

EVALUATION OF PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF SOME DAIRY CATTLE BREEDS IN EGYPT

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SUMMARY

An analysis of cow productive and reproductive traits was carried out on 5331 lactation records of four dairy cattle breeds. A total of 2131 daughters of 475 sires belonging to Holstein-Friesian (HF), Meuse - Rhine Yessel (MRY), Brown Swiss (BS) and HF x MRV breeds were available for the analysis. Productive traits analysed were total milk yield (TMY), 305-day milk yield (305 MY), lactation period (LP) and dry period (DP). Reproductive traits were number of services per conception (NOS), days open (DO), calving interval (CI) and age at first calving (AFC). Breed affected significantly ($P < 0.001$) all productive and reproductive traits. HF cows produced highest milk yield, showed longest LP. They maintained their superiority over the other breeds for milk yield in all parities. Despite lower fertility of HF cows expressed in highest estimate of NOS, DO and CI, they surpassed all other breeds in the mean milk yield per day of CI.

Keywords: Dairy breeds, productive and reproductive traits

INTRODUCTION

Comprehensive importation of dairy cattle breeds to Egypt, mostly pregnant heifers, began in the early 1970s. This policy has over the years been followed with a marked increasing trend towards risen importation

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volume. Breed differences in productive and reproductive traits were reported by many authors (Lee *et al.*, 1961; Brandt *et al.* 1966; Hollon *et al.* 1969; McDowell *et al.* 1974; Powell, 1985; Nieuwhof *et al.* 1989 and others). Design of breeding strategies for economic utilization of exotic dairy breeds needs information on their performance under the prevailing environmental conditions. The purpose of this study was to evaluate productive performance of some dairy cattle breeds under Egyptian conditions. Breeds studied were Holstein-Friesian, Meuse-Rhine-Yessel, Brown Swiss and Holstein-Friesian x Meuse-Rhine-Yessel. Non-genetic factors affecting productive and reproductive traits were considered in the statistical analysis.

MATERIAL AND METHODS

Data used in the present study were collected on three dairy breeds and one crossbred raised at dairy farms located in two different regions at Isamilia Governorate in the eastern part of Egypt. Productive and reproductive performance on 2131 individual cows having 5331 records was available for the study. Data were collected over a periods of six consecutive years started by 1982.

Breeds involved were Holstein-Friesian (HF), Meuse-Rhine-Yessel (MRY), Brown Swiss (BS) and the first cross HF x MR Y. Animals were imported as pregnant heifers from Ethitren Cattle Breeds Association (HF), Holland Association (MRY) and Verein Ostfriesischer Stammviehzüchter in west Germany (BS). The HF data covered three farms, namely farm number one, two and three in Al-SALHIA region, whereas the BS data were obtained from the fourth farm in El-KASSASIN region. MR Y cows and their crosses with HF sires were kept in farm number two in the first region. There were 1251 HF cows having 3297 records and sired by 288 bulls, 408 MR Y cows having 1026 records and sired by 112 bulls were available. The number of BS cows was 176, each had three lactations and were sired by 34 bulls. In addition there were 480 records on 296 first cross cows between 41 HF sires and MR Y cows. Cows in the first region were housed in an open fan-type corral free-stall while in the second region were housed in a rectangular corral system. Cows were milked twice daily in a parlor. All

animals in Al-SALHIA region were fed green fodder composed of Egyptian clover (*Trifolium alexandrinum*), Alfa alfa, sorghum and green-corn plus hay and concentrates. Amounts of feed were given according to cows live weight, production and pregnancy status. Feeding system in El-KASSASIN region was based mainly on green fodder and limited amount of concentrates.

Cows were bred artificially using imported frozen semen. Natural mating was only practiced with repeat breeders. Heifers were served for the first time when they reached 70% of the adult weight known for their breed, while cows were usually served 2 months post partum. Pregnancy was detected by rectal palpation 60 days after the last service. Cows failed to conceive were rebred in the next estrus. Calves were given colostrum 4 days after birth and housed in calf boxed where they were bucket fed afterwards until weaning at 56 days of age.

