were studied with relation with milk production in both breeds. The trends of the average milk production and reproductive efficiency at different age groups at first calving were estimated. Likewise, the average reproductive efficiency and age at first calving at different groups of milk production were determined. With increase in milk production there were decrease in reproductive efficiency and age at first calving. When the average milk production was related with age at first calving in both Friesian and crossbreed there are an increase in reproductive efficiency with increase age at first calving while milk production decreased. There were significant difference ($P < 0.05$) in average milk production and age at first calving between Friesian and crossbreed, while the difference was not significant for average reproductive efficiency, they were 84.04% and 83.17% respectively for Friesian and crossbreed.

The Pearson correlation coefficient as well as partial correlation coefficient between milk production and age at first calving was negative and significant in both breeds. Likewise, between milk production and reproductive efficiency was negative in both breeds and significant in Friesian only. On other hand, Pearson correlation and partial correlation coefficients between reproductive efficiency and age at first calving were positive and significant in both breeds.

It can be concluded that for improving efficiency in Friesian and crossbreed cattle, it is necessary that functional traits interims of reproductive efficiency and age at first calving deserve primary consideration beside milk production into national breeding programmers.

إنتاج الحليب والأداء التناسلي لأبقار الفريزيان وأبقار الفريزيان المضرّب مع الشرابي

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الخلاصة

حسبت الكفاءة التناسلية لسجلات 104 بقرة فريزيان نقية و 48 بقرة مضرّبة [فريزيان X شرابي (سلالة محلية)]. درست الصفات الوظيفية functional traits المتمثلة بالكفاءة التناسلية والعمر عند أول ولادة مع علاقتهما بمعدل إنتاج الحليب في السلالتين. تم دراسة تغيرات معدل إنتاج الحليب ومعدل الكفاءة التناسلية في المجاميع المختلفة للعمر عند أول ولادة. بالإضافة إلى تغيرات معدل الكفاءة التناسلية والعمر عند أول ولادة في المجاميع المختلفة لإنتاج الحليب. لوحظ أن زيادة إنتاج الحليب يصحبه انخفاض في الكفاءة التناسلية والعمر عند

أول ولادة في كلا السلالتين، من جهة أخرى انخفاض معدل إنتاج الحليب وارتفاع نسبة الكفاءة التناسلية عند مجاميع العمر عند أول ولادة ترتفع معدلاتها وفي كلا السلالتين. كان هناك اختلاف معنوي بين السلالتين في معدل إنتاج الحليب والعمر عند أول ولادة، في حين كان معدل الكفاءة التناسلية لا تختلف معنوياً بين السلالتين وكانت 84.04% لأبقار الفريزيان و83.17% للأبقار المضربة.

معامل الارتباط لبيرسن بالإضافة إلى معامل الارتباط الجزئي بين معدل إنتاج الحليب والعمر عند أول ولادة كانت سالبة ومعنوية في السلالتين. كذلك معدل إنتاج الحليب والكفاءة التناسلية كانت سالبة لدى السلالتين، ولكنها معنوية لدى الفريزيان فقط. من جهة أخرى معامل الارتباط لبيرسن والارتباط الجزئي بين الكفاءة التناسلية والعمر عند أول ولادة كان موجباً ومعنوياً في السلالتين. من ذلك نستنتج من أجل تحسين كفاءة الأبقار يجب الانتباه إلى الصفات الوظيفية functional traits المتمثلة بحساب الكفاءة التناسلية والعمر عند أول ولادة وشمولهما بالإضافة إلى إنتاج الحليب في برامج الخطة الشاملة لتحسين الأبقار. بالإضافة إلى توفير المعلومات عن الصفات الوظيفية بسجلات خاصة وفي سجلات السائل المنوي للثيران لأخذها بنظر الاعتبار في التلقيح والتحسين الوراثي.

Introduction

The primary goal of dairy cattle breeding is to increase the efficiency of reproduction and milk production (1, 2, 3). Reproductive efficiency is the one of most important characters of functional traits as mentioned by (2, 4, 5). Reproduction inefficiency in lactating dairy cows not only is a source of frustration to dairy producers and their consultants but also substantially reduces dairy for profitability (3, 6).

