Some Fertility Indices in an Artificially Inseminated Bunaji and Bokoloji Herds in Kaduna State, Nigeria

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Abstract: This study was conducted in order to determine fertility indices of Bunaji and Bokoloji cattle in artificially inseminated cattle herds. A total of four hundred and eighty five (485) inseminations were carried out by experienced inseminators using deep frozen semen at Niyya farms, Kaduna State, Nigeria from May 1995 to December, 1998. The data was subjected to analysis of variance and least squares analysis. The overall conception rate, calving rate, number of services per conception, post partum oestrus period, days open and calving interval were 46.5%, 72.6%, 2.1, 174.7 days, 206.4 days and 471.2 days respectively. The year and breed were found to significantly affect some of the indices. The Bunaji breed performed better in terms of number of services per conception, post partum oestrus period and days open. The Bunaji are therefore better adapted to the environment than Bokoloji. The results obtained were below the recommended values but nevertheless encouraging. Efforts should therefore be made to improve the management system in the herds such as adequate nutrition.

Key words: Bokoloji • Bunaji • Fertility Rate • Artificial Insemination

INTRODUCTION

Cattle production is very essential in the economics of the developing countries as the animals and their products play vital roles in alleviating the nutritional and economic challenges of such countries. The Zebu (Bos indicus) is the type which forms the foundation for both milk and beef production in Nigeria. However, the productivity and reproductive performance of Zebu cattle that are indigenous to the tropics is low [1,2]. Zebu cattle have relatively poor fertility traits characterized by late maturity and long intercalving intervals attributed to an exceptionally large number of factors which often interact with each other [3-6]. The low productivity has been reported to be one of the several adaptive features that help keeping the animals in equilibrium with the stressful environment [7].

The optimal reproductive rate in livestock production is that which gives maximal economic profit per breeding female per year. In the case of cattle, it is maintaining a calf per cow per year [4,8]. To determine the reproductive performance of cattle, it is necessary to consider the fertility indices. Thus, reproduction is a vital factor in determining the efficiency of animal production [9]. Assessment of fertility should not be based on a single criterion but on all criteria in conjunction with each other.

The fertility indices include post partum anoestrus period, days open, service interval, calving interval, pregnancy rate, conception rate, number of services per conception (NSC), calving rate, non return rate and AI index [10]. These indices are affected by genetics [1,11,12], climate [13,14], age and parity of the dam [15,16], nutrition and body condition score of the dam [13,17], suckling [4,18,19], infectious diseases [12,20,21] and inaccurate oestrus detection [16,22].

The use of indigenous cattle as a female resource for cross breeding with exotic dairy breeds by artificial insemination (AI) has been proven to be effective in producing a dual-purpose (milk/beef) animal suitable for many tropical regions [19,23]. The crossbred cattle have
shown significantly better performance than indigenous Zebu cattle [6,24]. However, few studies in Nigeria have indicated the effect of some factors on the fertility of cattle in AI programmes [14,19,22,25]. The objective of this study was to obtain some fertility indices and hence evaluate the reproductive performance of Bunaji and Bokoloji cows in an AI programme in a private farm in Kaduna state, Nigeria.

MATERIALS AND METHODS

Location: Kaduna State has a land area of 48,473 km² and a cattle population of 3.1 million and is located between latitudes 9°N and 11.3°N and longitudes 10.3°E and 9.6°E [26]. The state experiences a typical tropical continental climate with distinct seasonal regions ranging from cool to hot dry with daily temperatures of 14°C-30°C and relative humidity of 72%. The seasonality is pronounced with the dry season being longer than the wet season. The state is divided into a northern and a southern part. The latter enjoys heavier rainfall in the southeast; the rainfall distribution is about 1530 mm while in the northeast it is about 1015 mm annually [3,25]. The farm known as Niyya, covers over 350 hectares of land and is located in Inlowo village, Kaduna state, Nigeria, about 60 km along Kaduna-Abuja express way.

Animals: The study that spanned between May, 1995 and December, 1998 considered two indigenous breeds of cattle, the Bunaji (White Fulani) and Bokoloji (Sokoto Gudali). Their ages varied from mature heifers of 3 years and above, to cows between 4 years and 9 years with some having over 4 parities, with a good body condition score (BCS) of 3.0 and above [27]. The animals were grazed on natural pastures and supplementarily fed on silage and concentrate when necessary. In addition, herd health management programmes of all the animals such as vaccination, deworming, ectoparasite control, haemoparasite control and culling unfit animals were employed. Newly purchased animals were quarantined for at least 4 weeks before introducing them into the main herds.

