Effects of *Pennisetum purpureum* supplemented with different legumes as sources of protein on growth performances and carcass characteristics of Guinea pigs

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ABSTRACT

Aim: The study was aimed to evaluate some legumes plants in the diet on growth performances and carcass characteristics of Guinea pig feed on *Pennisetum purpureum*.

Method and Materials: A total of 48 females and 8 males-adult Guinea pigs aged of 5 months and weighing averagely 450±50g were used to the experiments. Females Guinea pigs were first put in breeding for a period of 31 days and then organized in a completely randomize blocks design into four groups of 12 females each. Each group received *P. purpureum ad libitum* and 20g DM/day/animal of a diet corresponding to the group.

Results: The results showed that the diet PP-DI has permitted to obtain the highest mean live weigh both at birth (86,00g) and weaning (181,88g). But, at a week eight, the highest mean live weight (347,42g) were obtained with treatment PP-AG.

Conclusion: It was concluded that diets containing legumes plants produce significantly higher total and daily weight, carcass characteristics and cecum weight.

Keywords: Legumes, *Pennisetum purpureum,* Guinea pigs, growth performances, carcass characteristics.

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Introduction

Food nowadays still remains as one of the main handicaps of caviaculture development in Africa (Miégoue et *al*., 2018a). However, an adequate diet of piglets produced early weaning, improved growth and survival rate after severity and, would reduce the demand in terms of body reserve in the mother during breastfeeding (Miégoué et *al*., 2019a). By improving the diet of guinea pigs, production can be intensified to take an advantage of the prolific nature of these animals, their precocity and their hardiness (Bindelle and Picron, 2013). Several solutions have been considered in order to improve the nutritional quality of tropical forage grasses with a view to better production of guinea pigs.

One of the most easily achievable solutions is the use of fodder legumes whose nutritional value is establish as a supplement of poor-quality food (Pamo et *al*., 2006; Boukila et *al*., 2009). The use of legumes can also be an effective solution in reducing the production cost of domestic herbivores in general and guinea pigs in particular. Indeed, Cigogna (2000) thought that the use of legumes can contribute to reduce the concentration rate of the ration from 25% to 14 or 15% even in case of early weaning.

Some forage legumes including *Desmodium intortum*, *Calliandra calothyrsus*, *Leucaena leucocephala* and *Arachis glabrata* are known to have excellent growth potential in tropical Africa (Pamo et *al*., 2003). Their leaves and those of other plants, rich in protein, can therefore be used as a dietary supplement for guinea pigs. In addition, *P. purpureum* has been used alone or in combination with *Tithonia diversifolia* (Noumbissi et *al*., 2013) or cassava leaves (*Manihot esculenta*) (Mweugang et *al*.

2014) in guinea pigs with higher weight gains in supplemented animals. In addition, in Africa in general and in Cameroon in particular, several plant species have a certain fodder potential but not yet explored in caviaculture. This study is proposes to contribute to improving the diet of guinea pigs through the valorisation of local resources available at low cost.

Materials and Methods

Experimental site

The study took place from October 2018 to March 2019 at the Teaching and Experimental Farm of the University of Dschang, located between 5° 25' and 5° 30' of Latitude North, 10° 0' and 10° 5' East Longitude and at an altitude of about 1420 m in West Cameroon. The climate of the region is equatorial, Cameroonian type linked to the altitude, with an average annual temperature of 20° C. The dry season runs from mid-November to mid-March, and the rainy season from mid-March to mid-November and corresponds to the main growing season. February and March are generally the warmest months, while July and August are the coldest. Average annual precipitation ranges from 1,500 to 2,000 mm, with relative humidity ranging from 40% (during the dry season) to 97% (during heavy rains). The dry season alternates with the rainy season (Pamo et *al*., 2005).

