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EVALUATION OF THE DAIRY AND GROWTH PERFORMANCE OF DJELLI CATTLE IN THE TRADITIONAL ENVIRONMENT OF NIGER

^aGuéro C. Issoufou*, ^bGréma Moustapha, ^cAdamou K. Ibrahim, ^dIssa Moumouni^a Abdou Moumouni University of Niamey, Faculty of Agronomy, Department of Animal Production, B.P: 10960 Niamey-Niger.^b Abdou Moumouni University of Niamey, Faculty of Science and Technology, Department of Animal Biology, B.P: 10960 Niamey-Niger.^c Djibo Hamani University of Tahoua, Faculty of Agronomic Sciences, Department of Animal Production and Food Technology, BP: 255: Tahoua-Niger.^d Abdou Moumouni University of Niamey, Faculty of Science and Technology, Department of Animal Biology, B.P: 10960 Niamey-Niger.

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ABSTRACT

The development of Djelli cattle breeding in Niger remains a challenge due to the limited information available on production performance. Therefore, conducting an evaluation of Djelli performance in its current breeding conditions in a traditional environment was deemed important. Evaluation of the production performance was carried out in three localities in the communes of Gothèye and Say in Niger. Manual milking followed by calf weighing was carried out on 81 farmers to determine their milk production. Descriptive statistical techniques such as mean and standard deviation were estimated using SPSS software v21. To compare means, an analysis of variance (ANOVA) followed by Tukey's multiple comparison test was also performed. The results revealed that the average daily milk production obtained by farmers was 1.66 ± 0.52 kg in the dry season, and 2.09 ± 0.73 kg in the middle of the rainy season. Average production at peak lactation was 2.48 kg in the dry season, and 3.47 kg at the end of the rainy season. The weight of male calves was higher than females ($P < 0.001$) at birth (21.68 ± 1.74 kg for males versus 20.27 ± 1.64 kg for females), at 1 month of age (30.17 ± 1.98 kg for males versus 28.43 ± 1.92 kg for females) and at 2 months of age (37.9 ± 2.4 kg for males versus 35.27 ± 3.01 kg for females). The average birth weight for both sexes was 20.93 ± 1.82 kg. The average daily gain (ADG) of male calves was also higher to that of females ($P < 0.001$) (270.31 ± 40.79 g in males versus 250 ± 43.68 g in females). In conclusion these results are likely to serve as the basis for a selection program aimed at improving the performance of the Djelli zebu from Niger.

Corresponding Author: Guéro C. Issoufou

Email: issoufouguero44@gmail.com

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INTRODUCTION

Niger is located in the Sahel region of West Africa. Niger is considered important in terms of livestock production in the world. Among the animal species raised in the

country cattle occupy a prominent place and are used in various income-generating activities (the sale of live animals, milk and cheese, etc.) (Zakari et al., 2019b). The cattle herd makes a considerable contribution to the

economy of the country's rural populations. According to national statistics, the average cattle herd over the last three years (2015-2017) accounted for 64.02% of total exports of live animals, compared with just 9.83% of the total volume of controlled slaughterings and 9.81% of the total volume of packaged hides and skins (Niger, 2014).

Livestock is an important economic activity in Niger, representing 49% of GDP and being the main export product alongside agriculture, uranium, and oil (Andres et al., 2014). Cattle are the most used (98.15%) for animal energy users in Niger, contributing to the development of agricultural mechanization in the country (Arifa et al., 2022).

