International Research Journal of Natural and Applied Sciences
ISSN: (2349-4077)
Impact Factor- 5.46, Volume 5, Issue 5, May 2018
Website- www.aarf.asia, **Email** : editor@aarf.asia , editoraarf@gmail.com

GROWTH PERFORMANCE OF SAANEN, RED MARADI AND THE CROSSBRED SAANEN VERSUS RED MARADI GOATS IN SOUDANESE AREA OF BENIN

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ABSTRACT

In order to judge the opportunity of using Saanen males to improve the productivity of Red Maradi goat, a study was conducted to evaluate growth performance of crossbreed kids (F1 and F2). The data were collected in the NGO "Fermier Sans Frontière" farm from 2012 to 2016 on 135 animals. The comparative performance results showed the near superiority (p <0.0001) of the Saanen breed for weights (3.58 ± 0.17 kg at birth, 11.97±0.45 at 1 month, 21.83 ± 0.61 kg at 3 months and 31.84 ± 0.60 at 6 months) on F1 crossbreed (2.15 ± 0.10 at birth, 7.60±0.25 at 1 month, 14.65 ± 0.34 at 3 months and 22.14 ± 0.34 at 6 months), F2 (2.94 ± 0.16 kg at birth, 9.24±0.43 at month, 16.26 ± 0.57 at 3 months and 24.25 ± 0.57 at 6 months) and on Red Maradi goat(1.62 ± 0 , 12 at birth, 5.16±0.32 at 1 month, 11.15 ± 0.43 at 3 months, 17.32 ± 0.43 at 6 months).The crossbreds expressed the best weights at specific ages (p <0.0001) compared to Red Maradi goat. This same observation was made with the

average daily gain ADG (p<0.0001). These results indicate a genetic progress of the breeds. The study therefore deserves to be continued.

Key words: *average daily gain, body weight, crossbred, performance, Red Maradi, Saanen*

INTRODUCTION

Over the past few decades, the gap between the supply of animal products and the demand of the population has steadily increased. This situation is attributable to the population growth recorded there. The forecasts of demographic evolution and the increase of the individual consumption of the animal products show that, by 2020, it will be necessary to produce more than 100 billion tons of meat in the developing countries (Faye and Alary, 2001). Faced with this challenge, an awareness of animal production is needed in all countries of the South. To this end, the agricultural investment plan (2010-2015) of Benin has planned to improve the food and nutritional security of the population through the use of dairy products which will increase from 106,254 tons in 2009 to 155,000 tons in 2015. In numerical terms, Benin has a large herd estimated at 2,000,000 head of cattle, 100,000 sheep, 500,000 goat heads, 500,000 head of pigs and 10,000,000 head of poultry (FAOSTAT, 2016). Despite this large herd, the national production of meat (58,835 tons) and milk (96 million liters) does not guarantee a complete coverage of animal protein needs of the growing population. Considering the export levels of livestock and imports of frozen meat as well as the contribution of game and non-conventional species, the actual available is estimated at 72,000 tons equivalent to an average national consumption of 9 kg / inhabitant / year of meat against an annual average of 13 kg / inhabitant / year for countries south of the Sahara even though the minimum standard recommended by FAO for developing countries is 21 kg / inhabitant / year. These imports were estimated at 197,393.35 tons of meat in 2014 (INSAE, 2016). In addition, conventional techniques for improving milk and meat production are expensive and less accessible to farmers in Africa, including Benin (Akouedegni et al., 2013). Thus the development of short cycle species for the production of meat and milk is the safest way to improve animal production in Benin. Depending on harsh climatic conditions, compared to sheep, goats have additional benefits to better withstand caloric stress and drought periods (Delgadillo et al, 1997). It is content with few food resources and takes advantage of all kinds of vegetation: grass, bushes, and branches even thorny. In addition, the prolificacy of goats can be used to rebuild herds after episodes of high mortality due to dry climate (ILCA, 2011). These animals, highly appreciated by the population, are particularly interesting for increasing

animal production because of their adaptation to the environment. Faced with this state of affairs, improving the performance of local goats by crossing with exotic breeds is an intermediate solution to fill the milk and meat deficit in our country.