Friesian cattle are known for their prolific reproduction and production (7, 8, 9). However, in Iraq Sharabi cows are considered as one of the important local breed in northern part. This breed characteristic in its adaptability to the environment of northern region. Genetic improvement of Sharabi breed can be achieved by crossbreeding with pure Friesian (8, 10, 11).

Reproductive efficiency, milk production and age at first calving are considered the most important factor which effect the economics of dairy enterprise as delineated by (2, 4, 12). The aim of this work is to study the trends of reproductive efficiency (breeding efficiency) and production of milk at different ages at first calving, as well as to compare both Friesian and crossbreed (Friesian X Sharabi) for this traits. Furthermore, to find the Pearson correlation coefficients and partial correlation coefficient among milk production, reproductive efficiency and age at first calving in both breeds.

Materials and Methods

The records of 104 pure breed Friesian and 48 crossbreed [Friesian X Sharabi (native breed)] half-bred from 1978-2002 were collected from Al-Rashidia farm in Mosul city included in this study. The reproductive efficiency was calculated by the following formula (13):

$$RE = 12 \times \frac{\text{no. calves born}}{\text{age of cow (mo.)} - \text{age at first breeding (mo.)} + 3} \times 100$$

mo. = month

no. = number

The traits involved in this study were reproductive efficiency, milk production and age at first calving for both breeds. The average of traits with their standard deviation were calculated. The trends of the average milk production and reproductive efficiency

at different age at first calving were estimated. Likewise, the average reproductive efficiency and age at first calving at different group of milk production were determined. Statistical difference between breeds were done as delineated by (14).

The Pearson simple correlation coefficients among milk production, relative efficiency and age at first calving have been estimated with their significant differences than zero. Also, the partial correlation coefficient between any two traits excluding third one was done. The test of significant of partial correlation coefficients carried out for the null hypothesis $H_0: \rho = 0$ against the alternative hypothesis $H_1: \rho > 0$ or $\rho < 0$ which is one sided (one tail) test as long as the simple correlation coefficients already have been known and estimated, and the direction of estimated values were determined (15).

Results and Discussion

Age at first calving is the earlier measure of reproductive performance in dairy cattle, only after first calving production cycle commences. Recently the reproductive efficiency is the most important measurement of reproductive performance. Therefore, the most useful characters of the functional traits are measurement of reproductive efficiency and age at first calving.

The average age at first calving, and average reproductive efficiency at different groups of milk production as well as their standard deviation are shown in detailed in (Table 1). They were 33.09 ± 4.8 month for Friesian and 35.94 ± 5.1 month for crossbreed for age at first calving, and 84.04 ± 6.14 % in Friesian and 83.17 ± 4.79 % in crossbreed for reproductive efficiency. The statistical difference between breeds were highly significant ($P < 0.01$) for age at first calving, while, it wasn't statistically significant for reproductive efficiency. These results were in agreement with (1, 2, 12). Likewise, the differences between breeds for functional traits were mentioned in other researches (7, 8, 12). Table (1) shows with the increase in milk production, there were a decrease in reproductive efficiency and age at first calving. The average milk production and average reproductive efficiency at different age groups at first calving are summarized in (Table 2). The average $\pm$ standard deviation for milk production were 2719 ± 326.4 kg for Friesian and 2393.6 ± 404.9 kg for crossbreed, and these was highly significant difference ($P < 0.01$) between two breeds. These results are in agreement with (2, 7, 8, 12). It seems when the average milk production is related with age group at first calving in both Friesian and crossbreed, there is an increase in reproductive efficiency with the increase of age at first calving while the milk production decrease (Table 2).

The Pearson correlation coefficients among the milk production age at first calving and reproductive efficiency were carried out to estimate the amount and direction of the correlation between these traits are shown in (Table 3). The Pearson correlation coefficients were negative between milk production with both age at first calving and with reproductive efficiency. These coefficient were significant ($P < 0.05$) for Friesian. While, for crossbreed was significant for milk production and age at first calving, and nonsignificant for milk production and reproductive efficiency. However, the correlation coefficient between reproductive efficiency and age at first calving were positive and significant which were 0.197 and 0.285 respectively for Friesian and crossbreed.

