# EVALUATION OF LACTATION PERFOMANCE OF ZEBU x TAURUS CATTLE IN KERALA

By

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requirement for the degree

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**1983**

## DECLARATION

I hereby declare that this thesis entitled "EVALUATION OF LACTATION PERFORMANCE OF ZEBU x TAURUS CATTLE IN KERALA" is a bonafide record of research work done by me during the course of research and that the thesis had not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship, or other similar title, of any other University or Society.

Mannuthy,
29-4-1985.

STEPHEN MATHEW

CERTIFICATE

Certified that this thesis entitled "EVALUATION OF LACTATION PERFORMANCE OF ZEBU x TAURUS CATTLE IN KERALA" is a record of research work done independently by Sri. Stephen Mathew under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship, or associateship to him.

Mannuthy,
29-4-1983.

DR. G. MUKUNDAN
(CHAIRMAN, ADVISORY BOARD)
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Dedicated to the loving memory

of

my beloved father Sri. Augusthy Mathew

and

my beloved brother Sri. P. A. Joseph

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# C O N T E N T S


| | Page No |
|---|---|
| INTRODUCTION .. .. | 1 |
| REVIEW OF LITERATURE .. .. | 3 |
| MATERIALS AND METHODS .. .. | 15 |
| RESULTS .. .. | 20 |
| DISCUSSION .. .. | 38 |
| SUMMARY .. .. | 51 |
| REFERENCES .. .. | .. |
| ABSTRACT .. .. | .. |


---oOo---

LIST OF TABLES


| Table No | | Page No |
|---|---|---|
| 1 | Average milk production of Local x Jersey crosses in the hilly and heavy rainfall areas of Kerala, Uttar Pradesh and Andhra Pradesh States. | 6 |
| 2 | Mean ages at first calving of Non-descript cows and its crosses with Brown Swiss and Jersey breeds. | 11 |
| 3 | Means, standard errors and coefficient of variations of first lactation milk yield in 305 days (kg) in different groups of crossbred cattle in Kerala. | 21 |
| 4 | Means, standard errors and coefficient of variations of first lactation milk yield in 305 days (kg) of different crossbreds at different locations of Kerala. | 22 |
| 5 | Least squares analysis of variance for first lactation milk yield in 305 days of crossbred cattle of Kerala. | 24 |
| 6 | Least squares means and standard errors of first lactation milk yield in 305 days (kg) of crossbred cattle of Kerala. | 25 |
| 7 | Least squares analysis of variance for first lactation milk yield in 305 days of Brown Swiss half-breds in Kerala. | 29 |
| 8 | Least squares means and standard errors of first lactation milk yield in 305 days (kg) of Brown Swiss half-breds in Kerala. | 30 |
| 9 | Means, standard errors and coefficient of variations of ages at first calving (months) in different genetic groups of cattle in Kerala. | 32 |

| Table No | | Page No |
|---|---|---|
| 10 | Least squares analysis of variance for age at first calving in crossbred cattle in Kerala. | 33 |
| 11 | Least squares means and standard errors of ages at first calving (months) in crossbred cattle in Kerala. | 34 |
| 12 | Least squares analysis of variance for age at first calving in Brown Swiss half-breds of Kerala. | 36 |
| 13 | Least squares means and standard errors of ages at first calving of Brown Swiss half-breds in Kerala. | 37 |

# Introduction

# INTRODUCTION

Crossbreeding is the quick solution to improve the performance of the non-descript, low producing native cattle population of Kerala. Since 1950, various crossbreeding programmes involving exotic breeds were launched by the Governmental agencies. Initially the programmes were in the form of pilot studies on relative efficacy of crossbreeding of local cattle with Jersey and grading up with Indian milch breeds. The results obtained by the pilot studies were so promising that the Animal Husbandry Department in 1961 modified its breeding policy so as to extend crossbreeding with exotic bulls to the other areas of the State. The Indo-Swiss Project was started in 1963 with the objective of developing a multi-purpose breed of cattle for economic milk and meat production and draft power suitable for Kerala conditions using Brown Swiss bulls. Later a breeding policy was laid for the improvement of cattle dividing the State into two regions for this purpose. In Southern region comprising of Idikki, Alleppey, Quilon and Trivandrum, Brown Swiss was the exotic breed to be used for crossbreeding and in Northern region comprising of other districts, Jersey was the breed of choice. In 1976, Kerala Livestock Development and Milk

Marketing Board was constituted to co-ordinate the cattle husbandry activities of the various agencies viz. Animal Husbandry Department, Indo-Swiss Project and the Dairy Development Department.

Implementation of crossbreeding programmes was very successful and Kerala at present has around 14 lakhs of Zebu x Taurus cattle out of 30 lakhs of the total cattle population. As Jersey and Brown Swiss are the two main exotic breeds used for crossbreeding in Kerala, a knowledge on the performance of their crossbred groups will help to formulate the future breeding policy of the State. Hitherto, no systematic attempt has been made to evaluate the performance of the Brown Swiss and Jersey crossbreds and to compare their performances under field conditions. The traits, first lactation milk yield in 305 days, age at first calving and first lactation length were taken for the study considering their economic importance to the farmer. The present study of comparing the crossbred groups was based on these characters.

# Review of Literature

# REVIEW OF LITERATURE

With a view to evolve a cattle breed with high production potential and least susceptability to diseases, several attempts have been made to mix the exotic and Zebu inheritance through crossbreeding. The literature on the performances of crossbred cattle produced by crossing non-descript cattle with Jersey and Brown Swiss are reviewed hereunder.

## 1. First lactation milk yield

### a) Non-descript cattle

The majority of Indian cattle are non-descript. Rajkumar (1969) analysed the records of 15 animals of the Cattle Breeding Farm, Dehra Dun and reported the average lactation milk yield as 442.7 kg.

Nair (1973) studied the milk yield of 108 local cattle recorded as foundation stock in the Indo-Swiss Project, Madupetty, Kerala. He estimated the average first lactation milk yield to be 716.0 kg.

Katpatal (1977a) in a review on crossbreeding of cattle in India has given the average milk yield of local cattle calculated on the basis of field data. The data pertained to 2339, 129, 137 cows respectively in Chalakudy (Kerala), Vikasnagar (U.P.) and Visakhapatnam (A.P.). The mean

lactation milk yields at these places were 573 kg, 492 kg and 699 kg, respectively.

Nair and Kelath (1977) analysed the records of 425 non-descript cows reared by the local farmers of Kerala in the Intensive Cattle Development Project, Mavelikkara and reported that the mean first lactation milk yield upto 300 days was 793.04 ± 13.46 kg. Bhat and Mukundan (1979) analysed the records from the scheme on crossbreeding of cattle in hilly and rainfall areas, Cattle Farm, Thumburmuzhy and Indo-Swiss Project, Madupetty and found that the average milk yield was 333.4 kg and the milk yield per day of calving interval was 1.1 kg.

b) Brown Swiss x Non-descript cows

Nair (1973) studied the performance of the Brown Swiss x Non-descript crossbreds at the Indo-Swiss Project, Madupetty. He reported an average first lactation milk yield of 93 half-breds as 1959.0 ± 534.0 kg and of seven 3/4 breds as 2499.0 ± 729.0 kg.