Productive traits examined included total milk yield (TMY), 305-days milk yield (305 MY), lactation period (LP) and dry period (DP). Reproductive traits studied were number of services per conception (NOS), days open (DO), calving interval (CI) and age at first calving (AFC). Both groups of traits were analysed using Harvey's (1977) mixed models where sires and cows-within-sires, as random components, contributed to variance components associated with differences among sires of paternal half-sibs and among cows having repeated measurements, respectively. Data on TMY, 305 MY, LP, DP, NOS, DO and CI were analysed fitting the effects of breed, parity, year and season of calving, sire and cow within sire. Data on AFC were analysed fitting the effects of breed, year and season of birth and sires within breed. Interaction effects were dropped from the model as preliminary analysis indicated nonsignificance in most cases. Similarly, age effect nested within parity was excluded since it had non-significant effect on most studied traits.

RESULTS AND DISCUSSION

Productive traits

The F-values for productive and reproductive traits are given in Table 1. Breed influenced significantly ($P < 0.001$) all traits where it was the most

affecting in the model resulting in more than 40% of the total variation in TMY and 305 MY. Parity affected significantly ($P < 0.001$) all traits.

Table 1. The F- values for productive and reproductive traits residual standard deviations.

| Source | d.f | TMY | 305MY | LP | DP | NOS | DO | CI |
|----------------------|------|------------|-----------|-----------|----------|-----------|-----------|-----------|
| Breed | 3 | 1244.86*** | 914.21*** | 119.13*** | 12.25*** | 101.58*** | 135.11*** | 111.78*** |
| Sires/ Breed | 471 | 1.34*** | 1.45*** | .95 | .95 | .98 | 1.10 | .90 |
| Cows/Sires/ Breed | 1674 | 1.79*** | 1.95*** | 1.12** | .88 | 1.12*** | .96 | 1.13*** |
| Parity | 3 | 286.16*** | 276.36*** | 14.46*** | 15.92*** | 20.17*** | 20.43*** | 23.17*** |
| Season of calving | 3 | 7.62*** | 2.65*** | 6.96*** | 4.34** | 7.31*** | 8.41*** | 19.24*** |
| Year of calving | 5 | 17.90*** | 5.12* | 24.87*** | 3.34** | 18.86*** | 19.89*** | 26.88*** |
| Residual d.f | 6171 | | | | | | | |
| Residual S.D. | | 1004.98 | 910.97 | 66.61 | 33.40 | 1.38 | 63.66 | 63.94 |

TMY = Total milk yield (kg), 305MY = 305-day milk yield (kg), LP = lactation period (d), DP = dry period (d), NOS = number of services per conception, DO = days open (d), CI = calving interval (d).

* $P < 0.05$

** $P < 0.01$

*** $P < 0.001$

Season and year of calving affected significantly all productive and reproductive traits. As it would be expected, TMY and 305 MY were significantly influenced by both sires and cows within sires. Means and standard errors for TMY, 305 MY, LP, DP, NOS, DO and CI are given in Table 2 on a within breed basis. Other factors, however, will not be considered further, as they were included in the model only to remove their effects and increase accuracy of breed comparison.

HF cows exceeded markedly all other breeds in TMY and 305 MY where they produced 2031 and 1657 kg more milk above the overall mean for both traits, respectively. Crossbred cows produced lower milk than HF cows but much higher than both MRY and BS cows. Results in Table 1 indicate significant ($P < 0.001$) breed effect on LP and DP where it accounted for 6.2 and 0.6% the total vision in both traits, respectively. HF cows had longest LP and second longest DP. Results for the effect of breed on milk yield agreed with those of Brandt *et*

al., (1966), Hollon et al., (1969) and Zarnecki et al., (1991). Superiority of HF cows in milk production over the other dairy breeds is well known. Estimates for LP in the parent work are much higher than those reported by Hollon et al., (1969), Mohamed (1987), Madalean et al., (1990) and Ahmed (1991). Other estimates for LP ranging from 322 to 350 days were reported by Ragab et al., (1973), Galal et al. (1974) and Ashmawy (1975) for Friesian cattle in Egypt. The overall estimate for DP in the present study is much lower than the average of 150 days reported by Mohamed (1987) and that of 101 days reported by Khattab and Ashmawy (1988) for Friesian cattle in Egypt. Means reported here for DP fall within the range of estimates obtained on dairy breeds and their crosses with Indian breeds (e.g. Wood, 1985; Dias and Alliarre, 1982; Gill and Batanie, 1979; Schaeffer and Henderson, 1972). The overall estimate of 82 days for DP found here reflects the serious efforts in these herds to maintain its length within the known and acceptable limit of 60 days.

