International Journal of Animal Science, Husbandry and Livestock Production ISSN: 2141-5191 Vol. 6(4), pp. 312-321, May, 2020. Available online at www.advancedscholarsjournals.org © Advanced Scholars Journals

*Full length Research paper*

# Effect of cowpea haulm complementation on the intake and *in vivo* digestibility of *Dactyloctenium aegyptium* L. (Willd) in small ruminants in Sahelian zone, Ati-Chad

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**Accepted 13 May, 2020.**

**A study of effect of cowpea haulms complementation on intake and *in vivo* of *Dactyloctenium aegyptium* in small ruminants was conducted in November 2018, at University of Ati, Chad. The intake and *in vivo* digestibility assessment of *D. aegyptium* in goats and sheep was the main objectives. Six rams and six goats aged between 20 and 24 months, weighing 31.83±3.02 and 28.62±2.97 kg respectively, were housed in metabolic cages. The first group received 1000g of *D. aegyptium* daily ($DF_0$), and the second group received the same quantity of DF0 +30% of cowpea haulms ($DF_{30}$). After 14 days of adaptation, data were collected during 7 days. The intake of DM (999g) and OM (834g) were significantly higher ($p<0.05$) in sheep with complemented diet ($DF_{30}$), except CF (247g).While control ration ($DF_0$) was significantly ($p<0.05$) more ingested by rams than goats. Comparable ($p>0.05$) effects was observed on DM (72.3%) and OM (70.9%) digestibility in goats with all rations. While the digestibility of OM (55.5%) and CF (76.1%) were significantly ($p<0.05$) higher in sheep with ration $DF_{30}$. Meanwhile, the digestibility of DM (61.0%) and OM (64.04%) of control ration were significantly ($p<0.05$) higher in goats, except for CF (76.92%). The same trend was observed in sheep with complemented ration ($DF_{30}$). Nitrogen intake was significantly ($p<0.05$) higher in both goats (8.53g) and sheep (6.68g). Fecal excretion (2.90g) and retained nitrogen (4.68g) were significantly ($p<0.05$) higher in goats with complemented ration ($DF_{30}$). Inversely, urine excretion (2.61g) and digestibility (50.89%) of nitrogen were significantly ($p>0.05$) higher in sheep receive complement ($DF_{30}$). Nitrogen digestibility (62.40%) was significantly ($p>0.05$) high in goats with ration $DF_0$, while cowpea haulm complementation enhanced a significant ($p>0.05$) digestibility of nitrogen in sheep. Therefore, the complementation with cowpea haulm increase intake and digestibility of *D. aegyptium* in small ruminants.**

**Keywords**: Digestibility, *Dactyloctenium aegyptium*, complementation, Small ruminants, Sahel.

## INTRODUCTION

Livestock employs more than 80% of the populations, and about 40% of the rural population survive from this sector (Djalal et al., 2014; Ministère de l'élevage, 2018). It is a considerable source of income of breeders, with a livestock capital value estimated at more than 137 billion FCFA, equivalent to 53% of the GDP (Ministère de l'élevage, 2018). According to the ministry in charge of livestock, it is undoubtedly the most dynamic sub-sector of the primary sector, leading the national economic growth (Ministère de l'élevage, 2018). Recently, Chad Republic decided to pay back to Angola, 75000 cattle in compensation of 100 million de dollars loan, on the bases of 13500 cattle per year (Alwide info, 2020).However, the persistence of drought cycles in recent years led to migration of pastoralists towards agricultural areas, where some reside in urban and peri-urban centers (Lawal et al., 2017) and sedentarized. Under the natural