However, very few scientific studies have been carried out on the improvement of the zootechnical performances of local goats in general and of Red Goats of Maradi, particularly in Benin. It is aware that the promoter of the Farm NGO "Fermier Sans Frontière" of Banhounkpo in partnership with the Belgians decided to improve the performance of milk production and butchery of red goats of Maradi by mixing with goats Saanen. The choice of the goat Red Goats of Maradi like local breed is not fortuitous because, the dwarf goat is bad dairy: its average production would be around 35 kg, or 4 to 5 times less than the red goat of Maradi (Pagot , 1985) which nevertheless adapts well to the climatic conditions of North-Benin. The present study is part of the dynamics of the adaptation of exotic goats (Saanen goat) and the improvement of the performance of local goats in order to obtain a good breed of dairy, beef and adapted to the conditions of North Benin.

MATERIAL AND METHODS

Study environment

This study was conducted in the farm of the NGO "Fermier Sans Frontière" in the municipality of N'Dali in northern Benin. The farm is located 40 km north of Parakou on the Parakou-Bembèrèkè axis. Saanen goats were imported in 2012. This farm is located in the Sudanese zone of Benin with a tropical climate is characterized by a long rainy season (April to October) and a long dry season (November to March). The average rainfall varies between 1100 mm and 1200 mm up to 900 mm. During the dry season, the harmattan, hot and dry wind, blows from the Northeast. It is responsible for the sharp drop in relative humidity from the month of November. The vegetation is composed of wooded savannahs, trees and shrubs savannahs. The frequent species are: *Combretum nigricans*, *Detarium microcarpum*, *Gardenia erubescens* and *Gardenia ternifolia*. The floristic composition of the herbaceous layer varies with the age of the formation. The dominant species are: *Pennisetum polystachion, Indigofera spp* and *Tephrosia pedicellata*.

Management of animals

The animals studied are F1 hybrid kids born from the cross between selected Red Maradi and Saanen males, and F2 goats born from crossbreeding between F1 females and other Saanen

males. The reproduction is controlled in this farm to avoid consanguinity. For the assessment of weight performances, 18 Saanen goats, 39 Maradi red goats, 58 crossbred F1 and 20 crossbred F2 were used. From the beginning of the farm activities, the animals were conducted in intensive breeding with separation of the sexes and genetic groups to ensure the control of the kinship. Goats are fed a trough feed consisting of 2 to 3 kg of feed. During the rainy season, these forages consist of legumes such as *Leuceana, Glyricidia* and others and grasses such as *Panicum C1*, *Andropogon*, *Pennisetum* plus a quantity of hay which ranged from 0.2 to 0.5 kg / head /day. During drought, the composition and evolution of the nutritional value of pastures varies. Thus, the pruning of fodder trees (*Afzelia africana, Khaya senegalensis,* and *leucaena*) and crop residues are involved in feeding the animals during this lean period. The silage made during the rainy season allows feeding lactating goats during this period. In addition, 5 kg of concentrate mixed with the corn bran, sorghum and Okara is distributed to all the goats daily. The goats of choice also receive a supplementation of about 0.2 kg per goat at the end of gestation and at the beginning of lactation. The dietary supplement is composed of grain corn, dried brewer's grains, the *Parkia biglobosa* powder and roasted soybean. In all cases, the cornadis makes it possible to individualize the distribution of food. In addition, water is available at will and it is of good quality, food is neither moldy nor soiled, the "lick stone" (salt and mineral supply) is self-service.

The animals have been identified since birth. A hygiene program was rigorously applied by the farm technician. The parasitic diseases in young and mastitis in lactating females were the most reported. The goat shed was regularly sprayed with insecticides and disinfected with frequent litter changes. As for the animal prophylaxis program, young people and adults have been vaccinated against contagious diseases such as foot-and-mouth disease, brucellosis and Small Ruminants Plague. Also, prevention against Trypanosomosis, and a preventive treatment against the internal and external parasites were applied twice a year.

Evaluation of growth performance

The animals are weighed regularly using 5 kg load cells to weigh animals at birth and 65 kg and 100 kg load cells for animals over one month of age. The live weights of the animals at birth (W0), at three months (W3) and at six months (W6) are recorded. The corresponding average daily earnings are calculated (Lhoste et al., 1993): average daily gain (ADG) from birth and three months (ADG 0-3), from three to six months (ADG 3-6), and from birth to six month (ADG 0-6). The data sheet provides information on the number of the kid, the number of the mother, the season of birth, the date of birth, the calving rank of the mother, the sex of

the animal, the parity (single, double, triple) at birth, date of death, date of weaning. These weights are measured early in the morning by the same person. A general linear model (GLM) of R.3.4.3 software (R Core Team, 2017) has been fitted to the data to test the potential effect of fixed factors of variation.

