The Effect of Region, Season and Year of Calving on Complete Milk Records of Egyptian Buffaloes

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A total number of 4903 complete lactation milk records produced by 1755 Egyptian buffaloes were analyzed using the least squares techniques according to a mathematical model which included the effects of region, season and year of calving, and the interaction of region by season.

The overall mean total milk yield was 1968 kg. Region 2, which included the herds located south to Cairo, had significantly higher milk yield (2075 kg, P<0.05) than region 1. Spring-calving buffaloes had the highest mean milk yield (1996 kg) though not statistically different from the winter and summer means. A generally negative trend was observed in the mean milk yield over a period of 42 years from 1931 to 1972. All effects studied contributed 12.66% of the total variation in milk yield, with year of calving alone accounting for 7.75% of the variation.

Non-genetic sources of variation in total milk yield are numerous and have variable effects on dairy records. Statistical evidence of the effect of season, farm, year, and other major factors on milk yield in Egyptian buffaloes was reported in many studies (Ragab et al., 1970 and 1973) but in very few the effects were quantitatively evaluated.

The purpose of this paper was to estimate the contribution of region, season and year of calving to the total variation complete milk yield records of Egyptian buffaloes.

Material and Methods

Data

The data used in this study included sets of total milk yield records of Egyptian buffaloes 150 day lactation period or more. The total number of
records was 4903 made by 1755 buffaloes over a period 42 years (1931-1972),
and representing all available records in six farms from which age at calving
could be computed. The farms belonged to the Ministry of Agriculture, Uni-
versity of Cairo, University of Ain-Shams, and the Military farms. Three
of these farms were located north to Cairo (Region 1), while the others were
south to Cairo (Region 2). The first region have relatively mild weather all
over the year, and more forage are usually available for animal feeding that
region than in region 2.

Data were classified into six year classes. The first comprised the records
which started before 1950. Records begun during the period from 1951 to
1970 were grouped in four classes each of four years. The last class included
all records begun after 1970. Four seasons of calving were distinguished:
autumn (September 1 to November 30), winter (December 1 to February 28),
spring (March 1 to May 31), and summer (June 1 to August 31). Better cli-
matic and pasture conditions usually prevail during winter and spring.

Statistical procedures

Part records were extended to 365-day basis using the extention factors
developed by Abdel-Aziz et al. (1973). Least squares techniques (Harvey, 1960)
were used to analyze the data according to a fixed effects model including
region season and year of calving, and interaction between region and season.
The following linear model was assumed to underly each milk record.

\[ Y_{ijk} = u + R_i + S_j + T_k + (RS)_{ij} + e_{ijk} \ldots (1) \]

where:

- \( Y_{ijk} \) = the total milk record made by the \( i \)th buffalo calving at the \( j \)th region
  in the \( k \)th season of the year,
- \( u \) = the overall mean of the total milk records,
- \( R_i \) = an effect due to the \( i \)th region, and \( i = 1, 2 \),
- \( S_j \) = an effect due to the \( j \)th season of calving, and \( j = 1, 2 \ldots \), \( 4 \),
- \( T_k \) = an effect due to the \( k \)th year group, and \( k = 1, 2 \ldots \), \( 6 \).
- \( (RS)_{ij} \) = an effect due to the interaction between the \( i \)th region and the \( j \)th
  season of calving, and,
- \( e_{ijk} \) = a random effect associated with the individual observation and
  assumed to be random, independent and normally distributed with
  mean zero and variance \( \sigma^2 \).

Duncan's multiple Range test as described by Harvey (1960) was
used in comparisons among subclass means.

Results and Discussion

Several studies indicated the important effect of some environmental factors on total milk yield Egyptian buffaloes (Abdel-Aziz et al., 1973, Asker and Bedair, 1961, Ragab et al., 1954, 1956, 1966, 1970 and 1973). To assess quantitatively the effect of each source of variation, the analysis of the data was performed in this study in such a way provide estimates of each of the effects considered in the linear models underlying each record. The model included the effects of region, season and year of calving, and the interaction between region and season. These effects were supposed to be major factors that could influence total milk yield.

