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EFFECT OF SEASON OF CALVING ON SOME ECONOMIC TRAITS OF CROSSBRED DAIRY COWS

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ABSTRACT

The effects of season of calving on economic traits of crossbred dairy cattle produced under various projects sponsored by the Pakistan Agricultural Research Council were studied during the years 1974 to 1980. These animals were stationed at the Livestock Production Research Institute, Bahadurnagar (LPRI), Livestock Experiment Station, Karachi (LES) and the University of Agriculture, Faisalabad (UAF) Local Sahiwal (SWL) cattle were crossed with two European breeds, Holstein Friesian (HF) and Jersey (J) at LPRI and UAF. At LES, the native Red Sindhi (RS) was crossed with the HF and J breeds. At LES and UAF, the crossbred progeny, thus produced comprised of halfbreds only, while at LPRI 3/4 HF and 3/4 J groups were also available for this study. A highly significant influence of season of calving on milk production was observed among the LPRI groups, whereas this effect was non-significant at LES and UAF. The sire-breed by season interaction was non-significant at all stations for milk production. However, for days dry the season and sire-breed by season were significant in LPRI and highly significant in UAF groups. These effects were significant for days open at LPRI and highly significant for calving interval at UAF and LPRI. Generally, the milk production was the highest in the spring calvers and lowest for the summer calvers. Also, the animals calving in winter produced more than those calved either in summer or fall season.

INTRODUTION

Previous studies on tropical cattle indicated that milk production varied significantly among the cows calving in different seasons of the year. The winter

calvers were considered superior in lactation performance (Dutt and Singh, 1961, Bhatnagar and Chaudhary, 1962; Sundaresan *et al.*, 1965 and Ahmad *et al.*, 1978). It is believed that high milk production requires a high metabolic rate and to a certain degree milk production and heat tolerance are, therefore, inversely correlated. The adverse effects of seasonal variation on the performance of cattle might be caused through climatic stress on animal body and indirectly by impairing the availability of suitable pastures. The latter situation could be modified through suitable breeding plans. It should, however, be realized that there is quite a variation in the adaptability of livestock for a given set of environmental conditions. The present work was carried out to study the effects of season of calving on the economic traits of crossbred dairy cows produced under major dairy cattle crossbreeding programmes sponsored by the Pakistan Agricultural Research Council.

MATERIAL AND METHODS

Source of data : The data were obtained from the following projects:

1. Breeding adapted strains of dairy cattle through crossing Sahiwal, Jersey and Holstein Friesian. This project was initiated at the University of Agriculture, Faisalabad (UAF) in July, 1973.

2. Study on the production performance and adaptability of crossbred cows under the subtropical environment of the Punjab. This project was implemented at the Livestock Production Research Institute (LPRI), Bahadurnagar, District Okara in November, 1974.

3. Studies on evolving well adapted synthetic strains of dairy cattle with superior production by crossing indigenous milch breeds with suitable improved exotic breeds. This project was implemented in Sind province at the Livestock Experiment Station (LES), Karachi.

Local Sahiwal (SWL) cattle were crossed with two European breeds, Holstein Friesian (HF) and Jersey (J) at the LPRI and UAF. At LES, native Red Sindhi (RS) cattle were crossed with the HF and J breeds. At LES and UAF, the crossbred progeny, thus produced, comprised of halfbreds only, while at LPRI, 3/4 HF and 3/4 J groups were also available for this study.

Statistical procedures : The following linear model or its appropriate derivations were used :

$$Y_{ijklmno} = u + SB_i + DB_j + Y_k + S_l + L_m + AL_{mn} + (SD)_{ij} + (SY)_{ik} + (SS)_{il} + (YS)_{kl} + b_1(DIM)_{ijklmno} + b_2(DIM)^2_{ijklmno} + e_{ijklmno}$$

where,

Y = character measured on the ijklmnoth individual ;

u = the population mean to all records ;

SB_i = the effect of the ith sire-breed ; $i = 1, \ldots, 3$;

DB_j = the effect of the jth dam-breed ; $j = 1, \ldots, 4$;

Y_k = the effect of the kth year group of calving ; $k = 1, \ldots, 6$.

S_l = the effect of the lth season of calving ; $l = 1, \ldots, 4$;

L_m = the effect of the mth parity ; $m = 1, \ldots, 5$;

AL_{mn} = the effect of the nth age of calving in mth parity; $n = 1, \ldots, 5$;

$(SD)_{ij}$ = the interaction between ith sire-breed and jth dam-breed.

$(SY)_{ik}$ = the interaction between ith sire-breed and kth year of calving ;

$(SS)_{il}$ = the interaction between ith sire-breed and lth season of calving;

$(YS)_{kl}$ = the interaction between lth season and kth year of calving;

(DIM) = days in milk (lactation length);

$(DIM)^2$ = quadratic effect of lactation length;

b_1 and b_2 = partial regression coefficients of the character; (Y_{ijklm}) on (DIM) and $(DIM)^2$, respectively;

$e_{ijklmno}$ = random error associated with the $Y_{ijklmnoth}$ observation.

The above model was developed after conducting a series of preliminary analyses to determine which fixed effects were unimportant and what covariates were suitable for these data. All effects were assumed to be fixed except the error term which was assumed to be normally distributed with a mean of zero and homogeneous variance. Interactions such as 3-way (or of higher order) were assumed to be non-existent.