The complete model is as follows:

$Y_{ijkl} = \mu + Breed_i + Sex_j + Season_k + Rank_l + Parity_m(Breed*Sex)_{ij} + e_{ijklm}$

With:

Y_{ijkl} = animal performance;

μ = overall mean;

$Breed_i$ = breed effect (Saanen, Maradi red, crossbred F1and crossbred F2);

Sex_j = effect of sex (male and female);

$Season_k$ = effect of the season of birth (dry season and rainy season);

$Rank_l$ = effect of kidding rank of animals (R1, R2 and R3);

$Parity_m$ = Range size (single, double and triple);

$(Breed*Sex)_{ij}$ = effect of breed and sex interaction;

e_{ijklm} = residual value

The significance of the effects of the variation factors was determined by Fisher's test. The Student-Newman-Keuls (SNK) test was used to compare significantly different means.

RESULTS

Breed and sex

In the analysis of variance of weight at different ages of Saanen, Red Maradi goat and F1 and F2 hybrids, only breed and breed * sex interaction were considered as factors of variation

Weight performance

Tables 1 show the least squares mean birth weights, weaning weight, 6 months of age, by breed, sex, parity, kidding rank and kidding season. The breed and the breed*sex interaction have a highly significant influence in the weight at birth, at 1 month, 3 and 6 months ($p < 0.0001$).

Table 1. Least squares ± standard errors (SE) for birth weights, pre-weaning, weaning and post-weaning weight (6 months) by breed and sex.

Variation factors	N	W0	W1	W3	W6
Breed		***	***	***	***
Saanen	18	3.58±0.17a	11.97±0.45a	21.83±0.61a	31.84±0.60a
Crossbreed (F1)	58	2.15±0.10b	7.60±0.25b	14.65±0.34b	22.14±0.34b
Crossbreed (F2)	20	2.94±0.16c	9.24±0.43c	16.26±0.57b	24.25±0.57c
Red Maradi	39	1.62±0.12d	5.16±0.32d	11.15±0.43c	17.32±0.43d
Sex		*	***	**	***
Male	33	2.71±0.12a	9.08±0.33a	16.63±0.44a	24.79±0.44a
Female	102	2.43±0.08b	7.90±0.23b	15.32±0.31b	22.99±0.31b
Breed*Sex		***	***	**	***
Saanen male	6	4.07±0.24a	12.55±0.67a	22.18±0.90a	32.89±0.87a
Crossbreed (F1) male	17	2.41±0.15cd	8.13±0.43c	15.36±0.57b	22.78±0.55cd
Crossbreed (F2) male	6	2.87±0.23c	8.93±0.65c	16.08±0.86b	24.51±0.84c
Red maradi male	4	1.39±0.27e	6.02±0.77d	12.05±1.02c	17.50±0.99e
Saanen female	12	3.29±0.18b	10.75±0.50b	21.05±0.66a	30.29±0.64b
Crossbred (F1) female	41	2.11±0.10de	7.08±0.29cd	13.84±0.38bc	21.00±0.37d
Crossbreed (F2) female	14	2.69±0.16cd	8.32±0.44c	15.64±0.59b	23.14±0.57cd
Red maradi female	35	1.48±0.11e	4.67±0.32e	10.39±0.43d	16.32±0.42e

*a,b,c,d : Least-squares means with different superscript letters on the same column differ significantly (p<0.05). NS : No significantly ; *p <0.05 ; **p<0.01 ; ***p<0.001 ; W0 : birth weight ; W1 : birth at 1 month ; W3 : weight at 3 months (weaning); W6 : weight at 6 months.*

The breed had a significant effect (p<0.001) on weights. The goats of the Saanen breeds showed the best growth performances, followed respectively by the F2 and F1 crossbreed goats. The crossing between Saanen and Red Maradi goat therefore improved the growth performance of the crossbreed. The sex had a significant effect on birth weight (p<0.05) up to six months of age (p<0.001). Male kids showed better performances.