Nair and Kelath (1977) analysed the first lactation 300 days milk records of 425 $F_1$ crossbreds maintained by the local farmers of Kerala. They reported milk yield of 1611.40 ± 12.79 kg in this group and observed 12.99 per cent heterosis.

Sosamma (1982) found the least squares mean of Brown Swiss half-breds as 1698 kg based on a study of 685 cows kept by the farmers around Mavelikkara.

o) Jersey x Non-descript crossbreds

Rajkumar (1969) estimated the average milk yield of Jersey x Non-descript crossbreds ($F_1$ and $F_2$). The data comprised of 46 and five heads of cattle, respectively, maintained at Cattle Breeding-cum-Dairy Farm, Dehra Dun. The average milk yields were 1573.0 kg and 1130.3 kg, respectively.

Nair (1973) analysed 28 records maintained at the District Livestock Farm, Kodappanakunnu, Kerala. The average 305 days first lactation milk yield was reported to be 1140.13 ± 45.84 kg in half-breds which had been procured from local farmers of Neyyattinkara crossbreeding area.

The average milk production of Local x Jersey crosses in the hilly and heavy rainfall areas of Kerala, Uttar Pradesh and Andhra Pradesh reported by Katpatal (1977a) is given in table 1.

On perusal of literature, it can be seen that the crossbreds have higher milk production compared to local Zebu cattle of this country.

Table 1. Average milk production of Local x Jersey crosses in the hilly and heavy rainfall areas of Kerala, Uttar Pradesh and Andhra Pradesh States.

| Location | Period | Proportion of Jersey inheritance | | | | |
|---|---|---|---|---|---|---|
| | | 1/4 | 1/2 | 3/4 | 7/8 | $F_2$ |
| Chalakudy | (1956-74) | 1159 (49) | 1411 (1015) | 1426 (271) | 1796 (22) | 1601 (40) |
| Vikasnagar | (1958-70) | - | 1151 (97) | 1102 (18) | - | - |
| Visakhapatnam | (1971-72) | 1216 (9) | 1774 (138) | 1999 (36) | - | - |

(Katpatal, 1977a)

The parenthesis shows the number of observations.

Factors affecting lactation milk yield

a) Age at first calving

An early age at first calving is expected to enhance the productive life span of a cow (Bhasin and Desai,1967). On analysing the data of 117 Hariana cows at State Cattle Breeding Farm, Basei, Jaipur, the above workers stated that first lactation yield was not significantly affected by the age at first calving, while the first two lactations have negative association.

Kushwaha and Mishra (1969) studied the data of 245 Sahiwal cows at the Government Dairy Farm, Kanpur. They observed that the correlation between the age at first calving and the first lactation yield was positive upto 48 months but non-significant and the cows calving at 42 to 48 months of age produced largest quantity of milk.

Basu and Ghai (1977) analysed the records of 656 Holstein x Sahiwal crossbreds at Military Farm, Ambala and found that age at first calving did not significantly influence the first lactation milk yield.

The coefficient of correlation between the milk yields in different lactations and the age at first calving were, in general, negative and significant in 667 Friesian x Sahiwal crosses of various military farms (Shriram et al. 1979). They observed that the milk yield

was highest in the age group of 901-1000 days and a declining trend was noted in the milk production with the advancing age beyond the optimum level.

Sosamma (1982) observed a significant influence of age at first calving in first lactation milk yield in Brown Swiss crossbreds.

b) Year of calving

Year of calving is another non-genetic factor that influences the milk yield. The total first lactation yield was significantly affected by year of calving in the Brown Swiss x Sahiwal crossbreds at Karnal (Bhatnagar et al. 1979).

Chowdhary and Barbat (1979) found that period of calving had significant effect on lactation yield in Holstein-Friesian x Hariana crossbreds in the semi-arid region of Rajastan.

Sosamma (1982) observed significant influence of year of calving on first lactation yield in Brown Swiss crossbreds.

c) Season of calving

Nair (1975) analysed the records of 114 calvings of 66 Red Sindhi cows and 49 calvings of 27 Jersey x Red Sindhi $F_1$ generation cows. The study showed the highest

lactation yield in rainy season calvers followed by summer and winter seasons calvers. But the analysis of variance revealed that the season of calving had no significant influence on lactation yield.

Raheja and Balaine (1976) analysed the data available at the All India Co-ordinate Research Project on Cattle and Haryana State farms and reported that the season did not significantly influence the milk yield in Brown Swiss and Jersey crossbreds with Hariana. Bhatnagar *et al.* (1979) stated that the season of calving significantly affected the lactation milk yield in the Brown Swiss crossbreds at the State Livestock Farm, Kalyani (West Bengal) and reported that the season of calving significantly affected the part and total lactation yield.

Sosamma (1982) analysed the data of Brown Swiss crossbreds and observed a significant influence of season of calving on lactation milk yield.

d) Location

The agro-climatic and the managemental variations are reflected in the production levels of Jersey, Brown Swiss and Holstein Friesian half-breds at the All India Co-ordinate Research Project centres on cattle (Katpatal, 1977b). Significant effect of farms on production was

noticed in the 1721 Friesian, 129 Jersey and 1794 Brown Swiss crossbreds reared at different farms, by Rao and Nagarcenkar (1979).

The majority of the reports indicate that the factors such as year, season and location have significant influence on lactation milk yield, whereas the effect of age at first calving is not significant.

2. Age at first calving

One of the most highly desirable economic traits in dairy cattle is low age at first calving. An early age at first calving increases the life-time production, reduces the generation interval and would be helpful for enhancing genetic gain rapidly through selection. Age at first calving of the non-descript cows and their crosses with Jersey and Brown Swiss breeds are given in table 2.

Factors affecting age at first calving

Good feeding and management may bring down the age at first calving (Mahadevan, 1953). On analysing the data of Brown Swiss crossbreds with varying levels of exotic inheritance at National Dairy Research Institute, Karnal, Bhatnagar et al. (1979) observed significant effects of genetic groups, months and year of calving on age at first calving. Chawla and Mishra (1982) noticed

Table 2. Mean ages at first calving of non-descript cows and its crosses with Brown Swiss and Jersey breeds.

a) Non-descript cows

| Investigator | Quantity of data | Average age at first calving Months/days | Location |
|---|---|---|---|
| Rajkumar (1969) | 15 | 1486 | Cattle Breeding Farm, Dehra Dun. |
| Nair (1973) | 32 | 39.5 ± 6.4 | Indo-Swiss Project, Kerala. |
| Patel et al. (1976) | - | 49.7-58.1 | Local farmers of Kerala. |
| Bhat and Mukundan (1979) | - | 38.5-58.7 | Kerala. |

Table 2. Contd.....

b) Brown Swiss x Non-descript crossbreds

| Investigator | Genetic Group | Quantity of data | Average age at first calving Months/days | Location |
|---|---|---|---|---|
| Nair (1973) | Brown Swiss half-breds | 22 | 34.5±5.1 | Indo-Swiss Project, Kerala. |
| Patel et al.(1976) | Brown Swiss crossbreds | - | 31.8 | Local farmers of Kerala in plains. |
| -do- | -do- | - | 33.5 | ,, in high ranges. |
| Girija (1980) | Brown Swiss crossbreds | 64 | 43.2±2.06 | Farms under Kerala Agricultural University. |
| Sosamma (1982) | Brown Swiss half-breds | 213 | 44.2 | Local farmers at Mavelikkara, Kerala. |

Table 2. Contd.....

c) Jersey x Non-descript crossbreds

| Investigator | Genetic Group | Quantity of data | Average age at first calving Months/days | Location |
|---|---|---|---|---|
| Rajkumar (1969) | Jersey $F_1$ | 31 | 1206.2 | Cattle Breeding Farm, Dehra Dun. |
| -do- | 50% Jersey $F_2$ | 9 | 1152.5 | -do- |
| Nair (1973) | Jersey $F_1$ | 28 | 1535.1±56.22 | District Livestock Farm, Kodappanakunnu. |
| Girija (1990) | Jersey crossbreds | 281 | 40.2±0.95 | Farms under Kerala Agricultural University. |

significant effect of season, period and location on age at first calving in Sahiwal cattle and reported that heifers calved in March-May months had significantly lower age at first calving. Significant influence of genetic group and year of calving on age at first calving was observed by Sosamma (1982).

