Comparative Analysis of Lactation Traits of Holstein-Friesian White-Fulani Zebu and Their F1 Crossbred Cows in Nigeria.

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Introduction
Crossbreeding Holstein-Friesian cattle with the indigenous Zebu cattle of Nigeria for improved milk production started after the end of the second world war (Olutogun, 1976). The first wave of importation was made to Shika and Vom in northern Nigeria while others were Agege, Ibadan, Nsukka and other parts of Nigeria by Government establishments. Reports of performance of these importations were not encouraging as the animals eventually died out. In recent times private companies also imported exotic animals for upgrading the local stock. One of such companies was the West African Milk Company that traded in evaporated and reconstituted milk by leasing the defunct Nigeria Veterinary Research Institute dairy farm in Vom, northern Nigeria. The objective of this dairy farm was to provide raw milk for its operation in Nigeria as stated by Dangut (1994). Whereas some reports are available in the literature on the lactation traits of the imported Holstein-Friesian and those heifers born in Nigeria and their F1 crossbreds on Government and research stations in Nigeria (Malau-Aduli et al, 1996, Mbap and Ngere, 1995, Buvanendran et al, 1981, Laseinde, 1979 Knudsen and Sohael, 1970), report on commercial production environment is scanty. The objectives of this study therefore are to evaluate the performances of the imported Holstein-Friesian, the Holstein-Friesian that were born in Nigeria, the White Fulani Zebu and their F1 crossbred heifers under the same commercial environment in four lactations. It will also determine the sustainability of these cows for commercial milk production under the prevailing tropical environment of Jos plateau and of Nigeria.

Material and Methods
The Integrated Dairy Farm, Vom, Nigeria. The Integrated Dairy Farm, IDF, is located on longitude 09°43’ north of the equator and latitude 08°45’ east of Greenwich at an altitude of 1280 m above sea level in the savannah ecozone of Nigeria. Rainfall commences on the farm in April of each year and stops in October with an annual mean of 1500 mm. The highest temperature of 24°C is recorded in April at the start of the rains while the lowest of 15°C is in January at the peak of the harmattan season. Relative humidity is low at 55% on the average.

The West African Milk Co, WAMCO, the owner of IDF leased 500 ha from the Nigeria Veterinary Research Institute, Vom in 1986. It developed 350 ha for fodder crops and pasture production. In 1988 it purchased 100 White Fulani heifers from the adjacent local herds in Bauchi and Plateau states of Nigeria and commenced crossbreeding with imported semen of Holstein Friesian bull from Netherlands. In 1989, IDF imported 76 in-calf heifers and one bull of Holstein-Friesian also from Netherlands. The cows were managed according to their physiological state and genotype. They were grazed on allotted planted pastures of Chloris guyana and offered green fodder crops of maize and soya. The cows were milked twice daily (0700 and 1700 hrs) during which they were offered concentrate feed. The HFI, HFN and the HWF cows were offered 22 percent protein concentrate and were machine-milked in a milking parlor while WFZ were offered 17 percent protein concentrate but hand-milked in a shed with calf at foot. Water from borehole was reticulated to the grazing paddock and in the cow barn with mineral salt licks fed ad libitum. Routine activities for tick control were carried out weekly during the rainy season and monthly during the dry season under the supervision of the resident veterinarian. Deworming was done by drenching with albendazole while prophylactic...
vaccination was carried out for rinderpest, foot and mouth disease, contagious bovine pleuropneumonia and anthrax. Cows on heat were artificially inseminated with semen imported from Netherlands. At parturition calves were permitted to suckle their dams for five days and thereafter bucket-fed till weaning. After milking, each cow’s production were weighed and recorded. Only F1 female calves were retained. Data collected on milk production were entered into computer using Microsoft excel package.

Statistical analyses. After all the necessary verification, the data was analyzed with SAS (1999) general linear model (GLM) procedure. The independent variables for the final analysis were genotype, stage of lactation from the first to the forth while the dependent variables were total lactation before dry-off (TOLAC), daily milk yield, (DYIELD) both in kg and number of days in lactation, (LACDAY) in days. Means of significant dependent variables were compared using the PDIF option of procedure GLM of SAS (1999).

RESULTS AND DISCUSSION
Least square means (± standard errors) are presented in Table 1. Total lactation (TOLAC) for the imported Holstein-Friesian (HFI) varied from 6177 kg for the forth lactation to 7495 kg in the 2nd lactation. These are the highest yield recorded in Nigeria for this genotype. The first importation into Vom averaged 2552 kg (Knudsen and Sohael, 1970) while Mbab and Ngere (1995) reported 2953 kg. At Agege Dairy Farm in southern Nigeria, Laseinde (1979) reported 3150 kg per lactation. Genetic progress over time in the world Holstein-Friesian breed can easily be observed from these results in Nigeria. For those exotic cows that were calved in Nigeria (HFN) however, milk production was 2 percent less than those imported cows (HFI) in this study as shown in Table 1. Similar reports were stated earlier at Vom with 42% difference (Knudsen and Sohael, 1970) and at Agege with 16.6 percent (Laseinde, 1979). Similar comparative result at Vom at the commencement of exotic dairy importation into Nigeria was 74 percent (imported 2552 vs. 1463 kg locally calved : Knudsen and Sohael, 1970) These results implied the lack of appreciable adaptation of the animals in the tropical environment in spite of the world improvement of the breed for heat tolerance. Daily milk yield however was similar for both imported and locally calved cows in the first lactation yield in this study. This is due to less days in lactation for those cows calved in the country. Cows born in Nigeria stayed in lactation less than those imported probably due to management bias or heat stress.