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effect of climatic and anthropogenic hazards (reduction and degradation of pasture, over exploitation), the Sahel region is faced with insufficient pasture (Azoutane et al., 2019; Mbatbral et al., 2019). To overcome pasture insufficiency, especially in arid and semi-arid areas, breeders rely on regular sale of feeds by women (Bencherchali and Houmani, 2017; Azoutane et al., 2019). However, the empirical use of feeds and the marketing of crop residues and kitchen wastes is common (Lawal et al., 2017). Furthermore, forages scarcity causes food insecurity and significant economic losses to pastoralists in Sahelian zones (Djalal et al., 2014; Azoutane et al., 2019). Faced with climatic hazards, population growth and Farm mechanization in this zone (Tendonkeng et al., 2014), new strategies should be developed in order to improve biomass production to maintain the important herds (113.56 million heads) held by this country (Ministère de l'élevage, 2018; Alwide info, 2020). Several studies have been devoted to herd management, the role of herdsman, the use of crop residues and animal health care (Chaibou et al., 2012). Few studies have concerned the nutritive value of natural forages as a means of improving ruminants feeding and rational use of feeds. The objective of this study was to evaluate the effect of cowpea haulm complementation on the nutritive value of *Dactyloctenium aegyptium* L. (Willd) in small ruminants.

## MATERIALS AND METHODS

### Study area

The study was conducted in October 2018, at the Scientific Garden of the University of Science and Technology, Ati (JSUSTA) in the province of Batha in Chad (Figure 1). Located in the center of the country, Ati extends between 13°12'30" and 13°14'00" North latitude and 18°19'00"and 18°21'00" East longitude, with an area of 21 km$^2$ (Mbatbral et al., 2019). Temperatures range from 14 to 42°C. The rainy season ranges between June and September, and the dry season goes from October to May. Its relief is slightly uneven with temporary streams of water. The soils are sandy and compact clay loamy in the north. There are large dune silts and trays with closed depressions or "*ouadis*" sometimes very close, with vegetation of the Sahelian type (Béchir and Mopaté, 2015; Azoutane et al., 2019).

