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# Productivity of Two Indigenous Nigerian Cattle Breeds and Their Crossbred Under Range Grazing Management

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## ABSTRACT [ENGLISH/ANGLAIS]

A study was conducted to determine the productivity of *Muturu*, *Ndama* and their crossbred cattle under range management in Ebonyi state-Nigeria. The birth rate and milk yield of the cow as well as the birth weight of the calves were observed. The growth and zoometric indices were calculated from the observed parameters. The cow birth rate in early rainy season was superior ( $p < 0.05$ ) to late rainy, early dry and late dry seasons' birth rates, 24.37% as against 15.56%, 6.92% and 7.00% respectively. *N'dama* breed produced the highest milk yield among the breed of cattle (19.30 kg) as against 13.30 kg and 13.83 kg/month/cow for Crossbred and *Muturu* cattle respectively. The highest milk yield (peak yield) was obtained in second month of lactation (26.81 kg). Season, sex and breed significantly affected the birth weight ( $p < 0.05$ ) of the two Nigeria breed and their crossbred cattle. The male calves' birth weights (14.10 kg) were superior to female (12.53 kg). *N'dama*, *Muturm* and the crossbred calves birth weights varied significantly ( $p < 0.05$ ) having 16.17 kg 9.97 kg and 12.76kg respectively. The birth weight of calves in the rainy seasons was heavier than dry season. The milk yield and birth weight from the cattle first filial generation heterosis were negative (-2.69% and - 2.37% respectively). The shape index (0.02%), depth index (6.57) and growth index (5.81%) and cow index (55.71%) have positive heterosis.

**Keywords:** *N'dama*, *Muturu*, cattle, crossbred, milk, birth rate

## RÉSUMÉ [FRANÇAIS/FRENCH]

Une étude a été menée afin de déterminer la productivité des *Muturu*, *Ndama* et leurs bovins métis dans la gestion des parcours d'Ebonyi-Nigeria. Le taux de natalité et le rendement en lait de la vache ainsi que le poids de naissance des veaux ont été observés. La croissance et les indices ont été calculés à partir zoometric les paramètres observés. Le taux de natalité de la vache en saison des pluies début était supérieur ( $p < 0,05$ ) du taux de natalité tardive des pluies, début et fin sèche saisons sèches », 24,37% contre 15,56%, 6,92% et 7,00% respectivement. Race N'Dama a produit le rendement le plus élevé du lait parmi les races de bovins (19.30 kg) contre 13.30 kg et 13.83 kg /mois/vache pour le bétail croisées et *Muturu* respectivement. Le rendement le plus élevé du lait (le pic de production) a été obtenue en deuxième mois de lactation (26.81 kg). Saison, le sexe et la race touchées de façon importante le poids de naissance ( $p < 0,05$ ) de la race deux Nigeria et leur bétail croisé. Le poids à la naissance des veaux mâles (14,10 kg) ont été supérieurs aux femmes (12,53 kg). N'Dama, *Muturm* et les poids de naissance des veaux croisés variait considérablement ( $p < 0,05$ ) 9,97 kg 16,17 kg et ayant 12,76 kg respectivement. Le poids à la naissance des veaux dans la saison des pluies a été plus lourd que la saison sèche. La production de lait et poids à la naissance de la génération du bétail hétérosis première filiale ont été négatifs (-2,69% et - 2,37% respectivement). L'indice de forme (0,02%), l'indice de profondeur (6,57) et l'indice de croissance (5,81%) et l'indice de vache (55,71%) ont hétérosis positif.

**Mots-clés:** *N'Dama*, *Muturu*, bovins, croisement, le taux de natalité le lait

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## INTRODUCTION

Range grazing is one of the major traditional feeding systems of ruminant animals in many developing nations like Nigeria [1] Plate 1. The animals are grazed through nomadic pastoral system as in the case of Nigerian Fulani herdsmen [2]. The breeds of cattle involved in Nigerian

range grazing are the indigenous Zebu cattle such as *white Fulani* or *Bunaji* cattle, *Sokoto gudali* and *Adamawa gudali* cattle. While the non Zebu cattle are the *Muturu N'dama* and *Keteku* cattle. The Federal government of Nigeria had in the past, developed a cattle breeding scheme to provide breeding stock to Nigerian cattle farmers. These

indigenous cattle were mapped out as elite cattle to be properly developed and synthesized through selective breeding and culling so that their heterosis can be exploited [2].

