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Laying And Growth Performance Of Batéké Chickens Raised In A Controlled Environment In Brazzaville, Republic Of Congo

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Abstract
Meat and eggs from traditional chicken farming contribute significantly to food security by providing animal protein to populations. The main objective of this study is to evaluate the laying and growth performance of Batéké chickens raised in a controlled environment. For this purpose, 50 Batéké chicken breeders from three departments of the Republic of Congo were selected to carry out this study. The sex ratio was 10 hens to one rooster. These animals were fed with conventional feed. Laying performance was assessed by determining the laying rate. Day-old chicks were obtained from eggs fertilized by artificial incubation. After 6 months of rearing with initial laying disturbances, 1856 eggs were laid by 40 Batéké hens, including 1406 sterile eggs, among which were small-sized, cracked, broken eggs and 450 fertilized with a hatchability of 50%. The growth performance of Batéké hens was determined by the variables of actual feed consumption, the feed conversion and consumption index, the live weight of the subjects and the average daily gain.

Keywords: *Laying, Growth, Controlled environment, Batéké hens, Brazzaville*

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I. Introduction

Poultry farming occupies a prominent place in Africa in general and in the Republic of Congo in particular. It is dominated by poultry (chicken, duck, and turkey) and represents 98% of the poultry population (Gueye, 2003). Chicken is a meat without taboos and is the most consumed meat (FAO, 2018). Family or traditional poultry farming practiced in rural areas in Congo is an important pillar in the fight against poverty and food insecurity among populations (Akouango, 2004).

Among the breeds or strains of chickens found in Africa, traditional chickens represent approximately 80% of the poultry population and constitute a significant proportion of meat (25 to 70%) and egg (12 to 36%) production. These foods contribute significantly to food security by directly providing animal protein to families (Bessadok et al., 2003).

In Africa, local chickens are raised for their meat and egg production. These foods are widely consumed by the populations. These are the Beldi chicken in Morocco (Sarter., 2004), Baladi, Fayoumi in Egypt (Galal., 2006) and Kabyle in Algeria (Moula et al., 2011a), the Batéké chicken in Congo Brazzaville (Akouango et al., 2004).

Despite their generally slow growth compared to exotic strains, local or village chickens demonstrate superior adaptation to local environmental conditions and have better meat quality that is in line with market requirements and consumer preferences (Yuan et al., 2015). They are generally robust, survive with little or no inputs and adapt to fluctuations in the availability of quality food. The study conducted by Saya Ngouonimba et al., (2019) in the northern and southern outskirts of Brazzaville showed that the local chicken or Batéké raised in family farming is characterized by enormous phenotypic variation. The rich genetic diversity seems to evolve in an anarchic manner. Hence, this breed could be the support for an animal selection plan allowing breeders to have significant yields than those obtained so far. The market value of local chickens is higher than that of exotic or selected chickens (Ayssiwede, 2013).

Although family poultry farming or family poultry farming is of nutritional, sociocultural and economic importance, unfortunately its growth is still limited by various constraints linked to its low productivity potential (Saya Ngouonimba et al., 2019). It is considered a secondary household activity, practiced mainly in rural areas. It is closely linked to the place occupied by women in this breeding (Mack et al., 2005). It is often associated with agricultural activities, in particular, food and cash crops, which constitute the primary occupation of farmers, meeting the daily food needs of the family, also generate monetary income.

This breeding recognized as extensive breeding is characterized by the wandering of poultry with inadequate health monitoring by means of traditional pharmacopoeia. It is exposed outside of diseases and predators, but also to the quantitative and qualitative food deficit. This food imbalance accentuates malnutrition in traditional chickens, weakens their resistance to parasites and diseases, increases mortality in the flock and consequently reduces productivity.

The hardiness of local chickens allows them to wander. The search for investments reflects the inability of families to invest money to improve this precarious breeding system. This is how an experimental study was initiated in a controlled environment or station, taking these constraints into consideration. As part of the policy or program for improving traditional breeding systems in Congo with a view to genetic improvement, several studies have been carried out on Batéké chickens raised in a controlled environment (Akouango et al., 2004; Akouango et al., 2010; Saya Ngouonimba et al., 2019; Adzona et al., 2024). It is in this same framework of improving the productivity of Batéké chickens that the present study was initiated, with the general objective of evaluating the laying and growth performances of Batéké chickens raised in a controlled station.

