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SOME FACTORS INFLUENCING MILK PRODUCTION TRAITS OF PURE AND CROSSBRED COWS IN THE TROPICS

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ABSTRACT

10 year record of 879 lactation yield of three breeds of cows comprising Brown Swiss (pure), White Fulani (indigenous) and Brown Swiss x N'Dama (crossbred) raised and maintained at the teaching and Research farm of the University of Ibadan was used to investigate effect of some factors on milk production traits. Breed exerted significant (P<0.01) effect on all the production traits. Lactation milk yield, milk yield per day and lactation length was significantly (P<0.05) affected by calving interval while the age at first calving had significant (P<0.05) effect on production years and lifetime yield indicating that where calving interval had significant effect, age at first calving had no significant effect and vice versal. The seasonal effect (P>0.05) had no influence on the production traits except on the lactation milk yield. Calving interval and age at first calving did not follow any trend of effect, however on the average 16-18 months calving interval, 23-32 month age at first calving was best for most of the production traits. The phenotypic and genetic correlation coefficients amongst the milk production traits revealed a high genetic association between the genes controlling these traits with exception of productive years.

Keyword: *Lactation, Production traits, Breed.*

INTRODUCTION

An important aspect of the overall efficiency in reproduction of dairy cattle has many component parts among which are breed, season, calving interval and age at first calving. Calving interval and age at first calving have been the predominant measure of reproduction in cows during its productive life. The usual measure of breeding efficiency in dairy cow is by stating the interval in days between consecutive calving. Breed is one major factor that showed significant differences in milk yield between breed groups with variable lactation length (Mbap and Ngere, 1991).

Mbap and Ngere (1991) reported a duration of 492 days calving interval for Brown Swiss. However, due to the prevailing weather condition in the tropics, low level of feeding, the existing breeds and the practice of running calves with their mothers after calving, age at first calving is prolong, cow does not come on heat on time

and the interval between calving increases., thereby having an overall negative effect on milk production performance (Gopalan *et al*., 1971). Milk production performance has been discovered to be an important trait in selection procedure for both dairy and beef cattle.

The objective of this research was to study the influence of breed, season, calving interval and age at first calving and their optimal level for better performance and productive years in the humid tropics.

MATERIALS AND METHODS

A 10-year period of 879 total lactation records of three breeds- Brown Swiss, White Fulani and Brown Swiss x N'Dama cows were utilized for the study. The research farm is situated 200m above sea level and lies $70^0 26^/N$ and $30^0 51^/E$ (Ozoje *et al*., 2001). The farm usually experience November-March seasonal period of dry condition. During raining season, according to records, cows were maintained on paddock planted with good pasture and supplement with concentrates and wet brewer's grain. After calving, cows were hand milked at 0500h and 1430h daily.

The data extracted from the lactation records excludes all abnormal lactations affected by abortion, stillbirth, death, transfer/sale, culling and sickness during lactation. The seasonal variations were grouped into four: April-June (early wet), July-September (late wet), October-December (early dry) and January-March (late dry). The calving interval was classified into 4 groups of 10 months interval while age at first calving has 5 groupings of 3 months interval. The grouping became necessary for easy handling of the data and the result in a way to create room for easy conclusion as it might be too ambiguous to discuss the variables one after the other. Milk production traits studied were lactation milk yield (LMY), lactation length (LL), milk yield per day (MYD), productive years (PY) and lifetime yield (LY).

The various factors considered as source of variation on milk production traits were examined to explained their influence using the following mathematical model:

$$Y_{ijklm} = U + B_i + S_j + C_k + A_l + e_{ijklm}$$

where:

Y_{ijklm} = Overall observation
U = Overall mean
B_i = effect of i^{th} breed (i=1,2,3)
S_j = effect of j^{th} seaso (j=1,2,3,4)
C_k = effect of k^{th} calving interval (k=1,2,3,4)
A_l = effect of l^{th} age at first calving (l=1,2,3,4,5)
eijklm = random error

Genetic and phenotypic correlations were estimated for all the milk production traits. SAS analytical package (1999) was used to analyse the data.