Animal material and Housing

For this test, 56 adult guinea pigs including 48 females and 8 males aged 5 months and weighing 450 ± 50g were used. All of these animals were purchased from villages surrounding the University farm and raised at the Teaching and Experimental Farm of the University of Dschang. To prevent a possible deficiency in vitamin C, the latter was distributed daily to all animals via drinking water (01 tablet of 240 mg in 1.5 liters of water) served *ad libitum*. As for the evaluation of the carcass characteristics and the measurements of the various organs, 20 animals regardless of sex, 8 weeks old, were sacrificed, at the rate of 5 young per batch.

The animals were distributed in lodges. These boxes made of plywood, each measured 1 m in length, 0.8 m in width and 0.6 m in height were provided with a lighting device also serving as a heating system. The animals were raised on the ground, on a 5 cm thick untreated dry wood shavings litter, renewed every 2 days to avoid the accumulation of feces and urine. Each compartment or box was equipped with 2 wooden feeders for concentrated food and 2 concrete drinkers (Figure 1). The various lodges were fitted with a mesh cover to protect animals from mice and other predators that could enter the breeding building. The wire cages and the plywood boxes were arranged in a compartment of one of the livestock buildings made of final materials at the Application and Research Farm of the University of Dschang.

Plant material

The plant material consisted of a grass (*Pennisetum purpureum*) and legume leaves (*Arachis glabrata*, *Desmodium intortum* or *Calliandra colothyrsus*). The grass was harvested in the forage plot of the University Teaching and Experimental Farm the day before and pre-wilted in one of the lodgings of the breeding building before being directly served the next day to the animals. The legume leaves, on the other hand, were harvested before flowering, dried, crushed and incorporated into a compound feed. A 100 g sample of each plant was taken, dried in an oven to constant weight, crushed and stored in plastic bags for the evaluation of their dry matter (DM), organic matter (MO), crude protein (PB) and crude cellulose (CB) (AOAC, 1990) (Table 1).

Conduct of tests

Preparation of the different rations

The ingredients were purchased from dealers in agricultural by-products in the city of Dschang. The proportions of the various ingredients used in the manufacture of the feed as well as the nutritional value shown in Table 2. Indeed, a 100g sample of each of the experimental rations was taken, dried, ground using an artisanal three-hammer grinder united with a 1mm mesh sieve and kept in plastic bags for the evaluation of their dry matter (DM), organic matter (MO), crude protein content (PB) and crude cellulose (CB) as described by AOAC (1990).

Table 1: Chemical composition of forages

Chemical composition	Different forages			
	Pennisetum purpureum	***Arachis glabrata***	***Calliandra calothyrsus***	***Desmodium intortum***
Dry matter (%)	94.83	90.92	93.29	92.38
Organic matter (% DM)	85.98	88.02	90.22	89.65
Crude protein (% DM)	14.87	20.00	23.98	23.79
Fat (% DM)	2.96	2.95	5.58	3.50
Crude fiber (% DM)	34.78	26.30	31.63	29.63
Ash (% DM)	14.02	11.98	9.78	10.35

Table 2: Percentage composition of the various ingredients and nutritional value of the experimental rations

Ingredient	Rations			
	R0	**R1**	**R2**	**R3**
Remoulding	31	25	25.5	26
Maize	30	24	25	25
Cottonseed meal	5	4	4	4
Palm kernel meal	25	20	21	21
Soybean meal	2	1.5	1.5	1.5
Fishmeal	3	2.5	2.5	2.5
Shell powder	2	1	1.5	1.5
premix *	1	1	1	1
Cooking salt	1	1	1	1
A. glabrata	0	20	0	0
C. calothyrsus	0	0	17	0
D. intortum	0	0	0	16.5
TOTAL	**100**	**100**	**100**	**100**
Valeur nutritive				
Dry matter (DM in %)	91.97	92.10	92.47	92.90
Organic matter (% DM)	89.83	90.81	87.29	89.78
Crude protein (% DM)	15.76	16.23	16.36	16.07
Fat (% DM)	08.74	04.80	06.65	06.32
Crude fiber (% DM)	17.48	19.94	12.95	15.44
Ash (% DM)	10.17	09.19	12.71	10.22
EM (Kcal / Kg MS)	2576.5	2471.56	2533.85	2549.55

