



# Milk Production Performance of Kuri Cows under Extensive Breeding Conditions of Lake Chad

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**Abstract** – This study evaluated the performance of the bovine Kuri breed in its natural environment i of Lake Chad. Eighty-eight (88) females were monitored over three lactations for four years (2009-2012). In all 32,665 daily measurements were carried out. Cows fed on natural pasture had accessed to some byproducts from developed agricultural plots. They were milked by hand in the presence of a calf to stimulate milk ejection before milking. Milk production was recorded by two daily milkings (In the morning and in the evening) twice a month for all lactations. The results showed a greater variation in the daily amount of 1.2 to 13.40 liters of milk produced. The variations observed were due to the suckling calf and hand milking likely to influence the degree of emptying of the udder. The average milk production was  $5.33 \pm 2.12$  liters per day, or 5.5 kg and varies by increasing according to the rank of lactation. The average length of lactation was  $332.87 \pm 77.2$  days and falls depending on the rank of lactation. The average milk production per lactation was 1776.66 kg, representing a standard production of 305 days of 1628.70 kg. The rank of lactation had a significant effect ( $P < 0.05$ ) on milk yield and duration of lactation. The dry season or harvest period had a positive effect and the rainy season or transhumance period a negative effect on milk production. The study has shown the significant potential of the Kuri cow and proved that non-genetic factors have a significant effect.

**Keywords** – Kuri Cow, Milk Production, Extensive Breeding, Lake Chad.

## I. INTRODUCTION

The Kuri cattle breed, known locally as *Boudouma*, *Bahari*, *Bare*, *Borrie*, *Dongole*, *Kuburi* is widely known as *White Lake Chad*. It is classified in the group of "humpless longhorn cattle" [1]; [2]. Its habitat is located in the islands and the Lake Chad coastline between 12° 20' and 14° 20' North latitude and 13° and 15° 30' East longitude, on the border between four countries, namely Cameroon, Niger, Nigeria and Chad. The southern part of the Lake is close to isohyets 500 mm, while in the North it is located above isohyets 250 mm with an average altitude of 287 m. Mixed milk and meat breed adapted to the aquatic environment, it presents a developed bone structure and the disproportionate cornage is typical of the breed. Classified as a tall straight and slender animal, 140 to 150 cm at the withers, the coat is clear, plain white or light-tan, mucous membranes are dark. Its average weight is 550 kg, animals fattening can reach 600 to 700 kg. The large horns

are light in color with black ends. They are carried in high lyre or wide open crescent. The section at the horn base of is round and can reach 80 to 100 cm in circumference [3] ; [4] ; [5].

Milk plays an important role in live of pastoralists in Chad. It is not only the basic food but also an important source of income after sale of livestock [6]. The performance data bases are, however, lacking for some local breeds (M'Bororo zebu and Toupourri taurine), fragmented and disparate for Arab zebu and old for Kuri taurine [5] ; [7]. Among the local breeds of Chad the Kuri plays an important role. Indeed, studies of this breed show that it produces relatively more milk [2] ; [8] ; [9] than other native breeds [10] ; [11].

The objective of this study was to evaluate the quantities of milk and analyze its production based on genetic and environmental factors. This will contribute to help in the implementation of the conservation program and / or genetic improvement of the Kuri cattle.

## II. MATERIALS AND METHODS

**Site:** center of Safeguard of the cattle Kuri (CSK) is located on a former island called Godjirom, which has become after the removal of water from the Mamdi polder and development of this, a kind of heap located about 15 km south east of the city of Bol. The delimited CSK part covers an area of 20 hectares, with a perimeter of 1783.34 m<sup>2</sup>. Lake Chad has 80 polders of Chadian side with sizes ranging from 500 to 2,000 ha. The land area of the entire polders is estimated at about 100,000 ha. To date, only 8 polders are developed and Godjirom Island is located in one of these 8 developed polders. The vegetation around the Centre is characterized by shrubs and herbaceous plants. The presence of the doum palm tree (*Hyphaena thebacea*) and *Acacia senegalensis* dominate the woody vegetation. The presence of *Calotropus posrocera* is observed everywhere.