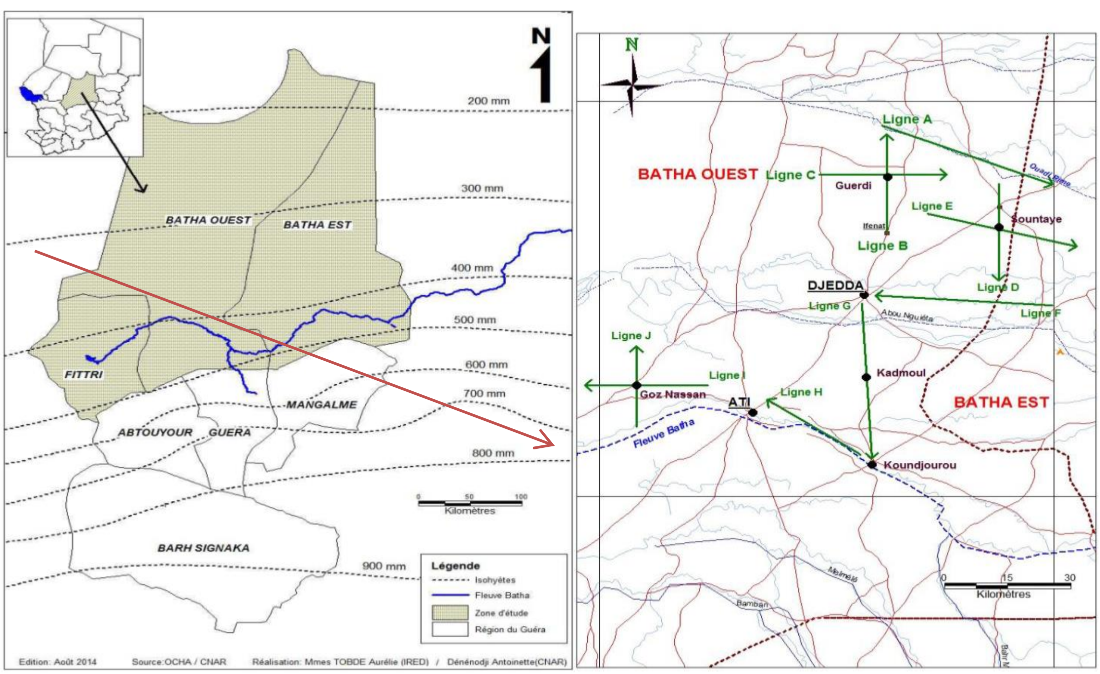

**Figure 1**: Location of the province of Batha, Ati in Tchad (Béchir and Mopaté, 2015)

### Animal material and health protection

Six (6) sheep and six (6) goats from Sahelian race (males) were purchased in the local market and used for this trial. Their ages which varied between 20 and 24 months, were determined by the method described by Corcy (1991). They were treated according to the sanitary methods described by Mubi et al. (2011).All animals received preventive treatments withOxytetracyclin20% long-acting (1ml/10 kg) and dewormed with Ivermectin 1% against gastrointestinal and pulmonary worms as soon as they arrived in the garden. They were identified by the numbered ear loops, and were acclimated for 30 days with experimental forages.

## Forages and feeds formulation

After a phytosociological investigation carried out in urban community of Ati (AUC), *Dactyloctenium aegyptium* (*Absabe* in Arabic), one of the major forages of AUC was cut for this purpose. This forage was mowed between August and September 2018, in the peri-urban pastures of the municipality of Ati. Mowing was done at the bottom of the plant about 5 cm above the ground as described by Theau et al. (2010). The hay obtained after drying in the shade at room temperature was stored for chemical analysis and *in vivo* digestibility assessment in small ruminants. The Cowpea haulms, one of the main feeds complements, were purchased from farmers for this purpose. Two rations were made from these forges for feeding trial as follows:

- *Dactyloctenium aegyptium* + 0% cowpea haulms ($DF_0$);
- *Dactyloctenium aegyptium* + 30% cowpea haulms ($DF_{30}$).

When animals were introduced into the cages, the rations were allocated to the different groups of animals for digestibility test.

## Experimental design

Six (6) goats and six (6) sheep were distributed one after the others into metabolic cages following a completely randomized plan (Figure 2). The cages were equipped with feeders and drinkers. Two (2) groups of three (3) animals were made with each species. Before their introduction into metabolic cages, each animal was weighed at the beginning and the end of adaptation period which lasted 14 days. Each group comprises tree animals having a comparable weight of about 31.83±3.02 and 28.62±2.97 kg respectively.

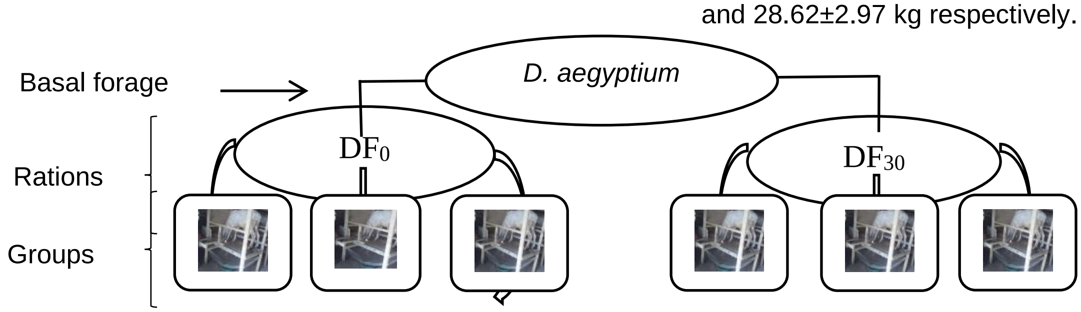


**Figure 2**. Experimental arrangement of the feeding test

## Feed intake and digestibility

### Feed intake

For the evaluation feeds intake and digestibility, animals were fed twice a day at 8 Am and 3 Pm. After 14 days of adaptation phase, feed consumption was measured during 7 days.

The feed offered and the refusal of each animal was collected and weighed before the next feeding. Feeds weighing were carried out using a weighing scale of 3kg maximum and 1g of sensitivity. While animals were weighed using 100 kg scale with 50g sensitivity. Whereas the urine of each animal was collected and measured daily using a 500 ml graduated cylinder. Then, a sample of 100g of rations and feces of each animal were collected in envelopes for chemical analysis. Similarly, 100 ml of urine was collected in 125 ml beakers where 10 ml of sulfuric acid ($H_2SO_4$) was previously introduced for nitrogen stabilization. Then, 10 ml was collected into test tubes and stored at 4°C in a refrigerator for determination of excreted nitrogen. A daily consumption of feed was determined by making the difference between the feed offered the day before and the refusal of each animal collected the next day. Water was served *ad libitum*.