II. Material And Methods

Material

Study environment

The study was carried out in Brazzaville, during 2024 in the farm school of the National School of Agronomy and Forestry (ENSAF) of the Marien Ngouabi University, located in district 14 of Makélékélé district 1 shown in Figure 1.

The climate of Brazzaville is humid tropical of the Bas-Congolese type. Average annual temperatures are around 25 ºC with small temperature differences not exceeding 5 ºC. The maximum temperature does not exceed 35 ºC and the minimum temperature remains above 20 ºC. It is characterized by two seasons: a rainy season from October to May with a decline in January and a dry season from June to September. Brazzaville is located at an altitude of nearly 301 m; with a latitude of 4º 15 ´58´´ to the South and a longitude of 15º 16´ 59 ´´ to the East of the Republic (Samba, 2014).

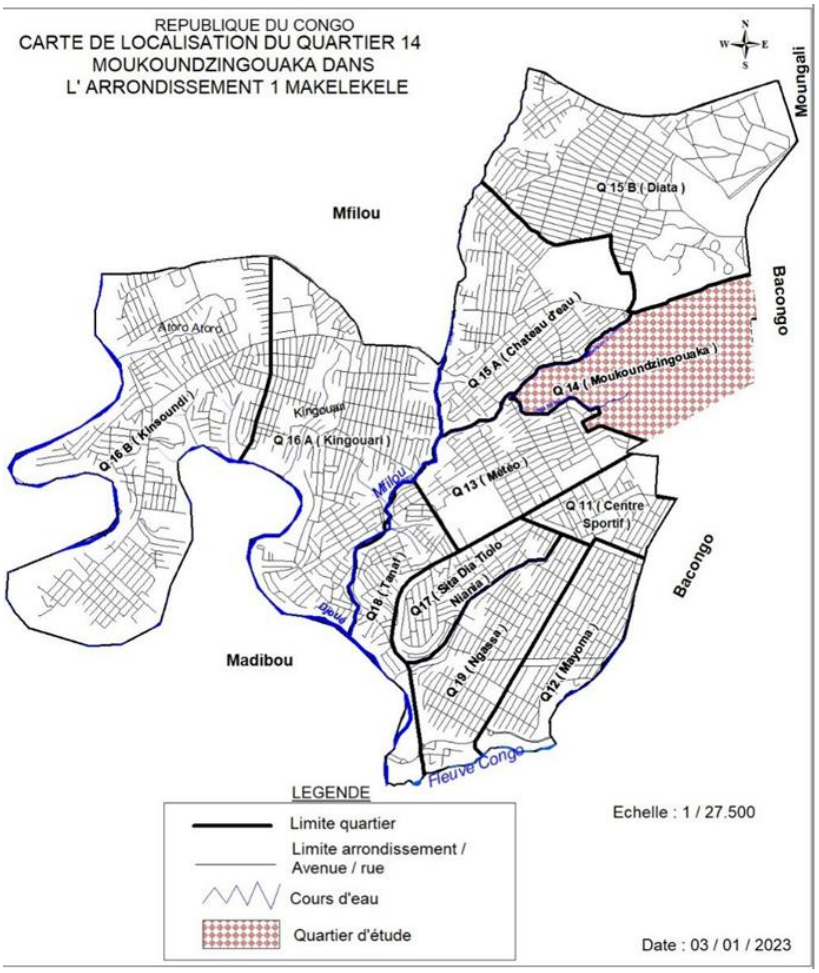

Figure 1: Study area

Animal material

The experiment involved 50 breeders from 3 departments of the country, including 10 from Bouenza, 25 from Pool and 15 taken from Brazzaville. These breeders were chosen taking into account certain selection criteria based on size and good condition.

Pre-experimental phase

Selection, purchase and transport of hens

For questions of proximity of the departments with the experimental site as well as morphotype uniformity, the purchase of local hens used was preceded by a prospecting study of certain localities which made it possible to locate the breeders and their numbers, then to retain the farms supplying the hens. The choice of breeders and their identification by marking were carried out to exclude confusion of the subjects during transport. However, the hens from the other two departments except that of Brazzaville were stored then transported to the bus station for their transport. As for the breeders from Brazzaville, after selection and purchase, the transport was carried out the same day.