**Animals:** animals involved in the study were females calved at CSK, and the data were recorded on their individual monitoring record sheet during four years, between April 2009 and June 2012 (Figures 1 and 2).



Figure 1: Kuri female in its natural environment



Fig.2. Kuri heifer from CSK in Lake Chad

**Sampling:** on first lactation, 18,800 observations were made on 80 Kuri females; during second lactation, 10,575 measurements were carried out on 45 cows and during third lactation, 3,290 observations were made on 14 females.

**Herd breeding system:** it is an extensive farming system, operating with minimal input and relatively close to traditional systems in the Lake Chad region. Natural pasture is mostly the only food source with some cotton cake supplementation in tough times. The Salt Lick has been available throughout the year. The center has a 14-hectare irrigable area for extra fodder.

In terms of grazing, the Lake Chad area provides important forage potential and the nature of plant species may not be similar. Two very different types of natural pastures exist in the Lake Chad region:

The pasture of continental area is occupied by thorny steppe shrub (*Acacia radiana*, *Acacia senegalensis*) and annual grasses whose forage availability varies by site, between 400 and 1000 kg DM/ha [12]. For pastures in the lakeside areas, non-palatable species are especially *Reeds*, *Papyrus*, *Pistia stratiotes* (floating plants). However, the best pastures are on the lower islands flattened by erosion and consist of *Voschia cuspidata* (kaffa), plants whose sweet rhizome is consumed by humans. *Leersia hexandra* (tam) and *Sacciolepis africana* are grazed by cattle, despite a depth of water ranging between 1 and 2 meters and contain 12% to 30% DM. With very good fodder, polders offer significant agronomic potential due to soil fertility and irrigation possibilities. One finds *Pennisetum* which may have a yield of 40 tones DM/ha and in irrigation, *Leucaena*, a fast growing fodder tree, with excellent food value [13]. Regarding herd management, the rangeland management is done depending on the periods of the year:

**Period of cold dry season:** this period is the time of the year when the temperature is lower but the grasses of

the pastures are desiccated and insufficient. It is located between the months of November and February. At this time, the animals are stationed at the Safeguard Center.

**Period of hot dry season or lean season:** it lasts for four months between the off-season crop harvest and the beginning of the rainy season (March to June). Crop residues from the off-season crop campaign in the hot season depleting rapidly and the food situation becomes precarious. Towards the end of this period, rainfall is less important to promote the rapid growth of the grass. Feeding becomes difficult resulting in lower animal zootechnical performances.

**Period of the rainy season or transhumance:** seasonal migration to grazing grounds occurs at the beginning of each rainy season, following a given path. All the animals in the Lake Chad area and those in the Safeguard Center are affected by this obligatory seasonal movement, mainly because of pressure from bloodsucking and biting flies and insects, of which are the *Culex* sandfly, *Tabanidae*, etc. [14], but not in search of pastures. Migration usually begins in July or August and lasts approximately three (3) months.

**Milking Method:** at the Center, the evaluation of milk yield of the studied cows is done based on two milkings a day, in the morning at 6 hours before the release of the animals and in the evening at 18 hours after they have returned from grazing and twice a month (once a fortnight). Milking is done by hand by a drover in the traditional manner in the presence of a calf triggering beforehand the milking process. The milk yield is measured using some graduated containers of 1.2 to 5 liters. The daily average is calculated from two milkings of the day. The monthly average is obtained from the two measurements of the month. The daily entries, the monthly reports and individual animal monitoring sheets were used as basis to compile some data.

#### **Data Analysis**

The data were analyzed using the SPSS software (Statistical Package for the Social Sciences [15]). Collected information was synthesized in averages, standard deviation and range. Variables were subjected to analysis of variance (ANOVA). The breakdown of averages was made on season and lactation rank factors. The meaning of averages was observed at 5% threshold.

### **III. RESULTS**

#### **Daily milk production of the Kuri cow**

Out of all the observations, the lowest milk yield was 1.20 liter and the highest 13.40 liters from a total of 32,665 milkings. Measured absolute individual variations per lactation, range from 2.60 to 9.20 liters in the first lactation, 1.40 to 13.00 liters in the second and 1.20 to 13.40 liters in the third lactation.