Average daily gain (ADG)

The table 2 show the least squares mean daily gain from birth to weaning (ADG 0-3), from 3 to 6 months of age (ADG 3-6) and 6 months of age (ADG 0-6) by breed, sex and breed*sex interaction. The breed significantly influences the growth rate of the kids in the different categories (p <0.0001) at all times. Sex only significantly influenced ADG 0-30 (p <0.05) and ADG 0-60 (p <0.001), while breed*sex interaction significantly influenced all growth periods.

Table 2. Least squares ± standard errors (SE) for Average daily gain (ADG) by breed, sex, and breed*sex interaction

Variation factors	N	ADG 0-3	ADG 3-6	ADG 0-6
Breed		***	***	***
Saanen	18	202.80 ± 6.78a	103.83 ± 4.77a	146.24 ± 2.68a
Crossbreed (F1)	58	138.81 ± 3.81b	83.81 ± 2.68b	107.38 ± 1.51b
Crossbreed (F2)	20	147.95 ± 6.38b	86.96 ± 4.48b	113.10 ± 2.52c
Red Maradi	39	105.79 ± 4.82c	72.31 ± 3.40c	86.66 ± 1.91d
Sex		*	NS	***
Male	33	154.58 ± 4.90a	89.63 ± 3.44a	117.47 ± 1.94a
Female	102	143.09 ± 3.46b	83.83 ± 2.44a	109.23 ± 1.37b
Breed*Sex		***	**	***
Saanen male	6	204.01 ± 9.99a	115.40 ± 6.93a	153.38 ± 3.95a
Crossbreed (F1) male	17	146.48 ± 5.93b	84.50 ± 4.11bcd	111.06 ± 2.35cd
Crossbreed (F2) male	6	147.72 ± 9.72b	93.31 ± 6.74b	116.63 ± 3.84c
Red maradi male	4	118.38 ±11.04c	67.07 ± 7.66d	89.06 ± 4.37e
Saanen female	12	199.12 ±7.51a	96.89 ± 5.21b	140.71 ± 2.97b
Crossbred (F1) female	41	132.17 ± 4.00bc	81.82 ± 2.78bcd	103.40 ± 1.59d
Crossbreed (F2) female	14	144.50 ±7.05bc	83.00 ± 4.90bc	109.35 ± 2.80cd
Red maradi female	35	99.19 ±4.56d	70.30 ± 3.16cd	82.68 ± 1.80e

*a,b,c,d : Least-squares means with different superscript letters on the same column differ significantly (p<0.05). NS: No significantly; *p <0.05 ; **p<0.01 ; ***p<0.001 ;*

There is a significant difference between the ADG 0-3 of the different breeds (p <0.0001). Pure Saanen has a better growth rate from birth to 3 and 6 months, followed by F1 and F2 hybrids and finally Maradi reds regardless of sex. After weaning, the ADG 3-6 of Saanen is still significantly (p<0.01) higher than other kids. The Saanen male have a significantly higher post-weaning speed than other males.

Other factors of variation

This analysis concerns other factors of variation that may affect the growth of kids. The breed and sex studied in the previous paragraphs will be taken into account only the kidding season and the parity and breed *parity interactions and breed*season of birth.

Weight performance

The breed*season of kidding and breed * parity interactions have a highly significant influence ($p < 0.0001$) in the model.

The breed*parity interaction had a significant influence on the birth weight of the kids of the different breeds ($p < 0.05$), here F1 and F2 hybrids and pure breeds (Saanen and Red Maradi goat).

At 1 month, a significant difference is always observed between the weight of the pure breeds and that of the F1 and F2 hybrids ($p < 0.05$), with Saanen showing the highest weight in both simple and multiple parity. It should be noted that there is a significant difference in F1 and F2 hybrids ($p < 0.05$); single-range kids being heavier than those of multiple litters.

From weaning, there is no significant difference between kids of simple and multiple litters within each breed (Table 3).

With regard to the breed * season of birth model, the season also significantly influenced the birth weight of the kids of the different breeds ($p < 0.05$), here the F1 and F2 hybrids and the pure breeds (Saanen et Maradi red goat).

At 1 month, a significant difference is still observed between the weight of the pure breeds and that of the F1 and F2 hybrids ($p < 0.05$), the Saanen showing the highest weight both in the rainy season and in the dry season. It should be noted that there is no significant difference in F1 hybrids ($p > 0.05$); the kids born in the rainy season are heavier than those born in the dry season.