The very few reports available indicate that genetic group and period influence the age at first calving.

3. First lactation length

Nair (1973) reported 167 days as the average first lactation length of the 108 non-descript cattle which formed the foundation stock of the Indo-Swiss Project, Kerala.

Nair (1973) estimated the average first lactation length of 27 $F_1$ Jersey x Non-descript cows at District Livestock Farm, Kodappanakunnu, Kerala as 321.32 ± 14.34 days. On analysing the data of crossbreds of the Indo-Swiss Project, Madupetty, Nair (1975) found the average first lactation length of 98 Brown Swiss half-breds as 293 days and in seven Brown Swiss crossbreds (75 per cent) as 305 days. The aforesaid works give an indication that the crossbreds are having a longer lactation length than that of non-descript, native cattle.

# Materials and Methods

## MATERIALS AND METHODS

Data on cows reared by the farmers of Indo-Swiss Project area of Kattappana (Idikki District) and Intensive Cattle Development Project areas of Kanjirapally (Kottayam District), Chalakudy (Trichur District) and Mavelikkara (Alleppey District) under the milk recording-cum-progeny testing programme of the Kerala Livestock Development and Milk Marketing Board formed the material for the study. Kattappana and Mavelikkara are the Brown Swiss crossbreeding areas and Chalakudy and Kanjirapally are the Jersey crossbreeding areas. Data included observations spread over a period of four years from 1978 to 1981. Milk recording is done both in the morning and evening at monthly intervals starting from the 20th day of calving to a period not beyond 305 days. These recordings are used to estimate 305 days lactation milk yield.

The main items of observations were 1) first lactation milk yield in 305 days 2) age at first calving and 3) first lactation length.

The classification of data for the study was as follows:

i) Genetic Group

The cows under study were classified into four groups 1) Brown Swiss half-breds 2) Unclassified Brown Swiss crosses 3) Jersey half-breds and 4) Unclassified Jersey crosses. The term unclassified refers to the animals with above 50 per cent exotic inheritance and also those having exotic inheritance, the percentage of which is not known as to whether it is 50 per cent or above and the half-breds include the animals having 50 per cent of the exotic inheritance.

ii) Age group

The age at first calving ranged from 23.0 to 93.6 months. The animals were grouped into four classes 1) below 36 months 2) between 36 months and 47.9 months 3) between 48 and 59.9 months and 4) 60 months and above.

iii) Year of calving

1978, 1979, 1980 and 1981 were the four years to which the data belonged.

iv) Season of calving

Two seasons of freshening were delineated based on the data of rainfall given in the Farm Guide by the Farm Information Bureau for the period from 1901 to 1950 as

1) Dry season : rainfall below 200mm/month. This includes the months from November to April.

2) Rainy season : rainfall above 200mm/month and includes the months from May to October.

v) Sex of the calf

The effect of both sexes were considered for the study. The mean, standard error and coefficient of variation of the traits were estimated by the methods given by Snedecor and Cochran (1967). To examine the effects of various genetic and non-genetic factors, the data were subjected to least squares analysis of variance for non-orthogonal data using the technique described by Harvey (1966).

The following models were used

1. First laction milk yield in 305 days

$$Y_{ijklmn} = \mu + G_i + A_j + P_k + S_l + S_m + e_{ijklmn}$$

where

$Y_{ijklmn}$ = The observations on the $n^{th}$ individual with $m^{th}$ sex of calf calved in $l^{th}$ season of the $k^{th}$ year belonging to the $j^{th}$ age group of the $i^{th}$ genetic group.

$\mu$ - overall mean when equal sub class members exist

$G_i$ - effect of the $i^{th}$ genetic group

$A_j$ - effect of the $j^{th}$ age group

$P_k$ - effect of the $k^{th}$ year

$S_l$ - effect of the $l^{th}$ season

$C_m$ - effect of the $m^{th}$ sex of the calf

eijklmn - random error associated with Yijklmn which is assumed to be normally and independently distributed with zero mean and variance. $\sigma^2 e$.

2. Age at first calving

$$Y_{ijk} = \mu + G_i + P_j + e_{ijk}$$

where

$Y_{ijk}$ = observation of the $k^{th}$ individual in the $j^{th}$ year of the $i^{th}$ genetic group

$\mu$ - overall mean when equal sub-class members exist

$G_i$ - effect of the $i^{th}$ genetic group

$P_j$ - effect of the $j^{th}$ year

$e_{ijk}$ - random error associated with $Y_{ijk}$ which is assumed to be normally and independently distributed with zero mean and variance $\sigma^2 e$.

Least squares analysis were done with these models on pooled data and on Brown Swiss half-breds, the group which had a sizeable number. For the Jersey crosses, separate analyses could not be carried out due to want of sufficient corresponding information on aspects like age at first calving.

The pair wise mean comparisons were done by Duncan's multiple range test (DMRT) as modified by Kramer (1957).

All the statistical analysis of the data were carried out using BURROUGHS 4700 computer with 300 K core storage, punched cards as input medium and line printer as an output medium located at the Indian Agricultural Statistics Research Institute (IASRI), New Delhi.

# RESULTS

The present study was undertaken to compare the first lactation milk yield in 305 days, age at first calving and first lactation length of different cross-bred groups of cattle in Kerala and to study various genetic and non-genetic factors affecting these traits.

## 1. First lactation milk yield in 305 days

The uncorrected mean, standard error and coefficient of variation of first lactation milk yields in 305 days of different genetic groups in Kerala are presented in table 3. The uncorrected mean values were found to be 1508.8 ± 14.3 kg in Brown Swiss half-breds, 1562.6 ± 28.7 kg in unclassified Brown Swiss crosses, 1580.3 ± 47.0 in Jersey half-breds and 1559.0 ± 31.5 in unclassified Jersey crosses. Location wise study showed that the uncorrected average first lactation yield of Brown Swiss crosses at Mavelikkara and Kattappana were 1583.4 ± 15.1 kg, 1318.0 ± 20.3 kg respectively and for Jersey crosses at Kanjirappally and Chalakudy were 1360.2 ± 27.0 kg and 1929.3 ± 49.2 kg respectively (Table 4).