Considering the overall climate of the plains (Sind and Punjab province) of Pakistan, the years were divided into the following four seasons :

a. SPRING - mid February through end of April,
b. SUMMER - beginning of May through mid September,
c. FALL - mid September through mid November, and
d. WINTER - mid November through mid February.

RESULTS AND DISCUSSION

The effects of season of calving on milk production and lactation length were studied in various genetic groups. The milk production for spring calvers was generally the highest and for summer calvers the lowest with only one exception i. e., the Sahiwals at LPRI, where the milk yield was almost equal for the two seasons. Also, the animals calving in winter generally produced more milk than those calved either in summer or fall. These results are in agreement with those reported by Chaudhary and Chaudhary (1977) and several other workers. The exceptions to this trend were the 1/2 HF - 1/2 SWL of LPRI and 1/2 HF - 1/2 RS of LES. The biological reasons for these trends in the amount of milk produced are evident. For example, a cow calving in spring or winter season has a better environment generally in her initial period of lactation because of relatively low environmental temperature and abundance of green fodder. There are also considerations such as hand milking; the effectiveness of milkmen in getting the animals completely milked during hot weather could have been affected to a certain extent. However, most managemental influences should cancel out over time because average values have been used in this study. The main causes of reduced milk production in summer and fall seasons were primarily attributed to the nutritional status of the animals and their ability to dissipate heat fast enough. Das and Balaine (1980) also reported higher milk yield and longer lactations for the cows calving in spring and winter seasons There was a high phenotypic correlation of the order of 0.51 - 0.98 between lactation length and milk production in different genetic groups. This justified the similarity of influence of freshening season on milk production and lactation length.

The influence of season was studied through analysis of variance technique. At LPRI, a highly significant influence of season of freshening on milk production was observed (Table 1). However, the seasonal effect at LES (Table 2) and UAF (Table 3) station was non-significant. Lalli (1979) also reported a non-significant influence of calving on milk yield and lactation length for Red Sindhi and its crosses with Jersey, using 62 and 97 lactation records, respectively. There could be two underlying causes for a non-significant seasonal influence as suggested by the analyses. In the case of LES groups, the station is situated at the coast and weather does not follow extremes of summer and winter season while for the UAF groups the records were not well distributed across the season.

Table 1. *Analysis of variance for lactation yield at LPRI*

Source	df	M.S.
Sire-breed	2	4424824.7460**
Dam-breed	2	46292.4330
Year	5	5267810.8540**
Season	3	4052920.7730**
Parity	4	353792.9823
Age (parity)	5	1767407.6640**
Sire-breed X dam-breed	2	12576804.8300**
Sire-breed X year	10	1520559.2123**
Sire-breed X season	6	222131.2725
Season X year	15	1714670.6410**
Days in milk	1	9107555.4053**
(Days in milk)^2	1	838863.7114
Error	653	282195.5007
Total	709	

**P < .01.

Table 2. *Analysis of variance for lactation yield at LES*

Source	df	M.S.
Sire-breed	2	1865301.6250**
Year	3	952996.7007**
Season	3	144341.5958
Parity	2	28516.7757
Age (parity)	3	26387.1056
Days in milk	1	14917518.7912**
Error	63	195188.1297
Total	77	

**P < .01.

Table 3. *Analysis of variance for lactation yield at UAF*

Source	df	M.S.
Sire-breed	2	1904388.7600*
Year	6	489342.5100
Season	3	99028.6214
Parity	4	773046.7390
Age (parity)	6	971859.2272
Sire-breed X year	7	807882.7949
Sire-breed X season	6	74788.0399
Days in milk	1	3864457.6337*
(Days in milk)^2	1	75973.8681
Error	56	700694.0648
Total	89	

*P < .05.

The sire-breed x season interactions were non-significant at all stations for milk production and days in milk. Ruvuna (1981) and Ruvuna *et al.* (1984) reported similar results in a crossbreeding experiment in India using three native breeds (Sahiwal, Red Sindhi and Tharparkar) and three crossbreds with Brown Swiss (F_1 crosses between Brown Swiss and three native breeds, inter se crosses and 3/4 Brown Swiss).

The effect of season of calving was studied on other traits of economic importance as well. For days dry, the season and sire-breed x season were significant in LPRI groups and highly significant in UAF groups but the seasonal influence on days dry, if any, was not important for LES groups. Buragohain and Sharma (1980) also reported a non-significant effect of season of calving on subsequent dry period in local Indian breeds and their crosses with Holstein Friesian. The effect of season of calving and sire-breed x season interaction was found significant for days open in LPRI groups only. The findings of Misra *et al.* (1980) support a non-significant effect of season on days open as seen in this study for LES and UAF groups.

The calving interval was significantly affected by season of calving in LPRI and UAF groups. Also, the sire-breed x season interaction was significant

at these stations. The length of gestation did not appear to be influenced by season of calving in LES and UAF groups. Chandramohan and Bhat (1981) observed in Sahiwal cattle that gestation length was significantly affected by farm, period of years and sex of calf but not by season of calving or weight ofd am at calving.

The observed variations in the lactation yields obtained in different seasons were attributed to nutrition, management and environmental conditions. Generally, the cows calving in spring season produced the maximum amount of milk, apparently, due to low environmental temperatures and availability of good quality fodder. The animals that calved in winter season were next in the order of merit. The summer calvers were considered the poorest due to severe hot climate and also due to the non-availability of good quality fodder. These results suggest that breeding may be synchronized in a way that most calvings should occur in late winter or early spring season. This may eliminate seasonal/nutritional stress in the crossbred cows.

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