From weaning (3 months), there is no significant difference between the kids in each breed regardless of the season of birth (Table 3).

Table 3. Least squares ± standard errors (SE) for birth weights, pre-weaning, weaning and post-weaning weight (6 months) by breed*parity and breed*season of kidding interactions.

Variation factors	N	W0	W1	W3	W6
Breed*Parity		*	*	*	*
Saanen*Simple	12	3.97 ± 0.16a	12.17 ± 0.44a	22.02 ± 0.59a	31.86 ± 0.60a
F1 *Simple	25	2.60 ± 0.11cd	7.92 ± 0.30c	15.30 ± 0.41b	22.78 ± 0.41bc
F2 *Simple	5	2.66 ± 0.25c	8.80 ± 0.68c	15.85 ± 0.91b	24.48 ± 0.92b
Red Maradi*Simple	19	2.19 ± 0.13cd	5.28 ± 0.35d	11.18 ± 0.47c	16.96 ± 0.47d
Saanen*Multiple	6	3.44 ± 0.22b	10.25 ±0.62b	21.88 ± 0.83a	31.89 ± 0.84a
F1 *Multiple	33	2.06 ± 0.09d	7.24 ± 0.26c	14.39 ± 0.35b	21.52 ± 0.36c
F2 *Multiple	15	2.77 ± 0.14c	8.14 ± 0.40c	15.73 ± 0.53b	23.39 ± 0.53bc
Red Maradi *Multiple	20	1.30 ± 0.12e	4.72 ± 0.34d	10.98 ± 0.46c	16.87 ± 0.46d
Breed * Kidding season		***	***	***	***
Saanen* Rainy season	7	4.11 ± 0.20a	12.37 ± 0.50a	22.00 ± 0.66a	32.31 ± 0.67a
F1 * Rainy season	32	2.22 ± 0.11cd	7.51 ± 0.27c	14.16 ± 0.35b	21.31 ± 0.35c
F2 * Rainy season	2	3.21 ± 0.42b	8.50 ± 1.06c	15.35 ±1.41b	24.43 ± 1.42b
Red Maradi* Rainy season	27	2.10 ± 0.14cd	5.67 ± 0.37d	11.57 ± 0.48c	17.39 ± 0.49d
Saanen* Dry season	11	3.49 ± 0.20b	10.70 ± 0.50b	21.96 ± 0.66a	31.44 ± 0.67a
F1 * Dry season	36	2.59 ± 0.10c	7.65 ± 0.25c	15.68 ± 0.33b	23.08 ± 0.33bc
F2 * Dry season	8	2.17 ± 0.21cd	8.71 ± 0.53c	15.53 ± 0.70b	23.89 ± 0.71b
Red Maradi* Dry season	12	1.45 ± 0.13d	4.47 ± 0.32d	10.69 ± 0.42c	16.54 ± 0.43d

*a,b,c,d : Least-squares means with different superscript letters on the same column differ significantly (p<0.05). NS : No significantly ; *p <0.05 ; **p<0.01 ; ***p<0.001 ; W0 : birth weight ; W3 : weight at 3 months (weaning); W6 : weight at 6 months. F1: crossbred F1 and F2: crossbred F2.*

Average daily gain (ADG)

The breed*season interaction had a significant influence on ADG 0-3 (p <0.001) and ADG 3-6 (p <0.05); the same is true of the breed* size of the litter in the model of (p <0.001). The breed-parity interaction revealed the significant superiority of the ADG 0-3 growth rate of Saanen kids and the F1 and F2 hybrids on local kids regardless of litter size (p <0.001). Within the Saanen breed, no significant difference was observed regardless of the growth period between goats from single litters and multiple born kids. Within the hybrid group, goats from single litters had a significantly higher weight gain compared to multiple born kids (p <0.001). This superiority of the growth rate of simple over multiples fades between 3 and 6 months.

The Saanen kids showed the best growth rates than others. The F1 and F2 crossbred kids born in the rainy season had a significantly high ADG 0-3 (p <0.0001) compared to their

congeners born in the dry season and especially compared to the local kids (Maradi's red goat). Between 3 and 6 months, the season has no significant influence (p> 0.05) on the ADG of hybrid kids born in the dry season and those born during the rainy season. The difference is still significant between locals and hybrids, with the latter showing the fastest growth rate.