Indeed, the choice of breeders was made fundamentally according to the conformation and productivity of the hens. Roosters and hens reach sexual maturity at the age of approximately five (5) months (Technical Institute of Poultry Farming, 2003). To produce fertilized eggs, adult hens were put together with adult roosters according to the ratio 1 rooster for 9 hens.

Preparation of the premises and reception of the hens

A crawl space was carried out 15 days before the arrival of the animals. The premises were cleaned, washed with soapy water and disinfected with bleach. The windows of the building were closed to prevent wind circulation and ensure the thermal comfort of the chicks. All breeding equipment (feeders and drinkers, etc.) was also washed and disinfected with bleach.

On the eve of the reception of the hens, the litter consisting of wood shavings was put in place in the single henhouse subdivided into cages, at a rate of 10 subjects/m2, in a free room on the concrete floor on a litter of 15 cm.

The thermometer was installed in the henhouse to measure the temperature inside the building. The heating and lighting system consisted of two 100 W bulbs, and allowed the living area of the subjects to be heated to a temperature of 28°C. A footbath consisting of bleach was placed at the entrance to the building.

Upon arrival of the breeders, the following checks were carried out: the count, the condition of the subjects and the average live weight of the subjects. Weighings were carried out, with an electronic scale with a precision of 5 kg.

Experimental phase

Experimental device

The breeding was carried out in a single room at a rate of 9 hens for one rooster; or a sex ratio of one rooster for 9 hens as shown in Figure 2 of the experimental setup.

Figure 2: Illustration of the experimental device

Egg laying and incubation

- Laying, collection and weighing of breeder eggs:

Egg production begins at the sexual maturity of the hens, around 20 weeks (5) months for improved breeds and a little later for local hens. The hens lay even if there is no rooster, but the eggs are sterile. To have fertilized eggs, there must be a rooster among the hens. For our experiment, active and fertile roosters were raised together with the hens to allow mating.

Consumption of the laying feed led the hens to trigger egg laying. The laid eggs (Figure 3) were collected twice a day, in the morning upon arrival and in the afternoon. The collected eggs were placed in the cells and stored in packaging to prevent deterioration.

Figure 3 : Laid eggs

- Preparation and incubation of eggs

The eggs intended for incubation were selected taking into account their size, shape, degree of property, weight (50g) and the condition of the shell.

Storage of eggs

After collection and selection of the eggs, they were placed in cells (figure 4) then in a cardboard box while taking into account the following factors:

• storage temperature (19 °C);
• storage humidity 82%.

The eggs were stored, the air chamber at the top and the other side at the bottom. They were kept for 14 days at the most before putting them to artificial incubation.

Figure 4: Placement of eggs laid in the cells

Incubation

The eggs were placed in an incubator that has the same conditions as if they were under a mother hen.

Before incubating the eggs, the prerequisites for strict compliance with artificial incubation were taken, including:

• place the incubator in a room containing fresh air, shaded, quiet and well ventilated;
• perform a preheating, that is to say, operate the incubator without eggs (to avoid any sudden change in temperature because this causes the death of the embryos);
• check other factors that play a very essential role in carrying out artificial incubation such as temperature, ventilation and humidity.

Artificial incubation was made possible by also taking into account the following factors to be verified:

• Capacity of the incubator: 258 eggs
• Temperature (37.9°C): the incubator must provide the same temperature as the hen when she incubates her eggs;
• Humidity (R.H = 59): the eggs lose water during the incubation period, the rate of water loss depends on the relative humidity maintained in the incubator;

• Ventilation by electric fans and using the open air in the incubator; the embryo developing in the egg needs oxygen and releases carbon dioxide, as it grows, it needs an increasing supply of fresh air;
• Weight of the eggs to be incubated (50 g);
• Duration of artificial incubation 21 days including 18 days of incubation + 3 days of hatching.

Candling

Candling is a process that uses light to assess the quality of eggs. It allows determining fertilized and unfertilized eggs. For the present study, it was carried out on the 18th day of artificial incubation. On the 18th day, the embryo remains in the center and does not stick to the shell.

Hatching

Hatching is the opening of the protective shell at maturity and the emergence of the chick (figure 5). It was carried out from the 19th day.