### In vivo digestibility

Data on chemical composition of feeds and feces were used to calculate the apparent digestibility coefficients (CUDa) of DM, OM, CF and CP according to the formula described by Roberge and Toutain (1999)as follows.

CUDa X (%) = (X ingested-X excreted) / (X ingested) × 100

The digestibility of organic matter (OM), crude protein (CP) and carbohydrates was determined by the methods described by AOAC (2000). Indeed, gross energy (GE), energy for milk production (UFL) and energy for meat production (UFV) were calculated using various formulas (Sauvant, 1981; Jarrige, 1991; Van Soest, 1994).

## Chemical analysis

Chemical analysis of forages was carried out at the Animal Production and Nutrition Research Unit of Dschang University (URPRONAN) and at the Food Quality Control Center of N'djamena (CECOQDA). All feeds and fecal samples (100g) were oven-dried at 60°C for 48 hours until constant weight was obtained. The samples were ground (1 mm in size) using a tri-hammer mill.

The dry matter (DM) and ash concentration were determined using the methods described by AOAC (2000). The crude protein (CP) and crude fiber were analyzed using respectively the Kjeldahl and Weende methods (AOAC (2000).

### Statistical analysis

Data on intakes and *in vivo* digestibility of diets were subjected to two ways analysis of variance (animal species and rations), following general linear model in completely randomized plan. The means were separated by Duncan's multiple range test, when there were significant differences at the level of 5% (Steel and Torrie). Analysis were performed using SPSS 20.0 software. The statistical model was as follows.

$Y_{ij} = \mu + \alpha_{ij} + \beta_{ij} + e_{ij}$, where:

$Y_{ij}$ = observation on the animal j having received the rations i,
$\mu$ = general average,
$\alpha_i$ = effect of the ration i,
$\beta_j$ = effect of the ration j,
$e_{ij}$ = residual error on animal j having received ration i.

## RESULTS AND DISCUSSION

### Chemical composition

The analysis of the chemical composition show that dry matter (DM), organic matter (OM), crude fiber and lipid content were more elevated in *D. aegyptium* than in cowpea haulms (Table 1).

**Table 1**: Chemical composition of *Dactyloctenium aegyptium* and cowpea haulm

| **Analyzed parameters** | **Forages** | |
|---|---|---|
| | ***D. aegyptium*** | **Cowpea haulm** |
| Dry Matter (%) | 96.0 | 95.3 |
| Ash (% DM) | 9.03 | 9.71 |
| Organic Matter (% DM) | 90.97 | 90.27 |
| Crude Protein (% DM) | 9.41 | 10.60 |
| Crude Fiber (% DM) | 38.51 | 26.9 |
| Lipid (% DM) | 3.07 | 1.40 |
| Carbohydrate (% DM) | 75,02 | 75.48 |
| Digestibility of OM (%DM) | 82.37 | 56.49 |
| Digestibility of CP (g/100gOM | 25,26 | 25.42 |
| UFL/kg DM | 0.58 | 0.79 |
| UFV/kg DM | 0.79 | 0.83 |

DM: dry matter; OM: organic matter; CF: crude fiber; OM: organic matter digestibility; CP: crude protein; UFL: energy for milk production; UFV: energy for meat production

Similarly, ash and crude protein concentration were more elevated in cowpea haulms. Though, digestible organic matter was elevated in *D. aegyptium*. While carbohydrate and crude protein digestibility as well as energy for milk and meat production were more elevated in cowpea haulms.

### Effect of cowpea haulms complementation on intake of DM, OM and CF of *D. aegyptium* in goats and sheep

The complementation of *D. aegyptium* with cowpea haulms (Table 2) had positive effects on intakes of DM, OM and CF in both sheep and goats. The intake of the chemical constituents of *D. aegyptium* was significantly ($p<0.01$) higher in all animals with the complemented ration, except for CF in sheep. When *D. aegyptium* was not complemented, the intakes of DM, OM and CF were significantly ($p<0.01$) higher in goats. Comparatively, cowpea haulms induced significantly ($p<0.01$) higher intake of DM and OM in sheep, except for CF that was significantly ($p<0.01$) higher in goats.