The average daily milk yield was 5.33 liters per day, or 5.5 kg on the whole. Significant differences ( $P < 0.05$ ) in averages were observed between females in the first lactation and females in the 2<sup>nd</sup> and 3<sup>rd</sup> lactations (Table 1).

**Table 1: Change in daily milk yield of the Kuri cow based lactation rank in Lake Chad.**

Parameter		Lactation Rank			Total
		1 <sup>st</sup> lactation	2 <sup>nd</sup> lactation	3 <sup>rd</sup> lactation	
Mean	Liter	4.88±1.73 <sup>a</sup>	5.30±2.19 <sup>b</sup>	5.41±2.12 <sup>b</sup>	5.33±2.12
	Kg	5.03	5.47	5.58	5.50
Maximum		9.20	13.00	13.40	13.40
Minimum		2.60	1.4	1.20	1.20
Number of observations		18,800	10,575	3,290	32,665
Lactation number		80	45	14	139

Different superscript letters in rows are significantly different (P<0.05).

### Lactation length

From all observations, the average length was 332.87 ± 77.2 days, 11 months and 3 days. Based on the lactation rank, significant average differences (P<0.05) were

observed between the first and third lactations, and between the second and third lactations (Table 2). The shortest (170 days) and the longest (495 days) durations of lactation were only observed in second lactation.

**Table 2: lactation length in days of the Kuri cows according to the lactation rank in Lake Chad**

Parameter	Lactation rank			Total
	1 <sup>st</sup> lactation	2 <sup>nd</sup> lactation	3 <sup>rd</sup> lactation	
Mean	347.57±74.47 <sup>a</sup>	342.93±83.49 <sup>a</sup>	322.95±81.47 <sup>b</sup>	332.87±77.22
Maximum	420	495	484	495
Minimum	258	170	386	170
Lactation number	80	45	14	139

Different superscript letters in rows are significantly different (P<0.05).

### Milk production per lactation

The average production of three lactations was 1,721.57 ± 482.90 liters with a maximum of 3,630 liters and a minimum of 567.50 liters, representing 1,776.66 kg on average, corresponding to a standard production of

1,628.70 kg in 305 days. This production has varied according to the rank of lactation (Table 3). The increase in Milk yield was progressive with rank lactation. The mean differences were significant between the 1<sup>st</sup> and 3<sup>rd</sup> (P<0.001) and between the 2<sup>nd</sup> and 3<sup>rd</sup> (P<0.01) lactations.

**Table 3: Evaluation of milk production (kg) of Kuri cow according to lactation length and in 305 days in the Lake Chad**

Parameter	1 <sup>st</sup> lactation		2 <sup>nd</sup> lactation		3 <sup>rd</sup> lactation		Total	
	By lactation	In 305 days	By lactation	In 305 days	By lactation	In 305 days	By lactation	In 305 days
Mean	1,676.93 <sup>a</sup>	1,537.20	1,689.52 <sup>a</sup>	1,555.50	1,836.63 <sup>b</sup>	1,683.60	1,736.66	1,628.70
Maximum	2,617.56	2,397.30	3,746.66	3,431.25	3,425.88	3,138.45	3,746.16	3,431.25
Minimum	944.90	866.20	585.68	536.80	771.94	707.60	585.66	536.80

Different superscript letters in rows are significantly different (P<0.05).

### Seasonal variation of milk production

The monthly variation in milk production per lactation rank over a period of 4 years was observed. Thus, in ranking 1, the peak of milk production was observed in August with about 5.5 liters per day; in rank 2, the maximum of the production was noted in September with about 6 liters per day, and in rank 3, production began to increase in March and remained essentially constant from

May until September with about 7 liters per day (Figure 3).

In general, a decrease in milk production was noted in September, which is towards the end of transhumance and continued, with a slight increase until March and then had a rebound in April. The period of stable production was observed between May and August. For the three lactations, we always notice a decline from September to start the increase only from May (Figure 4).