Livestock in Niger is made up of one breed (*Bos taurus*), the kouri (4%), products of various crosses or crossbreeds representing (2%) and 4 breeds of zebu, the Azawak (65%) (Issa et al., 2016), the Bororo (18%), the Goudali (3%) and the Djelli (7%) (Marichatou et al., 2005). Despite its small size (7%), the Djelli zebu remains a very valuable animal genetics for breeders due to its ease of adaptation to climate change and its ease of fattening with carcass yields of 48 to 50%. It is also the most widely sold cattle breed in the river region (Zakari et al., 2019a). The anatomical characteristics of the Djelli female's reproductive tract are comparable to those of the Azawak, Niger's most dairy breed (Moussa et al., 2014). However, few studies such as Kubkomawa et al. (2017) and Olorunnisomo (2019) have focused on the production performance of the Djelli zebu. Moreover, there are no in situ conservation programs for this breed in Niger (Niger, 2013). In Niger, few studies have been carried out on the daily milk production and calf growth of the Djelli zebu, as with the country's other cattle breeds, yet the livestock development strategy (SDDEL 2013-2035) recommends monitoring the performance of local cattle breeds (Niger, 2013).

The performance of the Djelli zebu still needs to be evaluated, to develop an in-situ conservation program conducive to the development of its breeding.

The main objective of this study is to evaluate the production performance of Djelli cattle in traditional environments in Niger. One of the objectives is to determine the average quantity of milk milked per Djelli suckler cow according to the seasons, and the second is to determine the average daily gain (ADG) of Djelli calves. The study hypothesises that (1) the average quantity of milk milked by the Djelli suckler cow is

similar to that of high-producing Sahelian breeds and (2) the average growth of Djelli calves is higher than that of calves of African tropical breeds.

The results obtained will be used to diagnose the overall production performance of the Djelli zebu, and as a basis for selection aimed at improving the dairy performance of the local Djelli zebu breed.

MATERIALS AND METHODS

Study environment

This study was carried out in three localities (Yelwani, Koulbaga and Say) located in the Niger River region (Figure 1), which is the breeding area par excellence for the Djelli zebu of Niger. The region is located in the extreme west of Niger, between 11°50' and 15°45' N latitude and 0°10' and 4°20' E longitude. It covers an area of 97,251 km² (around 7.7% of the country's surface area) and had an estimated population of 3,280,333 in 2018 (49.6% male, 50.4% female), representing 15.9% of the Nigerien population (Zakari, 2020). The Tillabéri region is divided into 13 departments, 45 communes and the regional authority. Traditional power is exercised at the highest level by 31 canton chiefs, 9 groupings and 1946 administrative village and tribal chiefs (Zakari, 2020).

Data Collection Methods

The study took into account male and female Djelli cattle production data covering the period from February to October 2023, i.e. 9 months in the villages of Yelwani, Koulbaga and Say in the Tillabéri region. The methodology consisted of a simple, random selection of households based on the availability of breeders, the presence of suckling females in the household and their accessibility. A total of 45 households with 166 lactating females were involved in this study (Table 1). The study sample comprised 81 cows with new births, i.e. 48.79% of the suckler calf population. Out of Total, only 69 calves of both sexes (Table 1) were weighed from birth to 2 months, i.e. 85.18% of all births.

Milk quantities were measured once a week for three months from the 2nd week after calving whereas colostrum was not taken into account. The milking equipment (Figure 2a) consists of a digital scale, a 5-liter calabash for milk collection and a bucket for post-milking storage. Only the quantity of milk milked was recorded. Milking begun after a brief tete-a-tete of milk stimulation by the calf. The calf was tied to one of its

mother's legs to prevent the operation from being disrupted.