### Effect of cowpea haulm complementation on the digestibility of DM, OM and CF of D. *aegyptium* in Sheep and Goats,

The digestibility of DM, OM and CF (Table 3) of all rations were comparable ($p>0.05$) in goats while complemented ration ($DF_{30}$) induced a significant ($p>0.05$) digestibility of OM and CF in sheep, except for DM. Though, goats digested significantly ($p<0.05$) the DMand OM of

**Table 2**. Effect of cowpea haulms complementation on the intake of DM, OM and CF of *D. aegyptium* in sheep and goats

| Intake (g DM/d) | Species | Diets | | SEM | *p* |
|---|---|---|---|---|---|
| | | $DF_0$ | $DF_{30}$ | | |
| DM | Goats | $785^{aA}$ | $801^{bA}$ | 13.3 | 0.001 |
| | Sheep | $615^{aB}$ | $999^{bB}$ | 0.51 | 0.001 |
| | SEM | 12.3 | 5.32 | | |
| | *p* | 0.002 | 0.001 | | |
| OM | Goats | $655^{aA}$ | $719^{bA}$ | 11.1 | 0.001 |
| | Sheep | $537^{aB}$ | $834^{bB}$ | 9.84 | 0.001 |
| | SEM | 10.2 | 10.71 | | |
| | *p* | 0.000 | 0.006 | | |
| CF | Goats | $290^{aA}$ | $369^{bA}$ | 4.93 | 0.001 |
| | Sheep | $234^{aB}$ | $247^{bB}$ | 3.22 | 0.102 |
| | SEM | 5.56 | 1.96 | | |
| | *p* | 0.007 | 0.001 | | |

a,b: Means values carrying different letters in the same row are significant at 1%
A,B: Means values carrying different letters in the same column are significant at 1%
SEM: significant error of means; P: probability.
DM: dry matter; OM: organic matter; CF: crude fiber; $DF_0$: *D. aegyptium* + 0% of cowpea haulm; $DF_{30}$: *D. aegyptium* + 30% of cowpea haulms.

**Table 3**. Effect of cowpea haulm on the digestibility of MS, MO, and CF of *D. aegyptium* in goats and sheep

| Digestibility (%DM) | Species | Diets | | SEM | *p* |
|---|---|---|---|---|---|
| | | $DF_0$ | $DF_{30}$ | | |
| DM | Goats | $64.04^{aA}$ | $72.25^{aA}$ | 11.3 | 0.58 |
| | Sheep | $47.63^{aB}$ | $58.04^{aB}$ | 2.26 | 0.12 |
| | SEM | 2.54 | 1.73 | | |
| | *p* | 0.032 | 0.015 | | |
| OM | Goats | $61.0^{aA}$ | $70.9^{aA}$ | 12.2 | 0.635 |
| | Sheep | $44.04^{aB}$ | $55.5^{bB}$ | 1.76 | 0.012 |
| | SEM | 1.73 | 3.21 | | |
| | *p* | 0.004 | 0.014 | | |
| CF | Goats | $76.92^{aA}$ | $80.83^{aA}$ | 13.7 | 0.461 |
| | Sheep | $68.92^{aA}$ | $76.11^{bA}$ | 0.92 | 0.004 |
| | SEM | 2.28 | 1.29 | | |
| | *p* | 0.09 | 0.093 | | |

a,b: Means values carrying different letters in the same row are significant at 5%
A,B: Means values carrying different letters in the same column are significant at 5%
SEM: significant error of means; P: probability.
DM: dry matter; OM: organic matter; CF: crude fiber; $DF_0$: *D. aegyptium* + 0% of cowpea haulm; $DF_{30}$: *D. aegyptium* + 30% of cowpea haulms.

of CF of all diets were comparable ($p>0.05$) in all animals, but significantly ($P<0.05$) higher in sheep with complemented ration ($DF_{30}$).

