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INTER-RELATIONSHIPS BETWEEN AGE AT FIRST CALVING AND PRODUCTION DURING FIRST LACTATION OF IMPORTED FRIESIAN CATTLE AND THEIR LOCALLY BORN DAUGHTERS

By

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An investigation was undertaken to study the inter-relationships between age at first calving and milk production during the first lactation of imported Friesian dams and their first generation daughters. The average age at first calving for the dams and that for the daughters were 25.8 and 31.1 months respectively. The simple correlation coefficient between daughters' yield and age at first calving was highly significant (0.204) and that between dams' yield and age at first calving was also highly significant (0.269). Simple regression coefficients of daughters' or dams' yield on each of their age at first calving were 93.3 and 50.2 respectively. The difference between these regression coefficients was beleived to be due to the size of the animal at the time of calving since the dams were younger and presumably smaller in size.

The simple correlation between daughter's yield and dams yield was significant (0.124) and the regression coefficient was found to be 0.14. A multiple regression equation for predicting daughters yield based on dams yield and daughters age at first calving was constructed.

It is commonly observed that when cattle of European origin are reared in hot regions they calve at an older age than the stock introduced for the first time from temperate countries. In the Ministry's herd of Friesian cattle two facts were observed :

(*i*) the imported pregnant stock from the Netherlands calved in Egypt at a younger age than their locally born first generation daughters.

(*ii*) the average production of the first lactation for the imported dams was lower than their daughters.

The present study was conducted primirily to determine the relationship between the observed differences in age at first calving and production between the daghters and their dams. Furthermore, the relationship between daughter-dam production of the first lactation was also investigated.

Material And Methods

Source of Data

The herd under investigation consisted of imported stock of Friesian cattle and their locally born daughters. Importations of cattle-as pregnant heifers—began in 1960 and since then they were kept and reared at the Sakha Experimental Station. Their first progeny were born within few months following the importations.

The 305 day first lactation milk yield of 319-records of dam-daughter pairs were used. Abnormal records and those of a lactation period less than 200 days were excluded. The daughters were served at 18 months of age or when attained a suitable size for breeding. Hand milking was practiced morning and afternoon, calves were pail fed and weaned at an age of $3\frac{1}{2}$ months.

Methods of Analysis

Assuming the following:

y	denotes milk yield — 305 days, first lactation.
x	denotes age at first calving in months.
i	denotes duaghters.
j	denotes their imported dams.
Y_i	expected milk yield for daughters.
Y_j	expected milk yield for dams.

(*i*) the regression coefficient of daughters yield (y_i) on their age at first calving (x_i): $b_{yi\ x_i} = \dfrac{\text{Cov.}\ (y_i.\ x_i)}{\text{Var.}\ (x_i)}$

(*ii*) the regression coefficient of daughters yield (y_i) on their dams yield (y_j): $b_{yi\ yj} = \dfrac{\text{Cov.}\ (y_i.\ y_j)}{\text{Var.}\ (y_j)}$

(*iii*) the regression equations expressing the effect of age at first calving on milk yield would be:

$$Y_i = \bar{y}_i + b_{yi}\ x_i\ (x_i - \bar{x}_i) \quad \text{for daughters} \qquad (1)$$

and $$Y_j = \bar{y}_j + b_{yj}\ x_j\ (x_j - \bar{x}_j) \quad \text{for dams} \qquad (2)$$

(*iv*) the regression equation expressing the effect of dams yield on daughters yield would be:

$$Y_i = \bar{y}_i + b_{yi}\ y_j\ (y_j - \bar{y}_j) \qquad (3)$$

(*v*) the partial regression equation expressing the estimated daughter's yield in terms of her age and dams yield would be:

$$Y_i = \bar{y}_i + b_{yi\ xi\ .\ yj}\ (xi - \bar{x}i) + b_{yi\ yj\ .\ xi}\ (yj - \bar{y}j) \qquad (4)$$

where :

$by_i\ x_i\ .\ y_j$ = the partial regression coefficient of daughters' yield on her age at first calving and holding dams' yield constant.

and $by_i\ y_j\ .\ x_i$ = the partial regression coefficient of daughters yield on dams' yield and holding daughters' ag at first calving onstant.

Results And Discussion

The correlation coefficients and the linear equations expressing the relationships between milk yield and age at first calving are summarized in Table (1) and illustrated in Figs (1) and (2).