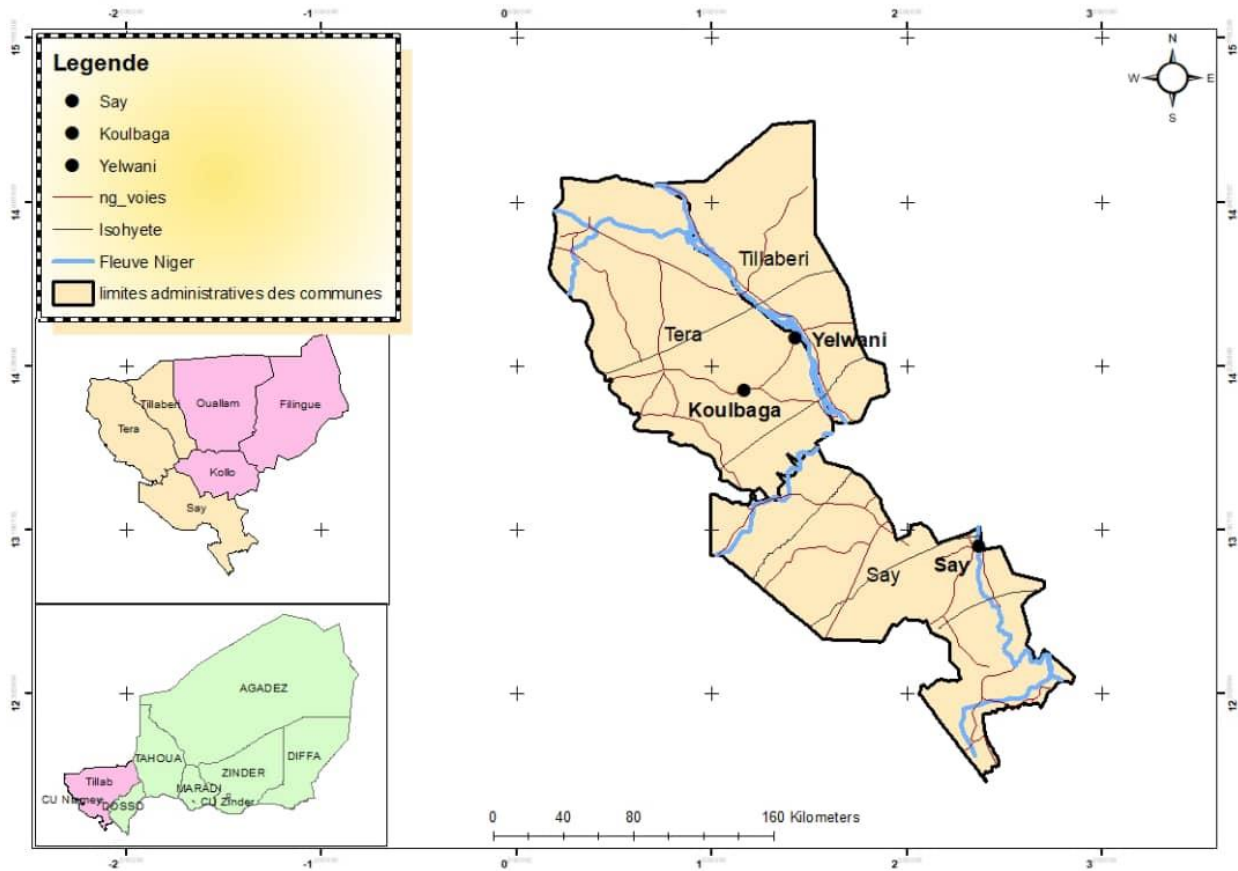


Figure 1. Map of the Niger River region, showing study locations.

Table1. Distribution of households surveyed, suckler cow numbers, new births and calves of both sexes weighed between 0 and 2 months, by locality

Locations	Households surveyed	suckler cows	new births	Calves weighed from 0 to 2 months
Koulbaga	17	82	35	32
Yelwani	13	57	27	23
Say	15	30	19	14
Total	45	166	81	69

Total daily milk production (QJ) was calculated according to the following formula:

$QJ = (Q1 + Q2)$ where Q1= morning milking quantity and Q2= evening milking quantity

The weight of each calf was recorded at birth, one month after birth and two months after birth to assess average daily gain (ADG), using a 100 ± 0.1 kg scale (Figure 2b). Only calves with all three weighings complete were taken into account. Data from calves with incomplete

weighings were removed. Average daily gains (ADG) were calculated using the formula proposed by Lhoste et al (1993).

$$GMQ (g/d) = (\sum Wf - Wi) * 1000 / \Delta T$$

Where: Wf = final weight; Wi = initial weight; ΔT = time between two weighings in days.