The results of least squares analysis of variance for pooled data are presented in table 5. It was seen that the effect of genetic groups was highly significant

Table 3. Means, standard errors and coefficient of variations of first lactation milk yield in 305 days (kg) in different groups of crossbred cattle in Kerala

| Genetic Group | No. of observations | Mean | Coefficient of variation |
|---|---|---|---|
| Brown Swiss half-bred | 1295 | 1508.9 ± 14.3 | 34.1 |
| Unclassified Brown Swiss crosses | 361 | 1562.6 ± 28.7 | 34.9 |
| Jersey half-breds | 96 | 1380.3 ± 47.0 | 33.4 |
| Unclassified Jersey crosses | 320 | 1558.0 ± 31.5 | 36.2 |

Table 4. Means, standard errors and coefficient of variations of first lactation milk yieldin 305 days (kg) of different crossbreds at different locations of Kerala

| Crossbred Group | Location | No. of observations | Mean | Coefficient of variation |
|---|---|---|---|---|
| Brown Swiss crossbreds | Mavelikkara | 1265 | 1583.4±15.1 | 34.0 |
| Brown Swiss crossbreds | Kattappana | 391 | 1318.0±20.3 | 30.6 |
| Jersey crossbreds | Kanjirapally | 302 | 1360.2±27.0 | 34.5 |
| Jersey crossbreds | Chalakudy | 114 | 1929.3±49.2 | 27.2 |

and the effects of age at first calving and year of calving were significant on first lactation milk yield. The season of calving had no influence whereas a highly significant effect of the sex of the calf was observed. As there was confounding of genetic groups and location, location effect could not be estimated.

The least squares means of the 305 days first lactation milk yield of different genetic groups along with Duncan's multiple range test are given in table 6. The means were 1482.0 ± 19.7 kg in Brown Swiss half-breds, 1544.7 ± 32.4 kg in unclassified Brown Swiss crosses, 1359.2 ± 57.4 kg in Jersey half-breds and 1559.8 ± 37.3 kg in unclassified Jersey crosses. The Duncan's multiple range test revealed that Jersey half-breds differed significantly from other three genetic groups. The production of unclassified Jersey crosses was observed to be significantly higher than Brown Swiss half-breds as well as Jersey half-breds. There was no difference in lactation yield between Brown Swiss half-breds and unclassified Brown Swiss crosses and between unclassified Brown Swiss crosses and unclassified Jersey crosses.

The least squares means for different age groups along with the Duncan's multiple range test are detailed in the table 6. The values obtained were 1434.2 ± 23.8 kg

Table 5. Least squares analysis of variance for first lactation milk yield in 305 days of crossbred cattle of Kerala

| Source | df | MSS |
|---|---|---|
| Genetic group | 3 | 1293378.6** |
| Age group | 3 | 974892.9* |
| Year of calving | 3 | 1013339.6* |
| Season of calving | 1 | 369723.9 |
| Sex of the calf | 1 | 2697008.3** |
| Error | 2060 | 272761.9 |

*P/_0.05 **P/_0.01

Table 6. Least squares means and standard errors of first lactation milk yield in 305 days (kg) of crossbred cattle of Kerala

| Factors | | (n) | Mean |
|---|---|---|---|
| Overall mean ($\mu$) | | (2072) | 1486.4 ± 24.5 |
| <u>Genetic Group</u> | | | |
| Brown Swiss half-breds | | (1295) | 1482.0 ± 19.7 a |
| Unclassified Brown Swiss crosses | | (361) | 1544.7 ± 32.4 b |
| Jersey half-breds | | (96) | 1359.2 ± 57.4 abc |
| Unclassified Jersey crosses | | (320) | 1559.8 ± 37.3 ac |
| <u>Age Group</u> | | | |
| Below 36 months | (Age group 1) | (625) | 1484.2 ± 23.8 |
| Between 36 and 47.9 months | (Age group 2) | (725) | 1539.5 ± 28.8 a |
| Between 48 and 59.9 months | (Age group 3) | (334) | 1508.9 ± 36.8 |
| 60 months and above | (Age group 4) | (188) | 1414.1 ± 45.3 a |

(Contd.....)

Table 6. Contd.....

| Factors | (n) | Mean |
|---|---|---|
| Year of calving | | |
| 1978 | (379) | 1549.5 ± 33.7 bc |
| 1979 | (759) | 1521.4 ± 24.8 d |
| 1980 | (839) | 1460.2 ± 25.6 bd |
| 1981 | (95) | 1414.7 ± 58.2 c |
| Season of calving | | |
| Dry season | (1062) | 1500.3 ± 26.1 |
| Rainy season | (1010) | 1472.6 ± 28.4 |
| Sex of the calf | | |
| Male calf | (907) | 1523.0 ± 27.5 a |
| Female calf | (1165) | 1449.9 ± 26.7 a |

The means with common superscripts are significantly different.

for age group 1, 1538.5 ± 28.8 kg for age group 2, 1509.9 ± 36.8 kg for age group 3 and 1414.1 ± 45.3 kg for age group 4. The Duncan's multiple range test showed that except the difference between the age group 2 and 4, no other difference was statistically significant.

The means obtained by the least squares analysis for different year of calvings were 1549.5 ± 33.7 kg in 1978, 1521.4 ± 24.8 kg in 1979, 1460.2 ± 25.6 kg in 1980 and 1414.7 ± 58.2 kg in 1981 (Table 6). The Duncan's multiple range test revealed that the means in 1978 differed significantly from those in 1980 and 1981. The difference between the means in 1979 and 1980 were also significant.

The least squares means of lactation milk yield in different seasons are presented in table 6. The means obtained were 1500.3 ± 26.1 kg in dry season and 1472.6 ± 28.4 kg in rainy season. The difference between the two means was not statistically significant.

The least squares means of lactation yield of dams with male calves and dams with female calves are shown in table 6. The mean yields obtained were 1523.0 ± 27.5 kg and 1449.9 ± 26.7 kg, respectively. The difference between the two means was statistically significant.

The least squares analysis of variance for first lactation milk yield in 305 days of Brown Swiss half-breds

is detailed in table 7. It showed that the effect of age at first calving was significant whereas the effects of year of calving and the sex of the calf were highly significant while season of calving had no significant influence on the trait.

The least squares means of Brown Swiss half-breds along with Duncan's multiple range test are presented in table 8. The mean values were 1495.7 ± 32.9 kg in the cows with age at first calving below 36 months, 1492.2 ± 26.1 kg in the group between 36 months and 47.9 months, 1450.9 ± 34.0 kg in the group between 48 and 59.9 months and 1350.4 ± 42.5 kg in the group 60 months and above. The Duncan's multiple range test showed that cows of age group 60 months and above significantly differed from all other age groups and the rest three age groups were homogenous.

The least squares means in different years of calving were 1537.8 ± 30.7 kg in 1978, 1533.7 ± 24.2 kg in 1979, 1460.9 ± 24.9 kg in 1980 and 1256.8 ± 69.5 kg in 1981. The Duncan's multiple range test revealed that the effect of the year 1981 was significantly different from all other year groups, and mean in 1980 differed significantly from that of 1979.

The least squares means in the dry season was 1459.9 ± 24.6 kg and in the rainy season was 1434.8 ± 27.4 kg (Table 8).

