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Heritabilties and Breeding Values of Production and Reproduction Traits of Holstein Cattle In Iraq

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Summary

A total of 4714 records collected from 733 cows progeny of 13 sires through the period from 1989 to 2000 in Al-Nassr Dairy Cattle Station were used to estimate the heritability and breeding values of sires for total milk yield, days in milk, calving interval, dry period and age at first calving. Individual animal models were fitted to the total milk yield from all lactations to estimate breeding values by Restricted Maximum Likelihood methodology. Heritability was estimated by using different methodology. Their values for milk yield, days in milk and dry period, calving interval and age at first calving were (0.05-0.21), (0.02-0.09), (0.32-1.00), (0.00-0.23) and (0.36-0.43) respectively. The estimated breeding values for milk yield ranged from –394.00 to 475.00 kg. Estimates of the positive breeding value (BV, %) was 48.56 %. Breeding values of days in milk ranged from -5.44 to 6.30 days and 45.48% respectively. However, sires showed lower (23%) positive breeding value for both dry period and calving interval and age at first calving (30%). Their breeding values ranged from -15.95 to 49.60 days for dry period, -8.14 to 11.91days for calving interval and -2.10 to 2.28 months for age at first calving.

Keywords: heritability, breeding values, dairy cattle, Holstein.

Introduction

The estimates of genetic parameters, i.e. heritability and repeatability of different production and reproduction traits and genetic correlations among them are needed for the formulation of effective breeding plans and for the estimation of breeding values.

Estimates of genetic parameters and breeding values, using animal models, for dairy traits from tropical and semi-tropical Holstein cattle are rare. Very few cattle genetic parameters studies (15 out of 490) from tropical regions used animal models (1). Of the 10 reports from Kenya, only three were on European breeds, and these used half-sib models to estimate variance components. Estimates of heritability for milk yield from European breeds kept in the tropics were lower than those from similar breeds kept in temperate countries. The conclusion of (2) was supported by (1) that different methods of correcting for lactation length should be compared using the same data set.

Best linear unbiased prediction procedure (BLUP) using animal model is now considered the method of choice for the estimation of breeding values of animals. It is considered more appropriate to use the estimates of genetic parameters from the same model as is used for the genetic evaluation of animals. Thus, the present study was planned to compute heritability estimates of different production and reproduction traits of Holstein cattle in Iraq using the latest available analytical procedure.

Material and Methods

Data

Data consisted of lactation records of 733 cows born from 1987 and onwards and calved between 1989 to 2000. Pedigree information and the data used in this study were obtained from the Al-Nasr Dairy Station. Prior to analyses, abnormal records affected by diseases or abortion and animals having calving interval less than 310 and greater than 650 days, and lactation length less than 220 and greater than 450 days were excluded from the data set. The calving months were grouped into four seasons: December to February (winter), March to May (spring), June to August (summer), and September to November (autumn). After editing,

the data set consisted of 3581 multiple lactation records (up to parity 5) on 733 cows which are daughters of 13 sires. Milk records were pre-adjusted for 305-day lactation length. Characteristics of the data set are given in Table 1.

Table 1. Characteristics of the data set used for genetic parameter estimates

Description	Total
Records in data	4714
Cows in data	733
Sire in data	13
Years (1989-1998)	10
Seasons	4
Lactations	5

Statistical Analysis

Data were initially tested for the completeness and conformity using (3). The major analyses were carried out using least-squares fixed-and mixed-model procedures. The models used included: the random effects of sire; the random effects of the dam (where she appeared in the analytical matrix more than once); and the fixed effects of origin (foundation or born on station), parity, year of birth or parturition, season of birth or parturition and sex of calf.

Heritabilities were calculated by the paternal half-sibling by using MINQUE, ANOVA, ML and REML within (3).

Results and Discussion

Estimated heritabilities measured by different methods for each trait are shown in Table 1. Total milk yield heritability calculated by MINQUE was close to normal values (0.25). Values estimated by different methods for all studied traits were highly variable. Some values exceeded the normal values of the trait in concern. The reason behind that variability was the small number of sires used in this study. However, these values were in general higher than those obtained by (4) of Turkish born Simmental cattle, who used even smaller population size (232 cows). Whereas, (5) and (6) reported very close h^2 for 305-day milk yield (0.22).

The present estimate of heritability for day in milk is similar to the values of 0.01, 0.09, 0.10 and 0.13 reported by (7), (8), (9) and (10) respectively. On the other hand, higher h^2 estimates for this trait were reported by (11), (12) and (13) using different breed's data sets and ranged from 0.17 to 0.48.

The h^2 estimate for dry period was higher than the findings of (14), who found that its heritability was between 0.05 and 0.06. The major part of the variation in lactation length and dry period is due to non-genetic factors and rapid response could be expected by improving environmental conditions such as feeding regime and management system.