*VitA : 3000000UI, Vit D : 600000UI, VitE : 4000mg, VitK : 500mg, Vit B1 : 200mg, Vit B2 : 1000mg, Vit B6 :400mg, Vit B12 : 4mg, Fer : 8000mg, Cuvre : 2000mg, Zinc : 10000mg, Sélénium : 20mg, Manganèse : 14000mg, Méthionine : 200000mg, Lysine : 78000mg.

Different rations thus prepared were used to manufacture the granules using a mechanical granulator of traditional manufacture.

Evaluation of reproductive and growth performance according to the different rations

For this trial, females were placed in a completely randomized device consisting of 4 lots with 12 repetitions per lot. The animals were crossed with a ratio of 2 males to 12 females for 31 days and then the males were isolated (Pamo et *al*., 2005). The animals were identified by numbered loops attached to the left ear. Each of the rations was distributed twice a day between 8 a.m. - 9 a.m. and 4 p.m. - 5 p.m., respectively to the concerned batch as follows:

PP: *P. purpureum ad-libitum* + 20g of R0;
PP-AG: *P. purpureum ad-libitum* + 20g of R1;
PP-CC: *P. purpureum ad-libitum* + 20g of R2;
PP-DI: *P. purpureum ad-libitum* + 20g of R3

The young in each batch were weaned and monitored individually up to 8 weeks of age when five young animals were used to assess carcass characteristics and gut measurements. In weaners, the quantities of food served were adjusted according to their weight from the quantities served to the mothers. Refusals for each lot were collected and weighed every morning before the new service. During the study, drinking water was served *ad libitum* daily. *P. purpureum* was served *ad libitum* twice a day to animals. In addition, with regard to the concentrated food, 20g / animal / day of the different rations of concentrate were also served twice a day (1/4 in the morning and ¾ in the evening).

Growth performance

Each newborn was identified at birth and weighing weekly until the 3rd week (weaning). The weights recorded help to assess the pre-weaning growth of the piglets. At weaning, each guinea pig was sexed and sent to the fattening lot corresponding to its mother's diet. Their weights were also taken every week until their 8th week and this allowed us to assess the post-weaning weight change from the 3rd to the 8th week as well as the weight gains (GT and GMQ) at the 8th week.

Carcass characteristics and digestive tract organs Assessment

At the end of the feeding trial, 5 animals per treatment aged 8 weeks, taken at random and fasted for 12 h, were slaughtered by cervical dislocation and then bled in the throat for the evaluation of the carcass characteristics, weighing and measurement of body mensuration. The carcass (carcass yield) and the proportion of the different organs (digestive system, intestine, skin, liver and cecum) in relation to body live weight at slaughter were evaluated. All weighing were made using a digital scale with a capacity of 3 kg and precision 1 g. The length of the intestine was measured using a 1mm precision tape measure.

Data analysis

Data on the growth of the young were subjected to the analysis of the variance with two factors (food ration and sex) according to the general linear model (GLM). Data on carcass, digestive tract and liver characteristics were subjected to a one factor analysis of variance (food intake) according to the GLM. When the significant differences existed between treatments, the separation of the means was made by the Waller Dunkan test at the 5% significance level (Steel and Torrie, 1980). The analysis software used was SPSS 19.0

Results

Growth performance of guinea pigs according to rations

Weekly weight evolution of piglets from birth to weaning

The inclusion of legume leaf meal in the ration has resulted in a steady increase in animal weight over time (Fig 1). The mean weights of guinea pigs in the batch submitted to the ration containing D. *intortum* were higher than those of animals of the other batch. However, animals in the control group had the lowest average weights compared to those of animals submitted to rations containing legumes.