Table 7. Least squares analysis of variance for first lactation milk yield in 305 days of Brown Swiss half-breds in Kerala

| Source | df | MSS |
|---|---|---|
| Age group | 3 | 968350.1* |
| Year of calving | 3 | 1572071.9** |
| Season of calving | 1 | 183669.4 |
| Sex of the calf | 1 | 2067773.7** |
| Error | 1284 | 258360.8 |

*P/0.05 **P/0.01

Table 8. Least squares means and standard errors of first lactation milk yield in 305 days (kg) of Brown Swiss half-breds in Kerala

| Factors | | n | Mean |
|---|---|---|---|
| Overall mean (M) | | (1295) | 1447.3 ± 21.4 |
| Age Group | | | |
| Below 36 months | (Age group 1) | (284) | 1495.7 ± 32.9 a |
| Between 36 and 47.9 months | (Age group 2) | (556) | 1492.2 ± 26.1 b |
| Between 48 and 59.9 months | (Age group 3) | (286) | 1450.9 ± 34.0 c |
| 60 months and above | (Age group 4) | (167) | 1350.4 ± 42.5 abc |
| Year of calving | | | |
| 1978 | | (302) | 1537.8 ± 30.7 a |
| 1979 | | (468) | 1533.7 ± 24.2 b |
| 1980 | | (466) | 1460.9 ± 24.9 bc |
| 1981 | | (57) | 1256.8 ± 69.5 abc |
| Season of calving | | | |
| Dry season | | (630) | 1459.8 ± 24.6 |
| Rainy season | | (663) | 1434.8 ± 27.4 |
| Sex of the calf | | | |
| Male | | (557) | 1488.1 ± 26.7 a |
| Female | | (736) | 1406.5 ± 25.0 a |

The means with common superscripts are statistically significantly different.

It was observed that 1488.1 ± 26.7 kg and 1406.5 ± 25.0 kg were the least squares means of the dams with male calves and dams with female calves, respectively, which were significantly different.

2. Age at first calving

The uncorrected means, standard errors and coefficient of variations of ages at first calving of different genetic groups are presented in table 9. It was observed that the mean age at first calving in Brown Swiss half-breds was 46.4 ± 0.4 months, 38.4 ± 0.6 months in unclassified Brown Swiss crosses, 41.7 ± 1.4 months in Jersey half-breds and 39.5 ± 1.2 months in unclassified Jersey crosses.

Least squares analysis of variance for age at first calving in different genetic groups are presented in table 10. It showed that the influence of genetic groups was highly significant and the year of calving was significant.

The least squares means for Brown Swiss half-breds was 46.0 ± 0.5 months, 38.0 ± 0.8 months for unclassified Brown Swiss crosses, 41.1 ± 2.1 months for Jersey half-breds and 38.9 ± 1.5 months for unclassified Jersey crosses (Table 11). The Duncan's multiple range test revealed that the Brown Swiss half-breds had significantly higher age at first calving and all the other genetic groups were homogenous. The pooled mean of age at first calving for

Table 9. Means, standard errors and coefficient of variations of ages at first calving (months) in different genetic groups of cattle in Kerala

| Genetic Group | No. of observations | Mean | Coefficient of variation |
|---|---|---|---|
| Brown Swiss half-breds | 1259 | 46.4 ± 0.4 | 27.9 |
| Unclassified Brown Swiss crosses | 312 | 38.4 ± 0.6 | 25.8 |
| Jersey half-breds | 35 | 41.7 ± 1.4 | 20.1 |
| Unclassified Jersey crosses | 76 | 39.5 ± 1.2 | 25.5 |

Table 10. Least squares analysis of variance for age at first calving in crossbred cattle in Kerala

| Source | df | MSS |
|---|---|---|
| Genetic group | 3 | 6081.5** |
| Year of calving | 3 | 420.6* |
| Error | 1674 | 149.7 |

* P/0.05 , ** P/0.01

Table 11. Least squares means and standard errors of ages at first calving (months) in crossbred cattle in Kerala

| Factors | No. of observations | Mean |
|---|---|---|
| Overall mean ($\mu$) | 1681 | 41.0 ± 0.7 |
| Genetic Group | | |
| Brown Swiss half-breds | 1258 | 46.0 ± 0.5 abc |
| Unclassified Brown Swiss crosses | 312 | 38.0 ± 0.8 a |
| Jersey half-breds | 35 | 41.1 ± 2.1 b |
| Unclassified Jersey crosses | 76 | 38.9 ± 1.5 c |
| Year of calving | | |
| 1978 | 353 | 40.9 ± 0.9 |
| 1979 | 626 | 42.5 ± 0.6 a |
| 1980 | 637 | 40.8 ± 0.8 a |
| 1981 | 65 | 39.6 ± 1.6 |

The means with the common superscripts are statistically different.

different years were 40.9 ± 0.9 months for 1978, 42.5 ± 0.6 months for 1979, 40.8 ± 0.8 months for 1980 and 39.6 ± 1.6 months for 1981. The Duncan's multiple range test showed significant difference only between 1979 and 1980.

The least squares analysis of variance presented in table 12 showed that the year of calving did not significantly influence the age at first calving of Brown Swiss half-breds.

The least squares means of age at first calving of Brown Swiss half-breds in different years are shown in table 13. The values for year of calving were 46.6 ± 0.8 months for 1978, 47.6 ± 0.6 months for 1979, 45.5 ± 0.6 months for 1980 and 44.0 ± 2.0 months for 1981.

3. First lactation length

The uncorrected mean lactation lengths obtained were 300.5 ± 0.5 days, 299.6 ± 1.0 days, 295.6 ± 2.4 days and 295.3 ± 1.7 days in Brown Swiss half-breds, unclassified Brown Swiss crosses, Jersey half-breds and unclassified Jersey half-breds, respectively.

Table 12. Least squares analysis of variance for age at first calving in Brown Swiss half-breds of Kerala

| Source | df | MSS |
|---|---|---|
| Year of calving | 3 | 432.4 |
| Error | 1253 | 168.1 |

* P/0.05 , ** P/0.01

Table 13. Least squares means and standard errors of ages at first calving (months) of Brown Swiss half-breds in Kerala

| Factors | n | Mean |
|---|---|---|
| Overall mean (M) | 1257 | 45.9 ± 0.6 |
| Year of calving | | |
| 1978 | 290 | 46.6 ± 0.8 |
| 1979 | 465 | 47.6 ± 0.6 |
| 1980 | 456 | 45.5 ± 0.6 |
| 1981 | 46 | 44.0 ± 2.0 |

The means with common superscripts are ~~statistically~~ significantly different.

# Discussion

# DISCUSSION

## 1. First lactation milk yield in 305 days

The uncorrected mean value of first lactation yield in 305 days was found to be highest in unclassified Brown Swiss crosses (1562.6 ± 28.7 kg) followed by unclassified Jersey crosses (1559.0 ± 31.5 kg), Brown Swiss half-breds (1508.8 ± 14.3 kg) and Jersey half-breds (1380.3 ± 47.0 kg). The mean lactation milk yield of Brown Swiss half-breds, estimated in the present study is found to be lower than that (1958.0 ± 534.0 kg) reported by Nair (1973) for the Brown Swiss half-breds in the farm under Indo-Swiss Project, Madupetty. The higher production in the farm-bred animals may be due to the better management available in the project farm. Nair and Kelath (1977) reported an uncorrected average yield of 1611.40 ± 12.79 kg in the Brown Swiss half-breds maintained by the local farmers around Mavelikkara. The higher value obtained at Mavelikkara by these workers may be due to the non-inclusion of cows of shorter lactation length. The least squares mean for first lactation yield reported by Sosamma (1982) is also higher than the present mean. The higher value (1698.0 kg) may be due to the period differences or the limitation in the number of observations. Moreover, the data were only from Mavelikkara.