The least squares analysis of variance of the total milk yield is presented in Table 1. All sources of variance showed evidence of statistically significant effects on total milk yield.

**TABLE 1. Least squares analysis of variance of total milk yield.**

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>D.F.</th>
<th>M.S.</th>
<th>V%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region</td>
<td>1</td>
<td>46,283,371,149*</td>
<td>5.60</td>
</tr>
<tr>
<td>Season of calving</td>
<td>3</td>
<td>1,253,561,253*</td>
<td>0.20</td>
</tr>
<tr>
<td>Year of calving</td>
<td>5</td>
<td>23,484,042,565**</td>
<td>7.75</td>
</tr>
<tr>
<td>Region x season</td>
<td>3</td>
<td>957,867,119*</td>
<td>0.14</td>
</tr>
<tr>
<td>Residual</td>
<td>4290</td>
<td>345,838,918</td>
<td>86.32</td>
</tr>
</tbody>
</table>

* P < 0.05  ** P < 0.01

All factors studied contributed 13.68% of the total variation in total milk yield. Among all non-genetic factors studied, year of calving contributed 7.75%. Differences between regions accounted for 5.60% of the total variation, while 0.20% and 0.13% of the total variation were due to season of calving and region x season interaction respectively.

The least squares means and standard errors of the total milk yield are presented in Table 2. The overall mean of the total milk yield was 1968 kg. Comparing the region means, region 2 which comprised the three herds located south of Cairo was found to have significantly higher yield (2075 kg, P<0.05).

TABLE 2. Least squares means (×) standard errors (S.E.) and results of Duncan's Multiple Range Test(1) of total milk yield.

<table>
<thead>
<tr>
<th>Classification</th>
<th>No.</th>
<th>×(kg)</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall mean</td>
<td>4903</td>
<td>1968</td>
<td>9.894</td>
</tr>
<tr>
<td>Region</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Region 1</td>
<td>2987</td>
<td>1862a</td>
<td>12.489</td>
</tr>
<tr>
<td>Region 2</td>
<td>1916</td>
<td>2075b</td>
<td>14.448</td>
</tr>
<tr>
<td>Season of calving</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autumn</td>
<td>1626</td>
<td>1933a</td>
<td>17.612</td>
</tr>
<tr>
<td>Winter</td>
<td>1412</td>
<td>1994b</td>
<td>17.948</td>
</tr>
<tr>
<td>Spring</td>
<td>945</td>
<td>1996b</td>
<td>18.911</td>
</tr>
<tr>
<td>Summer</td>
<td>920</td>
<td>1950ab</td>
<td>20.448</td>
</tr>
<tr>
<td>Year of calving</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 1</td>
<td>703</td>
<td>2026a</td>
<td>23.238</td>
</tr>
<tr>
<td>Group 2</td>
<td>479</td>
<td>2151b</td>
<td>25.792</td>
</tr>
<tr>
<td>Group 3</td>
<td>508</td>
<td>2127b</td>
<td>25.814</td>
</tr>
<tr>
<td>Group 4</td>
<td>1021</td>
<td>1756c</td>
<td>20.477</td>
</tr>
<tr>
<td>Group 5</td>
<td>1771</td>
<td>1770c</td>
<td>18.380</td>
</tr>
<tr>
<td>Group 6</td>
<td>421</td>
<td>1980a</td>
<td>28.874</td>
</tr>
</tbody>
</table>

(1) Within each classification means not followed by the same letter differ significantly from each other (P < 0.05).

Considering season of calving, the lowest total milk yield was that of autumn-calving buffaloes (1933 kg P< 0.05), which was significantly different from winter and spring calvers. No significant differences were found among the mean milk yield of the winter, spring and summer calvers.

A generally negative trend was observed in the mean milk yield of the year groups. However, the buffaloes calving before 1960 had significantly higher means (P<0.05) than those calving thereafter, with the exception of the mean milk yield of the last group which was not significantly different from the yield of the first group.

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References