At birth, animals fed on the ration containing *D. intortum* presented the highest weight (Figure 2) and those of the control group the lowest. The average guinea pig weight in the PP-AG batch was comparable (P> 0.05) to that of the PP-CC and PP-DI batch but statistically (P <0.05) higher than that of the PP batches.

At the 1st and 2nd week, the average weights of animals submitted to the PP-AG and PP-CC rations were comparable (P> 0.05) but statistically (P <0.05) lower than those of the animals of the PP-DI ration.

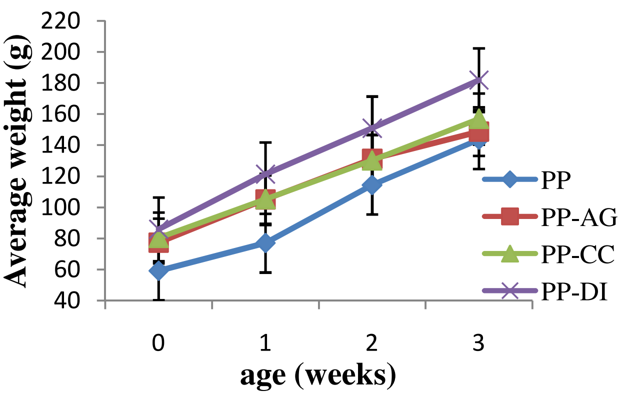

Fig. 1: Variation in the weight of piglets from birth to weaning, depending on the protein sources of the ration.

Furthermore, these average weights were significantly (P <0.05) higher than those of animals in the control group. The highest weights were obtained with the animals subjected to the PP-DI ration and the lowest with those of the PP ration during the first two weeks. At weaning, animals fed with the PP-DI ration showed the highest weight and those with control ration the lowest. The weight of the animals submitted to the PP, PP-AG and PP-CC rations were comparable (P> 0.05). On the other hand, the weight of guinea pigs from the batch submitted to the ration containing *D. intortum* was significantly (P <0.05) higher than that of animals from the other batches. Thus, animals submitted to the PP ration obtained the highest weight gains and those of the PP-AG ration the lowest.

Weight growth of young post-weaned guinea pigs during the fattening test

Post-weaning weight evolution of young guinea pigs

Adding legumes to the rations resulted in an increase in the weight of animals from the 3rd to the 8th week (Fig 2). From the end of the 4th week to the end of the 6th week, the animals in the PP-DI ration had significantly (P <0.05) the highest average weight and those fed with the PP-AG ration the lowest. On the other hand, the weights obtained with the PP-AG, PP and PP-CC treatments remained statistically comparable (P> 0.05) but, significantly (P <0.05) lower than those of the PP-DI ration containing *D intortum*. At the end of the 7th week, with the animals fed the PP-CC, PP-AG and PP rations on the one hand and those of the PP and PP-DI rations on the other hand, the weights of the young guinea pigs presented no significant difference (P> 0.05). At the end of the 8th week, the inclusion of the meal from the legume leaves had no significant effect (P> 0.05) on the weight evolution of the weaners. From weaning to 8 weeks of age, the PP, PP-AG, PP-CC and PP-DI treatments led to a weight gain of respectively 56.03%; 57.17%; 59.75% and 46.31%. Thus, the ration containing *C. calothyrsus* obtained the best weight gains and that containing *D. intortum* the lowest weight gains.

