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BREED COMPARISON OF DAIRY CATTLE FOR BIRTH WEIGHT IN THE HUMID TROPICS OF NIGERIA.

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Target Audience: Researchers, vetenarians, breeders, farmers.

ABSTRACT

Data from 653 birth records of three dairy breeds of *Bos taurus* (Holstein, HH, Brown Swiss, BB and Jersey, JJ) and one of *Bos indicus* (Sahiwal, SS) were analyzed to determine their comparative birth weights and non-genetic factors affecting this trait in the humid tropics of Nigeria. Using harvey's least squares procedures, breed, year and season of birth ($p<.001$) and sex of calf ($p<.01$) were important sources of variation in birth weight of these breeds. Brown Swiss, Holstein, Sahiwal and Jersey weighed 36.71±.85,32.64±.24,20.22±.73 and 27.08±.94 kg respectively at birth. Males within the breed were 5 to 16 per cent heavier than females at birth. Between year variation reflected changes in the breed composition, climate and management. Calves born in early wet, late wet and early dry seasons were heavier than those dropped in late dry season while seasonal calving indicated an advantage when cows were bred to calve in the wet season.

The study shows that the choice of these breeds as candidates for crossbreeding in the peri-urban dairy development programs in the humid tropics should consider their birthweights before mating them to any indigeneous breed. It was also observed in this study based on the characteristics of these imported breeds that when contemplating crossbreeding programs for either milk or meat production in this agroclimatic zone, these adapted breeds are good candidates. The result further indicates that mating animals to calf in the rainy season will elicit heavier birthweight irrespective of the breed of choice and this will give the calves a good start for rapid weight gain in later life . The implication of the report is that if dairy beef production system is to be included in future urban dairy program, breeds with heavier birthweights are recommended since birthweight is highly correlated genetically with other growth performance traits.

Key words: Bos taurus, bos indicus, dairy cattle, birth weight, humid tropics .

DESCRIPTION OF THE PROBLEMS

Choice of breed in modern dairy production in the tropics is dependent on the particular production system and environment (4). However in the sub-saharan

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African countries of West Africa dairy production is not specialized and milk is a byproduct of cattle husbandry. Traditionally cattle is selected for survival first and then for milk, meat and work (13). Increasing the efficiency and profitability of dairy production in the tropics is however becoming imperative. Consequently many countries in this agroclimatic zone had made several efforts at modernizing its dairy production potentials. Through many aid programs several *Bos taurus* and *Bos indicus* dairy breeds were imported for crossbreeding for dairy production. The objective of such importation includes combining the adapted native Zebu genes with high milk producing ability of exotic dairy breeds in several crossbreeding schemes. However most of such efforts failed to yield sustainable and positive results (8) due to both biological and environmental reasons. Many of such efforts were never reported in the literature on dairy production in the humid tropics (13). Consequently in envisaging any sustainable cattle production system in the future it is paramount to review the efforts of the past so that cattle breeds that are adapted to the stressful tropical environment would be utilized for maximum benefit. The specialized production systems of Europe and America would not be attractive in this less developed cattle production environment. Therefore triple purpose or at least dual-purpose production scheme will attract interest. Adaptability, survivability and production efficiency should become the foci of future development efforts.

Birth weight of calves is indicative of growth potential of cattle breeds and this then becomes an important trait to consider in crossbreeding efforts. Therefore, it is the objective of this study to compare the birth weights of various breeds of dairy cattle that were used at the Iwo Road urban dairy pilot scheme in southwestern Nigeria.

MATERIALS AND METHODS

Data on birth weight of calves of three *Bos taurus* and one *Bos indicus* dairy breeds imported into Iwo Road Urban Dairy Farm in the metropolis of Ibadan by the Oyo State Ministry of Agriculture were extracted from the records of the Ministry. The farm is located on latitude 7° 43' North of the Equator and longitude 3° 09' East of Greenwich. The mean temperature is 26°C (minimum 21°C and maximum 33°C) while the average precipitation is 1500 mm per year. Although the two main seasons in Ibadan is the rainy and dry seasons; based on the monthly precipitation and the pattern of herbage growth and availability the two seasons were sub-divided into four in this analysis. These are the late dry (January to March), the early wet (April to June), the late wet (July to September) and the early dry (October to December).