Comparative evaluation of Holstein-Friesian and the White Fulani Zebu showed the superiority of the Holstein breed for milk production. The Zebu cattle produced only 11.5, 17.7, 17.3 and 26.4 percent milk compared with imported dairy breed in the 1st, 2nd, 3rd and 4th lactation respectively. This is also reflected in DYIELD. This superiority is unassailable and is due probably to the choice of adaptation to the myriads of environmental stresses that Zebu had to cope with over time. Days in lactation showed similar comparison in that the priority for survival in the harsh environment takes precedence over productivity for the indigenous Zebu stock. Maximum milk production reported for WFZ in Nigeria varied from 800 kg in Vom (Sohael, 1984), 900 kg in Agege and Ibadan (Laseinde, 1979; Olaloku, 1973), 1100 kg at Shika (Johnson et al, 1984) and 1600 kg in this study. The earlier reports were from Government research stations while this study is from commercial environment where profitability is of paramount consideration. Furthermore maximum selection pressure for milk production was exerted at IDF thereby removing the poor producers from lactation to lactation. The performance of F1 crossbred was similar to those reported in the literature with heterosis for milk production varying from 3.2% at Agege (Laseinde, 1979), 5.5% in this study and 36.8% at Vom (Knudsen and Sohael, 1970). This reflects the continued genetic improvement of the Holstein-Friesian breed and lack of selection and genetic improvement of the White Fulani Zebu of Nigeria.
Table 1. Least square means (± S.E) of lactation traits of Holstein-Friesian, White Fulani Zebu and F1 crossbred cows at IDF Vom, Nigeria (1989-1993).