The *N'dama* and *Muturu* breeds of Nigerian indigenous cattle are noted because of their peculiar qualities. These breeds of cattle were considered for upgrading because their low productive capacity in term of milk and meat production. However, they are hardy, tolerant to trypanosomiasis disease and of reasonable beef conformation [4].

In Nigeria, *N'dama* and *Muturu* breeds are used as beef animals. In South East of Nigeria *Muturu* cattle is pride among other cattle because of its cultural value within the rural setting. The cattle is seldom used as work animal as it has limited stamina [4] but can be useful in other cultural purposes, such as title taking, settlement of bridal rite and burial ceremonies. Under the traditional feeding systems, the productivity of these animals in term of quantity of milk and meat produced per head of an animal is hardly determined. Yet these animals are of great value to the economy of the nation and they contribute significantly to the food supply of the people in this region. This work is, therefore, intended to look at the performance of these indigenous cattle raised in the South East of Nigeria under traditional rangeland management.

## MATERIALS AND METHODS

### Experimental Site

The study was conducted in Ebonyi State Nigeria located between latitude 18°05' and 08°20' E and longitude 06°40' and 06°45' N and within humid tropical climate. The area has pseudo-bimodal rainfall [5]. There were two basic seasons, namely rainy season and dry season considered during the period of study but the seasons were further classified as early and late rainy season and early and late dry season respectively. The dry season is characterized with harmattan, low humidity and low rainfall while the rainy season is characterized with high relative humidity and rain fall. The seasonal variations affect the vegetation of Ebonyi State, which is a derived savanna region with common herbaceous plants, shrubs and few trees. The forages flourish during early rainy season, grow old and flower during late rainy season, dry and become scarce during late dry season. Trees, shrubs, perennial grass, legume and some other herbaceous plants are the only available forages during the late dry season because of plant desiccation and death on the rangeland. Fresh

plants species are only found along the river banks of Ebonyi Rivers and *fadama* areas, which have dysteric leptosol soil [7].

### Experimental Animals

Two indigenous humpless breeds of cattle namely *N'dama*, *Muturu* and their crossbred, which constituted a total number of 225 cattle were involved in the investigation. The cattle were randomly selected from 180 experimental sites and were observed during their breeding season.

### Experimental Procedure

The experimental procedure involved dividing the Ebonyi state into three zones based on geo-political location; namely central, North and South Zones. Three local governments areas were randomly selected in each zone and a minimum of twenty farmers were selected from a local government area. A farmer was determined based on having a minimum number of three breeding cow per replicate study.

### Data Collection

Primary data were collected by the interview schedules and questionnaires while the secondary data were collected from the existing Federal Government Cattle Breeding Centre at Oshiri, Ebonyi State, Nigeria. The data were obtained from management record, health record and breeding records of Oshiri Cattle Breeding Centre. The birth weights, weaning weight of calves and body weight of mature animals were obtained directly from weighing scales during the experimental period. The management and inventory records were used to obtain the number of birth, birth weight, sex, parity etc.

### Milk Collection Procedure

Milk collection data were obtained from both primary data and secondary data from government breeding farm. Each lactating cow was provided with a space of 4.5 m<sup>2</sup> for feeding, watering and milking. Sometimes the cows were milked while grazing on the rangeland. Five days after parturition lactating cows and their calves were allowed to enter the milking cubicles where milking occur. Combinations of both full hand and finger trips milking were used by the women who used cups, bowels and kettle to collect the milk. Milk was collected twice daily 9.00am and 5.00pm Nigeria time. Milk from each cow was weighed separately each day.

### Linear Measurements

The linear measurements conducted were height at wither which was determined by measuring the shoulder rise to the ground (peak point), the body length (the distance from the rump to wither) and crest depth (distance from wither to bottom brisket surface just behind elbow). The diagonal length of the animals was determined by measuring the distance from the point of shoulder to the pin bones outside. The girth circumference was measured with measuring tape just behind the shoulder. These body measurements were used to determine the body indices. These body indices include:

Shape index (SI) =  $\frac{\text{Diagonal length at wither}}{\text{Height at wither}}$

Depth index (DI) =  $\frac{\text{Chest depth at wither}}{\text{Height at wither}}$

Cow index (CI) = The difference between the interval logarithm of cow weight and natural logarithm of calves one year.