Cattle management

Planted pastures of Giant Star (*Cynodon plectostactum*), Elephant grass (*Pennisetum purpureum*) and the Centro (*Centrosema pubescens*) legume mixture were available for grazing and cutting in fenced paddocks. Animals were kept in open sided barns at night and during the hot part of the day but

were allowed grazing early in the cool of the morning and evening in adjacent paddocks. Water and salt licks were available *ad libitum* both in the paddocks and in the barns. Routine deworming and spraying for ticks were undertaken while cows received 20 per cent crude protein concentrate feed based on milk production of each cow at milking time. Milking was twice daily at 0700 hr and 1700 hr . Vaccination against notifiable diseases like Anthrax, Haemorrhagic Septicemia, Black Quarter and Brucellosis were routinely administered. Veterinary care was available as the needs arose.

Cattle breeds and breeding

The *Bos taurus* breeds were Holstein-Friesian, Brown Swiss and Jersey which were imported from Europe directly to the farm or transferred from Moor Plantation Ibadan herd or from Ikenne Dairy Farm herd between 1965 and 1977. The *Bos indicus* breed, Sahiwal, was imported from Kenya in 1977. Artificial insemination and hand mating were used at different times on the farm. Heat was detected by visual observation twice a day and teaser bulls fixed with chin balls at other times. Artificial insemination was carried out by a trained veterinarian. Bulls of individual breeds were used in different paddocks for hand mating. Pregnant cows were dried three weeks before parturition. At parturition calves were weighed and identified with a neck plastic tag. Calves suckled their dams for the first five days of life but were bucketfed at the rate of 10 percent of their body weight until they were weaned at three months of age. Thereafter the calves were allowed to graze in paddocks and fed weaners' concentrate feed containing 16 per cent crude protein, also on weight basis. Calving was on the year round basis as there were no breeding season.

Statistical analysis

Birth weight records of 653 calves comprising 512 Holstein, 42 Brown Swiss, 53 Jersey and 46 Sahiwal born between 1970 and 1982 were available from the birth register on the farm. These were coded and entered into the computer. The final data sets was analyzed using (9) procedures and the model below was adopted:

$$Y_{ijkl} = \mu+g_i+n_j+a_k+s_l+(gs_{il})+e_{ijkl}$$

where

Y_{ijkl} = observed birthweight
μ = common mean
g_i = effect of breed (i=1,...4)
n_j = effect of season (j=1,...4)
a_k = effect of year of birth (k=1,...13)
s_l = effect of sex of calf (l=1,...2)
(gs_{il}) = breed x sex interaction
e_{ijkl} = residual error assumed to be random ,independently and normally distributed with mean zero and variances ?^{2}.

All other effects were assumed to be random in the final analysis.

Differences were separated by the Duncan's mutliple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Shown in Table 1 is the mean squares from the least squares analysis of variance of birthweight of calves born at Iwo Road Urban Dairy Farm. The overall mean and the standard error was 29.16±0.39 kg Table 2. Breed and sex of calf were significant sources of variation (p<.001).Both year (p<.001) and season (p.<01) of birth were also important sources of variation in determining the birthweight of calves in this environment. Brown Swiss (BB), and Holstein (HH), calves which are both *Bos taurus* breeds were the heaviest at birth with BB being 36% and HH 20% heavier than the Sahiwal (SS), a *Bos indicus* breed. The Jersey (JJ) was the smallest at birth being 16.5 kg and 12.4 kg smaller than BB and HH breeds respectively as shown in Table 2. It was however only 6.9kg smaller than the SS breed.This small breed at birth was the breed of choice in a crossbreeding programme in Zaire with the N'Dama cattle (13). One of the reasons advanced for the choice of JJ in the Congo program was to reduce the incidence of dystocia in N,Dama dams.

Table 1. Mean Squares (kg^2) of birthweight of *Bos taurus* and *Bos indicus* dairy cattle in the humid tropics of southern Nigeria.