TABLE 1.—REGRESSION AND CORRELATION COEFFICIENT'S OF 319 DAUGHTER DAM YIELDS AND AGE AT FIRST CALVING

Items	Regression Equa	R.
Dau. Y × A.C.	$Y_i = 3463 + 39.3\ (x_i - 31.1)$ ..(1)	0.204**
Dam Y × A.C.	$Y_j = 3113 + 50.2\ (x_j - 25.8)$ ..(2)	0.269**
Dau. Y × dam Y	$Y_i = 3463 + 0.14\ (Y_j - 3113)$ ..(3)	0.124*

It can be seen that a highly significant correlation exists between milk yield and age at first calving in both groups : the daughers and the dams.

The observed higher correlation coefficient for the dams over that for the daughters may be explained by the fact that the pregnant imported dams were particulary selected from the Dutch herds to calve at an average age of 25 months. This restriction was not applied to the daughters since all available daughters were used irrespective of their age at which they calved.

It can be also noticed from equations (1) and (2) that the regression coefficient for the dams is higher than that for the daughters. Since the dams calved at an age of six months younger than their duaghters (25.8 compared to 31.1 months). Then it is expected that their body size, in general, would be smaller. In other words, the dams were not fully grown or developed at the time of calving contrary to their daughters. Thus, in the case of dams, the rate of increase in yield with the advance in age is expected to be faster since the physiological processes of development towards maturity would be rather quicker. On the other hand, the daughters rate of inerease in yield with age would be slower as they already calved at an age where the body was more developed. This is clear from equations (1) and (2) where it could be