The research protocol was drawn up in accordance with ethical principles. Its validity was tested in consultation with the research supervision committee.

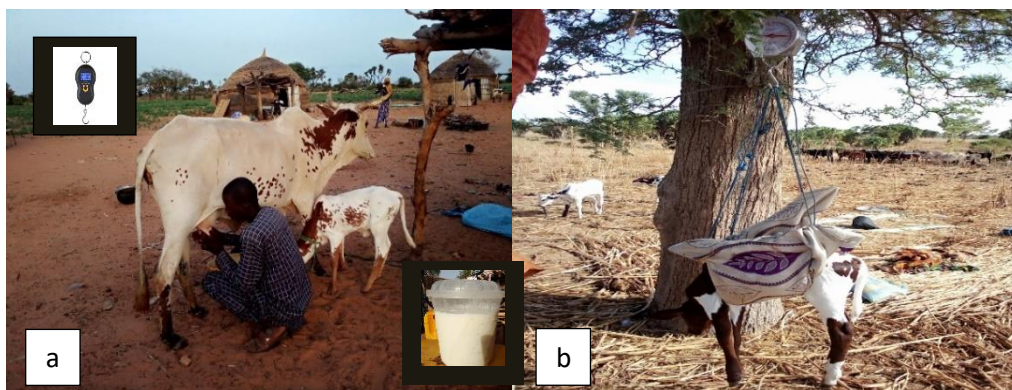


Figure 2. (a) Milking method for Djelli cows and (b) Weighing Djelli calves

Statistical analysis of data

The recorded data were analyzed using SPSS (Statistical Package for Social Science) version 2021. The model used was an analysis of variance (ANOVA). Statistical analyses were performed on daily milk production, calf weight at birth, at 1 to 2 months of age, and average daily gain (ADG). Comparisons of means were made using the Tukey test using significance level at 5% level.

RESULTS AND DISCUSSION

Interaction between periodicity and daily milk production according to the weeks of lactation of the Djelli cow

The statistical characteristics of the quantity of milk milked in kilograms per day in Djelli zebu suckler cows reared in traditional environments in the Niger River zone, according to the time of year, are shown in Table 2. Average individual daily production was 1.66 ± 0.52 (n=17) in the dry season, 2.09 ± 0.73 (n=49) from the beginning to the middle of the rainy season and 2.36 ± 0.70 (n=15) from the middle to the end of the rainy season. Production at peak lactation was 2.48 (n=17) in the dry season, 3.31 (n=49) from the start to the middle of the rainy season and 3.47 (n=15) from the middle to the end of the rainy season. The mean for all periods was 2.00 ± 0.64 (n=81), with a peak of 3.03 kg (n=81).

Table 2. Descriptive statistics of the quantity of milk per milking (kg/day) in Djelli zebu suckler cows according to the time of year in the traditional environment of the Niger River zone (n= 81).

Milking period	Headcount (n)	Minimum	Mean \pm Sta. Dev.	Maximum (Peak)	P-Value
FMA	17	0.75	$1.67 \pm 0,52^a$	2.48	p<0.001
MJJ	49	1.23	$2.09 \pm 0,73^b$	3.31	
ASO	15	1.06	$2.32 \pm 0,70^c$	3.47	
Total	81	0.96	$2.00 \pm 0,64$	3.03	

a,b Tukey test multiple comparison: each letter indicates a dairy performance subgroup whose column means do not differ from each other at the 5% significance level.

FMA=February March April (dry season), MJJ=May June July (Beginning to middle of rainy season), ASO=August September October (Middle to end of rainy season)

The average production of 2.00 ± 0.64 kg (n=81) in this study is similar to the 1.89 ± 0.59 litres/day obtained for white and red fulani reported by kouamo et al (2017) in small traditional farms in the northern Cameroon region. However, the average production in this study is well below the 3.56 ± 0.50 kg obtained in Azawak bred at the

Toukounouss station in Niger by Ali (2004). It is also well below the 3.92 ± 0.11 kg per day obtained by Doko et al (2012) in Girolando cattle at the Kpinnou breeding farm in southwest Benin.

