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Original Article

The Use of 120 Day Milk Production for Sire and Cow Genetic Evaluation in Libyan Dairy Cattle

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Abstract

This study was carried out using 1298 first lactation production records of Holstien Fresian Dairy cattle at Al-Nasir project. These records included total milk production (TMP), adjusted 305 day milk production (305DMP), 120 day milk production (120 DMP), and length of lactation. In order to assess the effect of year and season and the interaction of these two factors, one subclass was intiated and coded in the data. The year was devided into two seasons; hot season included the months (from May to October), and cold season included (from November to April). Breeding values of cows and sires were estimated for 120 DMP and 305 DMP using contemporary comparison. The analysis of variance with unequal subclass numbers indicated significant effect of year and season on all production traits (P<.01). Correlations between 120DMP,and 305DMP with TMP were 0.78 and 0.77 respectively. Breeding values of sires using 305DMP ranged from -315 to +414 kgs with a weighted mean of +36 kg, while for 120DMP the estimates ranged from –94.7 to 144.7 kg, and their weighted mean was +9.8 kg. The frequency distribution of breeding values showed that more than 51% of sires were of negative values. Correlation between 120DMP, and 305DMP expressed as contemporary deviations of cows and sire daughters averages were 0.76 for cows and 0.86 for sires. Correlations between breeding values of cows and sires for 120DMP and 305DMP were 0.76 and 0.86. All estimates were significant(P<.01) indicating large association between breeding values of 120DMP and 305DMP for the same animals. Rank correlations between 120DMP and 305DMP expressed for the same animals as cow contemporary deviations, sire average daughters deviations, cow and sire breeding values were: 0.87, 0.87, 0.87 and 0.74 respectively. These estimates indicate that cows and sires rank similarly when ranked according to their breeding values estimated using 120DMP and 305DMP.

120DMP could be used for genetic evaluation of sires and cows, And its adoption will be benificial to Libyan dairy industry through reduction of generation interval, and early decision making in culling, and selection of sires and cows especially in the absence of adequate correction factors to 305 days milk production.The accurate evaluation and proper use of sires is very important due to their large contribution and effect on population production. This study indicates that low production of imported cows is not only due to environment, but also due to breeding policies specialy in sires which contribute the most to this effect.

Key words: partial records, sire evaluation, genetic improvement.

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Introduction

There are many reasons that necesitate the use of partial production records in genetic evaluation of cows and sires in dairy cattle, because of longer time needed to establish the genetic evaluation through progney testing especially in case of sires. This prolonged period of time increases the generation interval, and reduces indirectly the genetic progress. The use of 120 day milk production (120DMP) will allow early genetic evaluation of cows and sires, which makes culling and selection decisions sooner, and reduces the generation interval. There are no correction factors to 305 day milk production (305DMP) estimated under Libyan conditions. Thus 120DMP will facilitate comparison under the same period without need for correction factors. This will eliminate biases due to use of unproper correction factors, and increases the number of daughters used to evaluate sires. The level of production at this period determines profitability of the cow. Previous investigation under the Libyan conditions using this data by (Hermas, 2015) indicated perfect genetic correlation of 1 between 120DMP and 305DMP, and a heritability estimate of 0.22 for 120DMP compared to 0.21 for 305DMP. These estimates were supported with estimates obtained priviously (Hansen ***et al.,*** 1983). These findings beside the mentioned points revealed and supported the choice of 120DMP as selection criterion for genetic evaluation of cows and sires. Sire evaluation through progeny testing using a criterion early expressed, suitably inherited, and well correlated genetically with total production is very important to the dairy production for sires will be responsible for more than 86% of genetic progress that can be established through testing, evaluation and use of potent animals in a population using A.I. This investigation was under taken to study the possibility of using 120DMP for sire and cow genetic evaluation, and evaluate breeding policies used in a Libyan large dairy herd.

Materials and Methods

This research was carried out using 1298 first lactation production records of daughters of 26 sires of Holstien Fresian dairy cattle at Al-Nasir project. Only first lactation records were used to avoid possible effects of selection. Data comprised of total milk production in lactation (TMP), adjusted 305 day milk production (305DMP),120 day milk production (120DMP), and length of lactation. In order to assess the effect of the year and season of production, and interaction between those two factors; one subclass of year and season was intiated and coded in the data. The year was devided into two seasons; hot season which included the months: May, June, July, Agust, September, and October, the cold season included the months November, December, January, Febrauary, March and April. The following model was used to study and eliminate the effects of year and season.

$Y_{ij} = \mu + YS_i + E_{ij}$

Where

Y_{ij} is the production trait.

μ is the over all mean.

YS_i is the i^{th} year season subclass where the effect of year and season was combined in one subclass.

E_{ij} the random error. N ~I(0, $\sigma^2 e$).