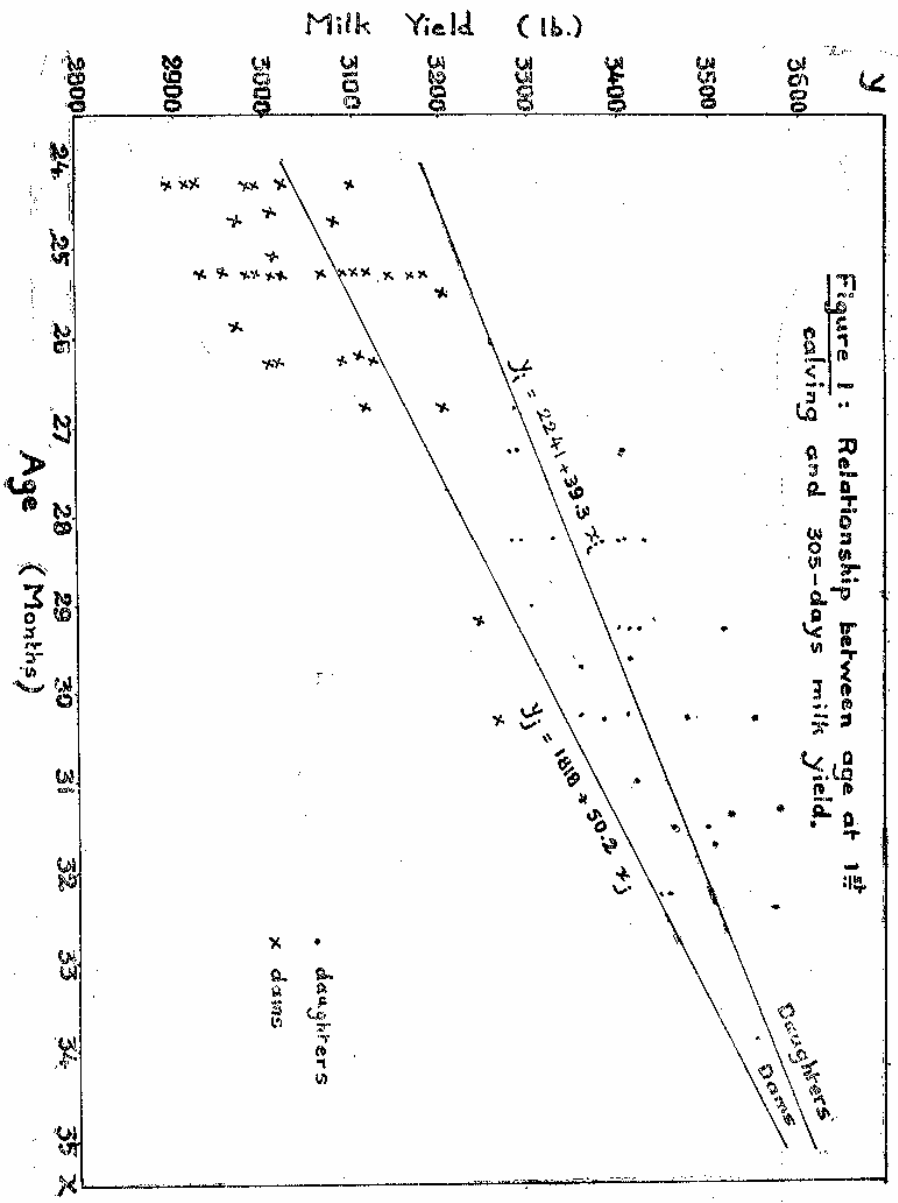

Figure 1: Relationship between age at 1st calving and 305-days milk yield.

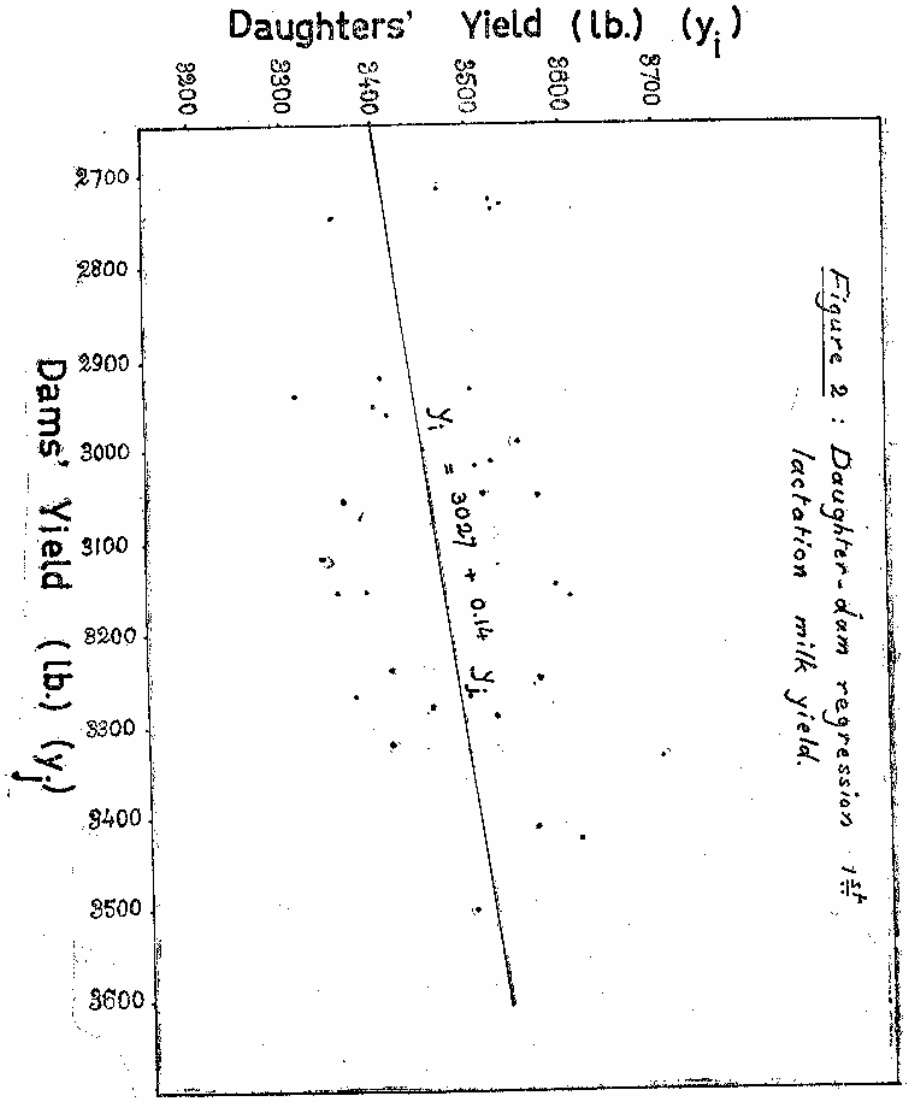

Figure 2 : Daughter-dam regression 1st lactation milk yield.

stated that for every increase of one month in the age of daughters there was a corresponding increase of 39.3 lbs of milk; and, there is a corresponding increase in dams yield of 50.2 lbs for every month increase in their age. This difference in the rate of increase in milk yield gets smaller the advance in age until it varishes at a point determined by extrapolation of the two lines in Fig. (1). The point of interception corresponds to 38.8 months and 3765 lbs. of milk.

