Estimating the breeding value of Holstein and Jersey Cows Based on Milk Yield and Birth Weight

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Abstract
The study was conducted at Marwari Farm Station in Iraq from November 1, 2023 to January 1, 2025. used total of 164 Jersey and Holstein cows evaluate the performance of sire. This study assessed colostrum production, milk production, birth weight, and weaning weight. The Best Linear Unbiased Prediction (BLUP) model was used to estimate the Breeding Values (EBVs) of sire offspring, revealing significant genetic variation across all traits: colostrum production, milk production, birth weight, and weaning weight. The use of BLUP led to a shift in the selection of the most suitable sire, highlighting that sire sequences can vary based on the specific trait under study.

Keywords: Holstein, Jersey, breeding value

Introduction

The relationship between the value of sire breeding for traits such as milk and colostrum production, calving and weaning weight, and their impact on lifetime performance in dairy cows is crucial to determining whether selecting dairy sire breeds based on calving performance enhances overall lifetime production (1). Colostrum and milk production, birth weight, and weaning are among the most important efficiency indicators for sustainable economic resources (2). Cattle evaluation programs are critical because the majority of genetic improvements are achieved through the selection of males rather than females, which are the most important and predominant source of fresh milk and dairy products for human consumption worldwide (3). Meanwhile, milk production from dairy cows has always been a focus of attention in cattle farming. The breed of cows is one of the most important factors in determining the amount of colostrum produced, which is supposed to be sufficient for the calf as nutrition and immunity (4). Previously, production was evaluated through females, but now it is through males, which represent the most important axis in this process (5). In dairy cattle breeding, the selection of good sires is crucial for achieving genetic progress. Given these considerations, this search aims to use the Best Linear Unbiased Prediction (BLUP) method to estimate sires' values for productivity traits in Jersey and Holstein cows by using BLUP…..

Materials and Methods

The study used performance data from 164 daughters of 13 sir at Marwari Farm in the Kalar district of Sulaymaniyah Governorate, north of Baghdad, from November 1, 2023 to January 1, 2025, to estimate the breeding values of Jersey and Holstein cows. Cows with abnormal or incomplete records were excluded from the analysis. For the traits of colostrum production, milk production, birth weight, and weaning weight, the sire breeding values for these traits were estimated using the Best Linear Unbiased Prediction (BLUP) method, proposed by (6.(The variance

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components of the random effects for the studied traits were estimated, from which (Best Linear Unbiased Prediction (BLUP) was estimated using the Restricted Maximum Likelihood (REML) method. The variance and covariance (VCV) matrix of the parent and the error for each trait was used for the purpose of conducting the positive definite test. This matrix must have realistic values (exist) and the associated eigenvalue matrix must be positive and definite to obtain estimates of the genetic parameters that must be within the permissible limits. The test was conducted on the variance and covariance matrices of the parent and the error for each group of the studied traits by calculating the eigenvalues associated with the test matrix

The Statistical Analysis System (7) statistical program was used to estimate the variance components according to the Restricted Maximum Likelihood (REML) method and breeding value estimates (Best Linear Unbiased Prediction (BLUP) by parental (Sire-Half-sib) according to (8).

Results and Discussion

estimates breeding value Best linear unbiased prediction (BLUP) for Holstein sires based on daily milk production and colostrum quantity.

After extracting the results in Table 1, it was found that there is a high genetic variation between the parents for the studied traits of Holstein cows, the best sire number in milk production was 132539 with a breeding value of 1.179, while the lowest was 13253 with a breeding value of -0.841, while the best sire number was 6537705 for breeding value in colostrum production of 0.509, while the lowest was sire 14063 with a value of -0.1698. The results are consistent with (1) where there was a high variation in the performance of sire for milk production. Overall breeding values did not show a clear trend across milk and colostrum production in this study. There was no convergence in sire performance for milk and colostrum production (5). The observed variation among sire confirms the genetic differences within the herd, which are likely due to the failure to cull animals with low production levels (9). This wide variation in estimates of the breeding value of sire is due to the failure to select sire breeders based on their breeding value for the traits required for production.

Table 1: estimates breeding value Best linear unbiased prediction (BLUP) for Holstein sires based on daily milk production and colostrum quantity.

	Daily milk production		**colostrum quantity**	
	sire number	BLUP estimates	sire number	BLUP estimates
1	132539	1.179	6537705	0.509
2	14063	0.257	12872	0.0580
3	12872	0.1126	1270	0.0291
4	12790	0.0995	1290	0.00068
5	15060	0.0651	15060	0.066
6	1270	0.0225	132539	-0.077
7	132539	-0.362	14063	-0.18
8	6537705	-0.532	13253	-0.1658
9	13253	-0.841	132539	-0.1698

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Total number of animals: 83

estimates breeding value Best linear unbiased prediction (BLUP) mates for Holsteins based on growth traits

From Table 2, it is clear that there is a high genetic variation between parents for the studied traits of Jersey cows, where the sir 12970 had the best value for birth weight 6.057, while the lowest was sir 132539 for the same trait 3.329 - while the number of sir 12970 was the best 7.239 in the weaning weight trait, while the lowest was sir 132539 - 5.359. The average weight gain was highest for sir 132539 with a value of 1.107, and the lowest value was -1.339 for sir 14063.

The results were consistent with what he found (2018), who similarly highlighted the diverse genetics and performance rankings of parents across different production traits and the degree of similarity between them. Genetic merit plays a pivotal role in a decision support tool specifically designed to increase production, enabling producers to focus on the most beneficial factor to maximize performance (10). Correlation and regression analysis were used to examine the association between phenotypic performance and the results of estimating the genetic merit of parents. Estimating it presents significant challenges and promising results, as it accurately estimates parental effects, reduces environmental influences, and enhances the heritability of production traits (11). The validity of predictions can be enhanced by increasing the number of relatives who contribute to the breeding value of parents. As previously mentioned for milk production traits, this wide variation in estimates of the genetic merit of parents is due to parents not being selected based on their breeding value according to the traits required for production.