Figure 5: Egg hatching

Feeding of hens and chicks

The control breeders were fed with laying feed purchased from a structure in the livestock feed manufacturing area "AGRO 4", containing 2856.56 Kcal/kg of energy and 15.55% of proteins. They received a diet of 120 g of feed/day/head. In the treated breeders, a supplement of spent grain bran (5g) was added to their diet. They also received 120 g of laying feed plus 5g of spent grain bran. The subjects were rationed twice a day: in the morning (8 a.m.) and in the afternoon (4 p.m.). Water was distributed ad libitum.
A prophylaxis program was implemented for the proper health monitoring of the animals.

The chicks were fed for eight (8) weeks in the same premises. They were divided into two batches of 100 subjects. The two batches of chicks were fed with feed containing the same ingredients and incorporation rates. Except the incorporation rate of spent grain bran and corn which was 50% each. Water was distributed ad libitum.

The feed made available to the breeders included the following elements:
• Corn;
• Palm oil;
• Soybean meal;
• Wheat bran;
• Cooking salt;
• Mineralized nitrogen compounds;
• Spent grain bran;
• Fish meal.

The quantities of feed were distributed taking into account the low performance of the local breed. They are shown in Table 1.

Table 1: Quantity of feed distributed per laying subject local breed

Age in days	Quantity of feed in g per day
Week 1	**30**
Week 2	**40**

Week 3	**65**
Week 4	**80**
Week 5	**100**
Week 6	**110**
Week 7	**120**
Week 8	**125**

The feed formula for chicks is as follows:

Table 2: Feed Formula used for both Treatments

Traitement 1	**%**	**Traitement 2**	**%**
Dregs	50	Corn	50
Wheat bran	23	Wheat bran	23
Soybean meal	12	Soybean meal	12
Fish meal	10	Fish meal	10
Flesh concentrate 10%	4	Flesh concentrate 10%	4
Table salt	0,5	Table salt	0,5
Limestone	0,5	Limestone	0,5
TOTAL	100	TOTAL	100

Study Variables

Residual Feed Consumption

The residual feed consumption allowed to calculate the Voluntary Feed Consumption (VFC). This was calculated by subtracting the quantities of feed distributed (D) and refusals (R)

VFC (g) = D – R

The weight of the subjects

It was taken by weekly weighing of the subjects on a 5kg electronic scale for weighing the hens;

Weight Gain (WG)

The weekly measurements of the animals' weights made it possible to calculate the Weight Gain (WG) by making the ratio of the weight gain at the end of the week (in days) minus the weight at the beginning of the week to the weight at the beginning of the week. It was determined using the following formula:

$$WG\ (g) = \frac{W2 - W1}{\mathrm{W1}}$$

Consumption index (CI)

The consumption index (CI) is the ratio of the amount of feed ingested during a given period to the animal's point gain during the same period. It reflects the overall feed efficiency. The lowest result reflects better assimilation of the feed. It is unitless and the formula used to determine it is as follows:

CI = (Quantity of feed consumed during a period (g)) / (Weight gain during the same period (g))

Laying rate:

It was calculated by the following formula

$$LR = \frac{\text{Number of eggs laid per day}}{\text{Number of hens present}} \times 100$$

Statistical analysis

The results obtained were processed with the Software

Excel for the constitution of the database after sampling and compilation;

SPSS for the comparison test of the means of the treatments: weight gain, consumption index, conversion index and relative growth in Chicks from 0 to 8 weeks. And the correlation test on the number of hatched and unhatched chicks, relative growth, number of eggs laid, conversion index, consumption index, quantity of feed consumed per week, actual consumption, weight gain, incubation period in breeders

III. Results

Evolution of the laying rate on the breeding batches

The correlation between the laying rate of the treated hens and the control hens is significant for those having received, in addition to the feed, a supplement of spent grain bran compared to those having received only the laying feed. The results of the laying rate are shown in Table 2.