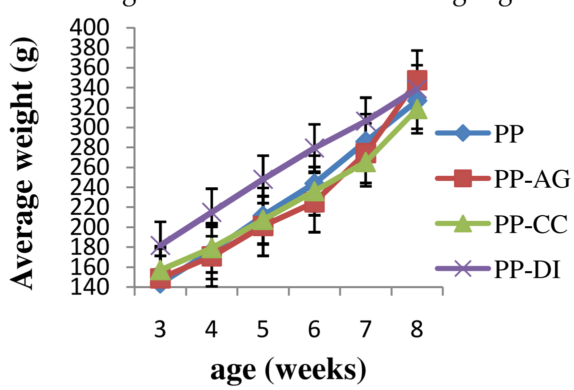

Fig. 2: Weight change after weaning of young guinea pigs according to the different rations

Carcass characteristics and some measurements of the organs involved in digestion in guinea pigs-

Carcass characteristics

Apart from the proportion of the liver, all the other parameters at slaughter were significantly (P <0.05) affected by the variation of protein sources in the ration. In fact, the significantly higher live weight at slaughter, organ and carcass weights (P <0.05) were obtained with animals submitted to the ration containing *D. intortum* and the lowest with animals subject to the witness ration. The same is true for carcass yields. No significant difference (P> 0.05) was however observed between the PP-DI and PP-CC treatments on the one hand for body weight, organ weight, carcass weight and yield and, on the other hand, between the weights of the animals in these lots and the weights of the head, the digestive tract, the commercial carcass as well as the yield of the conventional carcass of animals fed the PP-AG ration. These treatments allow to obtain the live weights at slaughter significantly (P <0.05) higher than that obtained with the PP-AG treatment and, the latter in turn gave results which were significantly (P <0.05) higher than those obtained from the PP treatment for the live weight at slaughter, the weight of the conventional carcass and the yield of the commercial carcass. The PP-AG treatment gave a statistically comparable result (P> 0.05) to other treatments for the weight of the head, the digestive tract and the commercial carcass.

The significantly higher proportions of head and digestive tract (P <0.05) were obtained in animals fed on the PP ration and the lowest in those of the PP-DI ration for the head and those of PP-CC for the digestive tract. The proportion of the head obtained with the PP-AG treatment remained comparable (P> 0.05) to that of the PP treatment on the one hand and, on the other hand to that of the PP-CC treatment. The proportions of the digestive tract of animals subjected to the PP ration were statistically (P <0.05) higher than those of the PP-AG, PP-CC and PP-DI treatments. Furthermore, these last three treatments were comparable (P> 0.05) to each other. The proportions of the liver remained comparable (P> 0.05) with each other whatever the treatment.

Characteristics of some digestion organs in guinea pigs

The inclusion of legume leaf meal in the ration significantly (P <0.05) influenced the weight and density of the small intestine as well as the length of the caecum (Table 4).

Table 3: Carcass characteristics of the guinea pig according to the different rations

Parameters	Treatments				SEM	P
	PP	PP-AG	PP-CC	PP-DI		
Weight (g)						
LWs	302.60^{c}	352.80^{b}	393.20^{a}	408.40^{a}	15.54	0.00
Head	48.20^{b}	53.00^{ab}	54.20^{a}	55.20^{a}	1.39	0.05
Heart	1.60^{b}	1.80^{b}	2.20^{ab}	2.80^{a}	0.16	0.02
Digestive tract	94.20^{b}	101.20^{ab}	108.20^{a}	109.60^{a}	2.07	0.01
Commercial carcass	106.40^{b}	151.00^{ab}	177.20^{a}	195.40^{a}	11.28	0.00
Classic carcass	178.80^{c}	228.20^{b}	257.00^{ab}	275.60^{a}	13.16	0.00
Yield (%)						
Commercial carcass	35.10^{c}	42.72^{b}	44.95^{ab}	47.68^{a}	1.22	0.00
Classic carcass	59.03^{b}	64.68^{a}	65.31^{a}	67.38^{a}	1.01	0.00
Proportions of organs (%)						
Head / LWs	15.92^{a}	15.07^{ab}	13.81^{b}	13.55^{c}	0.34	0.00
Liver / LWs	3.37^{a}	2.90^{a}	2.98^{a}	2.70^{a}	0.10	0.10
Digestive tract / LWs	31.12^{a}	28.69^{b}	27.56^{b}	28.88^{b}	0.46	0.04

a, b, c: means with the same letters on the same line are not significantly different at the 5% threshold; SEM: Standard Error on mean; P: Probability. ; LWs: Live weight at slaughter