The first lactation yield (in 305 days) in Jersey half-breds and unclassified Jersey crosses were 1390.3 ± 47.0 kg and 1558.0 ± 31.5 kg, respectively. The observation made in the present study is in agreement with the report (1373.0 kg) made by Rajkumar (1969) for the average lactation yield in $F_1$ Jersey crossbreds at Cattle Breeding-cum-Dairy Farm, Dehra Dun and that (1411.0 kg) reported by Katpatal (1977 a) for the Jersey half-breds in the hilly and heavy rainfall areas of Kerala.

The means obtained by least squares analysis showed highest yield in unclassified Jersey crosses (1559.8 ± 37.3 kg) followed by unclassified Brown Swiss crosses (1544.7 ± 32.4 kg), Brown Swiss half-breds (1492.0 ± 19.7 kg) and Jersey half-breds (1359.2 ± 57.4 kg). The least squares analysis of variance revealed that the genetic groups were significantly different. The yield of Jersey half-breds was significantly lower compared to the other groups. The difference between the unclassified Brown Swiss and Jersey crosses was not statistically significant. The lactation milk yield of Brown Swiss half-breds was significantly higher than that of Jersey half-breds but significantly lower than that of unclassified Jersey crosses. The difference between the Brown Swiss half-breds and unclassified Brown Swiss crosses was not

significant, whereas the difference between the Jersey half-breds and unclassified Jersey crosses was significant.

A significantly higher milk yield of the unclassified group of Jersey crosses over the Jersey half-breds could not be thought to be due to the higher percentage of exotic inheritance as the unclassified group had animals with 50 per cent exotic inheritance also. Moreover, the same explanation would not hold good for the Brown Swiss groups as the difference between the two groups of Brown Swiss is not significant. The present study indicates a superiority of unclassified Brown Swiss and Jersey crosses as well as Brown Swiss half-breds over Jersey half-breds. But the low number of Jersey half-breds (96) does not permit a conclusive statement. The unclassified Jersey crosses have significantly higher lactation milk yield compared to the Brown Swiss half-breds and the difference between the unclassified animals of both Brown Swiss and Jersey was not significant. So a higher exotic inheritance or a difference between exotic breeds cannot be assumed to be the reason for difference in milk yields. Hence a further study based on a sizeable number of Jersey, half-breds is felt necessary.

Factors affecting lactation milk yield

To examine the effect of various factors affecting

lactation milk yield, least squares analyses were carried out on pooled data and also on Brown Swiss half-breds.

a) Age at first calving

A significant influence of age at first calving on milk yield was noted on pooled data analysis. It was observed that the highest mean occured in the age group 2 (1538.5 ± 28.8 kg) followed by the age group 3 (1508.9 ± 36.8 kg), age group 1 (1484.2 ± 23.8 kg) and by age group 4 (1414.1 ± 45.3 kg). Duncan's multiple range test revealed a significant difference between age groups 2 and 4, whereas the other differences were not significant.

A separate analysis on Brown Swiss half-breds also, indicated a significant influence of age at first calving on milk yield. The age group 1 produced highest (1495.7 ± 32.9 kg) yield followed by group 2 (1492.2 ± 26.1 kg), group 3 (1450.9 ± 34.0 kg) and group 4 (1350.4 ± 42.5 kg). Pair-wise comparisons of means showed that the differences among the groups 1, 2 and 3 were not statistically significant whereas the age group 4 differed significantly from all other age groups.

The results of the present study is in agreement with the work of Sbriram *et al.* (1979) in Friesian Sahiwal crosses in Military farms and that of Sosamma (1982) in

Brown Swiss half-breds. However, Bhasin and Desai (1967), Kushwaha and Mishra (1969) and Bhasu and Ghai (1977) has found no influence of age at first calving on milk yield in Hariana cows at State Cattle Breeding Farm, Bassi, Jaipur, in Sahiwals at Government Farm, Kanpur and in Holstein x Sahiwal in the Military Dairy Farm, Ambala, respectively. Probably this disagreement may be due to the differences in the breed.

It was noticed that in Brown Swiss half-breds there is a trend of decrease in the milk yield as the age at first calving advances. This trend can be assumed to be due to the fact that animals getting better management calve early and produce more milk. The poor management probably raises the age at first calving consequently lowering the production.

b) Year of calving

Least squares analysis of variance on pooled data showed a significant effect of year of calving on first lactation milk yield, whereas in Brown Swisshalf-breds the effect was highly significant. This finding is in agreement with that of Bhatnagar et al. (1979) in Brown Swiss x Sahiwal crossbreds of National Dairy Research Institute, Karnal, Chowdhary and Barhat (1979) in Holstein x Hariana crossbreds under semi-arid conditions of Rajastan

and Sosamma (1982) in Brown Swiss half-brede in Kerala around Mavelikkara.

Analysis of pooled data showed a decreasing tendency of milk yield year after year. The yield in 1978 was 1549.5 ± 33.7 kg, 1521.4 ± 24.8 kg in 1979, 1460.2 ± 25.6 in 1980 and 1414.7 ± 58.2 kg in 1981.

The milk yield of cows calved in 1980 had significantly lower milk yield than those calved in earlier years. The animals calved in 1981 were significantly different only from those calved in 1978 but not those in 1979. The other differences between years were not statistically significant.

Separate analysis on Brown Swiss half-brede also showed a decreasing tendency of milk yield with years of calving. The highest mean was noticed in 1978 (1557.8 ± 30.7 kg) followed by 1979 (1533.7 ± 24.2 kg), 1980 (1460.9 ± 24.9 kg) and 1981 (1256.8 ± 69.5 kg). The mean in 1980 was significantly lower compared to those in 1978 and 1979. The mean in 1981 was also significantly lower compared to all other means while means in 1978 and 1979 did not differ significantly.

One of the most important criterion for the level of production is the remuneration to the farmer from his

dairy animals. A fairly good return is an inspiring factor for better care and management to increase production. The decreasing trend in milk production with years is quite expected where the cost of production increase without commensurative increase in the price of milk.

c) Season of calving

Pooled data analysis of least squares showed that the mean lactation milk yield in dry and rainy seasons were 1500.3 ± 26.1 kg and 1472.6 ± 28.4 kg, respectively. However, season did not exert any significant influence on milk yield. Similar trend was observed in Brown Swiss half-breds also, with respective means of 1459.8 ± 24.6 kg and 1434.8 ± 27.4 kg. This is in conformity with the work of Nair (1975) in Jersey x Red Sindhi $F_1$ crossbreds at Kodappanakunnu farm, in Kerala, Raheja and Balaine (1976) in crossbreds of Brown Swiss and Jersey with Hariana at various centres of All India Co-ordinate Research Project on cattle. Nevertheless, Bhatnagar et al. (1979), Koley et al. (1981) and Sosamma (1982) found significant seasonal influence in the case of Brown Swiss half-breds at National Dairy Research Institute, Karnal and Jersey half-breds at Livestock Farm, Kalyani and Brown Swiss half-breds in Kerala, respectively.