To study the phenotypic relations between productive traits product moment

correlations were calculated for all traits.

Estimation of Breeding Values:

To estimate breeding values of cows, contemporary deviations(USDAreport 165) were calculated for each cow using the two traits 305DMP, and 120DMP Based on the following model:

$CD_{i(jk)} = C_{i(jk)} - CA_{(jk)}$

Where

$CD_{i(ik)}$ = the contemporary deviation of i^{th} cow in j^{th} season and k^{th} year.

$CA_{(jk)}$ = the average production for the trait in contemporaries of the same age in the j^{th} season and k^{th} year, excluding the record of the i^{th} cow.

$C_{i(jk)}$ = the production of i^{th} cow in jthseason and k^{th} year.

Breeding values for cows were estimated by:

$$h^2 [CD_{i(jK)}]$$

Where h^2 the heritability of traits 120DMP, and 305DMP which were .22 and .21 as estimated in (Hermas, 2015) from the same data.These estimates were comparable to estimates by (Hansen *et al.,* 1983, and Visscher and Goddard, 1995).

Breeding values of sires were estimated using the daughters contemporary deviations (USDA report 165) :

$CD_{ij(kl)} = D_{ij(kl)} - CA_{(kl)}$

Where: $CD_{ij(kl)}$ =the contemporary deviation of i^{th} daughter of j^{th} sire in the k^{th} season in the l^{th} year.

$D_{ij(kl)}$= the production record of the i^{th} daughter of j^{th} sire in the k^{th} season in the l^{th} year.

$CA_{(kl)}$ = is the contemporary average of all other cows milked in the same k^{th} season l^{th} year, excluding all paternal half sisters of the cow from the j^{th} sire.

This will make the deviation as a comparison to daughters of other sires, or it is a comparison of the jth sire with the other sires.

The average daughters contemporary deviation was calculated for each sire in each year season as following:

$$CD\ j = \sum_{i=1}^{n} CD_{ij} \ / \ N$$

Where N is the number of daughters for the sire.

The breeding values of each sire was calculated as follows:

$$BVS = Nh^2 / 4 + (n-1)h^2 + \frac{4C^2}{N}(\sum ni^2 - N)[\overline{C}D_j]$$

Where

ni= number of daughters in each herd.

N = number of daughters per sire.

h^2 = heritability of the trait.

C^2 = Environmental correlation between paternal half sibs.

CD_j = Average contemporary deviations of all daughters of the evaluated sires.

These procedures were used to estimate breeding values of all sires using 120DMP and 305DMP. If the equation above is simplified to : $b1[CD_j]$ then b1 is the repeatability and it's square roote is the accuaracy of the breeding values estimated which will depend mainly on the heritability of the trait , and the number of daughters of the sire and their distribution in the herds.

To assess breeding policies, averages and weighted averages of breeding values were calculated for the 120DMP and 305DMP. Weighted average of breeding values were

calculated as :

$$\sum_{i=1}^{n} n_j BV_j \mid \sum n_j$$

Where BVj the breeding values of sires used and nj are the number of daughters of sires. Which show their genetic effect in the herd.

Results and Discussion

Table (1) summerizes the results of the effects of year and season on production traits. These effects were significant on all production traits at (P<.01) wich was in agreement with (Norman et.al., 1995) . With cows started their lactation in the cold season yielded more milk than cows in the hot season. Thus to compare cows and sires for estimation of breeding values, the effects of year and season were adjusted for or eliminated from production records used for this purpose as shown in the previous section. Breeding values their repeatabilities for sires using 305DMP, and 120DMP are presented in tables (2,3) respectively. Estimated breeding values of sires using 305DMP ranged from – 315 to +414 kg with over all mean of + 56.4 kg. The mean weighted by the number of daughters left by the sires was + 36.0 kg with large standard deviation which indicates large variation in breeding values of the sires used. The mean of breeding values of sires estimated by the use of 120DMP was 26 ± 60 and weighted mean was 9.8 kg. These breeding values ranged from – 95 to 145 kgs. Estimated breeding values of cows using 305DMP averaged – 4 kg, and with standard deviation of 337 kg. The breeding values estimated using both traits in sires and cows showed similar trends. Correlation between 120DMP and 305DMP and TMP are presented in table (4). Correlations between 120DMP and 305DMP and TMP were 0.78 and 0.77. Correlation between 305DMP and TMP was 0.71. The association between 120DMP and 305DMP expressed as deviations from contemporaries in year season subclasses for cows and sires; were 0.76 for cow deviation, and 0.86 for sire daughters average deviations. The correlations between breeding values estimated from 120DMP and 305DMP for each animal in cows and sires were 0.76 and 0.76 respectively. All estimates of correlations were significant at (P<0.01) indicating large association between these traits and breeding values estimated using traits in sires and cows. Table (5) presents the rank correlations between 120DMP and 305DMP. These estimates expressed as cow contemporary deviations, sire daughters average contemporary deviation, cow and sire breeding values were: 0.87, 0.87, 0.87, and 0.78, respectively. These correlations indicated that cows and sires rank similarly when ranked according to their breeding values estimated for 305DMP and 120DMP which was in agreement with (Jain ***et al.,*** 1991). With sires were lower in their rank correlations for the two traits, and that is may be because of differences in number of daughters and their distribution in different years and seasons. The average breeding values of cows were negative with large variation indicating poor breeding and culling policies. Large proportion of these cows should have been culled if there was a good selection and culling programs. On the other hand more than 51% of sires were negative in their breeding values. There was a progressive negative trend in the breeding values of sires used in the herd, the first stage was the use of sires imported with the orginal herd, and their mean breeding values was +229 kg, and it's weighted mean was +294.