Table 2: estimates breeding value Best linear unbiased prediction (BLUP) for parents based on growth traits for the Holstein breed

	Birth weight		**weaning weight**		**weight gain**	
	sire number	BLUP estimates	sire number	BLUP estimates	sire number	BLUP estimates
1	12970	6.057	12970	7.239	132539	1.107
2	14063	3.051	14063	3.764	15060	0.972
3	6537705	0.773	12872	0.902	13253	0.396
4	1270	0.511	1270	0.329	132539	0.357
5	12872	0.24	6537705	0.074	12872	0.319
6	132539	-1.522	13539	-0.866	1270	-0.366
7	13253	-2.539	15060	-3.647	12970	-0.469
8	15060	-2.0827	13253	-4.221	6537705	-0.922
9	132539	-3.329	132539	-5.359	14063	-1.339
Total number of animals: 83						

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estimates breeding value Best linear unbiased prediction (BLUP) descending for sire based on daily milk prediction and colostrum quantity for Jersey.

The studied average values were found below in Table 3 for Jersey cows, which represent the sire number for the quantity of milk produced, 6537705, the best quantity of milk produced, 6.439, while the lowest breeding value was sire 5027 for the same trait -2.425, and sire number 6537705 was the best colostrum quantity 3.741, while the lowest sire number 5027 had a breeding value of -1.364.

The results of the study are consistent with the findings(10) that milk production levels are affected by the breeding value of the sires, who had wide differences in merit, and that any change in apparent performance depends largely on the herd's BLUE for milk production (10 , 12). The productive traits of Holstein cows depend on the breeding value of the males inseminated by the herd with good traits such as milk and colostrum production and other important traits. This is determined by the performance according to the inseminated sir and his genetic potential, which determines the extent of fluctuations (13). This evaluation works to ensure the provision and retention of superior sires genetically and productively by spreading their genetic compositions and inseminating the largest possible number of females using artificial insemination from reliable sires and working to reduce the use of sires from the same herd. (14) showed that predicting genetic merit showed that its estimation depends on the most economical traits and ensuring their homogeneity in the producing herd.

Table 3: estimates breeding value (Best linear unbiased prediction-BLUP) in descending order for sires based on daily milk production and colostrum quantity jersey

	Daily milk production		**colostrum quantity**	
	sire number	BLUP estimates	sire number	BLUP estimates
1	6537705	6.439	6537705	3.741
2	1490	-0.848	1490	-0.372
3	1940	-0.854	1940	-0.717
4	5022	-2.310	5022	-1.271
5	5027	-2.425	5027	-1.364
Total number of animals: 83				

estimates breeding value Best linear unbiased prediction (BLUP) for parents based on growth traits of the Jersey breed

It was found that there is a high genetic variation between parents for the studied traits specifically, sire number 6537705 was the best for birth weight 6.439 while sire number 5027 was the lowest for the same trait -2.425 and sire number 6537705 was the best 3.741 for weaning weight trait while sire number 5027 was the lowest -1.364 and also the weight gain rate was the highest 1.107 and sire 132539 with a breeding value of 1.107 while sire 14063 was the lowest with a breeding value -1.339.

The above results are consistent with the differences in the genetic worthiness of the sire offspring inseminated to the herd through BLUP, which facilitated the estimation of birth weight, weaning weight, and weight gain rate in the study explained by (12), who showed that estimates of birth weight,

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weaning weight, and weight gain rate are important in evaluating herds that use a high percentage of sire offspring. Due to the lack of a measure of sire genetic worthiness, the rate of gain can be increased by retaining calves with higher body weights for breeding as replacements at a later time. Correctly linking these traits of calves to their parents is essential for recording to know breeding value in this study, where the differences were clear.

(15)demonstrated that birth weight, weaning weight, and weight gain not only affect individual cows' genetic worth, but also their relative estimates in the producing herd. (16) emphasized that knowledge of these traits, such as calving ability, birth weight, weaning weight, weight gain, colostrum and milk production, and others, when the trait has economic value and genetic diversity, including them in lifetime fitness indices increases the profitability of dairy herds and reduces future parental variance. This genetic diversity among parents leads to variation in the resulting parental breeding value values (17, 18). summarized the increased variation in parental breeding value estimates with accurate results compared to genetic analysis. The more homogeneous a herd is in terms of breeding objectives and selection parameters (19). Inaccurate and biased estimates based on traditional empirical models of dairy production systems are at increased risk of providing suboptimal results derived from errors in selecting candidates with high genetic merit based on low-heritable phenotypic traits (20.(

Table 4: estimates breeding value (Best linear unbiased prediction-BLUP) in descending order for parents based on growth traits for the Jersey breed

	Birth weight		**weaning weight**		**weight gain**	
	sire number	BLUP estimates	sire number	sire number	BLUP estimates	sire number
1	6537705	9.093	6537705	134.79	1490	0.323
2	1490	-1.553	1490	-1.708	6537705	0.164
3	1940	-1.586	1940	-2.429	1940	-0.0053
4	5022	-2.879	5022	-3.943	5022	-0.0932
5	5027	-3.073	5027	-5.398	5027	-0.388
Total number of animals: 81						

Conclusions

The more homogeneous the flock, the higher the estimates, and the results are more consistent with the breeding goal. The above estimates are attributed to variations in the homogeneity of the parents selected for the producing flock.

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