### Statistical Analysis

The data was subjected to analysis of variance (8) and least square means analysis (9) model

The statistical model for the analysis is represented as follows

$$Y_{ijkl} = \mu + A_i + B_j + C_k + D_l + E_{ijkl}$$

Where

$Y_{ijkl}$  = individual measurement  $E_{ijkl}$

$\mu$  = Overall mean

$A_i$  = Effect of years (1 - a)

$B_j$  = Effect of season (1 - 4)

$C_k$  = Effect of breed (1 - 3)

$D_l$  = Effect of sex (1 - 2)

$E_{ijkl}$  = Random error which is assumed to be independently distributed with a mean and variance,  $I, j, k, l$

### RESULTS

Table 1 shows the least square mean for birth rate of *N'dama*, *Muturu* and their crossbred from 2000 to 2008. There were no significant differences among the two breeds and their crossbred cattle from 2000 to 2008. However, the birth of the cattle differed significantly ( $p < 0.05$ ) among the four seasons. The birth rate in the early

rainy season was significantly superior to other seasons having the mean value of 2.38% as against  $7.00 \pm 2.00$ ,  $15.56 \pm 2.83\%$  and  $6.92 \pm 1.69\%$  for late dry season, late rainy season and early dry season respectively.

Table 2 shows the least means square value for birth weight of calves from the two breeds and their crossbred from 2000 to 2008. There were significant differences ( $p < 0.05$ ) among the birth weight of calves from the two breeds and their crossbred from 2000 to 2008. Also season, sex and parity had significant influence on birth weight. The birth of calves increased progressively from  $12.76 \pm 2.55\text{kg}$  at first parity to  $3.38 \pm 28\text{kg}$  at second parity and  $14.32 \pm 5.80\text{kg}$  at third parity. The male calves were superior ( $14.10 \pm 1.60\text{kg}$ ) to female calves ( $12.53 \pm 1.5\text{kg}$ ). The birth weight of calves in early rainy season were the heaviest ( $14.50 \pm 3.88\text{kg}$ ) as against late rainy season ( $14.50 \pm 3.88\text{kg}$ ), early dry season ( $13.08 \pm 2.86\text{kg}$ ).

Table 3 shows the least square mean for monthly milk yield per cow for the two breeds and their cross bred. There were significant differences ( $p < 0.05$ ) in the milk yield per cow. There were both genetic and environmental influences on milk yield among the cows. *N'dama* breed cow produced the highest milk yield ( $19.30 \pm 2.33$ ) per month among the two breeds and their cross bred with  $12.97 \pm 5.26$  kg for *Muturu* and  $13.83 \pm 2.44$  kg for crossbred cows. The peak milk yield for the two breeds and their crossbred cows occurred at the 2<sup>nd</sup> month of lactation ( $26.8 \pm 3.61$  kg).

Table 4 shows the heterosis of the two breeds and their crossbred cattle at first filial generation. Apart from the milk yield and birth weight, which were negative heterosis ( $-2.69\%$  and  $-2.37\%$  respectively), all other parameters from the two Nigerian indigenous breed and crossbred cattle were positive. The cow index the shape index was as low as 0.67%.

### DISCUSSION

Reproductive performance of breeding herds could be measured in terms of birth rate. The birth rate of the two breeds and their crossbred cows did not differ because *N'dama*, *Muturu* and their crossbred cows are monoparus short horn humpless (*Bos*, *Taurus*) cattle, which have similar genetic component in common [10]. However, environmental variation come into play as there were significant difference in the birth rate of the two breeds and their crossbred at various seasons of year from 2000 to 2008. This could be explained by the fact that some factors such as climate, disease as well as other challenges

affect the animals at different periods of the year. For instance, the rainy season were superior to other seasons namely the early dry, late dry and late rainy season because of suitable climate of the season such as adequate rainfall, photoperiod and humidity resulting to the production of abundance nutritive forages within the rangeland at that early rainy season period. As the season progress, the weather changed resulting in harsh environmental condition that reduced both the forage quantity and quality. As the season moved to the late dry season, the forages and water supply become scarce, leading to the animal having a long trek in order to obtain their feed and water. Also energy are spent by these animal while looking for grazing pasture in this period, which can only be available along the river banks [1]. The late rainy season was also accompanied with high disease incident, declining nutrient density among the forage species due to lignifications of succulent plants and other biochemical changes that occur that can lower the plant crude protein. Forages like grasses become very tall and inaccessible to the cattle so that the cattle are not able to obtain adequate nutrient within the surrounding rangeland.