Table 4. Least squares ± standard errors (SE) for Average daily gain (ADG) by breed*parity, and breed*kidding interactions

Variation factors	N	ADG 0-3	ADG 3-6	ADG 0-6
Breed*Parity		***	***	***
Saanen*Simple	12	200.56 ± 6.28a	100.66 ± 4.32a	143.47 ± 2.57a
F1 *Simple	25	141.04 ± 4.35b	82.24 ± 2.99bc	107.44 ± 1.78bc
F2 *Simple	5	146.46 ± 9.73b	93.38 ± 6.70ab	116.13 ± 3.98b
Red Maradi*Simple	19	99.84 ± 4.99c	68.20 ± 3.43c	81.76 ± 2.04d
Saanen*Multiple	6	204.93 ± 8.89a	105.82 ± 6.12a	148.29 ± 3.63a
F1 *Multiple	33	136.98 ± 3.79b	79.37 ± 2.61bc	104.06 ± 1.55c
F2 *Multiple	15	143.94 ± 5.62c	84.41 ± 3.87b	109.92 ± 2.30bc
Red Maradi *Multiple	20	107.48 ± 4.87a	67.30 ± 3.35c	84.52 ± 1.99d
Breed * Kidding season		***	***	***
Saanen* Rainy season	7	198.71 ± 7.11a	107.39 ± 4.94a	146.52± 2.95a
F1 * Rainy season	32	132.58 ± 3.77b	81.32 ± 2.62bc	103.29 ± 1.56c
F2 * Rainy season	2	134.83 ± 15.08b	99.96 ± 10.49ab	114.91 ± 6.25b
Red Maradi* Rainy season	27	105.22 ± 5.17c	66.24 ± 3.59c	82.95 ± 2.14d
Saanen* Dry season	11	205.32 ± 7.11a	97.37 ± 4.94ab	143.64 ± 2.95a
F1 * Dry season	36	145.50 ± 3.56b	80.35 ± 2.47bc	108.27 ± 1.47bc
F2 * Dry season	8	148.46 ± 7.54b	89.22 ± 5.24ab	114.61 ± 3.13b
Red Maradi* Dry season	12	102.63 ± 4.55c	68.89 ± 3.16c	83.35 ± 1.89d

*a,b,c,d : Least-squares means with different superscript letters on the same column differ significantly (p<0.05). NS: No significantly; *p <0.05 ; **p<0.01 ; ***p<0.001 ;*

DISCUSSION

Effect of breed on growth performances

The results obtained on the weights at the crossbreed (F1 and F2) were better compared to the Maradi Red goat. This denotes a genetic progress, but less than the Saanen, showing that improvements remain to be made. These birth weights were similar to those already found in Maradi red goat, both at the station and at the farm, by other authors (Denis, 1975; Haumesser 1975; Oumara, 1986 and Marichatou et al., 2002).

Between 0 and 3 months, the overall average daily gains (ADG) of the different breeds of goat were better than those observed between 3 and 6 months. This can be explained by the

fact that during the first few months, young animals are in a phase of rapid growth. According to the French Livestock Institute (2005), Alpines must weigh at least 32 kg and Saanen 35 kg, or 50% of the adult weight for breeding. In order to achieve this goal, the average daily gain (ADG) must be: 180 to 200 g / day during the first two months, 150 g / day from two to four months, 100 to 110 g / day from four months to the protrusion. The daily weight gains vary widely among authors and environments with regard to Maradi red goats. They are stronger at the beginning, from 0 to 30 days (on average 70g / day), then decrease regularly (40 g / day) from three months (Charray et al., 1980, Tillard et al., 1997, Ziebe , 1996). Tamboura et al. (2001) determined in the central plateau of Burkina Faso a ADG of 131.1 g / d during the first 120 days, compared to 19.2 g / day from 0 to 3 years in the Red Goats of Maradi.

Effect of sex on growth performance

Male kids had better birth weights than females. This advantage of males on females could be attributed to the physiological difference that is observed between the two sexes. The results from this study are similar to those obtained by Planchenault (1993) and Charray et al. (1980). On the other hand, these results are contrary to those reported by Katongole et al. (1994), Traore et al. (2006) and Gnanda (2008), who found no differences between males and females before 12 months of age, respectively in goats of northern Cameroon, the local goat Mossi of Burkina Faso and the goat of Sahel Burkina Faso.