**Effect of complementation with cowpea haulms on the balance of nitrogen of *D. aegyptium* in small ruminants**

Nitrogen intake and digestibility from *D. aegyptium* varied significantly (p<0, 05) in small ruminants with cowpea haulm complementation (Table 4). The nitrogen intake and nitrogen retention of all diets were significantly ($p<0.05$) high in goats.

The highest values were obtained with complemented ration ($DF_{30}$). Nitrogen intake and urine excretion of nitrogen were significantly ($p<0.05$) increased in both sheep and goats with the same diet. Complemented ration increased significantly ($p<0.05$) nitrogen retention in goats than sheep.

Goats digested significantly ($p<0.05$) nitrogen from control diets, while sheep obtained a significant ($p<0.05$) digestibility of nitrogen with complemented ration.

**Table 4**. Nitrogen intake and digestibility from *D. aegyptium* in sheep and goat

| Nitrogen balance | **Species** | **Diets** | | **SEM** | ***p*** |
|---|---|---|---|---|---|
| | | **$DF_0$** | **$DF_{30}$** | | |
| Nitrogen intake | Goats | $6.70^{aA}$ | $8.53^{bA}$ | 0.11 | 0.001 |
| | Sheep | $5.29^{aB}$ | $6.89^{bA}$ | 0.004 | 0.001 |
| | SEM | 0.11 | 0.04 | | |
| | *p* | 0.003 | 0.001 | | |
| Fecal nitrogen | Goats | $2.44^{aA}$ | $2.90^{aA}$ | 0.16 | 0.33 |
| | Sheep | $3.18^{aA}$ | $2.80^{aA}$ | 0.21 | 0.70 |
| | SEM | 0.21 | 0.17 | | |
| | *p* | 0.19 | 0.22 | | |
| Urine nitrogen | Goats | $0.72^{aA}$ | $0.71^{aA}$ | 0.05 | 0.97 |
| | Sheep | $1.06^{aB}$ | $2.61^{bB}$ | 0.08 | 0.001 |
| | SEM | 0.02 | 0.09 | | |
| | *p* | 0.001 | 0.001 | | |
| Nitrogen retained | Goats | $3.53^{aA}$ | $4.68^{bA}$ | 0.16 | 0.014 |
| | Sheep | $1.38^{aB}$ | $1.25^{aB}$ | 0.22 | 0.921 |
| | SEM | 0.28 | 0.20 | | |
| | *p* | 0.007 | 0.001 | | |
| Nitrogen used | Goats | $62.40^{aA}$ | $45.33^{aA}$ | 11.46 | 0.498 |
| | Sheep | $31.83^{aB}$ | $50.89^{bB}$ | 0.83 | 0.000 |
| | SEM | 5.41 | 1.96 | | |
| | *p* | 0.001 | 0.025 | | |

a,b: Means values carrying different letters in the same row are significant at 5%
A,B: Means values carrying different letters in the same column are significant at 5%
SEM: significant error of means; P: probability.
$DF_0$: *D. aegyptium* + 0% of cowpea haulm; $DF_{30}$: *D. aegyptium* + 30% of cowpea haulms.