The peak lactation production of 3.03 kg observed in this study aligns with the findings of Nsangou et al. (2021),

who reported that indigenous breeds typically yield over 3.5 liters of milk during traditional, unsupervised rearing. However, the peak production of Djelli cows in this research falls notably below the 4.2 ± 1.5 liters per day achieved by Adamou et al. (2017) with Kouri cows in Niger, as documented at the Sayam station in Diffa. This comparison suggests that if Djelli cows were raised under similar conditions as Azawak, Girolando, and Kouri breeds, either through elite breeding programs or supervised traditional rearing, their milk output could be significantly enhanced, potentially rivaling that of the country's most productive breeds. Depending on the seasonal variation, the average daily production peak per individual ranges from 2.48 kg (n=17) during the dry season, 3.31 kg (n=49) at the onset of the rainy season, to 3.47 kg (n=15) from the middle to the end of the rainy season. This outcome is consistent with the findings of Choisis et al. (1990) in Mexico, where maximum milk production was observed during the rainy season (3.7 kg) and minimum during the dry season (2.2 kg) under traditional conditions. Similarly, the results of Doko et al. (2012) indicate higher milk production during the rainy

season compared to the dry season in Girolando cows at the Kpinou farm.

Growth assessment of Djelli calves of both sexes

Table 3 shows the Adjusted Means \pm Standard Deviation of the average daily weight and earnings of Djelli calves. Of the 69 Djelli calves weighed, the weight of the male calf was superior to that of the female ($P < 0.001$). The calf weight for males was 21.68 ± 1.74 kg versus 20.27 ± 1.64 kg for females at birth, 30.17 ± 1.98 versus 28.43 ± 1.92 kg at one month of age, and 37.9 ± 2.4 kg versus 35.27 ± 3.01 kg at two months of age. There was also a clear superiority of average daily gain (ADG) in the rainy season ($P < 0.001$) (281.49 ± 29.26 kg between May and July and 241.02 ± 42.31 kg between August and October) compared with the dry season (204.80 ± 21.97 kg between February and April). However, the difference in average daily gain (ADG) was slightly noticeable between males and females ($P < 0.135$) (270.31 ± 40.79 g in males versus 250 ± 43.68 g in females). The overall average GMQ for Djelli calves was 259.42 ± 43.28 g (n=62).

Table 3. Mean \pm standard deviation of Djelli zebu weight performance by time of year and sex.

Variable	Modality	N	PO	P1	P2	GMQ1 (0-1 month)	GMQ2 (1-2 month)	GMQ (0-2 month)
	Total	69	20.93 \pm 1.82	29.24 \pm 2.12	36.49 \pm 3.03	277.17 \pm 57.35	241.66 \pm 73.51	259.41 \pm 43.28
Period	ASO	13	23.78 \pm 1.46 ^a	30.76 \pm 3.09 ^a	38.25 \pm 2.86 ^a	232.68 \pm 97.56 ^a	249.35 \pm 80.54 ^a	241.02 \pm 42.31 ^a
	FMA	13	19.65 \pm 1.12 ^b	27.15 \pm 1.65 ^b	31.94 \pm 2.02 ^b	249.99 \pm 27.00 ^a	159.61 \pm 49.28 ^b	204.80 \pm 21.97 ^b
	MJJ	43	20.45 \pm 1.06 ^c	29.41 \pm 1.29 ^a	37.34 \pm 1.81 ^a	298.83 \pm 32.81 ^b	264.14 \pm 59.85 ^a	281.49 \pm 29.26 ^c
	P-value		p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
Gender	F	37	20.27 \pm 1.64 ^a	28.43 \pm 1.92 ^a	35.27 \pm 3.01 ^a	272.06 \pm 48.71 ^a	227.92 \pm 78.17 ^a	249.99 \pm 43.68 ^a
	M	32	21.68 \pm 1.74 ^b	30.17 \pm 1.98 ^b	37.90 \pm 2.40 ^b	283.06 \pm 66.27 ^a	257.54 \pm 65.35 ^a	270.30 \pm 40.79 ^a
	P-value		p<0.001	0.001	p<0.001	0.647	0.275	0.135