Effect of parity on growth performance

The size of the litter had an effect on the birth weight of the kids. Thus, single-range kids were heavier than multi-span kids. Similar results were obtained by Dumas (1980). Amoah et al. (1996) highlighted the impact of litter size on mean birth weights at birth.

Effect of the season on growth performance

The effect of the breeding season has identified the season for the best weight gain performance in kids. Thus, the heavier kids at birth have obtained in the rainy season this can be explained by the abundance and superior quality of forage in the rainy season unlike those of dry seasons. In this way, pregnant goats will benefit from a good forage diet, which will allow compensatory growth of pregnant goats having crossed the dry season and, in turn, those of embryos. Contrary results have been reported by Nardone et al. (2006), Zahraddeen

(2008), Chukukwa et al. (2010). They found that kids born during the rainy season had lower growth than those born in the hot dry season (March-May) and in the cold dry season (November-February). Indeed, despite the abundance of fodder, bad weather (high humidity and insect proliferation) have a negative effect on the mothers' dietary intake and therefore on milk production, which is the main source of nutrition for kids during this first phase of their life. The effect of the season reflects alternating physical environmental conditions, favorable or unfavorable to animal behavior (Alkoiret et al., 2016). During the dry season, all animals are in food restriction. The straw available to them this season is characterized by low dietary values, both nitrogen, to ensure maintenance needs (Rivière, 1991). The heat stress of the dry season on pregnancy may reduce the birth weight of animals (Collier et al., 1982). During the rainy season, goats receive quality forage, which allows them to maintain their milk production and provide conditions for good growth for kids.

CONCLUSION

This study allow to highlight and compare the zootechnical potential of the Saanen, Red Maradi goat and their crossbreed F1 and F2 on the farm of the NGO "Fermier sans Frontière" in Benin. The evaluated performances showed the superiority of the Saanen breed and crossbreds on the Maradi Red, for weight growth (weight and average daily gains). Ultimately, the superiority of the Saanen breed and the crossbred assumes that these breeds adapt to its new environment and express its performance. However, the crossing of Saanen males and Red Maradi females showed the superiority of F1 hybrids over the maternal breed in terms of growth and the paternal breed in relation to adaptability or resistance to stress. The application of crossbreeding of these two breeds may be even more beneficial if it comes after selection in the local breed of the best females. The latter should be properly fed during the pre-weaning period to allow the expression of the heterosis effect. Further studies should continue in later generations with other levels of crossing (F3, F4, ...) in order to be able to severely select the best performers to recommend to breeders.

ACKNOWLEDGMENTS

The authors thank the farm technicians of the NGO "Fermier Sans Frontière" for their frank and valuable collaboration during this study. We thank also the farm manager Mr. OUOROU BARE Chamsdine who gave his permission for the execution of this study.