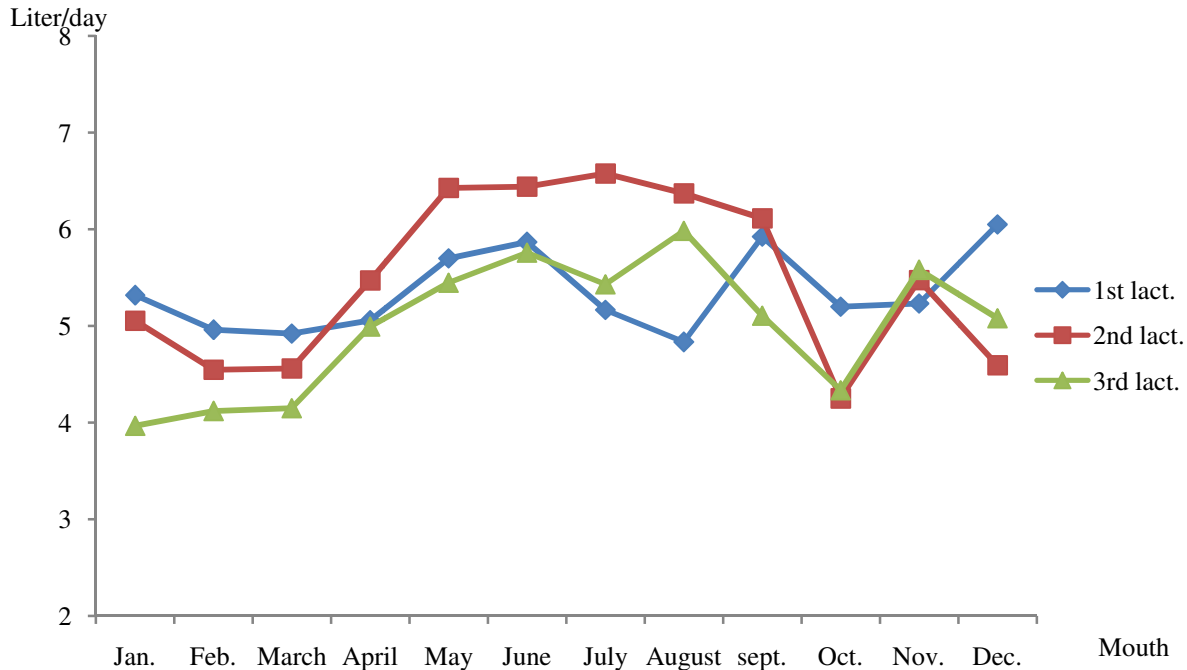


Fig.3. Change in milk production depending on the rank of lactating Kuri cows in the Lake Chad area

