EFFECT OF NON-GENETIC FACTORS ON THE PRODUCTIVE ~~(LACTATION)~~ PERFORMANCE OF HOLSTEIN FRIESIAN COWS IN VOM NIGERIA

ABSTRACT

A total of one thousand eight hundreds and thirty nine (1839) lactation records of cows calved from 2006 to 2017 were analyzed to estimate the effect of non-genetic factors on productive performance traits of ~~Holstein~~ Friesian Holstein cows in Integrated Dairy Farm Vom, Nigeria. Data were analyzed using ~~the~~ general linear models of SAS 2001 (version 8.0). Results revealed that the overall least square means of Lactation Milk Yield (LMY), Productive herd life (PHL), Herd life (HL), lifetime milk yield (LTMY) and lactation length (LL) were 4716.1 ± 243 litres 1831.8 days, 2984.9 days, 15524 litres and 268.00 ± 432 days respectively. Years of calving have significant ($P<0.05$) effect on LMY, PHL, HL, LL and LTMY of the dam. Parity has also significantly ($P<0.05$) influenced the lactation milk yield of the dam. The observed productive performance of Holstein Friesian cattle under Vom condition was generally commendable. This may be attributed to improved management practices (such as high quality feed), maternal gene effect and adaptation of Holstein Friesian breed to the climatic condition of Vom area.

Comment [H1]: Method still unclear

INTRODUCTION

In the tropic areas, despite the large and diverse animal genetic resources, the productivity of many livestock especially ~~the~~ indigenous dairy cattle remains low. This could be attributed to poor genetic potential, inadequate nutrition, poor health services and management problems. Thus, the production of milk ~~and milk products~~ in developing countries such as Nigeria is grossly inadequate and this has resulted in importation of exotic breeds from developed countries to sustain the demand of these products and increase livestock production through breeding strategies and policies in order to meet the need for quick solution to the problem of deficit in milk production (Adebambo, 2003). The increasing demand for milk and dairy products in Nigeria due to increasing population and improved standard of living may worsen if the bulk of multipurpose indigenous cows are with genetically low productive potentials (Alphonsus *et al.*, 2014).

The lactation performance of dairy cattle is usually measured by determining the total milk yield, lactation length, lactation persistency, milk lifetime production and herd life or longevity (Van Raden, 2003). Milk production level and lactation persistency are crucial factors determining the appropriate calving interval (Arbel *et*

al., 2001). In most modern dairy farms, a lactation length of 305 days is commonly accepted as a standard lactation length, but might not work for small holder dairy cows in which the lactation length is extended considerably in most cases. (Teodoro and Madalena, 2003; Masama *et al*., 2003 and Msangi *et al*., 2005).

The Holstein-Friesian bred of cattle is known for high productivity under ~~temperate~~ subtropic climates (Abdel Rahman and Aleman, 2008). It has an outstanding milk producing capability and is the world~~s~~ highest producing dairy animal (Paulson *et al*., 2015). The high productivity of Holstein-Friesian in temperate climates raises the question of how much of this superiority in production is maintained when the animals are transferred to tropical environments. Therefore, the objective of this study was to estimate the non-genetic factors on the productive (lactation) performance of Holstein Friesian cows in integrated Diary Farm Vom, Nigeria.

Comment [H2]: Overview of FH farming in negeria should be explained well as introduction part.

MATERIALS AND METHODS

Description of Study Area

The study was carried out in Integrated Dairy Farm (IDF) Ltd, a private commercial dairy farm located at Vom, Plateau State, Nigeria. Vom is situated on the Jos Plateau 29km South West of Jos city. It lies between latitude 9^{O} 43'N and longitudes 8^{O} 45' E and has an altitude of 1222M above sea level, with mean annual rainfall of 1400mm (55 inches). The area was defined by two seasons; rainy season (May – October) and dry season (November – April). The temperature ranges from 15-25^{O}C, but from mid November to late January, night temperature drops as low as 11^{O}C.

Herd Description and Animal Management

The Holstein-Friesian cattle were maintained under intensive management throughout the year. They were grazed on sown pasture in fenced paddocks containing grasses and legumes in the morning and evening, after which they were returned to the pen (stall). In the dry season mixture of concentrates and silage/hay were used to feed the cattle twice in a day. Steaming up was practiced at later stage of pregnancy (2-3 months before calving). The cows were milked twice daily

Comment [H3]: Please check english dictionary: friesian holstein or holstein-friesian

Comment [H4]: How many kg of feed? What do the ingredients? How about the nutrition value of feed base on Laboratory analysis?

(morning and evening) in the milking parlour using the milking machine. Calves were weighed 24 hours of life (after birth) and weekly thereafter. The animals were vaccinated against prevalent diseases and ecto parasites were also controlled using spray. Routine deworming was also carried out.