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Lactation Traits</th>
<th>N</th>
<th>Mean</th>
<th>N</th>
<th>Mean</th>
<th>N</th>
<th>Mean</th>
<th>N</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFI</td>
<td>TOLAC (kg)</td>
<td>63</td>
<td>6722.26</td>
<td>56</td>
<td>7495.50</td>
<td>38</td>
<td>7194.18</td>
<td>17</td>
<td>6177.70</td>
</tr>
<tr>
<td></td>
<td>(± S.E)</td>
<td></td>
<td>(250.25)</td>
<td></td>
<td>(252.87)</td>
<td></td>
<td>(269.90)</td>
<td></td>
<td>(760.55)</td>
</tr>
<tr>
<td></td>
<td>DIELD(kg)</td>
<td></td>
<td>21.57</td>
<td></td>
<td>22.51</td>
<td></td>
<td>21.66</td>
<td></td>
<td>19.20</td>
</tr>
<tr>
<td></td>
<td>(± S.E)</td>
<td></td>
<td>(0.55)</td>
<td></td>
<td>(0.61)</td>
<td></td>
<td>(0.81)</td>
<td></td>
<td>(1.77)</td>
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<tr>
<td></td>
<td>LACDAY(d)</td>
<td></td>
<td>305.98</td>
<td></td>
<td>338.92</td>
<td></td>
<td>337.78</td>
<td></td>
<td>304.92</td>
</tr>
<tr>
<td></td>
<td>(± S.E)</td>
<td></td>
<td>(10.84)</td>
<td></td>
<td>(9.13)</td>
<td></td>
<td>(11.29)</td>
<td></td>
<td>(14.60)</td>
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<tr>
<td>WFZ</td>
<td>TOLAC (kg)</td>
<td>49</td>
<td>772.64</td>
<td>37</td>
<td>1332.40</td>
<td>26</td>
<td>1248.59</td>
<td>9</td>
<td>1632.50</td>
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<tr>
<td></td>
<td>(± S.E)</td>
<td></td>
<td>(263.03)</td>
<td></td>
<td>(292.64)</td>
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<td>(337.35)</td>
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<td>(840.20)</td>
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<td></td>
<td>DIELD(kg)</td>
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<td>4.20</td>
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<td>7.15</td>
<td></td>
<td>5.93</td>
<td></td>
<td>7.13</td>
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<tr>
<td></td>
<td>(± S.E)</td>
<td></td>
<td>(0.58)</td>
<td></td>
<td>(0.70)</td>
<td></td>
<td>(0.91)</td>
<td></td>
<td>(1.96)</td>
</tr>
<tr>
<td></td>
<td>LACDAY(d)</td>
<td></td>
<td>174.19</td>
<td></td>
<td>172.51</td>
<td></td>
<td>199.65</td>
<td></td>
<td>196.87</td>
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<tr>
<td></td>
<td>(± S.E)</td>
<td></td>
<td>(11.4)</td>
<td></td>
<td>(10.57)</td>
<td></td>
<td>(12.83)</td>
<td></td>
<td>(16.13)</td>
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<tr>
<td>HFN</td>
<td>TOLAC (kg)</td>
<td>20</td>
<td>6588.67</td>
<td></td>
<td>7.15</td>
<td></td>
<td>5.93</td>
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<td>7.13</td>
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<tr>
<td></td>
<td>(± S.E)</td>
<td></td>
<td>(384.57)</td>
<td></td>
<td>(0.84)</td>
<td></td>
<td>(0.91)</td>
<td></td>
<td>(1.96)</td>
</tr>
<tr>
<td></td>
<td>DIELD(kg)</td>
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<td>22.39</td>
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<td>284.43</td>
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<td>16.88</td>
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<td></td>
<td>(± S.E)</td>
<td></td>
<td>(0.58)</td>
<td></td>
<td>(0.70)</td>
<td></td>
<td>(0.91)</td>
<td></td>
<td>(1.96)</td>
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<tr>
<td></td>
<td>LACDAY(d)</td>
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<td>149.19</td>
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<td>172.51</td>
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<td>199.65</td>
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<td>196.87</td>
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<td></td>
<td>(± S.E)</td>
<td></td>
<td>(11.4)</td>
<td></td>
<td>(10.57)</td>
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<td>(12.83)</td>
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<td>(16.13)</td>
</tr>
<tr>
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<td>TOLAC (kg)</td>
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<td>4095.31</td>
<td></td>
<td>384.57</td>
<td></td>
<td>284.43</td>
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<tr>
<td></td>
<td>(± S.E)</td>
<td></td>
<td>(278.11)</td>
<td></td>
<td>(0.84)</td>
<td></td>
<td>(0.91)</td>
<td></td>
<td>(1.96)</td>
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<tr>
<td></td>
<td>(± S.E)</td>
<td></td>
<td>(0.81)</td>
<td></td>
<td>(0.81)</td>
<td></td>
<td>(0.81)</td>
<td></td>
<td>(0.81)</td>
</tr>
<tr>
<td></td>
<td>LACDAY(d)</td>
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<td>288.97</td>
<td></td>
<td>288.97</td>
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<td>288.97</td>
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<td>288.97</td>
</tr>
<tr>
<td></td>
<td>(± S.E)</td>
<td></td>
<td>(12.05)</td>
<td></td>
<td>(12.05)</td>
<td></td>
<td>(12.05)</td>
<td></td>
<td>(12.05)</td>
</tr>
</tbody>
</table>

HFI = Imported Holstein –Friesian from Netherlands; WFZ=White Fulani Zebu
HFN = Nigerian-calved Holstein-Friesian; HWF =Holstein –Friesian x White Fulani Zebu (F1); N= No. of cows
TOLAC = Total lactation; DIELD = Daily Milk Yield; LACDAY = Lactation days.

Table 2 shows the rate of attrition of the dairy breeds in this study. This represented the rate of disappearance of the dairy cows from the herd. This is both an economic as well as a biological indicator of sustainability of the enterprise. It is the number of cows that were on the farm at the beginning and end of each lactation. Out of the 76 heifers imported from Netherlands to IDF, only 63, 56, 38 and 17 cows completed the 1st, 2nd, 3rd and 4th lactation respectively whereas for 100 heifers of White Fulani Zebu, only 49, 37, 26 and 9 completed similar lactations with Holstein-Friesian. The rate of removal of Zebu cows were higher than that of Holstein-Friesian based on milk productivity but this may be the decision of management.

Table 2: Rate of attrition (%) of imported Holstein-Friesian and White Fulani Zebu cows at IDF, Vom in Nigeria from the first to the forth lactation

<table>
<thead>
<tr>
<th>Genotype</th>
<th>First</th>
<th>Second</th>
<th>Third</th>
<th>Forth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holstein-Friesian</td>
<td>82.9</td>
<td>73.7</td>
<td>50.0</td>
<td>22.4</td>
</tr>
<tr>
<td>White Fulani Zebu</td>
<td>49.0</td>
<td>37.0</td>
<td>26.0</td>
<td>9.0</td>
</tr>
</tbody>
</table>

Rate of attrition is the % of cows that completed each lactation from the first to the fourth lactation

CONCLUSION

The results of this study clearly indicate the genetic superiority of HF when compared with WFZ for milk production. It further confirms the view that F1 crossbred show substantial
heterosis for milk production. The results also confirm that no appreciable selection for milk production has taken place in cattle germplasm in Nigeria.

REFERENCES