Source	df	Mean Squares
Breed of calf	3	2940.64***
Sex of calf	1	459.50***
Year of birth	12	180.76***
Season of birth	3	137.45**
Genotype x Sex	3	40.05*
Residual	630	25.11

*** = P<.001; ** = P<.01 *= P<.05

The large differences in birth weights of these genotypes may be connected with their divergent origin and extensive selection in the *Bos taurus* breeds . The BB breed is the oldest dairy breed in the world and is descended from cattle of the valleys and mountains of Switzerland as reported by (5). On the other hand HH originated in the northern provinces of Holland and in the Friesland part of Netherlands (3). The JJ breed is isolated in the Island of Jersey off the coast of the United Kingdom. The SS being the only *Bos indicus* has its centre of origin in the Indus valley in India. The result obtained for HH in this study is only 2.3kg smaller than the average reported by (3) in Europe. The JJ breed used in Nigeria was 33% smaller than the average reported by (3).The improved Sahiwal in weighed at birth 38 kg while that imported from Kenya by Nigeria weighed only 27 kg. The disparity may be due the intensive selection and improvement of the US Sahiwal whereas the Kenya strain were not selected

Table 2. Effect of genotype of calf on birthweight of dairy cattle of *Bos taurus* and *Bos indicus* origin in the humid tropics of Southern Nigeria.

Genotype	No.	LSM ± SEM kg)
Bos taurus		
Brown Swiss	42	36.71±0.85[a]
Holstein	512	32.64±0.24[b]
Jersey	53	20.22±0.73[d]
Bos indicus		
Sahiwal	46	27.08±0.94[c]
Overall mean	653	29.16±0.39

Means with different superscripts are significantly different at P<.05
LSM = Least Squares Mean
SEM = Standard Error of the Least Squares Mean

Table 3: Least squares mean (LSM) and standard error (SEM) of breed x sex of calf effects on birthweight of *Bos taurus* and *Bos indicus* dairy calves in the humid tropics of southwestern Nigeria.

Item	No.	LSM ± SEM (kg)
Breed x Sex		
Bos taurus		
Holstein		
Male	248	33.42 ± 0.33[a]
Female	264	31.87 ± 0.33[b]
Brown Swiss		
Male	27	38.81 ± 1.01[a]
Female	15	34.61 ± 1.33[b]
Jersey		
Male	27	21.01 ± 1.00[a]
Female	26	19.42 ± 1.02[b]
Bos indicus		
Sahiwal		
Male	19	29.14 ± 1.27[a]
Female	27	25.03 ± 1.14[b]

Means with different superscripts are significantly different at P<.05

and were unimproved. It is important to note that the descent and production characteristics of imported breeds for crossbreeding with the indigeneous

breeds of tropical Africa should be reasonably evaluated if dystocia is to be reduced to the minimum. It appears that this was done in the Iwo Road dairy project. However the breed by sex interaction (Table 3) had a salutary influence ($P<.05$) as in Table 1 on birthweight of calves in the environment. HH males were 5% heavier than females at birth while BB males were 12% superior to females. In the case of JJ, males were 8% heavier than female calves. For the only *Bos indicus* breed, the SS males were 16% superior to females. From this result it could be observed that the superiority of males over females for dairy breeds were smaller than that for those breeds used for beef. Both HH and JJ breeds are reknowned for milk production while BB and SS are utilized for both milk and meat. They are both dual purpose breeds. When sex was pooled across breed, male calves were 10% heavier than females as shown in Table 4. In a summary of sex effect on birth weight reported by (11), males are 5% more superior than female calves

Table 4: Least squares mean (LSM) and standard error (SEM) due to sex of calf on birthweight of Bos taurus and Bos indicus dairy calves in the humid tropics of southwestern Nigeria.