Table (2). Estimates of heritability of studied traits by different methods

Traits	Heritability estimated by			
	MINQUE	ANOVA	ML	REML
Total milk yield	0.214582	0.065938	0.05078	0.076826
Days in milk	0.089392	0.043876	0.020911	0.040422
Dry period	1.008029	0.321496	0.602072	0.782211
Calving interval	0.227448	0.063268	0	0
Age at 1st calving	0.412405	0.400435	0.358475	0.42877

The heritability of calving interval reported here was higher to 0.022 reported by (5). However, (7), (15), (16) and (17) reported nearly similar heritability estimates for calving interval of this study, ranged 0.07 to 0.16.

The heritability estimate for age at 1st calving was higher than those reported by (18), (19) and (10) (between 0.00 and 0.09) although there were marked differences in data sets, breed types, estimation models and procedures among

researches. The heritabilities of fertility traits in dairy cattle are lower than many other economically important traits. The low heritability of fertility traits indicates that the influence of herd, management and other environmental effects are greater than the genetic background (20 and 5).

The estimated breeding values for milk yield from animal model ranged from –394.00 to 475.00 Kg (Fig, 1). The corresponding values for days in milk, dry period, calving interval and age at 1st calving were -5.44-6.30 days (Fig 2), -15.95-49.60 days (Fig 3), -8.14-11.91 days (Fig 4) and -2.10-2.28 months (Fig 5) respectively. Percents of positive breeding values were 48.56%, 45.48%, 23.00%, 23%, 30% for milk yield, days in milk, dry period, calving interval and age at 1st calving respectively. Positive value of breeding value is favorite for milk yield only because the objective of dairy cattle breeding is rising the total milk yield. From this result there was less than 50% of sires that showed positive value, which may result in a low genetic improvements. The rest traits have to be shortened, therefore sires with negative breeding values are the favorite. Studied herd had high percentages of negative values except that of dry period. All sires showed very short ranges in their breeding values, which reflect low genetic differences among them. The genetic difference among the individuals is a factor, which determines the rate of genetic improvement that can be accomplished through selection. With low estimate of heritability, the improvement in a trait is much less through selection as compared to what could be attained by other environmental changes (21).