Table 2: evolution of the laying rate in hens

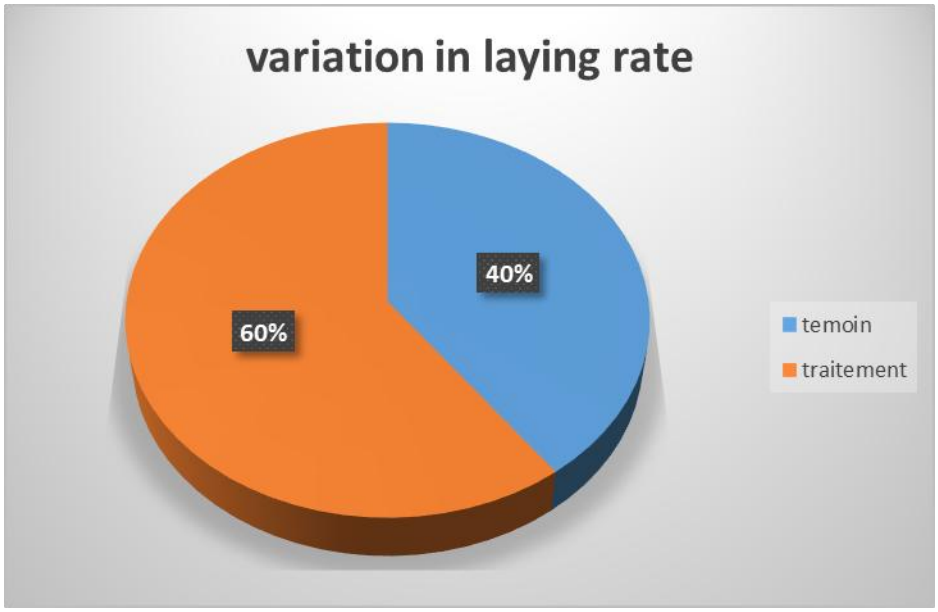

Figure 6: Laying rate of the local Batéké hen

Quantity of eggs at incubation and chicks hatched

During the rearing of breeders and during the laying of eggs, the eggs were kept for a maximum of 14 days before being placed in incubators.

Table 3 : Quantity of eggs at incubation and chicks hatched

DESIGNATION	Control hens	Treated hens
Type of feed	25	25
Quantity of eggs laid per batch	742	1114
Number of chicks per batch	180	270
Number of unhatched chicks	1406	
Total number of chicks	450	
Total quantity of eggs	1856	
Laying rate	40%	60%

Weight gain of chicks fed 50% of its spent grain and 50% of its corn from 0 to 8 weeks

The weight gain in chicks fed 50% of its spent grain and 50% of its corn is shown in the table below. This shows a difference, treatment 1 fed with the same feed with spent grain bran as energy intake has a lower average than treatment 2 fed with corn as energy intake; this from the 1st to the 4th week on the one hand and from the 5th to the 7th week on the other hand.

Table 4: Weight gain of both treatments from week 1 to week 5

Variable	Treatment	N	Mean Standard	Deviation	p-value
G P 1-4	1	100	29,39	27,925	0,76
	2	100	30,31	54,762	

Table 5: Weight gain of both treatments from week 5 to week 7

Group statistics

Statistiques de groupe					
Variable	Treatment	N	Mean Standard	Deviation	p-value
GP5-7	1	100	53,91	55,134	0
	2	100	75,34	75,663	

