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Supplementation effects of *Calotropis procera* dried leaves on the growth performance of sheep in dry season in Burkina Faso

Abstract

This study evaluated the effects of two levels of supplementation of dried leaves of *C. Procera* on sorghum straw ingestion and weight evolution of sheep Mossi breed in Burkina Faso. To this end, 15 sheep Mossi breed weighing an average of 13.3±3.2kg were divided into three groups of five (5) animals and subjected to three diets during 35 days in dry season (April-May). Group A (control) received finely chopped sorghum straw, while groups B and C received 100g and 200g of *C. Procera* dried leaves in addition to the sorghum straw. The forages distributed contained 2% of raw salt. Mean ingestion rates for sorghum straw were 55.44%, 61.39% and 60.58% for lots A, B and C respectively. The average daily gains (ADG) obtained were 5.7g and 1.1g for the animals of groups B and C, respectively, against -18.2g for those of group A. These results suggest the possibility of valorizing *C. Procera* dried leaves in the rations of sheep in farming area as strategic supplementation to ensure better production in the dry season.

Keywords: *calotropis procera*, sheep, nutritional supplementation, weight gain

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Introduction

Burkina Faso is an agro-pastoral country where livestock is practiced on all these forms. Agriculture and livestock occupy over 90% of the working population and form the basis of the national economy. The latter contributes more than 12% to the Gross Domestic Product (GDP) and 40% of the country's export earnings.[1] The national herd is important and diverse with an estimated ruminant population of 9 091 000 cattle, 9 278 000 sheep and 13 891 000 goats.[2] Livestock activities are carried out by more than 80% of households who derive all or part of their income.[3] Cattle are the savings account of the family business, while small ruminants constitute the current account that allows smallholder farmers to meet their daily needs.[4] This current account is used in health, education and traditional practices.[5] However, ruminant livestock production in the country is generally confronted with climatic hazards, overgrazing, population expansion and occupation of pasture areas aggravated by bush fires.[6] This situation is less predicted in the rainy season with natural grazing in quantity and quality. However, in the hot dry season, existing pasture does not represent nutritional values anymore, while it is rich in ligneous forages in some localities. These perennial woods could therefore be a solution to the feeding problem of ruminants in this lean season where animals lose a lot of weight in general and their zootechnical value in particular. Indeed, some invasive woody trees in Burkina Faso have interesting nutritive values for animals and could be used to improve qualitatively low-season dry season rations such as sorghum straw. The present study was conducted to study the nutritive value of dried leaves of *C. Procera* in order to determine its optimum level of incorporation into the ration of sheep in the dry season to improve their growth performance.

Materials and methods

Study site

Our study was conducted at the Saria experimental station (12°16' north latitude and 2°09' west longitude and 300 m altitude). The climate of the zone is of the Northern Sudanian type[7] where there are two great seasons: the rainy season from June to October and the dry season, from November to May. The average annual precipitation is about 800 mm. The vegetation of Saria is of the Sudanian type and characterized by the presence of an annual grassland savanna, with trees and shrubs. The most frequently encountered trees are *Parkiabiglobosa*, *Buttyrospermunsp, Faidherbiaalbida*, *Adansoniadigitata*, *Guierasenegalensis*. The herbaceous stratum is mainly represented by species such as *Pennisetumsp, Antropogonsp, Loudetiatogoensis* L. and *Schoenefeldiagracilis*.

Vegetal material

The dry leaves of *C. Procera* were used to carry out the experimental test. The leaves of the plant were harvested from February to March 2016. The drying was done in the shade sheltered from the sun and dust with a reversal of two to three times a day. Depending on the time of harvest, drying lasted 96hours on average. To facilitate the consumption of the prepared forage, it has been finely chopped. This product was stored in plastic bags for distribution to animals.

Sorghum straw of the Sariaso 16 variety (SCHV 186) was also used to conduct the test. Sariaso 16 is an improved variety belonging to the *C. Audatum* botanical breed co-developed in Burkina Faso by INERA and CIRAD in 2008. The plant has a height varying from

205 to 230 cm with the broad leaves. It is a dual-purpose plant with good forage value of straw when residues are harvested early. Straw drying was done according to peasant practices (in the field under the sun) which depreciate the forage quality of the product. The straw was finely chopped to facilitate apprehension and avoid wastage by animals.

Animals and experimental design

Fifteen sheep Mossi breed from the sheepfold of Saria experimental station and weighing an average of 13.3±3.2kg, were used for the experiment between April and May during hot dry season. These animals were divided into three groups (A, B and C) of five animals and homogeneous weight (P>0.05).