REFERENCES

1- Akouedegni, Koudande, Ahoussi et Hounzangbe- Adote, 2013. *J. Anim Sci Adv, 3 (2).* 74-82p.
2- Alexandre, Aumont, Fleury, Mainaud et Kandassamy, 1997, Performances zootechniques de la chèvre Créole allaitante de Guadeloupe. Bilan de 20 ans dans un élevage expérimental de l'INRA. *INRA Productions animales*, vol 10, num 1, 7-20
3- Ally, 1990. Caractéristiques de reproduction des ovins et caprins élevés en milieu traditionnel de Dahra-Djoloff, Sénégal. Thèse Méd. Vét. Dakar, 88 p.
4- Amoah, Gelaye, Gunthrie and Rexroad. Breeding season and aspects of reproduction in female goats. *J Anim Sci*, 74, 723-728, 1996.
5- Bassossa, 2012. Caractérisation phénotypiques et zootechniques de la chèvre naine. *Mémoireonline.com.*55p.
6- Bembello, 1961. La chèvre rousse et son exploitation au Niger. Thèse Doctorat Vétérinaire.
7- Charallah, 1994, Variations saisonnières de la fonction de reproduction chez la chèvre Bédouine femelle (Capra hircus). Thèse de Magister en science de la nature (physiologie animale endocrinologie), Université des Sciences de la Technologie Houari Boumediene, Alger. P23-204.
8- Charray , Coulomb, Haussemer, Planchenault, 1980. Les petits ruminants d'Afrique Centrale et de l'Ouest. Synthèse des connaissances actuelles. Maisons-Alfort : I EMVT, 295 p.
9- Chukukwa, Opara, Herbert, Ogbuewu. And Ekenyem B.U., 2010. Reproductive Potentials of West African Dwarf Sheep and Goat: A Review. *Res. J. Vet. Sci.*, 3: 86-100. URL: http://scialert.net/abstract/?doi=rjvs.2010.86.100. Consulté le 18/12/2015.
10- Ciappesoni, Milerski and Gabrielová, 2002. Estimation of breeding values in dairy goats with test day model (in Czech). In: Sborníkpřednášek z 5. Mezinárodní konference a setkáníchovatelů (SCHOK), 15.–16. *Listopadu, Seč, Czech Republic*, 93–96.
11- Collier RJ, Doelger SG, Head HH, Thatcher WW and Wilcox CJ, 1982. Effects of heat stress during pregnancy on maternal hormone concentrations, calf birth weight and postpartum milk yield of Holstein cows. Journal of Animal Science. 54 : 309-315.
12- Delgadillo, Malpaux et Chemineau, 1997. La reproduction des caprins dans les zones tropicales et subtropicales. *INRA Productions animales, vol 10, num* 1, 33-41.
13- Dumas, 1977. Etude sur l'élevage des petits ruminants du Tchad. Analyse des caractéristiques de la reproduction. *Maisons-Alfort, France, Iemvt*, 32 p. (Fiche de synthèse n° 5)
14- FAOSTAT, 2016. FAO Statistics Data. Retrieved December 15, 2015, from http://faostat3.fao.org/browse/Q/QA/E
15- Faye et Alary, 2001. Les enjeux des productions animales dans les pays du sud. INRA. Prod. Anim. Vol. 14, P3. Pagot, 1985.Elevage en pays tropicaux. *Maison neuve et Larose (2ème édition)*. 526p.

16- Gaddour, 2005. Performances de croissance et de production laitière des groupes génétiques caprins issus d'un croisement d'absorption de la chèvre locale dans les oasis du Sud tunisien. Mastère Génétique et Bio-ressources, faculté des Sciences, Tunis, Tunisie, 73 p.29.
17- Gnanda, Nianogo, Zoundi1, Faye et Zono. 2008. Effet d'une complémentation énergétique en période humide sur la production laitière de la chèvre du sahel burkinabé.
18- Gnanda, Zoundi, Nianogo, Le Masson et Meyer, 2006. Performances laitières et pondérales de la chèvre du Sahel Burkinabé en régime de complémentation basé sur l'utilisation des ressources alimentaires locales, *Revue d'Elevage et de Médecine Vétérinaire*, 58 (3), 175-182.
19- Haumesser, 1975. Quelques aspects de la reproduction chez la chèvre rousse de Maradi - Comparaison avec d'autres races tropicales ou subtropicales. *Revue Elev. Med. Vet. Pays Trop.* 28(2): 225-234.
20- Lhoste; Dolle; Rousseau et Soltner, 1993. Zootechnies des régions chaudes : les systèmes d'élevage.-*Monpellier : CIRAD*.-2887p.
21- Planchelnault D, Traoré MT, Roy F et Tall SH, 1986. Amélioration génétique des bovins N'dama. II- Croissance des veaux avant sevrage au ranch Madina-Diassa, Mali. Revue d'Élevage et de Médecine vétérinaire des Pays tropicaux. 39 (1) :51- 57.
22- Planchenault et Legal, 1993.Utilisation des races caprines exotiques dans les zones chaudes : contraintes et intérêts.- Maison-Alfort : CIRAD-EMVT.- 261p.
23- Riviere R, 1991. Manuel d'alimentation des ruminants domestiques en milieu tropical. Ministère de la coopération française. 529 pp.
24- Tamboura, et Berte, 2001. Système traditionnel d'élevage caprin sur le plateau central du Burkina Faso. INERA, Ouagadougou. URL : http://www.fao.org/wairdocs/ILRI/x5473B/x5473bor.htm. Consulté le 22/12/2015 .
25- Tillard, Moulin et Faugere, 1997. Le suivi individuel des petits ruminants au Sénégal : un mode d'étude des troupeaux en milieu villageois. *INRA Productions animales, vol 10, num* 1, 67-78.