Comment [H5]: Mention the disease or the example

Mating system

Artificial Insemination (AI) was the main breeding method used in the dairy farm.

Experimental Design

The experimental design used was the completely Randomized Design (CRD).

Data Collection

A total of one thousand eight hundred and thirty nine (1839) lactation records of Holstein Friesian cows were collected from 2006-2017 for analysis. Data on lactation length, lactation milk yield, total milk yield, productive herd life and longevity were computed from the lactation records as measures of productive performance.

Comment [H6]: It is a pure breed or mix breed? Imported from?

Statistical Analysis

Data obtained was subjected to Analysis of Variance (ANOVA) using the General Linear Models (GLM) procedure of Statistical Analysis System (SAS, 2001 version). Where there was significant different, means were separated using Duncan's New Multiple Range Test (DNMRT).

RESULTS

Lactation Milk Yield (LMY)

The result in Table 1 shows year of calving and parity have significant ($P<0.05$) effect on lactation milk yield (LMY) of Holstein Friesian cows in Vom Integrated Dairy Farm ~~Vom~~. The first two parities have lower LMY compared to the third to seventh parities which were statistically similar but significantly different with higher lactation milk yield.

Table 1: **Least Square Means for Effects of Year of Calving and Parity on Lactation Milk Yield (LMY) of Holstein Friesian Cows at Integrated Diary Farm, Vom.**

Factors	N	Lactation Milk Yield (Ltrs) LSM±SE
Year of Calving	**1116**	*
2006	197	4682±109^{cde}
2007	128	4601±308^{cde}
2008	150	5701±503^{ab}
2009	159	5328±142^{abc}
2010	135	5927±336^{a}
2011	106	5224±149^{abc}
2012	89	4981±170^{bcd}
2013	91	3941±190^{ef}
2014	49	3501±230^{f}
2015	12	3275±300^{def}
Parity	1116	*
1	416	4659±134^{b}
2	308	4867±162^{b}
3	195	5688±371^{a}
4	111	5203±176^{ab}
5	53	5283±264^{ab}
6	23	5199±378^{ab}
7	10	5661±419^{ab}
Overall Mean		**4716.1 ± 243**

Note: ^{abcdef}LSMean with different superscript in the same column for the same effect (factor) are significantly different; *= P<0.05 significant; N = Number of observation.

Lactation Length (LL)

Table 2 shows least square mean + SEM of lactation length. Year of calving significantly (P<0.05) affected the lactation length of Holstein Friesian cows at Vom

Comment [H7]: Better you give some opening sentences or paragraph before mention the Table

Integrated Dairy Farm, ~~Vom~~. The result revealed that the overall mean effect of LL was 268.00±432 days.

Table 2: **Least Square Mean for Effect of Year of Calving on Lactation Length (LL) of Holstein Friesian Cows at Integrated Dairy Farm, Vom.**

Year of Calving	N	Lactation Length (Days) LSM±SE
2006	880	*
2007	138	287.28±8.49^{ab}
2008	96	304.49±10.18^{a}
2009	113	299.50±9.39^{a}
2010	132	288.70±8.69^{ab}
2010	108	286.36±9.60^{ab}
2011	85	282.04±10.82^{ab}
2012	77	275.64±11.37^{bc}
2013	74	249.34±11.60^{bc}
2014	45	220.84±14.88^{cd}
2015	12	185.83±28.80^{d}
Overall Mean		**268.00±432**

NOTE: ^{abc} LSMean with different superscript in the same column are significantly different. * P<0.05; N=Number of observation.

Comment [H8]: Does the data of 2015 still uncomplete? If yes, better don't use it. However, if it was occured due to decreasing population, you may to use it but give explanation in the results part.

Productive Herd Life (PHL) and Herd Life (HL) or Longevity

Table 4 shows least square mean ± SEM of the effect of years of calving on Productive Herd Life and Herd Life (longevity) of Holstein Friesian cows at integrated Farm, Vom. Year of calving significantly (P<0.05) affected both the productive herd life and longevity of Holstein Friesian Cows at Vom Integrated Dairy Farm ~~Vom~~. The result showed the overall mean of the PHL and HL were 1831.8 days (5.07yrs) and 2984.9 days (8.2yrs) respectively.

Table 3: Least Square Means For Effects of Year of Calving on productive Herd Life and Herd life of Holstein Friesian Cows of IDF Vom.

Year of calving	N	Productive Herd Life (days) LSM±SE	Herd life (days) LSM±SE
	137	*	*

2006	30	2187.0±103.0[a]	3337.0±132.0[a]
2007	28	1799.0±85.2[bc]	3052.6±84.1[b]
2008	30	1992.8±70.5[ab]	3037.9±78.4[b]
2009	34	1592.3±47.4[c]	2859.0±46.3[bc]
2010	15	1588.1±63.6[c]	2638.0±117.0[c]
Overall Mean		1831.8±73.9	2984.9±91.6

NOTE: [abc] LS Mean with different superscript in the same column are significantly different; * = P<0.05, N=Number of observations.