Table 6: Weight gain of the two treatments from week 1 to week 7

Treatment	GP1-4	GP5-7
T1	29,39	53,91
T2	30,31	75,34

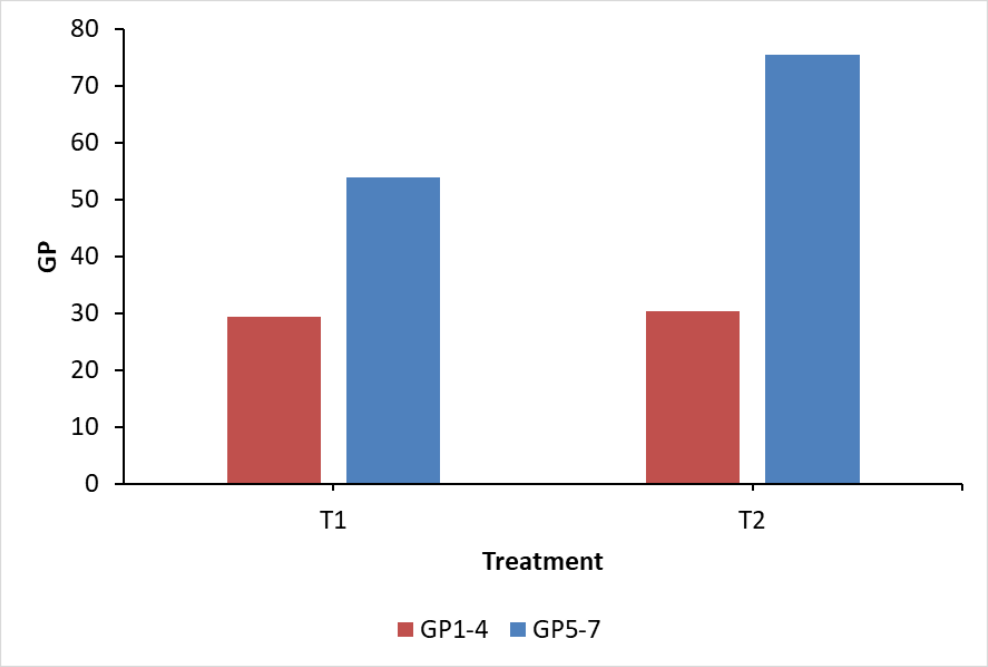

Figure 6: Comparative curve of the means of treatments 1 and 2 from week 1 to week 7

5- relative growth of chicks of the two treatments from 0 to 8 weeks

Table 7: Test of means of relative growth from week 1 to week 4

Group statistics					
Variable	Treatment	N	Mean Standard	deviation	p-value
CR1-4	T1	100	51,1804563	45,8088636	0,52
	T2	100	48,8673713	56,2802339	

Table 8: Test of means of relative growth from week 5 to week 7

Group statistics					
Variable	Treatment	N	Mean Standard	Deviation	p-value
CR5-7	T1	100	29,4343976	32,7191744	0
	T2	100	48,008222	71,8506403	

Table 9: Test of means of the two treatments of relative growth from week 1 to week 7

Treatment	CR1-4	CR5-7
T1	51,1804563	29,4343976
T2	48,8673713	48,008222

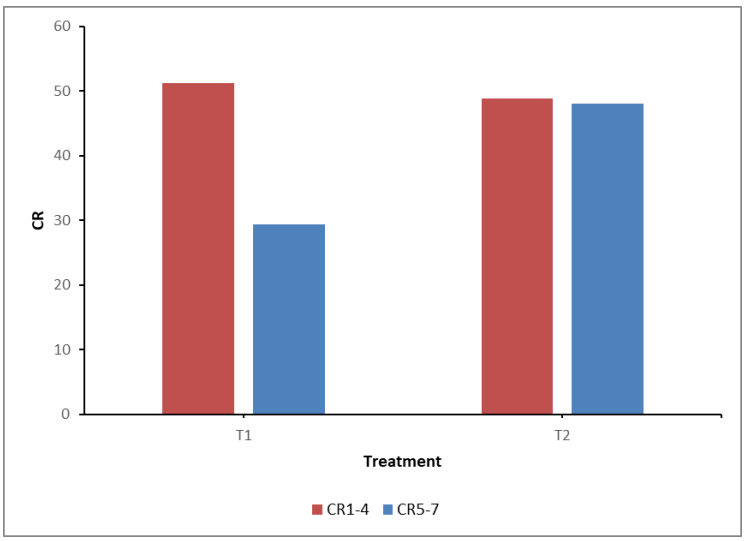

Figure 7: Curve showing the evolution of the relative growth of the two treatments from week 1 to week 7

6- consumption index of the two treatments from 0 to 8 weeks

Table 10: Test of the means from week 1 to week 4 of the consumption index of the two treatments

Group statistics					
Variable	Treatment	N	Mean standard	deviation	p-value
IC1-4	T1	100	35,6107493	38,3927281	0,014
	T2	100	44,1069214	57,2653421	

Table 11: Test of the means from week 5 to week 8 of the consumption index of the two treatments

Group statistics					
Variable	Treatement	N	Mean Standard	Deviation	p-value
IC5-8	1	100	29,4343976	32,7191744	0
	2	100	48,008222	71,8506403	