Feeding test was carried out on the three groups of sheep for 35 days by applying the following design:

A. Group A (control): Sorghum straw finely chopped and and containing 2% salt

B. Group B: Sorghum straw finely chopped and containing 2% salt+100g dry leaves of *C. Procera*;

C. Group C: Sorghum straw finely chopped and containing 2% salt+200g dry leaves of *C. Procera*

These quantities of dry forage distributed were determined during the adaptation phase (two week). Animals of three groups were carried out according to the practice of rural farmer's doing agro-pastoral system which predominate in the study area. Every day, all animals were taken to the pasture every day from 8h AM to 2h PM. They received the sorghum straw every morning at 7 am and in the evening at 2 pm throughout the experiment. *C. Procera* dried leaves were fed in the evening at 5h pm. Each morning, all refusals of each group were collected and weighed before serving again. All animals in both groups had *Ad libitum* access to water.

The following parameters were measured:

i. Dry matter (DM) values of dry forage (C. procera and sorghum straw) were determined using the AOAC method.[8] From this value, those of mineral (MM), organic (MO), crude protein (CP) and crude fiber (CF) were determined;

ii. Voluntary intake of the forage distributed. For this purpose, daily weighing of the quantities of *C. Procera* and sorghum straw distributed and the quantities of refusals were used to determine the daily voluntary intake as follows:

IV = QD-QR

Where, IV=Voluntary Intake, QD=Distributed Quantity, QR=Quantity Refused

iii. Weight growth of the animals of each group from individual weekly weighings made on dates D_0, D_7, D_{14}, D_{21}, D_{28} and D_{35} to establish the weekly average by group.

Statistical analysis

Data collected were used to calculate the means of each measured parameters before being subjected to a one-way variance analysis to discriminate their effects. The Tukey-Kramer test at 5% significance was used to compare the means obtained with the Costat software (version 6.20.4).

Results

Chemical composition

Table 1 gives the Chemical composition contents *C. Procera* dried leaves of and the sorghum straw distributed during the study. The dried leaves of *C. Procera* contain high dry matter (DM=93, 20%) and mineral (MM=17.02%DM) contents, good crude protein (CP) and low crude fiber (CF) content at the harvest stage. Sorghum straw has a low level of CP and a high value of crude fiber, the main source of energy for ruminants.

Animal feed consumption

Table 2 presents the cconsumption level of distributed fodder. Average ingestion rates of *C. Procera* were 100% and 98.68% in groups B and C respectively. The dry matter quantities of *C. Procera* leaves ingested in group C represent approximately the double of the quantities ingested in group B. In the three experimental groups, the animals did not consume all the sorghum straw and the ingestion rates varied significantly (P<0.05). The consumption of sorghum straw in the supplemented groups was higher than that in the control group, where the mean ingestion rate was 55.44%. In the groups supplemented, no significant differences (P>0.05) were noted between group B (61.39%) and group C (60.58%). In addition, Figure 1 indicates that consumption of 100 g dry leaves of *C. Procera* (per animal per day) induces a high intake of sorghum straw in the supplemented groups.

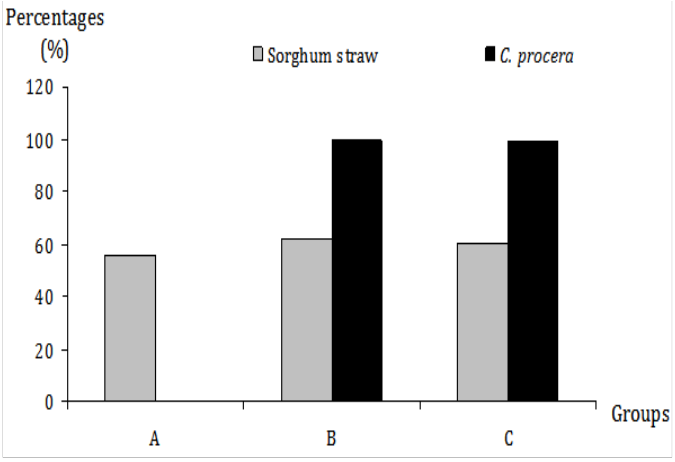

Figure 1 Influence of *C. Procera* dry leaves on the intake rate of sorghum straw during the experiment.

Effect on weight performance

The body weight and the Average Daily Weight Gain (ADWG) of sheep in the three groups are shown in Table 3. Mean of animal body weight in the control group increased from 13.4±2.0kg to 12.8±2.0kg while those of the supplemented groups increased from 13.36±3.2kg to 13.56±3.2kg for group B and from 13.36±3.1kg to 13.4±3kg for the group C. However, the comparison of sheep body weight presented no significant difference (P>0.05) between the three groups. But the ADWG obtained by the control group animals (-18.2±7.4g) were statistically lower (P<0.05) than those of the supplemented groups. However, the ADWG between the supplemental groups (B=5.7±8.0g and C=1.1±10.9g) did not show a significant difference (P>0.05) (Table 3).