The genetic makeup and environmental condition of the cow affects the birth weight of the calves [11, 12]. The birth weight of the calves from the two breeds and crossbred cattle were significantly ( $p < .05$ ) affected by year of birth, season, sex, and stage of parturition (table 2). Many research scholars have reported the effect of genetic, nutrition and disease condition of cow as the factors affecting the birth weight of calves [11, 12, 13, and 14]. Adequate nutrition of the cow during pregnancy increases the birth weight of calves [13]. The birth weight of *N'dama* varies from 12.26 kg to 16.17 kg under field grazing and stall-fed system [14]. Male calves have been found to be superior to female calves. The birth weight difference between sexes increased steadily from 4 kg at one year to 20 kg in four years [8].

It was discovered that calves born at first party weighed the lowest ( $12.16 \pm 2.55$ ) followed by second ( $13.3 \pm 2.8$  kg) and third party ( $14.32.58$  kg). This suggested the physiological reproductive change that occurred among the cows as their calving process continued. As the cows grow older, their reproductive systems developed and it could be in more position to deliver calves with higher birth weights.

The seasonal influence on birth weight was observed by obtaining the heaviest calves birth weight of  $14.50 \pm 3.88$

kg from rainy season as against  $14.12 \pm 3.3$  kg for the early dry ( $13.77.2.55$ ) and late dry ( $13.08 \pm 2.5$  kg). Availability of forages for the pregnant cow during pregnancy and conducive environment for them during this period can account for the superior birth weight of calves during this period.

The milk production per cow per month indicated the highest milk yield of  $26.8 \text{ kg} \pm 30$  (peak yield) for the indigenous breed showing a very low milk yield under grazing condition, when compare to indigenous zebu cattle ( $155.42$  kg) per month per cow [12, 13, 14]. There is need for improvement in milk production either through breeding and nutritional management for their indigenous breed [15].

However, there was a negative heterosis in the milk yield from the two breeds and their crossbred cows. Crossbreeding with other dairy breeds of cattle is necessary in Nigeria so as to improve the calf's weight from the cattle. Also nutritional management such as stall feeding that increase milk yield could help to improve the productivity of the two breed of cattle and their crossbred [6].

**Table 1:** This table shows the least squares means for birth rate of *N'dama*, *Muturu* and their crossbred from 2000 to 2008

Variable	N	X (%) ± S.E
Overall LSM	225	53.56 ± 9.54
YEAR:		
2000	4	34.67 ± 6.80
2001	6	52.01 ± 6.10
2002	8	57.78 ± 5.90
2003	10	39.00 ± 5.93
2004	14	52.00 ± 4.13
2005	20	26.00 ± 14.81
2006	24	34.66 ± 12.44
2007	77	81.21 ± 14.19
2008	56	59.09 ± 14.80
SEASON:		
Late dry Season	45	7.00 ± 2.00 <sup>a</sup>
Early dry season	105	24.37 ± 2.38 <sup>b</sup>
Late rainy season	64	15.56 ± 2.83 <sup>ab</sup>
Early dry season	42	6.92 ± 1.69
BREED		
N 'Dama	152	48.50 ± 8.73
Muturu	74	53.87 ± 7.84
Crossbred	29	62.40 ± 9.12

Within variables mean without a common superscript differ significantly ( $p < 0.05$ ).