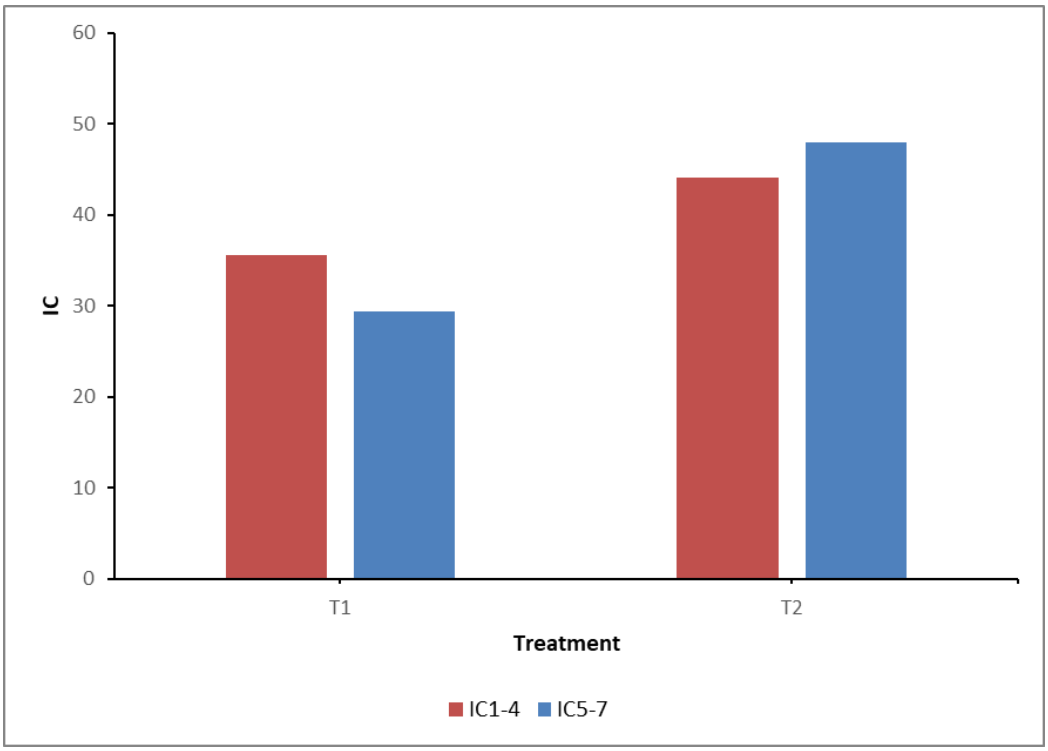

Figure 8: Curve showing the evolution of the feed conversion rate of the two treatments from week 1 to week 8.

IV. Discussion

Evolution of the laying rate of Batéké hens

Our results of the present study allowed us to have a 60% laying rate for the batch of treated subjects against 40% for the batch of control subjects. The correlation between the two laying rates is very significant at the 5% threshold ($p \leq 0.05$) for the treated batch. This can be explained by the additional contribution of spent grain bran in the diet of the treated subjects. Our results are similar to those obtained by some authors such as (Kassambara, 1989; Sonaiya, 1990; Buldgen et al., 1992; Moula et al., 2009; Ayssiwede et al., 2013) who believe that the laying rate of the local hen varies greatly depending on the country and can range from 42-90%, with an average of around 80% and that these variations are mainly due to the season.

Chick weight gain

The chicks were divided into two batches. One batch fed 50% spent grain bran and another 50% corn bran. The results obtained give an average weight of 29.39 g for the batch treated with 50% spent grain bran and 30.31 g for subjects fed 50% corn bran in the fourth week of the experiment. The difference not being too significant ($p>0.05$) between the two batches, reveals at least the importance that this local ingredient (bran of spent grain) can be substituted for corn. For example, the observations of the weighings gave the following: 40,45,80,95,150,160,305,350 g for weeks 1,2,3,4,5,6,7,8 for treatment 1 against 30,70,70,145,180,180,185, 195 g for treatment 2. These detailed weights only concern individual 1 for example.

Weight gain of breeders

During the period of the experiment, hens and roosters were weighed weekly. Our observations indicate that the weight of the subjects raised in a controlled station (average 1075g at the start) increases normally during their breeding, despite a period of adaptation due to the change of environment. The average weight obtained from our subjects (1313 g average at the exit) is higher than that obtained by Akouango et al., (2010) who indicate an average weight of males 1.4 ± 1 Kg and females 0.9 ± 9 Kg raised in scavenging. It is lower than the average weight obtained by Fosta et al., (2007) 2.5 1.3 Kg for males and for hens 1.8 Kg who worked in Cameroon.