Table 4: Weight and lengths of some digestion organs according to the treatments

Parameters	**Treatments**				**SEM**	**P**
	PP	PP-AG	PP-CC	PP-DI		
Weight (g)						
Liver	10.20^{a}	10.20^{a}	11.00^{a}	11.60^{a}	0.27	0.19
Large intestine	49.40^{a}	57.80^{a}	56.40^{a}	58.40^{a}	1.41	0.08
Small intestine	13.20^{b}	14.20^{b}	14.20^{b}	24.60^{a}	1.36	0.00
Caecum	38.40^{a}	42.80^{a}	38.80^{a}	44.00^{a}	1.08	0.16
Length (cm)						
Large intestine	99.50^{a}	100.36^{a}	102.70^{a}	107.30^{a}	1.35	0.16
Small intestine	130.00^{a}	141.00^{a}	142.00^{a}	143.00^{a}	2.42	0.18
Caecum	11.60^{b}	13.60^{a}	13.30^{ab}	15.00^{a}	0.40	0.01
Density (g / cm)						
Small intestine	0.10^{b}	0.10^{b}	0.10^{b}	0.18^{a}	0.01	0.00

a, b: means with the same letters on the same line are not significantly different at the 5% threshold when a is the highest value; SEM: Standard Error on mean; P: Probability.

Indeed, the significantly lower values (P <0.05) for the weight, size and density of the various organs of the digestive tract were obtained in animals submitted to the control ration and the highest in those submitted to the PP-DI ration. For the length of the cecum, the PP-CC ration made it possible to obtain values comparable (P> 0.05) to those of the PP-AG and PP-DI rations on the one hand and to those of the PP ration of somewhere else. On the other hand, with regard to the weight and density of the small intestine, the PP-DI treatment made it possible to obtain the significantly higher values (P <0.05). No significant difference (P> 0.05) was however observed between the PP, PP-AG and PP-CC treatments.

Discussion

Growth performance of guinea pigs according to the protein sources of their ration

Weight growth of pre-weaned piglets

At birth, the piglets subjected to the rations containing the legumes were heavier than those of the control batch. This can be attributed to the quality of the proteins received by their mothers. Since Guinea pigs are monogastrics herbivores it would have better valued proteins of plant origin. Indeed, the guinea pig is a monogastric herbivore with a high capacity of consumption of fodder (Dikko et *al*., 2009; Miégoué et *al*., 2019a). According to Niraj and Vardhan (2012), the consumption of food entirely of vegetable origin in guinea pigs slows digestion, allows good absorption of food and a more favorable balance of nutrients according to calories linked to good management of cell growth. A good quality protein of vegetable origin of 16% is enough to cover the needs of guinea pigs for maintenance (Miégoué et *al*., 2018b). Proteins also contribute to the increase in the number and size of cells, thereby causing muscle building (Egena et *al*., 2010). The weights obtained in this study were comparable to those obtained in guinea pigs by Niba et *al*. (2009). This shows that the rations used in this trial proved to be interesting for pregnant females. The highest birth weight was obtained from animals in the ration group containing *D. intortum*.

At weaning, the weights of the guinea pigs in all the batches had doubled and even more for the animals of certain batches. This would be associated with the rapid pre-weaning growth characteristic of guinea pigs. Indeed, the live weight of the guinea pig is more than doubled during the normal weaning at 3 weeks and will double again during the following 6 weeks (Cicogna, 2000). Similar observations have been made by Pamo et *al*., (2005). These results show that our rations remain within the margin of rations usable in guinea pigs.

