



## Effects of parity order, age at first calving and season of calving on productive performance of Friesian crossbred cattle in Sudan

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### Abstract

This study was carried out to determine the effects of parity orders, season of calving and age at first calving on total milk yield (TMY) and lactation length (LL) in a herd of Friesian crossbred cattle in Sudan. Data obtained from records from 2002 to 2011. The average TMY and LL were  $3988.2 \pm 36.2$  kg and  $355.8 \pm 2.4$  days, respectively. The TMY and LL were significantly ( $P \leq 0.01$ ) affected by parity orders. Highest TMY reported at 6<sup>th</sup> parity and longest lactation was recorded at 4<sup>th</sup> parity. Moreover, season of calving was significantly ( $P \leq 0.01$ ) affected on TMY and LL. In addition higher average values for TMY and LL were obtained in wet summer. The age at first calving had a significant ( $P \leq 0.01$ ) effect on TMY, while heifers calved in late age were significantly ( $P \leq 0.01$ ) higher in milk yield than heifers calved in medium and early age.

**Key words:** Parity order, age, season, productive performance, crossbred cattle

### المستخلص

أجريت هذه الدراسة لتحديد أثار ترتيب الولادات والموسم عند الولادة الأولى على متوسط إنتاج الحليب الكلي وطول فترة الحليب في قطاع هجائن الفريزيان في السودان. تم جمع المعلومات من السجلات للفترة من 2002 إلى 2011. وجد أن متوسط إنتاج اللبن الكلي وطول فترة الحليب  $3988.2 \pm 36.2$  كيلوجرام و  $355.8 \pm 2.4$  يوم على التوالي. وجد أن إنتاج الحليب الكلي وطول فترة الحليب قد تأثر بترتيب الولادة حيث وجد أن أعلى متوسط إنتاج حليب كلي في الولادة السادسة بينما أطول فترة حليب سجلت في الولادة الرابعة. كما وجد أن هناك تأثير معنوي لموسم الولادة على متوسط إنتاج الحليب الكلي وطول فترة الحليب حيث تم الحصول على أعلى متوسط إنتاج حليب كلي وأطول فترة حليب في فصل الصيف الممطر (من شهر يوليو إلى شهر أكتوبر). كما وجد أن العمر عند الولادة الأولى له تأثير معنوي على متوسط إنتاج الحليب الكلي حيث أن الأبقار التي ولدت في عمر متاخر سجلت إنتاجاً من الحليب أعلى مقارنة بالأبقار التي ولدت في عمر مبكر ومتوسط.

**كلمات مفتاحية:** ترتيب الولادات ، العمر ، الموسم ، الإداء الإنتاجي ، هجائن الأبقار

## Introduction

Crossing local cattle, which are hardy but of low milk production potentials, with exotic dairy breeds is a viable strategy for improving local milk production (Preston, 1989). In the Sudan, attempts to set up a dairy industry based on exotic cattle crossing dates back to 1925 with shorthorn breed, however, Friesian crossing was introduced in 1960 (Medani, 2003). The Friesian crossbreds were the most suitable for their good adaptability to the tropical environment in addition to their high yielding capacity. Lactation performance in dairy cattle was affected by genetic and environmental factors. Factors including climate, feeding, diseases, year and season of calving have been reported to affect milk production, lactation length and dry period (Msanga *et al.*, 2000). Breeding age, stage of lactation, parity and milking frequency also influenced the performance of dairy cattle (Tekerli *et al.*, 2009). The present study was undertaken to investigate the effect of parity, age at first calving and season of calving on productive performance of Friesian crossbred cattle in Sudan.

## Materials and methods

### Location, study animals and collection of samples

The data were obtained from records of Friesian crossbred cows from the Kenana Sugar Company Dairy Farm covering the period from 2002 to 2011. The farm is 300 km south of Khartoum (capital town of Sudan) on the eastern bank of the White Nile in the low

rainfall savannah region at approximately 13° N latitude and 33° E longitude and 410 meters above sea level (Ahmed *et al.*, 2007). The data were arranged to examine the effect of parity orders, season of calving and age at first calving on total milk yield and lactation length. The total number of dairy cows in the herd at the time of data collection was 696 (in first to seventh lactation) together with 741 young stock less than two years old and 269 heifers more than two years old. The foundation herd was formed in 1980 through purchases of crossbred heifers from other farms and the purchase of pure Kenana heifers which were later used for crossbreeding with Friesian bulls. Artificial insemination (AI) system was used many years ago by using 100% Friesian semen and natural service was resorted to after three failed inseminations. Cows were machine milked in two parlours with full capacity of 32 cows and the total weekly milk yield for each cow was entered into a computer recording program. Cattle feed was offered in the pens, consisting of: (*Dolecus, lablab*), *Clitoria*, Rhodes grass (*Glories, gayana*), Maize and Abu 70 (*sorghum spp*) and other grasses, concentrate feed was composed of groundnut cakes, wheat bran, and Maize forage, while molasses was fed *adlib*, cows were grouped into: three feeding groups according to the level of production (high, medium and low, yielders), dry cows and young stock. Calves were also kept in three separate units. Animals were housed in three long open sided stables with high roofs (5.5