RESULTS AND DISCUSSION

From the analysis of variance as presented in Table 1, breed had a high significant ($P<0.01$) effect on all the traits while seasonal variation had significant effect on lactation milk yield alone. Calving internal had significant ($P<0.01$) influence on lactation milk yield, lactation length and milk yield per day while age at first calving had significant ($P<0.01$) influence on productive years and lifetime yield.

Lactation Milk Yield

The least square means value presented in Table 2 showed that lactation milk yield of Brown Swiss was higher (1713.98kg) when compared with White Fulani (986.42kg) and Brown Swiss x N'Dama (1287.61kg) due to variation in genetic factors across the breeds. Seasonal variation revealed that cows that lactate between July-September had the highest value of 881.31kg. Also there was an increase of 14.5kg in lactation milk yield as the season changes from early wet season to late season. On the contrary, Mbap and Ngere (1991) reported that lactation milk yield did not differ significantly between cows of different breeds calving in the wet and dry season. Calving interval of 16-18 months had higher value (1616.20kg) and differs significantly from others. Similarly, optimal performance based on calving interval of 492 days (16-17 months) was reported for Brown Swiss by Mbap an Ngere (1991).

Lactation Length

In Table 2, Brown Swiss had higher lactation length of 362.5 days while Brown Swiss x N'Dama had the lowest lactation length. Systrad (2000) opined that cattle from the tropics have on the average shorter lactation length than cattle from the temperate region. Calving interval of 16-18 months also recorded higher lactation length of 312.2 days. This longer lactation length recorded in this result might not be unconnected to the longer calving interval.

Milk Yield per Day

In Table 2, White Fulani had the lowest milk yield per day of 1.92kg while Brown Swiss x N'Dama was intermediately close to Brown Swiss value. A difference of 2.74kg existed between the highest and lowest milk yield per day. The superiority of the crossbred (3.91kg) over the indigenous (1.92kg) agreed with the findings of Chowdharry and Barhat (1979). The least square means for calving intervals were not different, however 16-18 months calving interval had the highest value of 5.03kg (Table 2). This showed that cows that are allowed to observe calving interval of 16-18 months would yield more on daily basis.

Productive Years

The productive years as shown in Table 2, could be used as a measure of production adaptability. The result revealed that White Fulani had the superior productive years (9.44 years) followed closely by Brown Swiss x N'Dama (9.4 years). The result agreed with the findings of Ozoje *et al*. (2001) that the performance of crossbred over the exotic could be attributed to better adaptability and (or) gene combination. Ehiobu and Ngere (1986) reported that earlier age at first calving prolongs the productive life of any cow. This was in agreement with the findings in this study as the productive years decreases as the age at first calving increases. This may be due to the life span and physiology of the animal to produce well due to old age.

Lifetime Yield

In Table 2, the least square means showed that Brown Swiss gave more lifetime yield of 28172.05kg than the Brown Swiss x N'Dama. The yield obtained in the local and crossbreds were closer to each other, than to the exotic. Breed differences in yield obtained in this study was reported by Abdullah *et al*. (2002). The result of the least square means revealed that lower age

at first calving of a cow supports higher lifetime yield. 23-32 months, 32-42 months and 43-52 months gave higher yield than 53-62 months and 63-72 months age at first calving.

Genetic and Phenotypic correlations

Estimates of genetic and phenotypic correlation coefficients among the milk production traits in Table 3 were positive and high ranging from 0.90-0.998 for genetic and 0.83-0.98 for phenotypic correlation. This revealed a strong genetic association between the genes controlling these traits except productive years that had weak to no genetic association due to its low and near to zero correlation coefficient (0.11-0.21 for phenotypic and 0.01-0.22 for genetic correlation). All the coefficient of variation recorded in this study were greater that 28.7% and 26% reported by Singh *et al*. (1979) for lactation milk yield and milk yield per day.

CONCLUSION

Profitability, the ultimate breeding objectives in the dairy industry, is a function of production per lactation, production rate, age at first calving which determines productive years and decrease in cost of maintenance thus such factors affecting profitability should be examined to help farmers in achieving higher productivity. This study showed total breed effect on milk production performance leaving Brown Swiss followed by Brown Swiss x N'Dama as best performer while White Fulani stands in between the two. Moreover, seasonal variation seems to have little to no effect on milk yield while calving interval comes to play on length of lactation and short run milk production. Furthermore, age at first calving determines the long run milk production according to the result in productive years and lifetime yield. Therefore with any breed type a calving interval of 16-18 months, age at first calving of 23-32 months a high yielding aow could be produced under tropical environment. The result of this study further showed that farmers should worriless about season but rather allow 16-18 months calving interval and 23-32 months age at first calving for better milk yield.