Weight growth of young post-weaned guinea pigs during the fattening test

At 8 weeks, the average weight of animals submitted to the control ration was comparable to that of animals submitted to other rations. This testifies to the fact that the rations used in this test had the same protein levels and, the animals thus valued the different rations in the same way. In the present study, whether at birth, weaning or at 8 weeks of age, it was found that rations containing legumes had resulted in better weights. This observation could be attributed to the fact that guinea pigs are herbivorous animals and, they would better value proteins of vegetable origin. Indeed, due to the strictly herbivorous diet, the protein requirement of guinea pigs is moderate compared to that of a carnivore: a good quality protein of vegetable origin of 16% is enough to cover the needs of the guinea pig to the interview (Miégoué et *al*., 2018b). In addition, drying and incorporating the various legumes into the compound feed would have reduced the effect of anti-nutritional factors (Miégoué et *al*., 2019b).

Characteristics of the carcass and some organs involved in digestion in guinea pigs

Weight of guinea pigs at slaughter and carcass yields

Live weights of animals at slaughter and weights of different types of carcass were higher in animals fed legume-containing rations compared to controls. This observation is similar to that of Hedhly et *al*. (2010) in rabbits supplemented with oats (*Avena sativa*). This weight gain can be attributed to the protein quality of the legume-containing rations. Indeed, according to Baeza et *al*. (1999) carcass characteristics can be improved by increasing the rate and quality of protein in the food ration.

In this study, the highest live weight at slaughter obtained from animals subjected to the ration containing *D. intortum* (408.40 g) is higher than that of Niba et *al*. (2004) (364 g) in 15-week-old guinea pigs. This is due inter alia to the age factor and the quality of the ration. Obviously, age affects the weight of the carcass. Indeed, weight and age of slaughter variables are difficult to dissociate since different durations of fattening generate different slaughter weights (Liméa, 2009). The observations of Baeza et *al*. (1999) went in the same direction since these authors found that the increase in weight was generally positively correlated with the increase in age at slaughter. Hedhly et *al*. (2010) justify this observation by saying that increasing the age at slaughter results in a marked improvement in yields.

In fact, according to the remark made by Liméa (2009) the increase in weight at slaughter improves true yield of the carcass. This result could also be attributed to the low genetic potential of the guinea pigs used in this study compared to the improved breeds encountered in these South American farms.

Effect of different protein sources on some organs involved in digestion in guinea pigs

The weight of the guinea pigs liver remained comparable, regardless of the protein source in their diet. The lack of significant difference observed is probably linked to the small variation in the proportions between ingredients of the different rations, which accounts for the narrow intervals of variation of the bromatological characteristics between the different rations. Similar results have been observed by Kenfack et *al*. (2006) who worked on iso-nitrogen rations based on *P. purpureum* and *Arachis glabrata*.

The animals in the lot submitted to the ration containing *D. intortum* presented the highest weight of the cecum. This could be due to the fact that they ingested the greatest amount of fiber in this ration and the fibers promote the development of the organs involved in digestion. In fact, the caecum in guinea pigs, as in most pseudo-ruminants, is the organ strongly involved in digestion, especially cellulose. The caecum is in fact the equivalent of the rumen in ruminants (Lormeau, 2010). It is the preferred site for the digestion of fibers not degraded by enzymes, since it shelters the microbial flora capable of digesting cellulose (Picron, 2007). The more fiber the food provides, the more stress is placed on microorganisms and the more the caecum that houses them grows. These observations join those of Niba et *al*. (2004) in guinea pigs supplemented with cottonseed meal.

Conclusion

The evaluation of some forage legumes as an alternative protein source in the diet on the growth performances and carcass characteristics of guinea pigs (*Cavia porcellus L.*) fed with *Pennisetum purpureum* has shown that different treatments have significantly improved the weights of the piglets from birth to weaning but no effect was observed on weaner's weights at week 8. These treatments have improved carcass yields and significantly increased the weight of the liver. Based on the performances obtained with the different rations of this study, *Arachis glabrata*, *Calliandra calothyrsus* and *Desmodium intortum* can be used with good results as protein sources in *Cavia porcellus* feed.

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