The present results raise an important question regarding breeding heifers. At what age should heifers calve or, in other words, bred ? It seems that the size of the heifer determines the breeding age. Body weight at calving is partly determined by age at calving; and conversely, age at calving is influenced by body size. Further investigation of this point is required on dairy cattle in Egypt.

Various investigators have studied the effect of age at first calving and body weight on milk yield. In a study on Holstein cattle, Clark and Touchberry (1962), using multiple regression analysis of first lactation records found that, when holding the weight constant, an increase of one month in age was accompanied by an increase of 46 lbs of milk. They concluded that probably more of the variation in production was associated with body weight as with age. According to Erb an Ashworth (1961) their data clearly showed the rather large values for the relationship of age or wieght to yield when the effects of one were confounded with the other. Harville and Henderson (1966) found that the multiple regressions of first lactation on age and wieght were linear.

The relationship between daughter—dam first lactation yield is presented in Table 2 (equa. 3). From the regression coefficient it can be stated that the estimated daughters yield increases by 14 units with each increase of 100 units in dams yield. The linearity of this relationship was based on the findings of Van Vleck and Hart (1965a) and Bradford and Van Vleck (1964) who demonstrated a linear relationship of daughter dam first lactation yield, but failed to show a curvelinear relatiohship. However, instead of using acutal milk yield, these authors worked with the deviations from herd-mate averages. From the analysis conducted by Van Vleck and Hart (1965a) on 47000 Holstein pairs they presented the regression of dughters yield on dams yield in terms of deviations in the following linear expression :

$$y = -25.6 + 0.21\ (x - 27.6).$$

where y is the predicted daughter deviation and x is the dam deviation. These authors also reported a correlation coefficient between daughter-dam yields of 0.18. Their results suggest ahtat selection response can be predicted adequately even with very large selection differentials.

In another study of the same magnitude, Van Vleck and Bradfor (1965) and Van Vleck and Hart (1965b) concluded that about 18% of the within herd variation in first lactation milk records was due to maternal effects. They also estimated heritability of milk production from the regression of daughter' on their dams and reported values ranging from 0.35 to .40. In the present study heritability based on daughter — dam regression of first lactation was estimated at a avalue of 0.28.

Going back to Table (I), it might be interesting to set up a partial linear regression equation for predicting daughters' yield and combining dams yield and daughters' age a first at calving (equa. (4) thus :

$$Y_i = 3463 + 39.3\ (x_i - 31.1) + 0.15\ (y_j - 3113) \quad \ldots\ldots\ldots\ldots \quad (4)$$

where,

39.3 is the partial regression coefficient of daugher's yield on her age calving and holding dams' yield constant.

0.15 is the partial regression coefficient of daughters yield on dams' yield and holding daughers' age at calving constand.

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العلاقة بين العمر عند أول ولادة وانتاج اللبن فى الموسم الأول لقطيع من الأبقار الفريزيان المستوردة وبناتها المولودة محليا

الملخص

أجرى هذا البحث لدراسة العلاقة بين العمر عند أول ولادة وانتاج اللبن فى موسم الحليب الأول لقطيع من الأبقار الفريزيان المستوردة من هولندا وبناتها المولودة فى مصر . وجد أن متوسط العمر عند أول ولادة ٢٥ر٨ ، ٣١ر١ شهر لكل من الأمهات وبناتها على التوالى وكان معامل الارتباط بين العمر فى أول ولادة والادرار فى ٣٠٥ يوم معنوى جدا (٢٠٤ر٠ ، ٢٦٩ر٠ لكل من البنات والأمهات على التوالى) ومعامل الانحدار للادرار على العمر عند أول ولادة ٣٩ر٣ للبنات ، ٢ر٠٥ للأمهات . وقد يرجع الفرق الظاهر بين المعاملين الى حجم الحيوان عند الولادة حيث أن الأمهات كانت اصغر فى العمر عند ما وضعت من بناتها . وبالتالى تكون اصغر حجما .

كما وجد تلازم معنوى بين أدرار البنات وأمهاتها (١٢٤ر٠) ومعامل الانحدار وجد ١٤ر٠

هذا وقد وضعت معادلة انحدار متعددة للتنبؤ بأدرار البنات يعتمد على انحدار أدرار البنات على كل من عمرها وأدرار أمهاتها .