The lack of influence of season of calving on milk yield in the present study can be attributed to systems of managements. The crossbreds cows in the State are reared in almost intensive systems. Most of the nutrient requirement is met by stallfeeding rather than grazing and throughout the year feeding is more or less the same. When greens are scarce, additional concentrates are given to compensate, probably resulting in a non-significant seasonal variation.

d) Sex of the calf

On analysis of pooled data, a highly significant influence of the sex of the calf on milk yield was noticed. Similar observation was noticed in Brown Swiss half-breds also. The mean lactation milk yields were 1523.0 ± 27.5 kg and 1449.9 ± 26.7 kg while analysing pooled data and for Brown Swiss half-breds 1488.1 ± 26.7 kg and 1406.5 ± 25.0 kg for cows with male and female calves respectively.

In the field, calves are not weaned at birth and they are used to stimulate letting down of milk. The finding that the dams with male calves gave higher milk yield can be attributed to the biased treatment of farmers towards male and female calves. Generally the

female calves are allowed to suck more milk and the male calves are neglected.

2. Age at first calving

Age at first calving is a character of great economic importance. Based on the uncorrected averages, the lowest age at first calving of 38.4 ± 0.6 months was noticed in unclassified Brown Swiss crosses followed by unclassified Jersey crosses (39.5 ± 1.2 months), Jersey half-breds (41.7 ± 1.4 months) and Brown Swiss half-breds (46.4 ± 0.4 months).

The least squares means also showed the same trend as the uncorrected averages. The mean age at first calving in unclassified Brown Swiss crosses was 38.0 ± 0.8 months, 38.9 ± 1.5 months in unclassified Jersey crosses, 46.0 ± 0.5 months in Brown Swiss half-breds and 41.1 ± 2.1 months in Jersey half-breds. From the comparison of the Brown Swiss half-breds and Jersey half-breds, it was observed that the age at first calving was significantly higher in Brown Swiss half-breds than that in Jersey half-breds. It was noticed that the age at first calving of the Brown Swiss half-breds differed significantly from that of unclassified Brown Swiss crosses and Jersey half-breds did not differ significantly from unclassified Jersey crosses. No other genetic groups exhibited significant difference.

Nair (1973) reported the age at first calving in Brown Swiss half-breds of the Indo-Swiss Project, Madupetty, Kerala as 34.5 ± 5.1 months. This lower value may be due to the better managemental conditions existed in the Indo-Swiss Project. Good feeding and management will bring down the age at first calving (Mahadevan, 1953). The means obtained for Brown Swiss groups in the present study are higher than those (31.8 months in the plains and 33.5 months in the high ranges) reported by Patel et al. (1976) for the Brown Swiss crosses calved during the period from April 1973 to March 1974. Cross-breeding with Brown Swiss started in high ranges in 1967 and at Mavelikkara in 1969. Hence, in the investigation made by these workers only early calvers were included and the data did not include the information on many cows of the same age calving at a later stage. The present study related to a period from 1978 to 1991 includes late calvers also and can be considered to be one giving a more true picture of the field situation. Girija (1980) observed an age at first calving of 43.2 ± 2.06 months in Brown Swiss crossbreds without adjusting for environmental effect. The mean obtained for Brown Swiss half-breds is comparable to that (44.2 months) obtained by Sosamma (1982).

The age at first calving of the Jersey x Non-descript half-breds ($F_1$) in the Cattle Breeding-cum-Dairy Farm, Dehra Dun was reported by Rajkumar (1969) as 1206.2 days (40.2 months) which is comparable to the present value. He also found that the age at first calving in $F_2$ cows was 1152.5 days (38.4 months). Girija (1980) also noted an age at first calving of 40.2 ± 0.95 months in the Jersey crossbreds maintained at different farms of Kerala Agricultural University. This finding is comparable to those obtained for Jersey half-breds and unclassified Jersey crosses in the present study. The age at first calving of Jersey x Non-descript $F_1$ cows at Livestock Farm, Kodappanakunnu reported by Nair (1973) was 1535.1 ± 56.22 days (51.77 months) which is higher than the value obtained in this study, probably due to differences in management, they have received before procuring to the farm from the farmers around Neyyattinkara crossbreeding area.

To examine the effect of year of calving on age at first calving, least squares analysis of variance was done. In Brown Swiss half-breds a non-significant influence of year of calving on age at first calving was noticed though it was significant in pooled data analysis. This finding is not in agreement with Bhatnagar *et al.* (1979) who reported a significant effect of year of calving on age at

first calving in Brown Swiss crossbreds at National Dairy Research Institute, Karnal. Sosamma (1982) also reported a significant effect of year on age at first calving.

3. First lactation length

The mean lactation lengths obtained were 300.5 ± 0.5 days, 299.6 ± 1.0 days, 295.6 ± 2.4 days and 295.3 ± 1.7 days, for Brown Swiss half-breds, unclassified Brown Swiss crosses, Jersey half-breds and unclassified Jersey crosses, respectively. These findings show that all the crossbred groups have fairly good lactation length. This was comparable to that (293 days) reported by Nair (1973) in Brown Swiss half-breds at Indo-Swiss Project farm.

The raw data analysis resulted in unclassified Brown Swiss crosses ranking highest in milk yield followed by unclassified Jersey crosses, Brown Swiss half-breds and Jersey half-breds. Least squares analysis showed a change in the ranks. Unclassified Jersey crosses having the maximum milk yield and secondly the unclassified Brown Swiss crosses. The production of Jersey half-breds was significantly lower than that of Brown Swiss half-breds. But when the unclassified Jersey crosses and unclassified Brown Swiss crosses were homogenous, Jersey half-breds differed significantly from even the unclassified Jersey

crosses. The number of Jersey half-breds was very low - only 96 - and not comparable with other groups.

Ages at first calving in unclassified Brown Swiss crosses, unclassified Jersey crosses and Jersey half-breds did not differ significantly while that of Brown Swiss half-breds was found to be significantly higher from all other three classes. All the genetic groups had fairly good lactation length.

Lactation milk yield of 305 days and age at first calving are economically important to the farmer, and in this context these two characters are to be considered together. So at this stage, the superiority of either Jersey or Brown Swiss crosses cannot be established and accepted. The introduction of Jersey and Brown Swiss, both improved the milk production of the cattle of Kerala. While aiming at a further improvement, emphasis should be given to the merit of the sires rather than specificity of the exotic breed or the percentage of exotic inheritance.

# Summary

# SUMMARY

Data on cows reared by the farmers of Indo-Swiss Project area of Kattappana (Idikki District) and Intensive Cattle Development Project area of Kanjirappally (Kottayam District), Chalakudy (Trichur District) and Mavelikkara (Alleppey District) under the milk recording-cum-progeny testing programme of the Kerala Livestock Development and Milk Marketing Board were made use of in the present study. Data included observations spread over a period of four years from 1978 to 1981. The main items of observations were 1) first lactation milk yield in 305 days 2) age at first calving and 3) lactation length.

1. First lactation milk yield in 305 days

The uncorrected mean first lactation yields were 1508.8 ± 14.3 kg in Brown Swiss half-breds, 1562.6 ± 28.7 kg in unclassified Brown Swiss crosses, 1380.3 ± 47.0 kg in Jersey half-breds and 1553.0 ± 31.5 kg in unclassified Jersey crosses.