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Table 1 Chemical composition of *C. Procera* dried leaves and sorghum straw of the study

Feed	DM (%)	% DM			
		MM	CP	MO	CF
C. procera	93, 20	17.02	19.07	82.98	23.44
Sorghum straw	94,14	nd	3.9	91,4	34,4

DM, dry matter; MM, mineral matter; CP, crude protein; MO, organic matter; CF, crude fiber

Table 2 Intake level of fodder distributed during the experiment

Groups	Distributed fodder	Total quantity(g)		Ingestion rate(%)
		Served	Ingested	
A	Sorghum Straw	63000	34930	55,44
B	Sorghum Straw	59500	36530	61,39
	C. procera	3500	3500	100
C	Sorghum Straw	56000	33930	60,58
	C. procera	70000	6905	98,64

Table 3 ADG of sheep by experimental groups

Groups	Periods		Total weight gain (g)	ADWG (g)
	D_0	D_{35}		
A	13,4±2,0[a]	12,8±2,0a	- 640±260[a]	- 18,2±7,4[a]
B	13,3±3,2[a]	13,5±3,2a	200±282[b]	5,7±8,0[b]
C	13,3±3,1[a]	13,4±3,0a	40±384[b]	1,1±10,9[b]

a, b, c, Means with the same letters on the same column are not significantly different (P<0.05)

Discussion

Supplementation with forages rich in protein is often required to improve production in ruminant in farmers' areas where animal feed is based on the exploitation of natural pastures. The objective of our study is to improve this practice by exploiting the available natural resources such as *Calotropis procera.* The dry matter analysis of *C. procera* leaves showed a high percentage of dry matter (93.20%), which is slightly lower than that (94.6%) of Maroyi et al.[9] and above (84.65%) in Kanazoe[10] during the rainy season in Burkina Faso. These differences could be explained by the periods and place of harvest that are probably not the same in our study.

During the study, the distribution of dried leaves of *C. Procera* did not affect the general behavior of animals in the two supplemented groups. Kanazoé[10] and Fall et al.[11] reported the same in Burkina Faso and Senegal respectively. This may be due to the action of drying which could have eliminated the toxicity of the plant because it is admitted that fresh leaves are toxic to ruminants. Analysis of the ingestion rate in the study shows that *C. Procera* is very popular and increases sorghum straw intake. Fall et al.[11] showed that *C. Procera* leaves are more palatable and more digestible than pods and leaves of *Faidherbia albida*.

In our study, leaf supplementation of *C. Procera* positively influenced the intake rate of sorghum straw; the animals of the supplemented groups carried out an ingestion rate more than the control batch. This difference could be explained by the high percentage of nitrogen (N) contained in *C. Procera*[12] which increased digestibility[11] and consequently, the consumption of the distributed ration. This finding corroborates the observations made by Swanson et al.[13] that supplementation of poor fodder by food containing high protein and rich in carbohydrates creates favorable conditions in the rumen for the proliferation of microflora and increases their capacity to damage roughage. This suggests that the quantity of *C. Procera* distributed to animals would act as catalytic supplementation to improve the quantity consumed and digestibility of sorghum straw used to induce production as in the study.[14] Indeed, supplemented sheep behaved in a different manner depending on the quantity of dry leaves of *C. Procera* distributed. The animals of group B (100g of *C. Procera*) achieved a weight gain greater than those of group C. (200g of *C. Procera*). However, the control group knew a decrease of weight, which was expected because the straw was of poor quality.

The quantity of 100g of *C. procera* of group B induced the highest ingestion rate of sorghum straw and a higher weight gain compared to group C. This observation confirms the results of Kanazoé[10] carried out in the rainy season in Burkina Faso. This leads us to think like Abbassi et al.[15] that high consumption of *C. procera* has a detrimental effect on the deliberate ingestion of food due to the presence of toxic chemicals, including calotropin and calotropagenin contained in the latex, which have anti-palatability effects. It is probably this finding that led Maroyi et al.[16] to dry the leaves of the plant to reduce the latex level from 162mg/g to 2mg/g and thus reduce toxicity. The ADWG results in our study are lower than those found in other studies of sheep supplementation. Kanazoe[10] found an ADWG ranging from 70 to 81.42g with the same forage of the plant distributed in the same proportions as our study. This difference of the results could be related to the season. Boukila et al.[17] observed a weight loss of the control batch of -10.25g for animals receiving only *Brachiaria ruziziensis* against a GMQ of 32.75g for animals supplemented with 800g of fresh cassava leaves (*Manihot esculenta*).

Conclusion

The results of the study show that particular attention needs to be paid to the use of *C. Procera* in small ruminant farms in rural areas to improve their productivity. This can be achieved through a strategy of catalytic supplementation for optimum use of cereal straws available on family farms. Indeed, these straws are generally poor nutritive values during the hot dry season, where natural pasture is scarce and poor quality

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Conflict of interest

Authors declare that there is no conflict of interest.

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