Lifetime (Total) Milk Yield (LTMY)

The result in Table 4 shows that year of calving have significant (P<0.05) effect on life time milk yield of Holstein Friesian Cows at Integrated Vom Dairy Farm, ~~Vom~~. The overall mean of LTMY was 15524 ltrs.

Table 4: Least Square Mean for Effects of Year of Calving on Life time (Total) Milk Yield of Holstein Friesian Cows at Integrated Dairy Farm, Vom.

Year of calving	N	Productive Herd Life (days) LSM±SE
	321	*
2006	56	16671±1478[a]
2007	51	14360±3827[ab]
2008	41	18556±1513[a]
2009	45	18181±1283[a]
2010	47	16152±1135[a]
2011	41	13653±912[ab]
2012	40	11098±659[b]
Overall Mean		15524±1544

NOTE: [ab]LSMean with different superscript in the same column are significant different (P<0.05); *=P<0.05; N = Number of observations.

DISCUSSION

Lactation Milk Yield (LMY)

The mean LMY in the present study was found to be 4716.1 litres (Table 1). This is similar to the study of Makuza and Mc Daniel (1996) who reported mean LMY

of 4791 litres in Holstein Friesian breed at Zimbabwe. The mean LMY observed in the present study is higher than the mean LMY of 3710 litres reported by Tadesse *et al*. (2010), 3386.22 litres reported by Zelalem *et al*. (2015), 2757.3 litres reported by Sena *et al*. (2014) and 2149.19 litres reported by Kebede (2015). The lower LMY of Holstein Friesian cows reported in previous studies might be indicative of poor adaptation of the exotic breed to climatic and management condition in the study areas. However, the higher mean LMY in the present study might be associated with progressive improvement in management and adaptation of Holstein Friesian cows to the environment through time. Jariath *et al*. (1995) for Holstein Friesian in Canada and Kollalpitiya *et al*. (2012) in Sri Lanka reported higher Mean LMY of 5152 litres and 5519 litres respectively.

The significant effect for year of calving on LMY in the present study is ~~in agreement~~ linear with the findings of Tadesse *et al*. (2010) and Haile (2014) who reported significant effect of LMY on year of calving. The decreasing trends of years of calving ranging from 5927 litres to 3275 litres (2010 – 2015) in the present study could be attributed to changes in management/poor nutrition and climatic factors which played important role in milk yield. Failure to supplement hay/silage to lactating cows leads to low milk production. Access to good drinking water also increases LMY. Since 87% of milk is water, lactating cows should have free access to water. Any restriction in water supply will result in a drop in milk production (Massawe, 2011).

In the present study, there was definite increment of LMY from parity 1 to parity 3 (4659 litres – 5688 litres) and then decline from parity 3 (5688) to parity 6 (5199l) before increasing again in the seventh parity (5661 litres). This variation indicates that milk yield of cow increased with the maturity of udder but when the cows become older, milk production reduces and the structure of the udder may change due to fat deposition. however, maturity of ~~udder~~ mamary glands are greatly influenced by feeding and management practices of cows. The variation of LMY from one parity to another could also be attributed to maternal effect of additive gene transfer from the dam to its offspring. ~~Mwatawaba (2006) and Migose et al.(2006) also reported significant effect of parity on milk yield.~~

Comment [H9]: In the same or similar area?

Comment [H10]: Canada can not use as comparission, only use topical country

Comment [H11]: You use this kind of sentence / words to often. Please change the words or enaugh to mention it once

Comment [H12]: After how many parity or how old?

Comment [H13]: references

Comment [H14]: how about health?

Comment [H15]: Do not use this words to often, it may detected as self plagiarism by system

Comment [H16]: Reference?

Lactation Length LL

The overall mean lactation length in the present study was 268.00days (8.93 months). This agrees with Haile (2014) and Kebede (2015) who reported LL of 264.63 days and 252.23 days respectively in Holstein Friesian cows. However, it was shorter than 318.86 days, 366.5 days, 11.96 months, 9.1 months, 321.28 days and 333.9 days for Holstein Friesian cows reported by Massawe (2011), Usman *et al*. (2012), Zelalem *et al* (2015), Sena *et al* (2014) Fernando (2016) and Ayalew and Asefa (2013) respectively.

Comment [H17]: Make it simplier (Masawe, 2011; Usman, 2012,.....