The least squares analysis showed that the differences among genetic groups to be highly significant. The least squares means of the trait in different genetic groups of Brown Swiss half-breds, unclassified Brown Swiss crosses,

Jersey half-breds and unclassified Jersey crosses were 1492.0 ± 19.7 kg, 1544.7 ± 32.4 kg, 1359.2 ± 57.4 kg and 1559.8 ± 37.3 kg respectively. The Duncan's multiple range test showed that the Jersey half-breds had significantly lower production compared to all other genetic groups. The production of unclassified Jersey crosses had been significantly higher than the Brown Swiss half-breds as well as Jersey half-breds.

Pooled data analysis revealed that the age at first calving significantly affected the first lactation milk yield. The mean values were 1484.2 ± 23.9 kg, 1533.5 ± 28.8 kg, 1508.9 ± 36.8 kg and 1414.1 ± 45.3 kg respectively for age group 1 (Below 36 months), 2 (between 36 and 47.9 months), 3 (between 48 and 59.9 months) and 4 (60 months and above). It was also observed that all the age group means were homogenous except for the significant difference in the means of age group 2 and 4. The analysis on Brown Swiss half-breds showed that the influence of age at first calving was highly significant. The means obtained were 1495.7 ± 32.9 kg for age group 1 (below 36 months), 1492.2 ± 26.1 kg for age group 2 (between 36 and 47.9 months), 1450.9 ± 34.0 kg for age group 3 (between 48 and 59.9 months) and 1350.4 ± 42.5 kg for age group 4 (60 months and above). First three groups were homogenous. Age group 4 differed significantly from all the other three.

Analysis on pooled data showed that year of calving had significant effect on lactation milk yield. Separate analysis showed that in Brown Swiss half-breds the effect of year of calving was highly significant.

The influence of season of calving was not significant on both pooled data and Brown Swiss half-breds data analyses. Sex of the calf was found to be exerting a significant influence in both the analyses.

2. Age at first calving

The uncorrected average ages at first calving were 46.4 ± 0.4 months, 38.4 ± 0.6 months, 41.7 ± 1.4 months and 39.5 ± 1.2 months, respectively in Brown Swiss half-breds, unclassified Brown Swiss crosses, Jersey half-breds and unclassified Jersey crosses.

The least squares means of age at first calving in Brown Swiss half-breds, unclassified Brown Swiss crosses, Jersey half-breds and unclassified Jersey crosses were 46.0 ± 0.5 months, 38.0 ± 0.8 months, 41.1 ± 2.1 months and 38.9 ± 1.5 months, respectively. Brown Swiss half-breds had significantly higher age at first calving over the other three groups which were homogenous.

Pooled data analysis showed a significant effect of year of calving on age at first calving, but such a

significant effect was not observed in Brown Swiss half-breds.

3. First lactation length

The uncorrected average lactation lengths in Brown Swiss half-breds, unclassified Brown Swiss crosses, Jersey half-breds and unclassified Jersey crosses were 300.5 ± 0.5 days, 299.6 ± 1.0 days, 295.6 ± 2.4 days and 295.3 ± 1.7 days, respectively.

The raw data analysis resulted in unclassified Brown Swiss crosses ranking highest in milk yield followed by unclassified Jersey crosses, Brown Swiss half-breds and Jersey half-breds. Least squares analysis showed a change in the ranks. Unclassified Jersey crosses having the maximum milk yield and secondly the unclassified Brown Swiss crosses. The production of Jersey half-breds was significantly lower than that of Brown Swiss half-breds. But when the unclassified Jersey crosses and unclassified Brown Swiss crosses were homogenous, Jersey half-breds differed significantly from even the unclassified Jersey crosses. The number of Jersey half-breds was very low - only 96 - and not comparable with other groups.

Age at first calving in unclassified Brown Swiss crosses, unclassified Jersey crosses and Jersey half-breds

did not differ significantly while that of Brown Swiss half-breds was found to be significantly higher from all other three classes. All the genetic groups had fairly good lactation length.

Lactation milk yield in 305 days and age at first calving are economically important to the farmer, and in this context these two characters are to be considered together. So at this stage, the superiority of either Jersey or Brown Swiss crosses cannot be established and accepted. The introduction of Jersey and Brown Swiss both improved the milk production of the cattle of Kerala. While aiming at a further improvement, emphasis should be given to the merit of the sires rather than the specificity of the exotic breed or the percentage of exotic inheritance.

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## ABSTRACT

An investigation was undertaken to evaluate the lactation performance of the crossbred cattle (Zebu x Taurus) and to compare the performance of Brown Swiss and Jersey crosses under field conditions so that a breeding policy could be recommended. First lactation milk yield in 305 days, age at first calving and first lactation length were the characters studied. For this, data on the Brown Swiss crossbred maintained by the farmers at Mavelikkara and Kattappana and on Jersey crossbreds at Kanjirappally and Chalakudy under the milk recording-cum-progeny testing scheme of the Kerala Livestock Development and Milk Marketing Board were utilized. The observations spread over a period of four years from 1978 to 1991.

The uncorrected average first lactation yields were 1509.8 ± 14.3 kg in Brown Swiss half-breds, 1562.6 ± 28.7 kg in unclassified Brown Swiss crosses, 1380.3 ± 47.0 kg in Jersey half-breds and 1558.0 ± 31.5 kg in unclassified Jersey crosses.

The least squares means of first lactation yields in Brown Swiss half-breds, unclassified Brown Swiss crosses, Jersey half-breds and unclassified Jersey crosses

kg and 1999.5 ± 91.5 kg respectively. The Duncan's multiple range test showed that the Jersey half-breds had significantly lower production compared to all other genetic groups. The production of unclassified Jersey crosses had been significantly higher than the Brown Swiss half-breds as well as Jersey half-breds.

Least squares analysis on pooled data and Brown Swiss half-breds showed the significant influence of age at first calving, year of calving and sex of the calf on first lactation milk yield. But, season of calving did not significantly influence the milk yield.

The uncorrected average age at first calving in Brown Swiss half-breds, unclassified Brown Swiss crosses, Jersey half-breds and unclassified Jersey crosses were 46.0 ± 0.4 months, 38.4 ± 0.6 months, 41.7 ± 1.4 months and 39.5 ± 1.2 months respectively. The least squares means of age at first calving in Brown Swiss half-breds, unclassified Brown Swiss crosses, Jersey half-breds and unclassified Jersey crosses were 46.0 ± 0.5, 38.0 ± 0.3, 41.1 ± 2.1 and 38.9 ± 1.5 months respectively. Brown Swiss half-breds had significantly higher age at first calving compared to the other three groups which were homogenous.

The effect of year on age at first calving was not significant in Brown Swiss half-breds while pooled data analysis showed a significant effect of year on age at first calving.

The uncorrected average lactation lengths in Brown Swiss half-breds, unclassified Brown Swiss crosses, Jersey half-breds and unclassified Jersey crosses were 300.5 ± 0.5 days, 299.6 ± 1.0 days, 295.6 ± 2.4 days and 295.3 ± 1.7 days, respectively. This shows that all the crossbreds had fairly good lactation length.

Lactation milk yield and age at first calving are economically important to the farmer and in this context these two characters are to be considered together. The results obtained do not indicate the superiority of either Brown Swiss or Jersey crossbreds, over the other. The introduction of both Brown Swiss and Jersey improved the milk production of the cattle of Kerala. While aiming at a further improvement, emphasis should be given to the merit of the sires rather than the specificity of the exotic breed or the percentage of exotic inheritance.