Table 2. Number of observations, least-squares means (LSM) and standard errors (SE) for productive and reproductive traits per breed group.

| Breed group | n | TMY | | 305 MY | | LP | | DP | | NOS | | DO | | CI | |
|-------------|------|------|-----|--------|-----|------|----|-----|----|------|-----|-----|----|-----|----|
| | | LSM | SE | LSM | SE | LSM | SE | LSM | SE | LSM | SE | LSM | SE | LSM | SE |
| | | (kg) | | | | (kg) | | | | (kg) | | | | | |
| HF | 3297 | 5334 | 58 | 4857 | 60 | 360 | 2 | 83 | 1 | 3.3 | .05 | 152 | 2 | 433 | 2 |
| MRY | 1026 | 2318 | 76 | 2202 | 77 | 351 | 3 | 77 | 1 | 2.5 | .06 | 122 | 3 | 415 | 3 |
| BS | 528 | 1829 | 104 | 2031 | 106 | 305 | 4 | 84 | 2 | 2.6 | .08 | 103 | 4 | 390 | 4 |
| HFxMRY | 480 | 3731 | 114 | 3712 | 116 | 317 | 5 | 76 | 2 | 2.4 | .10 | 110 | 5 | 390 | 5 |
| Mean | 5331 | 3303 | 60 | 3200 | 62 | 333 | 2 | 80 | 1 | 2.7 | .04 | 122 | 1 | 407 | 1 |

TMY = Total milk yield, 305MY = 305-day milk yield, LP = lactation period, DP = day period, NOS = number of services per conception, DO = days open, CI = calving interval.

REPRODUCTIVE TRAITS

As shown in Table 1 breed affected significantly ($P < 0.001$) all reproductive traits and accounted for 5.5, 7.2 and 5.5% of the total variation in NOS, DO and CI, respectively. Parity, season and year of calving influenced significantly ($P > 0.001$) all these traits. Results in Table 2 show that HF cows required the highest NOS among all breed groups. HF cows had also the longest DO and longest CI among all breed groups. Lowest NOS was recorded for crossbred cows while shortest DO was obtained for BS cows that showed also shortest CI

along with crossbred cows. These results are in general agreement with those reported in the literature covering a wide range of breeds (McDowell *et al.* 1974; Laben *et al.* 1984; Stevenson *et al.* 1983; Morsy *et al.* 1986; Madalena *et al.* 1990; Morbeck, 1991). For Frisian cattle in Egypt, Ragab *et al.* (1973), Ashmawy (1975), Mohamed (1987), Khattab and Ashmawy (1988) and Ahmed (1991) reported higher estimates for DO and CI than those obtained for HF cows in the present study. Results in Table 2 indicate that high level of milk production may probably be associated with increasing NOS, DO and CI, ie lowering fertility. Laben *et al.*, (1982) observed that high yield had antagonistic association with reproductive efficiency, where number of breedings increased by 0.014 for each 100kg increase in 180-day yield of fat-corrected-milk. It is well documented that effective estrus detection is probably a major factor affecting reproductive efficiency.

In general, the longer LP, DP and higher milk yield for HF cows were accompanied by longer CI which may offset the superiority of this breed in milk production. Conversely, the other three breed groups had better reproductive performance, which was not compensated by their poor milk yield, so the mean yield per day of CI for these breeds is much lower than for HF breed.