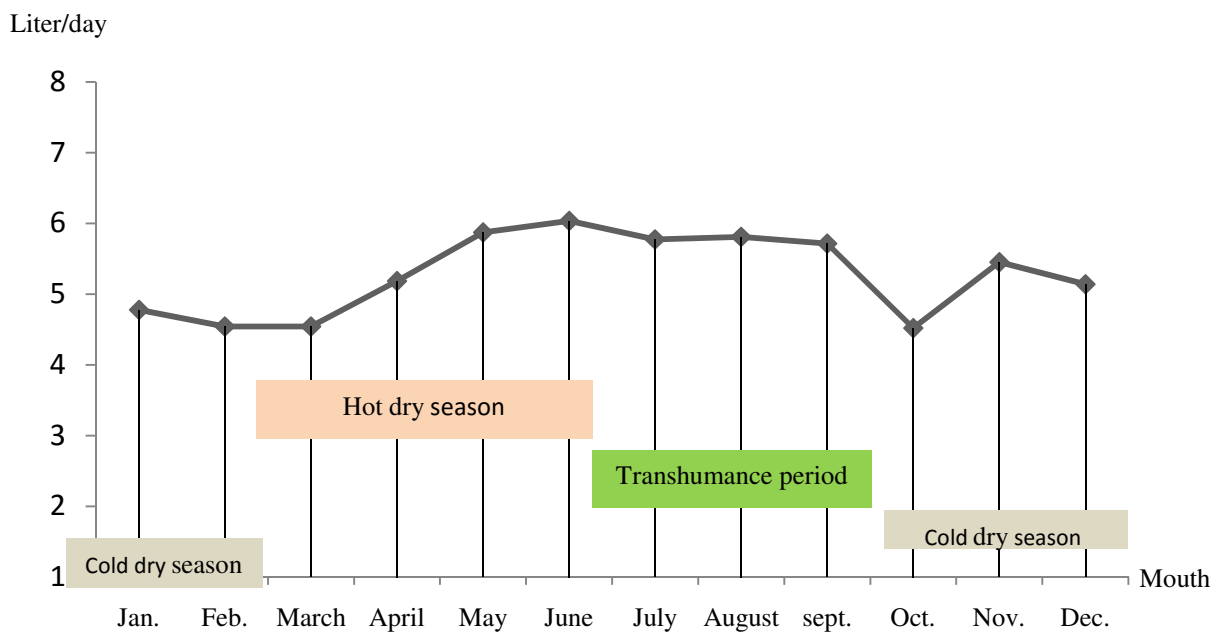


Fig.4. Average trend of seasonal variations in the daily yield over four years (2009-2012)

#### IV. DISCUSSION

Evaluation of milk production by the Kuri, in intensive cattle- farming over a period of four years, is a very important result. In addition, seasonal variations in production related to food resources and environment of the region can be used as a basis to reason and appreciate the improvements of the dairy production. The interval from 1.20 to 13.40 liters of daily milk yield with an average of 5.33 liters or 5.5 kg was in the range of 3 to 6 liters/day previously observed by some authors [2] ; [5] ; [8] ; [16]

and [17]. Reference [4] noted a similar production of 5 to 8 liters for a good Kuri cow in full lactation and [3] estimates that the yield may reach 6 to 10 liters per day. The daily averages ranging from 4 to 8 liters per day are obtained from 20 Kuri cows by [9]. The lowest average of 3.2 liters was reported by [18]. Despite these sharp differences in daily production levels observed in Kuri cows, this breed still holds the record of milk production among other local breeds in Chad. According to most authors, the Kuri cow is better milk producer compared to the Arab zebu which constitutes 90% of the cattle

population of Chad, with on average of 1.5 to 4 liters per day [10]. It is the same with the White Fulani zebu, which produces an average of  $1.9 \pm 0.5$  kg per day [11], the M'Bororo zebu with an average production of 1.2 to 2 liters a day and the Toupouri cow, a poor milk producer, with an average daily production of 0.5 liters per cow [3].

Compared to indigenous African cattle breeds, the average production of  $5.5 \pm 2.12$  kg per day was above most local breeds: 1.4 kg of daily milk production by Ankole cattle in Uganda [19],  $2.08 \pm 0.23$  kg per day by lactating dairy zebu evaluated in Burkina Faso [20],  $2.2 \pm 0.22$  kg by female zebras in the Sudan [21], 2.98 kg by the Barca race [22], 2.2 to 3.4 kg by the Boran cow [23]; [24] and 1.99 kg by Ogaden cattle [25] in Ethiopia and  $4.3 \pm 0.80$  kg by the N'Dama cow [26] in Côte d'Ivoire. The performance of some zebu females like Gudali with a production of 1.2 to 7 liters per day [27] in Burkina Faso and the Azawak with 6.11 liters [28] to 15 liters at Toukounous livestock station in Niger [29] are similar to those of the Kuri breed. The condition under which production was evaluated may lead to underestimate the actual capacity of the Kuri cow. Extensive breeding system, production practices and lack of experience of shepherds in milking as well as the fact of not taking into account the quantity of milk used by calves at the start of the milking process could constitute the main factors. Furthermore, other authors [30] reported the stimulating effect of suckling calves before milking to increase milk yield obtained.

The rank of lactation affected significantly ( $P < 0.05$ ) the lactation length. It was 347 days in the first lactation, 342 in second and 323 in third lactation. In Ethiopia, [31] also obtained significant results (406, 395, 332 and 305 days respectively in 1st, 2nd, 3rd and 4th lactations). In Cameroon, it was also observed a significant decrease in lactation length with lower averages of 295, 261 and 265 days respectively in 1st, 2nd and 3rd lactations among exotic races and their crosses [32]. These authors speculate that the lactation period decreases as the lactation rank increases; this would be related to the aging of the cow. The average lactation length of 332.87 days in our study was above the 314 days reported by [33] and [1] in the Kuri. In African traditional breeds, lactation length ranges from 6 to 10 months. Thus, they vary from 92 to 262 days in the zebu Gudali [27]; [34], 300 days on average for the Azawak [29] and 114 to 175 days respectively for the M'Bororo zebu [35] and the White Fulani [34] in Cameroon. The lactation length of 280 days is often recognized for cattle in tropical countries [36]. Most authors [2]; [4]; [8]; [17] set the lactation length of the Kuri cow between 180 and 300 days, which is lower than our results.