## DISCUSSION

Dry matter content of *D. aegyptium* was higher than the range reported by Kiema et al. (2012) and Klein et al. (2014) on tropical forages (90 to 95%). This could be explained by the fact that the forage was mown at the seedling stage in a hot climate in arid zone. Indeed, several authors (Sahar and Babo, 2013; Sawa et al., 2018) stipulated that the annual diversity of precipitation, temperatures and the phenological stage influence the chemical composition of plants. Ash concentration of forages was lower than that reported by Ali (2017) on *Echinocloa sp* (12.46%). This could be linked to uneven distribution of rainfall in the Sahelian zones, whereby plants could not properly store mineral elements in the walls (Archimede et al., 2009). This result was superior to the report by Kiema et al. (2012)and Melkamu (2013)on *Dactyloctenium aegyptium* (6.51 and 8.3% respectively).Organic matter concentration was superior to that reported by Melkamu (2013)and Sanou et al. (2016)(73 %; 87.50% respectively). This result agrees with the statement of Klein et al. (2014)that organic matter of tropical forages ranges between 80.82 and 94.74%. This could either be linked to environmental conditions (temperature, light, sol) that had positive effects on plants growth (Khetib-Chibani, 2013) and the proportion of lignin as well as the proportion of the stems and leaves used (Hughes et al., 2014).Total crude protein of forages was higher than those obtained by Melkamu (2013)and Sanou et al. (2016)on Sahelian grasses (8.7%; 8.12%). But it was lower to the observation of Ngoutane et al. (2011)on *Echinocloa pyramidalis* (15.6%). This result agrees with the statement of Khan et al. (1999) who observed crude protein variation in native grasses from 9.53 to 10.32% according to seasons. In fact, it is established that crude protein and soluble sugar decrease with the growing stage of the plant, while dry matter and crude fiber increase (Klein et al., 2014). Several authors also reported that, losses of nitrogen during haymaking and the different parts of the plant used, as well as the types of soil and it level of fertility are susceptible for chemical variations (Sawa et al., 2018; Mouchili et al., 2018. The concentration of crude fiber was inferior to that obtained by Melkamu (2013)on pasture forages (62.1%). This variation could be related to the age of the plant and its degree of lignification of cell walls (Kiema et al., 2012; Sawa et al., 2018). This result corroborates with the observations of Babatoundé et al. (2015) that the proportion of lignin increases gradually from growing stage until the shoot, and at this stage, protein concentration decreases from 15.5 to 9.3%. Pedoclimatic conditions and spacial distribution of vegetation (legumes/Graminaes) are the ultimate factors that affect chemical composition of plants (Hounvou et al., 2018; Sèwadé et al., 2016).Carbohydrate rate was elevated in cowpea haulm, while fat content was more elevated in *D. aegyptium*. Knowing that these elements are sources of energy, their concentration could be related to the rigidity of cell walls that varies with plants species. This result is in contradiction with there port of Ahounou et al. structural carbohydrates are significantly lower in tropical leguminous forages than grasses at similar stages of maturity. Digestible organic matter was higher in *D. aegyptium* than in cowpea haulm. This finding agrees with the observation of Fulkerson and Donaghy (2001) who observed the variation of digestibility of organic matter from 40 to 90% in tropical grasses. Plant digestibility seems to be influenced by high proportion of crude fiber and it duration in the rumen. This result was lower than that reported by Melkamu (2013)on pasture forages (62.1%). Several authors estimated that fiber concentration is the main factor that affect plant digestibility, and the variation rich 10 points for example in ray grass (*Lollium perenne* L) and common timothy grass (*Phleum pratensis)* digestibility (Baumont et al., 2008; Bouazza, 2014). Digestible protein, energy for milk and meat production were more elevated in cowpea haulm. Though, it is noticed that, concentration of lignin or tannin in forages is negatively correlated with digestibility (Bouazza, 2014). As such, high digestibility of organic matter and crude protein, could be linked with low level of crude fiber in cowpea haulm, inducing high production of energy for animal production (milk and meat). This result is consistent with the observations ofHughes et al. (2014)that tropical pastures are better able to meet energy and nutritional requirements of animals of smaller body size. Dry mater, and organic matter intakes were significantly ($p<0.05$) higher in sheep with all rations, except for crude fiber that was significant ($p<0.05$) in goats. This result corroborates the assertion that supplementation with high nitrogen feed, improves intake of poor feeds in dry season (Pamo et al., 2008; Devun et al., 2011). Indeed, cowpea haulms fermentation in the rumen could have enhanced microbial proliferation that accelerated feeds degradation, and it transit from the rumen-network to further digestive tract (Van Soest, 1994; Tendonkeng et al., 2014). Low intake of crude fiber in sheep could either due to the proportion of stem and leaves consumed, or to the concentration of ammonia in the rumen after proteins fermentation. As it could not be quickly recycled in the rumen, it was significantly ($p<0.05$) excreted through urine as revealed by several authors (Archibeque et al., 2001; Lemoufouet et al., 2014). Though, goats ingested significantly ($p<0.05$) chemical constituents from control diet. This could either be linked to mechanical degradation efficiency, or the quality of *D. aegyptium* served to goats. Some authors (Correa, 2011; Mickael, 2012)reported that chewing capacity is more observed in goats than in sheep (154 versus 128 jaws per minute). Cowpea haulm complementation had a comparable ($p>0.05$) effect on digestibility of *D. aegyptium* in goats. This result was higher to the observation of Sahar and Babo (2013)on *D. aegyptium* at flowering (52.8g/kg $pv^{0.75}$) and at heading (37.5 g/kg $pv^{0.75}$) stage. Various reports have stipulated that vegetative stages seem to be the main causes of nutrients variation in tropical forages (Sawa et al., 2018; Mouchili et al., 2019). Although, dry matter and organic matter of control ration were significantly ($p<0.05$) digested by goats. While complemented ration enhanced a significant ($p<0.05$) digestibility of organic matter and crude fiber in sheep, except dry matter. This result was inferior to the report of Melkamu (2013) on *D. aegyptium* (73%) and Matumuini et al. (2013), when maize stover complemented with *Tithonia diversifolia* leaves was fed to goats (23g). But it was superior to the result obtained by Lemoufouet et al. (2014), when maize stover was treated with 28% of hens droppings, associated with molasses in sheep (3.99g). In fact, variation in digestibility of these constituents could be linked to complement that enhanced the proliferation of cellulolytic bacteria with efficient degradation of forages and nutrients absorption that varied with animal species (Sauvant, 2000; Dawit et al., 2013). No significant ($p>0.05$) difference was observed for fecal excretions of nitrogen in both goats and sheep considering all rations. Whereas, urine excretion of nitrogen was significantly ($p<0.05$) higher in sheep with both rations. The reverse case was observed in goats for nitrogen retention. This implies that, cowpea haulm complementation had a variable effect on nitrogen utilization of *D. aegyptium* in small ruminants. This can be observed by significantly ($p<0.05$) excretion of nitrogen through urine in sheep and inversely, a significant ($p<0.05$) retention of this nutrient in goats, regardless of diets. Fecal excretion of nitrogen was higher to the report (0.70g) of Lemoufouet et al. (2014), but lower to that of Matumuini et al. (2013) (8g). This result agrees with the observation of Matumuini et al.(2013) that degradation leguminous forages produces ammonia that is excreted through urine to avoid toxicity. Though, nitrogen retention was inferior to that obtained by Matumuini et al. (2013) reported in goats fed maize stover complemented with fresh *Tithonia. diversifolia* leaves (6g). It was reported (Klein et al., 2014) that the nature and form of feed complements(hay and fresh leaves) are the factor effecting nutrients absorption in animals. There was no significant ($p>0.05$) effect of cowpea haulm complementation on nitrogen digestibility in goats. Whereas complemented diet induced a significant ($p<0.05$) digestibility of nitrogen in sheep. The result obtained with goats (64.40%) was higher to that reported by Idrissou et al. (2017) with *Panicum maximum* complemented with fresh *Leucaena leucocephala* in sheep (58.60%). This result seems to be an exception to the observation of Pathoummalangsy and Preston (2008) who believed that the rapid breakdown of leguminous proteins in the rumen limits its use, when fermentable carbohydrates are enough.

## CONCLUSION

The concentration of dry matter, organic matter, crude

fiber and lipid were more elevated in *D. aegyptium* than in cowpea haulm. Structural carbohydrate, digestible nitrogen and energy for milk and meat production were elevated in cowpea haulms. Chemical components of complemented ration were significantly ingested by goats and sheep; except for crude fiber in sheep. The intake of dry matter and organic matter were significantly higher in sheep with complemented diet, except for crude protein.
However, cowpea haulms complementation had a comparable effect on digestibility of dry matter and organic matter, as well as the fiber in goats. Whereas, digestibility of organic matter and crude fiber were significantly higher in sheep with complemented ration, except for dry matter.
Comparatively, the highest intakes of chemical constituents were observed in sheep with complemented ration. The reverse case was noticed in goats with control ration. Even if nitrogen was significantly excreted through urine in sheep with complemented diet, they a digested significantly nitrogen from this ration. While the reverse case was observed in goats control ration.

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