**Table 2:** This table shows the least square means for birth weight of three breeds of cattle from 1992 – 2000.

Variable	N	X (Days ± S.E)
Overall LSM	225	13.37 ± 2.81 <sup>a</sup>
YEAR		
2000	4	15.00 ± 1.23 <sup>b</sup>
2001	6	15.00 ± 1.55 <sup>b</sup>
2002	8	15.12 ± 2.45 <sup>b</sup>
2003	10	16.20 ± 2.83 <sup>c</sup>
2004	14	14.00 ± 3.43 <sup>ab</sup>
2005	20	13.12 ± 3.38 <sup>a</sup>
2006	24	12.69 ± 4.85 <sup>a</sup>
2007	77	13.88 ± 3.97 <sup>a</sup>
2008	56	12.77 ± 3.01 <sup>a</sup>
SEASONS:		
Late dry season	45	13.08 ± 2.56 <sup>a</sup>
Early rainy season	104	14.50 ± 3.88 <sup>b</sup>
Late rainy season	64	14.12 ± 3.98 <sup>b</sup>
Early dry season	42	13.77 ± 2.35 <sup>a</sup>
BREED:		
N'Dama	45	16.17 ± 2.11 <sup>b</sup>
Muturu	104	9.97 ± 3.32 <sup>a</sup>
Crossbred	64	12.76 ± 3.55 <sup>ab</sup>
SEX:		
Male	150	14.10 ± 1.60 <sup>b</sup>
Female	105	12.53 ± 1.50 <sup>a</sup>
Parity:		
1 <sup>st</sup> parity	156	12.76 ± 2.55 <sup>a</sup>
2 <sup>nd</sup> parity	88	13.38 ± 3.28 <sup>b</sup>
3 <sup>rd</sup> parity	11	14.32 ± 3.58 <sup>c</sup>

Within variables mean without a common superscript differ significantly ( $p < 0.05$ ).

## CONCLUSION

The birth rate and birth weight of calves as well as milk yield from N'dama Muturu and their crossbred cows under field grazing were affected significantly ( $p < 0.05$ ) by the environmental variations (seasons of the year) and breed of cattle. The two breeds of Nigerian indigenous cattle and their crossbred had very low milk yield with attendant negative heterosis. It is recommend that there should be crossbreeding between the two breeds with other breeds with higher productive capacities and better performance as well as good grazing management of the cattle on rangeland to improve the two Nigerian breed. Since the early rainy season was the best season that enhanced high cattle productivity in this region, cattle production should be planned to maximize resource available during this period of the year in this region and

other regions of the world that have similar ecological features.

**Table 3:** This table shows the least square means for monthly milk yields per cow for N'Dama, Muturu and their crossbred under field grazed and stall-fed system

Variable	N	X (kg) ± S.E
Overall LSM	225	16.55 ± 7.80
Months:		
1 <sup>st</sup>	102	18.44 ± 3.21 <sup>b</sup>
2 <sup>nd</sup>	102	26.81 ± 3.01 <sup>c</sup>
3 <sup>rd</sup>	102	21.13 ± 3.10 <sup>c</sup>
4 <sup>th</sup>	102	18.02 ± 3.35 <sup>b</sup>
5 <sup>th</sup>	102	9.61 ± 3.45 <sup>a</sup>
6 <sup>th</sup>	102	5.28 ± 3.3 <sup>a</sup>
BREED		
N' Dama	20	19.30 ± 2.23 <sup>b</sup>
Muturu	80	12.97 ± 5.26 <sup>a</sup>
Crossbred	70	13.83 ± 2.44 <sup>a</sup>

Within variables mean without a common superscript differ significantly ( $p < 0.05$ ).

**Table 4:** This table shows the Effect of heterosis on the cow/calves productivity

PARAMETERS	N'Dama	Muturu	Crossbred	
Sin	3	2	1	
Dam	55	47	25	
Heterozyosity (%)				Hete
relative F <sub>1</sub>	100		50	rosis
				(%)
Population				
growth rate %	39.23	44.91	52.64	25.12
Birth weight (kg)	16.17	9.97	12.76	-2.37
Weight at 6				
months (kg)	74.97	45.38	71.30	18.49
Weight at 12				
months (kg)	115.76	93.24	126.8	21.67
			4	
Weight at 24				
months	207.78	162.93	201.6	20.78
			3	
Pre-weaning				
daily wt gain (kg)	0.30	0.25	0.34	23.13
Post-weaning				
daily wt gain (kg)	0.25	0.21	0.28	21.17
Milk yield (kg)	114.66	83.78	96.55	-2.69
Shape index (kg)	60.11	55.67	58.26	0.67
Depth index (kg)	73.30	59.02	70.51	6.57
Calf growth index				
(kg)	38.48	43.48	43.13	5.51
Cow index (%)	19.20	29.48	37.90	55.71

**Plate 1:** This plate shows *Ndama*, and *Muturu* cattle and their crossbred on range grazing



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**CONFLICT OF INTEREST**

No conflict of interest was declared by authors.

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