Table 1. Effect of year and season on productive traits.

Trait	F – value	Level of significance	Effect
TMP	6.47	P< .01	**
120DMP	4.48	P< .01	**
305DMP	3.58	P< .01	**

** highly significant.

Table 2. Breeding values, Repeatabilities and accuracies of sires for 305DMP.

Sire	Number of Daughters	BV-305DMP	Repeatability	Accuarcy of Estimation
APACHE	55	+414	.75	.87
772	12	+371	.40	.63
875	114	+265	.86	.93
7347	11	+260	.38	.62
BUD	50	+224	.73	.86
BLACK	32	+206	.64	.80
1148	10	+192	.36	.60
431	8	+163	.13	.55
7385	17	+149	.48	.70
9	29	+99	.62	.78
18	30	+94	.62	.79
1580	7	+79	.28	.53
77	61	+39	.77	.88
20	80	+18	.81	.90
7399	7	-17	.28	.53
4391	11	-22	.38	.62
4601	63	-32	.78	.88
87	85	-40	.82	.91
19	24	-50	.57	.76
Liberty	23	-56	.56	.75
4	25	-85	.58	.76
2377	16	-98	.47	.68
1380	14	-122	.44	.66
183	18	-133	.50	.71
7343	3	-136	.14	.38
127	139	-315	.89	.94

Table 3. Breeding values, Repeatabilities and accuracies of sires for 120DMP.

Sire	Number of Daughters	BV-120DMP	Repeatability	Accuarcy of Estimation
APACHE	50	+120	.74	.86
772	11	+83	.39	.62
875	107	+72	.86	.93
7347	6	+35	.26	.51
BUD	37	+145	.68	.83
BLACK	30	+60	.64	.79
1148	9	+128	.34	.59
431	7	+62	.29	.54
7385	11	+119	.39	.62
9	26	+63	.60	.77
18	27	-38	.61	.78
1580	7	-38	.29	.54
77	51	-61	.75	.86
20	66	+86	.79	.89
7399	7	+2	.29	.54
4391	11	-5	.39	.62
4601	84	-28	.83	.91
87	67	-81	.80	.89
19	19	+48	.52	.72
Liberty	20	+12	.53	.73
4	21	+6	.55	.74
2377	16	-9	.48	.69
1380	13	-58	.43	.66
183	16	-62	.48	.69
7343	3	-52	.15	.38
127	114	-95	.87	.93

Table 4. Correlations between 120DMP, 305DMP and TMP expressed as production. Deviation from contemporaries and breeding values.

Trait	120DMP-305DMP	120DMP-TMP	305DMP-TMP
Production	0.78	0.71	0.77
CCD	0.76	-	-
SADCD	0.76	-	-
SBV	0.76	-	-

CCD = cow contemporary deviation.
SADCD = sire averages contemporary deviation.
SBV = sire breeding values.

The second stage was the use of sires raised and selected in the herd, and their mean breeding values was - 0.86 kg, and weighted mean was +21.6 kg. The sires of the first stage left only 166 daughters, while sires of the second stage left the whole rest of the cows. This indicates that there was no selection of the sires, and that methods of choice of young sires based mainly on production level of their dams were very unsufficient and actually harmful.

In conclusion the mangement of breeding herds for maximum genetic progress should involve using sound genetic and economic principles in identifing and mating best available animals. Sires are very important to be evaluated and properly used due to the very large contribution they have and large effect they exert on population production. The findings in this study show that evaluation of sires and cows based on 120DMP is possible, and that it is well correlated with evaluation based on 305DMP which was in agreement (Jain ***et al.,*** 1995). The adoption of this evaluation will be penficial to the Libyan dairy production, for it will reduce the generation interval, and will speed the genetic evaluation and ease the early decision in selecting and culling of sires and cows. There is a large indication that low production of imported cows is not only due to environment, but also due to breeding policies specially in sires which have a very large contribution to this effect.

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