This relationship is very significant, justifying the fact that the more the weight increases, the relative growth will also be expressed. This weight gain relationship of the controls and the treatment confirms the potential of local hens to increasingly express their performances if they are put in the right conditions. It should also be noted that this is a process that can take a little longer. Fattening is not practiced by traditional breeders because of the enormous requirement of fattening animals in balanced diet and with high energy and protein content

These results are higher than those obtained in The flock of local chickens raised at the CFPASA of Sidi Thabet in improved conditions and fed with a correct diet, recorded at the age of 56 days, weights of 550 g for hens and 580 g for roosters (Nwosu.,). Quantity of eggs at incubation and chicks hatched

Considering the total number of eggs put into incubation which is 1856 eggs, we only received 450 chicks (i.e. 180 in the controls and 270 in the treated). This can be explained in part by the fact that some eggs were not fertilized during candling; others malformed or of small calibers were simply removed. It is necessary to add disturbances of the electricity. All this could have an effect on the number of chicks at hatching.

The total number of eggs collected during the 6 months is 1856; i.e. 309 eggs on average collected each month. This shows an improvement in these hens accustomed in the past to total wandering with a random diet depending on the seasons. These average performances of 40.34 eggs per hen in 6 months of laying are much higher than those obtained by Riise et al., (2004): Egg production: 30-50 eggs/year/hen Long brooding periods Growth rate = 5-10 and lower than those of Bessadok et al., 2003, than those observed in Tunisia and which were 127 eggs per year with the local hen.

In view of the figure we can say that the result is zero in the short term but in the long term the results will be greatly improved. The positive linear correlations obtained indicate that hatching rates and age at the start of laying are closely linked to the weight of the egg laid

Relative growth of chicks

We know that relative growth is the expression of weight during a given period as a percentage of the initial weight, we retained this parameter in our study to have real values in local hens since the weight is different from certain species with a higher average weight.

From the first week to the fourth week, the observed average tests found that in treatment 1 the average is 51.18% of the initial weight against 48.86% of the initial weight for treatment 2. This correlation is significant showing that the valorization of the distributed feed was normally carried out.

On the other hand, observing the test of the means from the fifth to the seventh week, the observation is that growth is slowed down, or even decreases for treatment 1 to 29.43% of the initial weight against 48.00% of the initial weight for treatment 2. This correlation is not significant.

Practical example of relative growth for subjects of treatment 1 and 2:

12.5; 77.77; 18; 57.89; 6.66; 90.62 and 14.75% for treatment 1 against 16.66; 14.28; 25; 50; 118.75; 5.71 and 21% for treatment 2.

Chick feed consumption index

The chicks were fed with the feed manufactured on site, taking into account the formula chosen and the proportions of each ingredient. This study consisted of putting a food formula whose only difference should be in the energy intake; dried spent grain bran for treatment 1 and corn bran for treatment 2.

The quantities distributed are those used by Rhône Mérieux on broiler chickens in the tropical zone. This unique food formula took into account the two phases, namely start-up and finishing.

We know that most of the time, the breeding phases are accompanied by their feeding phases; but we have taken into account both phases in the incorporation rate.

During our work, we recorded data on the consumption index taken for two individuals, one for treatment 1 and the other for treatment 2.

For example, we have: 0.75; 0.88; 0.81; 0.84; 1; 0.57;0.92;0.55 for treatment 1 versus 1;1.14;1.62;1.6;0.85;0.88,1.08;1.14 for treatment 2.

J.C Fotsa., (2010) The feed conversion ratio between 12 and 16 weeks of age is normal (1550) and dwarfs (1260) are heavier than the heaviest local female (889g) from the northwest. Feed conversion ratios are 4.62. In adult females at 18 weeks.

V. Conclusion

This study aimed to evaluate the effect of station management on the growth performance of Batéké hens. The few performances observed during the breeding of local hens revealed a significant improvement in the variables studied. This stipulates that annual egg production can be improved if the subjects are placed in conditions that allow them to externalize their performance. The weight evolution was normal despite the disturbance at the beginning due to the acclimatization of the new environment and the feeding method.

The consumption index was convincing despite a disturbance at the beginning. This, in view of certain results found by other authors.

In view of the observations made in local subjects, it should be noted that the great phenotypic diversity which reflects the integration of exotic genes into the initial hen is well perceived by breeders as well as by local consumers. In these local populations, a great capacity for adaptation to climate variations is also estimated. Thus, it is still possible to undertake a program to conserve the genetic resources of the local population.

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