Oestrus Synchronization, Heat Detection and AI: The heifers and cows were palpated per rectum to establish their reproductive status. Those suitable for breeding were synchronized using prostaglandin F₂α (PGF₂α), Progesterone-Releasing-Intravaginal-Device (PRID) or their combination [28]. Visual heat detection was carried out thrice daily between 7:00 am and 8:00 am, 5:00 pm and 6:00 pm and 9:00 pm and 10:00 pm. A total of 485 inseminations were carried out by two experienced and qualified inseminators during the period of the study. Deep frozen Friesian or Montebeladi semen packed in 0.25 French Mini-straws were used and most of the inseminations were intra-uterine but occasionally mid-cervical. The cows were inseminated about 12 hours after onset of heat (AM-PM AI rule) [29] and only reinsenminated if they remained in heat 24 hours following the first insemination. Pregnancy diagnosis was carried out monthly to establish the response rate of the inseminated cows.

Data Analysis: The fertility indices including conception rate, calving rate, NSC, post partum anoestrus period, days open and calving interval were obtained from the data collected. Conception rate was calculated as the percentage of animals pregnant divided by the number of inseminations carried out. Calving rate was the number of cows that calved per the number of pregnant cows. The NSC was the number of inseminations per the number of animals pregnant. The interval between calving and first observable oestrus was the post partum anoestrus period while the interval from calving to successful insemination was the days open. Calving interval was the period between two successive calvings [10,12].

The results obtained were subjected to General Linear Model analysis of variance with year, season and breed as factors [30].

RESULTS AND DISCUSSION

The overall means obtained during the study period including the effects of year and breed are shown in Table 1. The mean conception rate of 46.5% recorded is lower than 67.8% [31], 50% [32] and 48.8% [4] reported in indigenous Nigerian cattle. However, in 1995, the conception rate was close to the value of 70% and 60-70% observed by Dawuda et al. [32] and Esslemont et al. [33] in Zebu and temperate breeds respectively. The conception rate was affected by year (P < 0.05) but not by breed (Table 1) or season (Table 3). The fact that season did not significantly affect the conception rate may be due to the apparent success of practicing feed supplementation particularly in the dry season. All the cattle were in good body condition for reproduction in this study. Hence, cows did not experience reproductive failure due to nutritional stress in the dry season.
Table 1: Effect of year and breed on fertility indices of cattle

<table>
<thead>
<tr>
<th>Year</th>
<th>Conception rate (%)</th>
<th>Calving rate (%)</th>
<th>NSC</th>
<th>Calving to 1st observable oestrus (days)</th>
<th>Days Open</th>
<th>Calving interval (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>46.5</td>
<td>72.6</td>
<td>2.1</td>
<td>174.7</td>
<td>206.4</td>
<td>471.2</td>
</tr>
<tr>
<td>Year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>$P &lt; 0.05$</td>
<td>$P &lt; 0.001$</td>
<td>$P &lt; 0.01$</td>
<td>$P &lt; 0.05$</td>
<td>$P &lt; 0.001$</td>
<td>$P &lt; 0.001$</td>
</tr>
<tr>
<td>1996</td>
<td>67.5$^a$</td>
<td>-</td>
<td>1.6$^b$</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1997</td>
<td>35.2$^a$</td>
<td>89.9$^a$</td>
<td>2.2$^a$</td>
<td>193.4$^a$</td>
<td>290.0$^a$</td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>37.9$^a$</td>
<td>64.5$^a$</td>
<td>2.2$^a$</td>
<td>208.9$^a$</td>
<td>198.9$^a$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>45.5$^a$</td>
<td>63.6$^a$</td>
<td>2.2$^a$</td>
<td>122.8$^a$</td>
<td>130.3$^a$</td>
<td></td>
</tr>
<tr>
<td>Breed</td>
<td>NS</td>
<td>NS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bunaji</td>
<td>44.3</td>
<td>73.7</td>
<td>2.0$^e$</td>
<td>143.9$^e$</td>
<td>166.3$^e$</td>
<td>455.3</td>
</tr>
<tr>
<td>Bokoloji</td>
<td>48.7</td>
<td>71.5</td>
<td>2.2$^e$</td>
<td>206.2$^e$</td>
<td>246.6$^e$</td>
<td>487.0</td>
</tr>
</tbody>
</table>

Values with different superscripts within the same variable differ significantly

Key: NS- Not Significant, NSC- Number Of Services Per Conception

Table 2: Effect of year and breed interactions on the days open period

<table>
<thead>
<tr>
<th>Year</th>
<th>Breed</th>
<th>Mean (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>Bunaji</td>
<td>186.6</td>
</tr>
<tr>
<td>1996</td>
<td>Bokoloji</td>
<td>393.5</td>
</tr>
<tr>
<td>1997</td>
<td>Bunaji</td>
<td>201.3</td>
</tr>
<tr>
<td>1997</td>
<td>Bokoloji</td>
<td>196.6</td>
</tr>
<tr>
<td>1998</td>
<td>Bunaji</td>
<td>111.0</td>
</tr>
<tr>
<td>1998</td>
<td>Bokoloji</td>
<td>149.7</td>
</tr>
</tbody>
</table>

Table 3: Effect of season on conception rate

<table>
<thead>
<tr>
<th>Season</th>
<th>Conception rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>146.5%</td>
</tr>
<tr>
<td>Season</td>
<td>NS</td>
</tr>
<tr>
<td>Dry</td>
<td>44.9%</td>
</tr>
<tr>
<td>Wet</td>
<td>48.1%</td>
</tr>
</tbody>
</table>

Key: NS- Not significant

Except in 1996, the calving rates fell short of the 80 – 90% of pregnant cows observed by Esslemont et al. [33]. However, the overall mean calving rate of 72.6% obtained in this study is quite impressive and higher than the values of 34.2-54.5% reported in local Fulani herds and 66% in government herds [34] and 55% demonstrated in traditional agro pastoral management system in Northern Nigeria [35]. Effect of year was highly significant ($P < 0.001$) on this reproductive index.

