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Analysis of Breed Improvement Strategies on Fertility Traits in Multigeno type Cattle Reared in Hot Humid Climate of Nigeria

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ABSTRACT

The performance of multi-genotype cattle raised in the hot humid conditions is compared with the aim of determining optimal fertility traits strains in the New Derived Guinea Savannah Zone of Nigeria. Age at first calving, calving interval, days open, number of services per conception, calving rate and herd life were analyzed using the least squares means procedure of analysis of variance. Significant differences were separated using a tukey test. Fertility traits were significantly ($P<0.05$) influenced by genotype, breed improvement and year of calving. Jersey and its crossbred cows had the optimal performance for fertility traits in Kwara State which could improve the livelihood and economies of dairy farmers in Nigeria.

Keywords: *Breeding strategy, Fertility markers, genetic improvement*

INTRODUCTION

The demand for increase milk production across the globe had led to marginal decline in milk production due to quest for protein sufficiency (Akinsola, 2017). Eurostat (2016) reported that improvement milk production, including fat and protein yield has been the main objective for selection in the dairy industry of most countries. However, continued selection for higher milk production has been questioned on a number of accounts as it has been widely associated with deleterious effects on health, fertility, conformation and welfare of cows (Miglior et al., 2005). Declining fertility seems to be caused by a combination of various physiological and management factors, which start at calving, and which all have an additive effect on reproductive efficiency.

Genetic selection for milk yield may change the energy partitioning in lactating dairy cows, causing a genetically induced negative energy balance and a lower body condition score (Gutierrez et al., 2006). The current study was designed to assess variation in fertility traits in dairy population in the hot humid conditions of Kwara State in Nigeria.

MATERIALS AND METHODS

The study was conducted at Shonga Farms situated in Edu Local Government (Kwara State, Nigeria). The farm is located in the tropical climate of Nigeria, with pronounced wet and dry seasons and steady high temperatures. Its geographical coordinates are 9° 1' north, 5° 9' East at an altitude 305m. The nearest meteorological station showed maximum rainfall in month of September which drops to zero in December.

The rainy season with duration of about 218 days, starts in April and ends in October (Climate-Data, 2015).Four multi genotype cattle of four purebred (Holstein Friesian, Jersey, Friesianx Bunaji and Jersey x Bunaji) belonging to different dairy herd while a total of 2320 multigeno type cattle (Holstein Friesian; n=408, Friesianx Bunaji; n=301, Jersey; n=922 and Jerseyx Bunaji; n=689) in 8 lactations were used in this study.

The summary of the production record was subsumed in (Table 1).Data for average milk production were obtained from the year 2008 through 2015 from different farm records in the Shonga herds.

Fertility Traits

Age at first calving (AFC) defined as the (in days) at which the cows first had its first calf Calving Interval (CI) defined as the period (in days) between the first and the next calving. Day open (DO) defined as the period (in days)

from calving to the next conception. Number of service per conception (NSC) defined as the number of service or matings to affect a pregnancy. Calving rate (CR) defined as the number of calves born per 100 services. Her life defined as the number of days a cow spent in the herd before culling.

Table1. *Distribution of genotype of cows per year of calving in Shonga Dairy Holdings (Kwara State)*

Year of calving	Holstein Friesian	FriesianxBunaji	Jersey	JerseyxBunaji	Total
2008	78	-	91	39	208
2009	37	40	137	52	266
2010	98	65	105	70	338
2011	86	82	96	93	357
2012	91	94	79	60	324
2013	16	20	94	90	220
2014	1	-	101	98	200
2015	1	-	129	80	210
Total	408	301	922	689	2320

Figure1. *Map of Kwara State showing Shonga Farms*

Fertility Traits

Age at first calving (AFC) defined as the (in days) at which the cows first had its first calf Calving Interval (CI) defined as the period (in days) between the first and the next calving. Day open (DO) defined as the period (in days) from calving to the next conception. Number of service per conception (NSC) defined as the number of service or matings to affect a pregnancy. Calving rate (CR) defined as the number of calves born per 100 services. Her life defined as the number of days a cow spent in the herd before culling.