Item	No.	LSM ± SEM (kg)
Sex of calf		
Male	321	30.59 ± 0.50^{a}
Female	332	27.73 ± 0.53^{b}

Means with different superscripts are significantly different at $P<.05$

and this was attributed to the slightly longer gestation period for male calves. The result obtained in this report was however twice that reported by (11). Calves dropped in the early and late wet seasons are the heaviest at birth as shown in Table 5 while those calved during the late dry season were the lightest. Calves dropped in early dry were intermediate. This observation was in consonance with that reported by (7) in Sierra Leone, Olutogun (13) at Upper

Table 5. Seasonal effects on birthweights of Bos taurus and Bos indicus dairy calves in the humid tropics of southwestern Nigeria.

Season	Mo.of the year	No.	LSM ± SEM (kg)
Late dry	Jan-Mar	171	27.77 ± 0.50^{b}
Early wet	Apr-Jun	169	29.68 ± 0.51^{a}
Late wet	Jul-Sep	124	30.02 ± 0.59^{a}
Early dry	Oct-Dec	189	29.15 ± 0.51^{a}

Means with different superscripts are significantly different at $P<.05$

at Fashola Stock Farm and (2) in Western Nigeria. When cows are bred to calve in the early and late wet seasons, the calves benefit from increased milk production by their dams and directly from the succulent grasses and legumes available during these seasons. This reason perhaps indicated that the introduction of breeding season will benefit the calves as well as improving the calving rates of the herd. Consequently it may be advantageous if cows are bred to calve in either the early wet or late wet season so that the calves could have a good start in life in this environment.

The significant effect of birth year is shown in Table 6. But there was no particular trend observable in this result. Variation observed may well be due to differences in the composition of the herd in each year or the number of calves born in each year.

Table 6. Effect of year on birthweights of *Bos taurus* and *Bos indicus* dairy calves in the humid tropics of southern Nigeria.

Year	No.	LSM ± SEM (kg)
1970	31	28.88 ± 0.97^{b}
1971	77	31.19 ± 0.64^{a}
1972	57	31.53 ± 0.75^{a}
1973	41	30.84 ± 0.84^{a}
1974	15	28.68 ± 1.37^{b}
1975	58	31.82 ± 0.74^{a}
1976	53	30.34 ± 0.75^{a}
1977	71	27.82 ± 0.66^{b}
1978	108	30.10 ± 0.58^{a}
1979	40	28.27 ± 0.89^{b}
1980	44	24.82 ± 0.86^{c}
1981	37	27.70 ± 0.92^{b}
1982	21	27.15 ± 1.17^{b}

Means with different superscripts are significantly different at $P<.05$

The effect of year per se may not be due to climatic variation between the years but perhaps due to changes in management .

In summary, except for Jersey breed all the *Bos taurus* breeds were heavier at birth than the *Bos indicus*. But the Sahiwal breed was 2.1 kg heavier than the Jersey breed in this study. Differences in genotype and origin lie as the basis for the differencies in birth weight of these diverse breeds. Furthermore intense selection for high productivity over a century for milk and meat in Europe and America was responsible for the superiority of *Bos taurus* over *Bos indicus*. Production environment also were different between the tropics and the temperate climate of Europe. This observation is similar to that of (12) where breed of calf accounted for about 31 per cent of the total corrected sum of

squares as in this analysis. Differences due to sex of calf within each genotype was due to the fact that male calves are generally carried longer in gestation than females. This finding is similar to that reported by (7) in Sierra Leone. In examining the motive for the importation of these breeds for the urban dairy project, it will appear that all necessary factors for compatibility and adaptability were serious investigated so that advantages of origin and potential productivity characteristics of these dairy breeds based on scientific investigation were fully addressed in this environment.

Thus it is observed that the choice of these breeds as candidates for the peri-urban dairy development at Iwo Road in southwestern Nigeria has credible merits. It was also observed in this study based on the characteristics of these imported breeds at birth that they generally weigh less in the tropics than either in their home country or in the developed cattle environment.

CONCLUSIONS AND APPLICATIONS

It can therefore be postulated that the phenomenon of genetic-environmental interactions may be responsible for some of the observation in this study. Therefore when contemplating crossbreeding programs for either milk or meat production in this agroclimatic zone, these breeds are good candidates. The result of this study further indicates that mating animals to calf in the rainy seasons will elicit heavier birthweight irrespective of the breed of choice.

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