The results of this study showed an overall NSC of 2.1 which is slightly higher than the 1.9 NSC reported in Zebu cattle [13]. In 1995 however, the NSC of 1.6 obtained tends to agree with values of 1.5 observed by Dawuda [36] in indigenous cattle. Mukasa-Mugerwa [12] reported NSC of 2.0 and above as poor. The NSC was affected by year ($P < 0.01$) and breed ($P < 0.05$). The Bunaji showed a better NSC than Bokoloji (Table 1).

The mean interval obtained for the post partum anoestrus period i.e. calving to first observable oestrus for all the years (Table 1) is about 2-3 times longer than the ideal interval of 60-90 days post partum recommended by Dawuda et al. [16]. The different ages and parities of the cows may be responsible for the long interval observed in this study. Older cows and primiparous cows have longer intervals than cows in the intermediate ages [37]. In addition, suckling may be another contributory factor. The calves were not weaned early, since the initial foundation stock in this study was not kept for milking purposes only. Early weaning would have shortened the calving to first observable oestrus interval [4]. Year effect on post partum anoestrus was significant ($P < 0.05$) with 1998 showing shortest mean of 122.8 days. This value agrees perfectly with the report by Dawuda et al. [16]. The short interval recorded may be as a result of the improvement on the management system on the farm.

The overall mean days open in this study was higher than 60-90 days [10] and 69-98 days [33] demonstrated in AI programmes. Year ($P<0.001$) and breed ($p<0.05$) effects (Table 1) were significant. Interaction between year and breed was also significant (Table 2). The year, 1996 x Bokoloji recorded the longest interval while the year, 1998 x Bunaji showed the shortest interval (Table 2) indicating breed differences. The reduction in the interval in 1998 (130.3 days) compared to 1996 (290.0 days) may possibly be attributed to the improvement on nutrition and hence early resumption of ovarian activity. With the results obtained from this study, achieving the target of one calf per cow per year would be impossible [4,8].

The calving interval is longer than 365 days reported in Vom government farms [1] and 439 days demonstrated in Shika farms in Nigeria [3] but shorter than 720- 900 days observed in nomadic cows [35]. Nevertheless, the calving interval compares favourable with 474 days reported by Iyorhema [38] in settled cattle herds in Zaria. Breed effects were not significant, although the interval was shorter in Bunaji than Bokoloji cows (Table 1).
Year therefore was a factor that significantly influenced conception rate, calving rate, NSC, calving to first observable oestrus and days open (Table 1). Conception rate and NSC were at their best in 1995, calving rate was at its peak in 1996 which was a reflection of the conception rate in 1995, while days open and calving to first observable oestrus i.e post partum anoestrus period were shortest in 1998. Thus, 1995 was the best year in terms of resumption of cyclicity (Table 1). Possible reasons for this despite practicing the same management system throughout the study period, could be due to the smaller herd size handled in 1995 and the initial enthusiasm of the management and staff with regards to herd health management and weaning the calves during take-off of the programme which yielded good results in the conception rate and NSC in 1995 and subsequent calving rate in the following year (1996). The significant early resumption of cyclicity in 1998 with an increase in conception rate could be due to improvement on the management such as nutrition and culling of older cows. However, the conception and calving rates dropped and NSC remained constant in the subsequent years as reflected by the effect of year (Table I). This could mean that, the hitherto enthusiasm of the management and staff was dwindling and there could be an inclusion of ‘problem cows’ in the study such as repeat breeders which were not culled from the herd.

Breed significantly affected three of the six indices studied ($P<0.05$) (Table 1). In all, Bunaji performed better than Bokoloji. This is possibly due to the fact that Bunaji were better adapted to the environment, extensively studied and probably fell within the conducive intermediate ages of 6 to 8 years or second to fourth parities. The Bokoloji perhaps constituted a higher ratio of heifers, primiparous cows and older cows. It has been reported that preconception is lowest and intervals longest in these group of cattle [12,16,37]. It can be inferred from this study that, AI in private farms tend to yield encouraging results. However, adequate attention should be given to the management practices in the farms such as selecting cattle in their optimum age for reproduction, adequate nutrition, early weaning of calves post partum, ideal calve management, prompt culling of problem cows such as repeat breeders etc.

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REFERENCES