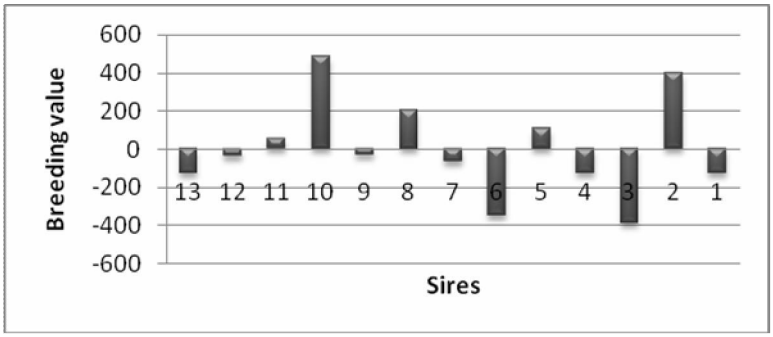

Fig.(1). Sire breeding value for total milk yield

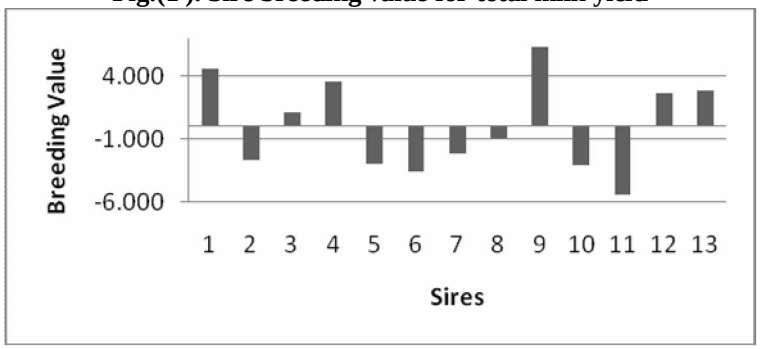

Fig. (2). Sire breeding value for days in milk

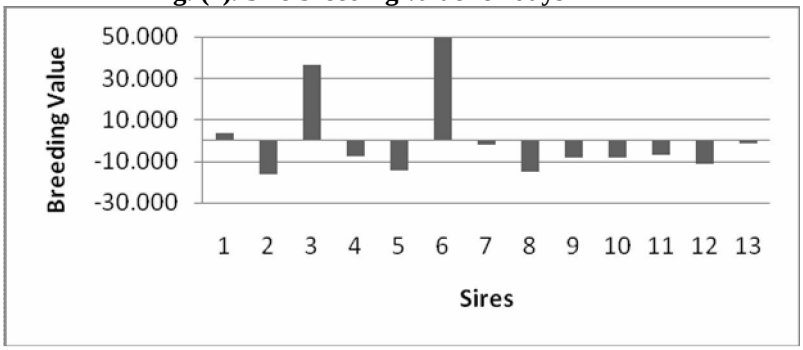

Fig. (3). Sire breeding value for dry period

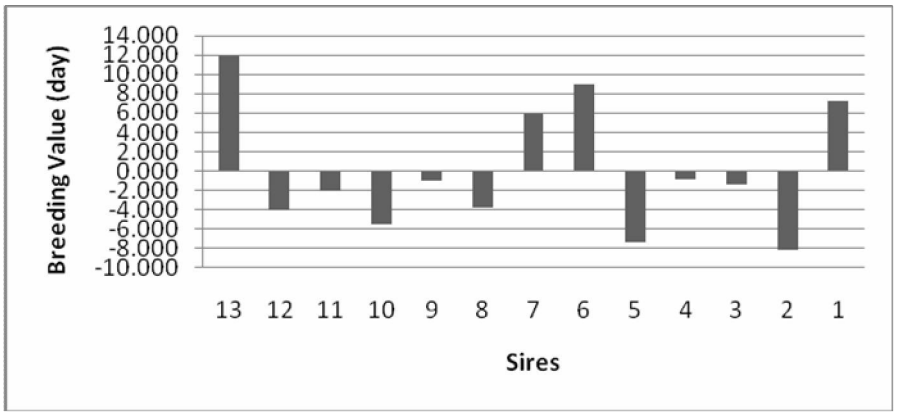

Fig. (4). Sire breeding value for calving intervals

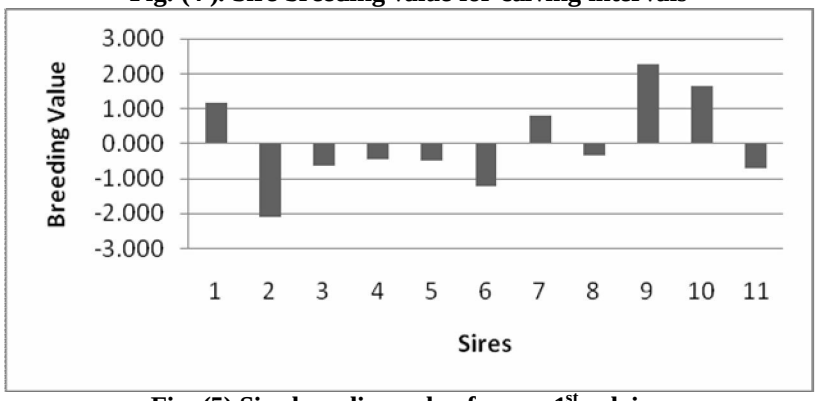

Fig. (5).Sire breeding value for age 1st calving

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المكافئات الوراثية والقيم التربوية للصفات الإنتاجية والتناسلية لأبقار الهوليشتاين في العراق

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الخلاصة

استخدم في هذه الدراسة 4714 سجلا لـــ 733 بقرة المولودة لـــ 13 ثورا للمدة من 1989 إلى 2000 في محطة أبقار النصر لتقدير كل من المكافئات الوراثية والقيم الإباء التربوية لصفات إنتاج الحليب الكلي وطول مدة الحلب والمدة بين ولادتين ومدة الجفاف والعمر عند أول ولادة. قدرت المكافئات الوراثية بعدة طرق. وتراوحت قيمها لكل من إنتاج الحليب ومدة الحلب ومدة الجفاف والمدة بين ولادتين والعمر عند أول ولادة (0.05-0.21) و 0.02-0.09) و (0.31-1.00) و (0.00-0.23) و (0.36- 0.43) على التوالي. وكان مدى القيمة التربوية المقدرة لإنتاج الحليب من -394.00 إلى 475.00 كغم ونسبة الذكور التي أظهرت قيما تربوية موجبة تساوي 48.56%. أما القيم التربوية لمدة الحلب فقد تراوحت بين – 5.44 إلى 6.30 يوم والقيم الموجبة وصلت إلى 45.48%. غير إن الإباء اظهروا قيما موجبة منخفضة (23.00%) لكل من مدة الجفاف والمدة بين ولادتين و30.00% للعمر عند أول ولادة. وتراوحت مديات القيم التربوية لهذه الصفات – 15.95 إلى 49.60 يوم و – 8.14 إلى 11.91 يوم و – 2.10 إلى 2.28 شهر على التوالي.