Data Analysis

Data were analyses using one-way Analysis of Variance (ANOVA) implemented in car package. A significant ANOVA was followed by Tukey's HSD test ($\alpha = 0.05$) using multcomp package (Hothorn et al., 2008) to identify the significant difference between the genotypes.

Results

Table 2 shows the Least squares means of reproductive traits across genetic and non genetic factors in Kwara State. Genotype effect was highly significant ($P<0.01$) for all the reproductive traits. The average AFC, NSC, DO, CI, CR and HL (N=2320) for all the genotypes were 1134.9±18.91, 2.4±0.03, 185.4±1.56, 409.2±5.87days, 47.3±0.48 % and 37.8±0.94 months, respectively. However, Holstein Friesian and Friesianx Bunaji were significantly ($p<0.01$) younger than Jersey and Jerseyx Bunaji at first calving in Kwara State. Jersey had the highest number of insemination per conception, which differed significant ($P<0.01$) from other genotypes. NSC was

similar for Holstein Friesian and Friesianx Bunaji and Jerseyx Bunaji. CI in Holstein (330±13.19 days) was 63 days shorter than Holsteinx Bunaji (393.8±11.30 d) which differed significantly (P<0.01) between the genotypes.

The Friesianx Bunaji, Jersey and Jerseyx Bunaji were similar in CI. Holstein, Friesianx Bunaji and Jersey cows had similar and shorter day open but differed significantly (P<0.05) from Jerseyx Bunaji cows which was longer. Calving rate was similar in Holstein, Jersey and Jerseyx Bunaji but differed significantly (P<0.01) from Friesianx Bunaji. Jersey purebred cows significantly (P<0.01) stayed longer in the herd as compared to other genotypes.

Breed improvement strategies had highly significant (P<0.01) effect on all the reproductive traits with the exception of NSC, CR and HL.The AI prolonged AFC but a converse trend was observed for NSC and C1. AFC, DO and CI were the only reproductive traits that differed significantly (P<0.01) by year of calving.

Table2. *Least squares means (LSM) and SE for the effect of genetic and non-genetic factors on reproductive traits of cows in Shonga Dairy Holdings in Kwara State*

Traits/Factors	N	AFC (days)	NSC	DO (days)	CI (days)	CR (%)	Herd life (months)
Overall mean	2320	1134.9±18.91	2.4±0.03	185.4±1.56	409.2±5.87	47.3±0.48	37.8±0.94
Genotype							
Holstein Friesian	408	1021.9±19.94^{a}	2.5±0.07^{b}	176.2±2.48^{a}	330.0±13.19^{a}	46.4±0.65^{a}	36.6±0.96^{b}
Friesian xBunaji	301	1083.5±15.69^{a}	2.7±0.06^{b}	177.4±1.21^{a}	393.8±11.30^{b}	41.3±0.46^{b}	29.9±1.18^{b}
Jersey	922	1220.0±16.84^{b}	2.1±0.09^{a}	175.4±1.52^{a}	375.4±4.52^{b}	56.8±0.64^{a}	54.2±1.57^{a}
JerseyxBunaji	689	1231.5±25.36^{c}	2.0±0.01^{a}	213.5±4.09^{b}	376.2±8.49^{b}	45.9±1.05^{a}	36.6±0.96^{b}
Breed improvement							
AI	2016	1138.1±23.04^{b}	2.8±0.05	176.4±1.71^{a}	390.3±10.83^{a}	46.7±0.77	36.2±1.01
NSS	304	1133.2±11.57^{a}	2.6±0.04	190.1±2.14^{b}	419.7±6.77^{b}	47.7±0.61	38.8±1.18
Breeding Year							
2008-2012	1688	1085.5±30.41^{a}	2.7±0.08	173.4±2.60^{a}	420.4±11.29^{b}	47.7±1.01	38.50±1.45
2012-2015	632	1130.7±23.16^{b}	2.6±0.07	183.6±2.99^{b}	382.1±12.56^{a}	48.8±1.14	44.32±1.76