meters) with no special cooling facilities. The farm had a modern computerized recording system which included exhaustive information about all animals in the farm (production, reproduction and health information). The records can be classified into Individual records (showing serial number, name and cow number, dam number, sire number, date of birth, mortality or culling), calving records (showing service date, bull number, and calf number, dates of calving; sex and birth weight), milk production records (included data of calving date of drying-off, monthly milk production, total milk yield, lactation length, dry period, daily milk yield and weekly milk yield) and daily cases record (includes information about any disease case which appears during the day and its treatment).

### Statistical analysis

The data were arranged to test how they were affected by parity order, age at first calving and season of calving on total milk yield and lactation length. To test the effect of parity order the data were grouped into 7 groups as 1st, 2nd, 3rd, 4th, 5th, 6th and 7th parities. To test the effect of season of calving, the data were grouped according to the month of calving into three calving seasons: March to June was taken as the dry summer, July to October represented the wet summer, whereas, November to February was considered as the winter season. For the age at first calving the data were grouped according to the age at first calving into early (24 to 30 month), Medium (31 to 37 months) and late ( $\geq 37$  months). The data were subjected to analysis of

variance using the Factorial ANOVA of the ANOVA module of the *STATISTICA* computer software to test the significance of effects of parity order, age at first calving and season of calving on total milk yield and lactation length. Where the factor effect was significant, the differences between means were examined using Duncan's multiple range test (StatSoft, 2011).

## Results and Discussion

### Total milk yield

The overall average total milk yield in this study was  $3988.2 \pm 36.2$  kg with coefficient of variation 23.9% (Table 1). This result is lower than the findings obtained by Ageeb and Hayes (2000), Mutaz (2006), El – Owni and ElZuber (2006) and Maluit (2010). They reported  $5117 \pm 123$ ,  $4193.8 \pm 145.4$ ,  $5182.4 \pm 165$  and  $5078.5 \pm 1366$  kg, respectively. It is also lower than that reported by Abubakar *et al.*, (1986) in Columbia, Wade *et al.*, (1990) in different states of America and Dimov *et al.*, (1995) in New York. They reported  $4281 \pm 1891$ , 9046 and 8060 kg, respectively. The present result is relatively similar to the finding value expressed by Irshad *et al.*, (2011) who obtained  $3992.41 \pm 16.2$  kg as total milk yield for Holstein Friesian in Pishin, Pakistan. The result in this study was higher than total milk yield obtained by Badri *et al.*, (2011a) who estimated  $1709.49 \pm 892.09$  kg for cattle in Sudan; Saeed *et al.*, (1987) who estimated  $1160 \pm 17.8$  kg as total milk yield for Kenana cattle (Sudan). Also is higher than  $3183 \pm 111$  kg reported by

**Table 1: Milking performance traits of Friesian crossbred cattle in KSCF during 2002 -2011**

Parameters	NO	Mean	S.E	C.V %
T.M.Y. (Kgs)	696	3988.2	36.2	23.9
L.L. (days)	696	355.8	2.4	17.7

T.M.Y: Total Milk Yield, L.L: Lactation length, S.E: Standard Error, C.V: Coefficient of variation.

Tadesse and Dessie, (2003) compared milk production performance for crossing between Holstein Friesian with Zebu cattle in Ethiopia. The variations in the different studies in the different countries may be due to the effect of environmental conditions namely combined stress of temperature and humidity and farm management level. The higher coefficient of variation (23.9%) of these traits revealed the high discrepancy level between observations. The analysis of variance indicated that the total milk yield was significantly ( $P<0.01$ ) affected by parity order (Table 2). The total milk yield was significantly increased with the increase in lactation number until it reached maximum yield at 6<sup>th</sup> parity and then it decreased. Similar result was reported by Badri *et al.*, (2011b) for Butana dairy cows (Sudan) and Saeed *et al.*, (1987) for Kenana dairy cows (Sudan). However the result of this study was in disagreement with that reported by Bhatnagar *et al.*, (1986) for Karana-Swiss and Karana-Friesian crossbred dairy cows. They reported no significant differences between different parities. The increase in milk

yield shown in this study might be due to increase in body weight and developing of the mammary gland with advance of parity order. Season of calving in the present study had significantly ( $P<0.01$ ) effect on total milk yield (Table 3). The average total milk yield in wet summer was higher than that in dry summer and winter. This result agreed with that reported by Ageeb and Hiller, (1991) for crossbred cows in the Sudan. It was however, in disagreement with that reported by Mutaz (2006), Maluit (2010), Ali *et al.*, (1988), Ibrahim (2003) and Yousif *et al.*, (1998) who concluded that the season of calving had no significant ( $P>0.05$ ) effect on total milk yield. In this study, the age at first calving had a significant effect ( $P<0.01$ ) on total milk yield (Table 4). The result showed that heifers calved in late age were significantly ( $P<0.01$ ) higher in milk yield than heifers calved in medium and early age. This finding is comparable to the findings by Cismas *et al.*, (2012) and El-Arian (2001). However this result was in disagreement with the findings by Elemam and Abu Nekheila, (2012) and Gatchearle *et al.*, (2009). The effect of

age at first calving may be attributed to the development of the udder and maturity.