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Table 1. Analysis of variance for various factors affecting milk production performance

Source of variation	df	LMY	LL	MYD	PY	LY
Breed	2	181839**	2657.3**	53.97**	24.90**	1.22E9**
Season	3	589022**	777.0	2.21	7.59	6.63E7
Calving interval	3	176749**	4991.0**	15.56**	7.06	2.72E7
Age at first calving	4	16644	699.9	2.78	34.03**	1.73E8
Error	866	235270	777890	1.31	5.09	2.20E7

** P<0.01 *P<0.05

df = degree of freedom; LMY = Lactation Milk Yield; LL = Lactation Length; MYD = Milk Yield per Day; PY = Production Years; LY = Lifetime Yield.

Table 2: Least square means for various factors affecting the milk production performance

	OBS	LMY	LL	MYD	PY	LY
Genotype						
Brown Swiss	270	1713.98± 94.49a	362.5±35.8	4.66±0.33a	8.69±0.31a	28172.05±113.37a
White Fulani	501	786.42±61.79b	358.4±39.2	1.92±0.30b	9.44±0.46b	14008.31±103.77b
BSND	108	1287.61±149.62c	221.2±36.5	3.91±0.37c	9.40±0.56c	15199.70±125.58c
Season						
April-June (early wet)	201	866.81±33.60b	242.5±12.2	3.44±0.03b	8.95±0.50b	19466.54±111.81a
July-Sept. (late wet)	166	881.31±36.13a	230.3±10.0	3.67±0.03a	8.90±0.51b	19615.56±115.25a
October-Dec. (early dry)	245	786.09±29.61b	217.2±13.2	3.46±0.02b	9.14±0.49a	19555.74±109.03a
Jan.-March (late dry)	267	783.15±33.76c	220.3±10.5	3.41±0.03c	8.42±0.50c	17868.91±113.18b
Calving interval (months)						
6-12	512	1064.23±90.44b	252.5±55.9	4.17±0.25b	8.94±0.28a	20662.19±150.96bc
13-15	306	864.90±108.84c	226.4±54.8	3.52±0.32b	8.88±0.39ab	18740.22±101.54cd
16-18	59	1616.20±83.82a	312.8±79.8	5.03±0.45a	9.32±0.69a	19692.36±155.33ab
>18	2	879.14±68.89c	222.9±78.1	3.96±0.15b	9.48±0.76a	20267.48±139.33a
Age at first calving (months)						
23-32	181	914.34±43.72a	269.5±65.9	3.45±0.33a	9.54±0.50ab	19586.94±113.86b
33-42	295	865.80±44.22b	233.8±77.7	3.71±0.31b	9.09±0.46b	19493.38±105.44b
43-52	251	843.18±59.38b	217.3±63.1	3.56±0.32c	8.83±0.39a	20034±17±109.14a
53-62	120	774.65±52.83c	235.0±70.0	3.37±0.35d	8.61±0.24ab	19018.97±147.66c
63-72	32	748.72±53.95b	229.0±80.3	3.40±0.43c	8.20±0.35c	17499.97±147.66c

OBS= Observation; LMY = Lactation Milk Yield; LL = Lactation Length; MYD = Milk Yield per Day; PY = Production Years; LY = Lifetime Yield.

Table 3. Genetic and phenotypic correlatin coefficient among milk production traits

	LMY	LL	MYD	PY	LY
LMY	1.00	0.99	0.90	0.22	0.80
LL	0.99	1.00	0.96	0.04	0.70
MYD	0.83	0.87	1.00	0.00	0.62
PY	0.21	0.11	0.17	1.00	0.48
LY	0.53	0.51	0.46	0.54	1.00

Note: Genetic correlation coefficient is diagonal to the right. Phenotypic correlation coefficient is diagonal to the left.