Age at first calving (AFC)

Breed affected significantly ($P < 0.001$) AFC and resulted in 63% of the total variation in this trait (Table 3). AFC was lowest (22 mon.) for crossbred cows and highest (33 mon.) for BS cows (Table 4). Estimates of AFC found here for HF, MRY and their crossbred heifers were much lower than corresponding values reported by Galal *et al.*, (1974), Ashmawy (1975), Ashmawy and Mokhtar (1984), Morsy *et al.*, (1986) and Ahmed (1991). Average AFC of 30.1 mon. for Holstein Friesian cows in USA was given by Foster *et al.*, (1988). In the period from 1960 through 1982 mean AFC for Holstein Friesian and Brown Swiss cows in USA was 27.5 and 28.0 mon., respectively as shown by Powell (1985). Corresponding means found here were lower for HF and higher for BS. These means reflect the managerial strategies adopted in these herds. The usual practice is to breed heifers for the first time according to their

body weigh not only age. In the herds where HF, MRY, and their crossbreds were kept, level of management allowed the growing heifers to reach the suitable body weight for breeding earlier. This practice may in turn have led to lowering AFC for these breed groups. Season and year of birth as well as sire of heifer had a significant ($P < 0.001$) effect on AFC. The effect of season and year of birth on AFC may reflect different managerial levels during different seasons and in subsequent years.

It is concluded from the present study that HF cows exceeded markedly all other breed groups in milk production traits. They maintained their superiority for milk yield for all parities despite lower reproductive efficiency. However, mean yield per day of CI for HF cows was found to be in favour of this breed group. Further studies, basically under experimental condition will be needed to quantify their overall economic superiority over other breeds.

Table 3. The F-values for age at first calving (AFC) and residual standard deviation.

| Source | d.f | AFC (mo) |
|-----------------|------|-------------|
| Breed | 3 | 1005.05 *** |
| Sires/breed | 418 | 1.37 *** |
| Season of birth | 3 | 3.03 ** |
| Year of birth | 5 | 23.77 *** |
| Residual d.f | 1701 | |
| Residual SD | | 1.58 |

* $P < .05$, ** $P < .01$, *** $P < .001$

Table 4 . Number of observations, least- squares means (LSM) and standard errors (SE) for age at first calving (AFC) per breed.

| Breed group | n | AFC (AFC) | |
|-------------|------|-----------|-----|
| | | LSM | SE |
| HF | 1251 | 24.3 | .17 |
| MRY | 408 | 23.6 | .29 |
| BS | 176 | 33.0 | .24 |
| HF x MRY | 296 | 22.0 | .29 |
| MEAN | 2131 | 25.7 | .14 |

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تقييم الاداء الانتاجى والتناسلى لبعض انواع ابقار اللبن فى مصر

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حللت سجلات الابقار للصفات الانتاجية والتناسلية باستعمال ٥٣٣١ سجل لاربعة انواع من ابقار اللبن ، وقد توفر للتحليل عدد ٢١٣١ بنت لها ٤٧٥ أب تنتمى لانواع الهولستين فريزيان (HF) ، موزيراين يسيل (MRY) . براون سويس (BS) وخليط الهولستين فريزيان X موزيراين يسيل. وكانت الصفات الانتاجية التى درست عبارة عن محصول اللبن الكلى ، محصول اللبن فى ٣٠٥ يوم ، طول موسم الحليب ، طول فترة الجفاف ، وكانت الصفات التناسلية عبارة عن عدد مرات التلقيح اللازمة للحمل ، طول فترة التلقيح المخصب، الفترة بين ولادتين ، العمر عند اول ولادة.

كان هناك اثر معنوى للنوع على جميع الصفات الانتاجية والتناسلية وقد انتجت ابقار الهولستين فريزيان اعلى محصول لبن واطهرات اطول موسم حليب وقد احتفظت هذه الابقار بتفوقها على على الانواع الاخرى فى محصول اللبن فى جميع المواسم الانتاجية ، بالرغم من الخصوبة الاقل لابقار الهولستين معبرا عنها فى صورة تقديرات اعلى لعدد مرات التلقيح اللازمة للحمل، طول فترة التلقيح المخصب وطول الفترة بين ولادتين الا انها فاقت الانواع الاخرى فى متوسط محصول اللبن لليوم الواحد من الفترة بين ولادتين.