**Table 2: Milking performance traits of the Friesian crossbred cows of different parity orders in K.S.C.F. during the period between 2002-2011**

Parity order	No of observation	Lactation length (days)	Total milk yield (kg)	Percentage of first lactation %
1	121	338.9 <sup>a</sup>	3048 <sup>a</sup>	100
2	112	349.9 <sup>ab</sup>	3271 <sup>b</sup>	107.3
3	106	362.7 <sup>b</sup>	3818.5 <sup>c</sup>	125.3
4	104	363.3 <sup>b</sup>	4378.4 <sup>d</sup>	143.6
5	102	360.9 <sup>b</sup>	4690.4 <sup>e</sup>	153.9
6	90	362.5 <sup>b</sup>	4694.3 <sup>e</sup>	154
7	61	357 <sup>ab</sup>	4582.7 <sup>e</sup>	150.3
S.E	-	6.4	71.3	-
L.S	-	*	**	-

Mean in a column with different superscripts are significantly (P<0.01) different  
 S.E: Standard Error L.S: level of significance

**Table 3: Milking performance traits of the crossbred cows in different seasons in K.S.C.F. during the period between 2002 -2011**

Season	No. of observation	Lactation length (days)	Lactation milk yield (kg)
Dry summer	179	348.2 <sup>a</sup>	3400.8 <sup>a</sup>
Wet summer	249	368.3 <sup>b</sup>	4471.7 <sup>c</sup>
Winter	268	349.3 <sup>a</sup>	3931 <sup>b</sup>
S.E	-	17.3	57.4
L.S	-	**	**

Mean in a column with different superscripts are significantly (P<0.01) different  
 S.E: Standard error L.S: level of significance  
 Dry summer (March-June).Wet summer (July–October).Winter (November–February).

**Table 4: The effect of age at first calving on total milk yield and lactation length in K.S.C.F. during the period between 2002 -2011**

Age at first calving	No.	Lactation length (days)	Total milk yield (kg)
Early	324	353.8	3884.3 <sup>a</sup>
Medium	218	355.0	4003.3 <sup>a</sup>
Late	154	361.1	4185.3 <sup>b</sup>
S.E	-	4.3	65.2
L.S	-	N.S	**

Mean in a column with different superscripts are significantly (P<0.01) different

Early = 24 – 30 months. Medium = 31 – 37 months. Late = > 37 months

### Lactation length

The lactation length in the present study was  $355.8 \pm 2.4$  days with coefficient of variation 17.7% (Table 1).

Similar results were reported by Ageeb and Hayes, (2000) in Sudan, Mokhtar, (1995) in Egypt and Mokhtar *et al.*, (1993). This value was higher than those reported by Mahassin *et al.*, (2004) for Butana cattle in Sudan, El-Nazeir *et al.*, (2004), Rahmatalla, (2002) and Msange *et al.*, (2000). The present result was however lower than those obtained by Abuzaid, (1999) and Rahmatalla, (2002). The analysis of variance revealed a significant effect ( $P<0.01$ ) of parity order on lactation length (Table 2). This result is similar to that concluded by Wala and Ibtisam, (2004) and Ahmed *et al.*, (1996), whereas Badri *et al.*, (2011a) stated that parity was not important source of variation on lactation length. The present study showed significant effect ( $P<0.05$ ) of season of calving on the lactation length (Table 2). The lactation was recorded in Wet summer (368.3 days). This result is in agreement Tekerli and Kocak, (2009) while it is in disagreement with the findings reported by Mutaz, (2006) and Maluit, (2010) who reported non-significant ( $P>0.01$ )

effect or season of calving on the lactation length. In this study, the age at first calving had no significant effect ( $P>0.01$ ) on lactation length (Table 3). This result is matching with that reported by Gahlot *et al.*, (2000) and Sadek *et al.*, (1994) but was in disagreement with that reported by Alnajjar, (1997) and Salem, (1999).

### Conclusion

Parity order affect total milk yield significantly and the 6<sup>th</sup> lactation showed the highest milk yield and this is an important trait in dairy management as guidance for milk herd replacement. Lactation length varies with both season and age at first calving. This study revealed that the recorded lactation length were higher than the recommended ideal lactation length (305 days) and that may be standardize by good herd management and practice during milking cows techniques recommended period which might increase milk yield for the consequent lactation. Total milk yield increased with the age at first calving for the milking herd, but it is known the earlier the age at first calving the most profitable is the dairy inter price. Heifers must calf at ideal age and good size and live weight.

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