The partial correlation coefficients between any two traits (milk production, reproductive efficiency and age at first calving) excluding third one were shown in (Table 3). The partial correlation coefficients were negative and significant ($P < 0.05$) between milk production and age at first calving in both breeds. Also, negative and

significant between milk production and reproductive efficiency in Friesian, likewise, it was negative but nonsignificant in crossbreed. On other hand, the partial correlation coefficient between reproductive efficiency and age at first calving was positive and significant ($P<0.05$) in both breeds (Table 3). These finding are in agreement with others (2, 4, 16, 17, 18).

Schmidt, et al., (19) mentioned that genetic factors contribute to milk production by approximately 30%, while environmental factors and reproductive management effects 70% of production. Likewise, various factors associated with decreasing reproductive efficiency are specially management factors. Also, the heritabilities of functional traits (reproductive efficiency and age at first calving) was found by others low (18, 20).

Cattle breeding nowadays is an international business. Bulls semen is currently being widely spread over the world without adequate information on functional traits. Functional traits are the characters of an animal that increase efficiency, not by higher output of products but by reducing the cost of input. Therefore the recording and incorporation of functional traits into national breeding programmers should have high priority for the international cattle breeding industry beside milk production. Although research has been undertaken for a long period, integration of functional traits in dairy cattle breeding goal is still major challenge for animal breeders.

Table (1) Average reproductive efficiency and age at first calving in different groups of milk production in Friesian and Crossbreed cows

Group according to milk production (kg)	Friesian			Crossbreed		
	% of animals	Average reproductive efficiency (%)	Average age at first calving (month)	% of animals	Average reproductive efficiency (%)	Average age at first calving (month)
Under 1501	4.81	89.8	38.36	8.33	88.9	40.78
1501 – 2000	11.54	87.9	37.41	12.50	88.1	39.25
2001 – 2500	21.15	86.2	36.27	35.42	84.4	36.89
2501 – 3000	38.46	85.1	33.78	25.00	81.8	34.67
3001 – 3500	18.27	78.7	29.63	14.58	76.9	31.82
3501 and above	5.77	73.4	28.84	4.17	76.6	30.13
Average ± standard deviation		84.04 ± 6.14 ^{ns}	33.90 ± 4.8 [*]		83.17 ± 4.79	35.94 ± 5.1

Ns: non significant difference between two breeds.

*: highly significant difference between two breed (P<0.01)

Table (2) Average milk production and reproductive efficiency in accordance with age at first calving in Friesian and Crossbreed cows

Group according to age at first calving (months)	Friesian			Crossbreed		
	% of animals	Average milk production (kg)	Average reproductive efficiency (%)	% of animals	Average milk production (kg)	Average reproductive efficiency (%)
Below 30	5.77	3185.5	77.8	6.25	3016.0	70.7
30 – 35	40.38	2853.0	80.7	25.00	2714.5	78.8
35 – 40	41.35	2657.6	86.8	41.67	2321.7	84.7
40 – 45	8.64	2388.0	88.5	16.67	2180.5	87.6
Above 45	3.85	2028.5	88.7	10.42	1878.8	87.9
Average ± standard deviation		2719.4 ± 326.4 [*]	84.04 ± 6.14 ^{ns}		2393.6 ± 404.9	83.17 ± 4.79

Ns: non significant difference between two breeds.

*: highly significant difference between two breed (P<0.01)

Table (3) Correlation among milk production, reproductive efficiency and age at first calving in Friesian and Crossbreed cows

Character	Spearman correlation coefficient		Partial correlation coefficient	
	Friesian	Crossbreed	Friesian	Crossbreed
Milk production and age at first calving	- 0.202 *	- 0.294 *	- 0.170 *	- 0.255 *
Milk production and reproductive efficiency	- 0.194 *	- 0.191 ^{ns}	- 0.161 *	- 0.117 ^{ns}
Reproductive efficiency and age at first calving	0.197 *	0.285 *	0.164 *	0.244 *

Ns: non significant.

* : (P<0.05)

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