The overall mean in the present study was shorter than the optimum value of 305 days required to maintain the optimum calving interval of 12-13 months. But if still falls within the range of 244-324 days reported by Syrstad (1995) for LL in the topics. The report in the current study shows year of calving to significantly (P<0.05) affect the LL. This also agrees with the findings of Peters *et al*. (2007), Mgeni (2010) and Haile (2014) who reported significant effect of LL on year of calving. Accurate LL could be indicative of progressive improvement in management such as proper feeding regimes, adequate dry period and disease control.

Comment [H18]: Uncomplete sentence, please recheck

Comment [H19]: Tropic?

Comment [H20]: indication

Productive Herd Life (PHL)

The overall mean PHL in the current study was 1831.8 days (5.02 yrs). This was slightly shorter than 5.85 years reported by Bognar *et al*. (2008) in Romania who reported a technical optimum milk production in Holstein Friesian cows. ~~It was~~ however higher than 1116 days, 1301 days and 1753 days reported Haile (2014), Gosha (2005) and Gebeyelu *et al* (2007) respectively. This makes the current result in the study to be commendable compared to others in the tropics. The year of calving significantly (P<0.05) influence PHL of Holstein Friesian cows at Integrated Dairy Farm Vom. In 2009 – 2010, year of calving recorded significantly lower PHL compared to previous calving years (2006 -2008). This could be attributed to variations in management in the years. The progressive decline in PHL over the years might also be associated with high rate of involuntary culling at early years.

Comment [H21]: please rewrite this part

Comment [H22]: because of...

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Longevity or Herd Life (HL)

The overall mean of HL in the present study was 2984.9 days (8.2 years) for Holstein Friesian cows. Longevity is of major economic importance in dairy cattle because it affects profitability by reducing replacement costs (Van Raden, 2003). The overall mean HL is similar to the work of Gebeyehu et al.(2007) who reported HL of 3048 days (8.3 years) on Holstein Friesian cows at Stella Dairy Farm, Ethiopia. However, it was higher than 2128 days and 2858 days reported by Haile (2014) and Goshu (2005) respectively. The mean HL was shorter than the optimum recommended HL of 9.35 years that optimize the economic and biological limits of dairy cows.

Comment [H24]: Similar country?

Life time (Total) Milk Yield (LTMY)

In the present study year of calving significantly (P<0.05) affected LTMY of Holstein Friesian cows. ~~This agrees with the work of Haile (2014) who reported that~~ year of calving significantly ~~(P<0.01)~~ influence life time (total) milk yield (Haile, 2014). The overall mean LTMY in the current study was 15524 litres. This was slightly shorter than the findings of Kabuga and Agyemang (1984) who studied 103 calving records of 35 Canadian Holstein Friesian imported into Ashanti (Ghana) and found the average life time production per cows to be 16186kg and ranged 13235 to 23689kg. the result of the current study is higher than 13517.5kg, 12749kg and 4665.75kg ~~reported by Massawe (2011), Goshu (2005) and Haile (2014) respectively.~~ However, studies in Tropical climate on Holstein Friesian cows in Pakistan by Atil *et al* (1999) reported higher LTMY value of 25423kg. the lifetime milk production is a determinant of net economic merit of dairy animals, therefore an animal is most profitable when its total life time milk production is maximum.

Comment [H25]: (Massawe, 2011; Goshu 2005;.....

Comment [H26]: Same country?

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Comment [H28]: Over all in discussion you always said that this condition due too poor of management and nutrition, however you have not analyzed it deeply such us feeding and nutrition technology application, type of farm management, disease and outbreak and specific farming method there.

CONCLUSION

Comment [H29]: Conclussion should be write in a paragraph, max 3-5 lines

The productive (lactation) performance estimated in the present study showed that year of calving had significantly (P<0.05) affected LMY, LL, PHL, HL and LTMY. Also parity significantly (P<0.05) affected lactation milk yield.

The present study showed that the mean of calving had significantly ($P<0.05$) affected LMY, LL, PHL, HL and LTMY. Also parity significantly ($P<0.05$) affected lactation milk yield.

The present study showed that the mean that of lactation milk yield, lactation length, productive herd life, herd life and life time milk yield falls within the optimum standard recommended for productive efficiency of Holstein Friesian cattle in the topics. Although lactation length is slightly below the 305 days optimum standard in temperate region but falls within the 244-324 days recommended in the tropics and herd life was slightly below the recommended 9.35 years. Lactation milk yield increases as the parity increases due to increase in development of the udder.

The Holstein Friesian (HF) cattle can be bred and maintained in tropical environments, although performing a little lower than those maintained in temperate climates, but the observed performance of Holstein Friesian in Vom Nigeria was generally commendable compared to other tropical condition. This could be attributed to progressive improvement in management practices such as high quality feed, maternal gene effect, disease control and adaptation to climatic condition due to a lower temperature.

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