^{abc} *Means of the same trait across genetic groups with different superscripts differ significantly (P<0.05); AFC-Age at first calving, NSC-Number of service per conception rate, CI-Calving interval, DO-days open, CR-Calving rate, AI-Artificial insemination, NSS-natural service, SE-Standard error; *P<0.05-significant; ** P<0.01-Highly significant; NS-not significant; N-sample size.*

DISCUSSION

This study reported breed differences in reproductive performance among the genetic groups of cows in Kwara State where the environmental temperature and humidity is high due to the location of the farm sharing tributaries with River Niger. In the present study, the average age at first calving (AFC) was 1134.9±18.91 days (37.83 months), which is shorter than AFC of 43.03, 43, 40.44, 42.16 and 39.2 months reported by Chandrasiri et al. (2007), Weerasinghe et al. (2008) in Sri Lanka, Tassew and Seifu (2009), Fekadu et al., (2011) and Tadesse et al., (2010) in Ethiopia for dairy cattle, respectively but higher than the value of 33.27 and 29.28 months reported by Kollalpitiya et al. (2012) and Ajili et al. (2007) in Sri Lanka and Tunisian Holstein-Friesian cows respectively. Murdi and Tripathi (1990) reported average age at first calving in Jersey cows to be 839.7 ± 4.48 days, which was lower than the findings of the present study. These obvious differences across the reports from other researchers may be attributed to different breeding practices employed by the farms, aspect effect of the climate and choice of the statistical design used for data analysis.

The average number of service per conception was 2.4±0.03. The present result is in contrast with services per conception (1.81±1) reported by Tadesse et al., (2010) for Friesian cattle in Ethiopia. The mean services per conception obtained is higher than services per conception of 2.0 reported in Holstein Friesian dairy cattle in Nigeria by Ngodigha et al., (2009) but was lower than 2.5 for Holstein Friesian in Iran (Ansari- Lari et al., 2010) and higher than the results reported by Lobago et al., (2007), 1.6 for

crossbred cows in the highlands of Ethiopia. The differences might be attributed to differences in management practices of the respective herds. Appropriate in time heat detection and insemination could be attributed to lower or higher number of services of per conception (Yifat et al., 2009). The findings of the present study on services per conception suggested comparatively better insemination services in the herds during the period of the study.

The day's open of 185.4 ±1.56 was consistent with the findings of Heins et al., (2008). Also, Holstein Friesian was 20 days less than contemporary purebred Jersey cows. This is similar to the trend obtained by some researchers (Dechow et al., 2007; Heins et al., 2008). Heins et al. (2008) found that Jerseyx Holstein had 23 less days open than contemporary purebred Holsteins.

Dechow et al. (2007) reported that first lactation BH had a significantly lower days open (113) than either the pure Holsteins (130). In addition, Dechow et al., (2007) found that crossbreds had 12.3 less days open in all lactations than the purebred dairy cattle. The overall calving rate within the period of study was low (47.3±0.48 %) but is comparable to calving rate of 41.08 % determined on communal grazing in South Africa (Bembridge and Tapson, 1993).

CONCLUSION

Artificial insemination techniques showed a good variation for improvement of fertility traits among multi-genotypes thus these traits can be used as candidate markers which could be used to develop direct lines for this trait and other correlated traits. Fertility traits in Jersey and its crossbred cattle in this study should be included in breeding programmers of dairy cattle in the new derived Guinea Savannah Zone of Nigeria, in order to maximize improvement of breeding goal involving traits related to income and costs.

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