The level of milk production increases with the availability of food and water resources, especially farming practices and environmental in addition to the genetic potential and control of damages caused by diseases. These factors play an important role in the externalization of animal production parameters. In general, exotic cow breeds have a better milk production

level than those of local race reared under the same operating conditions. Thus, the lactation length of Holstein cows evaluated in Morocco being 338 days is high compared to local cows reared in Martinique with 330 days [37] and in Morocco with 314 days [38]. The lactation length of these exotic breeds is much higher than that of the Kuri cows which was higher than that of the indigenous breeds in Chad: Arab zebu with 180-300 days [10], White Fulani 300 days [11] and M'Bororo with 180 days.

The average milk production per lactation ( $1,555.01 \pm 428.35$  kg) of the Kuri race based on our observations is equivalent to a standard production of 1,424.81 kg in 305 days. It was significantly higher than that reported by [1] at Animal Husbandry Center in Maiduguri, which was 1,260 kg with a record 2,440 kg. Reference [4] set the production of this race between 975 and 1,560 kg per lactation and [17] between 840 and 1,260 kg. Traditional cattle breeds generally have low milk production capacity. Thus, the local Tidili cow of Morocco has an average production of 933 kg during his entire lactation [39], the Mongolian cows in China with 600 kg, the Kazakh cows with 800 kg [10], the Boran females in Ethiopia with 771 kg per year [24], the Gudali zebu with 253.5 to 929.6 liters [27] and [34], the N'Dama and Baule taurines with respectively 475 and 400 kg [40], the Ankole cattle with 561 kg [19] and the Arab zebu of Chad with a production ranging from 800 to 1000 kg [8]. The performance of dairy Kuri cow is close to that of exotic cattle breeds reared under tropical conditions. Thus, the Holstein in Morocco produces an average of 6,239.1 kg of milk and the Montbeliard 5,451 kg [38] and the Montbeliard in Algeria with 2,200 to 3,250 kg [41]. The Jersey breed in Senegal has an average annual production of 3,274 kg [37]. In Cameroon, the milk production of the Holstein in pure race was significantly higher (2,508 liters) than that of pure race Jersey with 1,818 liters [32].

Seasonal variation in milk production among the cattle in Chad is important in most parts of the Chadian regions because it is linked to fodder availability. High milk production season is the rainy season extending from July to October [3]; [10]; [11]; [42]. Pastures are in abundance and quantities of milk are important during this period. In the Lake Chad region however, the rainy season is a period during which biting insects and poor conditions in and around Lake Chad compel animals to migrate on dry lands. Cows produce an average of 4.52 to 5.04 liters per month. The lowest yields were recorded in August and September over the four years of the study. During the period from April to June, considered a period of abundant end of harvest byproducts in developed and undeveloped polders, the average monthly production was significantly ( $P < 0.01$ ) higher (5.45 to 6.04 liters). Changes in dairy Kuri cow milk production in the Lake Chad area and especially at CSK depends on climatic, environmental and food factors altogether.

## V. CONCLUSION

Milk production by the Kuri cow, estimated under traditional breeding conditions, has shown that it has a production capacity which is superior to that of other indigenous breeds in Chad. The environment and the availability of food resources affect milk yield of Kuri cows. Under satisfactory conditions for the breed, milk yield can be improved because, genetically, Kuri cows have the potential to improve production as shown by the results of the study. There is need to encourage traditional animal breeders to manage the environment of Kuri cows so that the genetic potential of cows can be enhanced. In addition, commercial farms should be advised to adopt that cattle breed for a proper operation in dairy production in the tropical climate of Chad. Moreover, further studies are needed to assess the real potential of this breed under the best optimal food and milking conditions other than milking by hand.

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