The observed weight advantage of male calves over females at the standard age ($P < 0.001$) in this study aligns with the findings of Touré et al. (2017) and Seydou et al. (2022), who reported that male Azawak zebu calves weighed an average of 39 ± 10 kg, whereas females weighed 32 ± 4 kg in Ménaka, northern Mali, and 20.56 ± 3.32 kg for female calves compared to 23.33 ± 4.08 kg for male calves in mestizo in the Sudanian zone of Burkina Faso, respectively. The overall average

growth rate for Djelli calves at two months of age, which was 259.42 ± 43.28 g in this study, surpasses the 243 g/day recorded for Gudali zebu calves aged between 0 and 3 months as reported by Marichatou et al. (2005) in the peri-urban area of Bobo-Dioulasso, Burkina Faso. However, this average growth rate falls below the 269.72 g obtained between 0 and 3 months of age in the Azawak village by Ali (2004) in the agropastoral zone of Niger. These results indicate that under optimized

breeding conditions (including diet and health), the growth rate of Djelli zebu calves is notably superior to or comparable with that of Azawak, a renowned dairy breed in Niger. The study revealed the highest average daily gains (ADG) during the rainy season ($P < 0.001$), with ADG recorded at 281.49 ± 29.26 kg between May and July and 241.02 ± 42.31 kg between August and October, while the lowest ADG occurred in the dry season (204.80 ± 21.97 kg between February and April). These findings support the conclusions of Nsangou et al. (2021), who attributed the significantly higher weights observed in animals born during the rainy season to the abundance of forage production during this period compared to the dry season. However, our results differ from the trend observed in mixed-breed Holstein calves at birth as reported by Seydou et al. (2012), who noted a slightly higher gain in February ($P < 0.018$) (489.31 ± 29.25 kg) compared to June (474.12 ± 38.22 kg) between 0 and 6 months of age. This discrepancy can be attributed to the genetic differences between the two breeds, with Djelli Zebu being a purely local breed and the F1 product observed by Seydou et al. (2022) being a cross between a local and an imported breed.

The average birth weight of Djelli calves in this study, recorded at 20.93 ± 1.82 kg, is lower than the 34.75 kg reported by Nsangou et al. (2021) for crossbred Holsteins in Tropical Africa and also lower than the 23 kg observed by Aboly et al. (2021) in mixed-breed calves. This discrepancy is likely due to the additive genetic difference between the local Djelli calf and the mixed-breed calf. These results suggest that in the case of crossbreeding, the growth performance of Djelli calves could be significantly improved and even comparable to that of Holstein crossbreds. Finally, the results obtained on milk quantity and calf growth seem to invalidate the hypotheses formulated.

CONCLUSION

This study concludes that the production parameters (daily milk quantity, average daily gain) of Djelli cattle are increased in seasons of high forage production (rainy season) in traditional environments. However, these parameters are greatly reduced during the lean season (dry season). It would be coherent to aim for maximum velage at the start of the rainy season, to make better use of its performance. Overall, performance is similar to that of most of the country's highly productive breeds bred under purely traditional conditions. This work

deserves to be continued on station, where all feeding and health conditions are met, with a much larger sample of cows and calves of this breed. Under these conditions, research can be carried out over a longer period, focusing on parameters such as lactation number, number of daily calf feedings, milking technique, lactation duration and dry period, to gain a better understanding of all the aspects involved in raising this breed of cattle, which is highly prized by breeders in the river area. In addition, the local Djelli zebu deserves a genetic improvement program, as do most of the country's cattle breeds.

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