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Growth Performance of Weaned Piglets Fed with Seed Meal from the DRC Cultivar of Cajanus Cajan in the Republic of Congo

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Abstract **Original Research Article**

The present study evaluated the growth parameters of weaned crossbred piglets fed seeds of the DRC cultivar *Cajanus cajan* in the Republic of Congo. The results obtained in this study showed that from the 7th week of age until the end of the experiment, an increase in weight was observed in piglets from seed-based treatments and this significantly for the subjects of the lot 25% compared to other lots (0%, 50% and 75%). Live weights at the 9th week were 15.8525kg; 17.0775kg; 15.7580kg and 15.1160kg respectively for the 0%, 25%, 50% and 75% batches. The incorporation of seed meal from the RDC cultivar *Cajanus cajan* into the piglets' diet significantly improved the ADG ($P < 0.05$) of animals from the 4th to the 9th week of age, particularly in piglets from the batch T50% followed by batch T25% and T0% with respective values of 428.57±526.72; 287.14±188.33 and 261.43±45.68. Daily food consumption is lower in the control group than in the experimental groups (25%, 50% and 75%). Consumption indices (CI) did not increase with age. However, these results showed that the inclusion of seed meal from the RDC cultivar of *Cajanus cajan* had no significant effect on the consumption index of piglets of the different dietary treatments compared to the control.
Keywords: Performance, Weaned Piglets, *Cajanus Cajan*, Republic of Congo.

INTRODUCTION

In developing countries, the need for animal proteins is becoming more and more pressing given, among other things, a population with rapid demographic growth.

Faced with this ever-increasing demographic pressure, traditional systems of meat production based on ruminants have shown their limits since the various cycles of droughts of the 1970s and 1980s. Therefore, it is necessary and even urgent to promote livestock breeding. Short-cycle animals like pigs, whose enormous potential has made it possible in certain Asian and even African countries to meet meat needs (Mavoinenzela *et al.*, 2014).

Among these potentialities we can cite among others: short reproduction and production cycle, high feeding efficiency, high litter size and good adaptation to different ecosystems (Umutoni, 2012). Despite the enormous potential offered by pork, the Republic of Congo remains dependent on food imports made up of more than 70% products of animal origin (MAEP, 2018). The livestock subsector is as such an essential link in the strategy of reducing agri-food imports which amount to nearly 800 billion FCFA per year (MAEP, 2018).

In many countries, the protein feed of pigs is essentially based on soya provided in the form of meal. Indeed, soybean meal is the most used in poultry and pork rations but also the most expensive, which results in high meat production costs (Missoko *et al.*, 2023).

Alternative solutions are being considered for partial or total replacement of traditional food inputs with other available and less expensive sources (Missoko *et al.*, 2023). Indeed, unconventional food resources can be used as animal feed and can constitute alternative ingredients at lower cost (Hamad *et al*., 2000; Amaefule and Obioha, 2005).

Thus, several studies have been carried out to evaluate the use of grain legumes in the diet of livestock (Rao *et al*., 2002; Ayssiwede *et al*., 2010; Missoko, 2011; Shenkute *et al*., 2013; Ouattara *et al*., 2014; Among these legumes, Angola weight figures prominently (Mula and Saxena, 2010). Angola seeds (*cajanus cajan*) are relatively energetic, rich in protein (Defang *et al.*, 2014), appreciated by pigs and can be used in pig feed (Niyonkuru, 2002). In the Republic of Congo, it was reported by Diamouangana (2000) that with the increase in the price of certain raw materials used in the manufacture of livestock feed, particular attention should be paid to leaves and seeds of *Cajanus cajan* widely cultivated in the Niari valley and also reported by Angandza. (2021) that the RDC cultivar and the ICP 7035 variety of *Cajanus Cajan* adapt to the pedoclimatic conditions of Loutété and its surroundings and through the leaves and seeds, they can be incorporated into livestock feed for reduce production costs.

It is in this context that this work was undertaken to contribute to the search for alternative ways to improve the diet and productivity of pigs in the Republic of Congo.

MATERIALS AND METHODS

Study Site and Period

The experiment took place on the farm of the National School of Agronomy and Forestry in Brazzaville, Marien NGOUABI University; during the period from September to November 2022. It is an experimental farm which is located within the NSAF compound, in district 1 Makélékélé, Moukoudzigouaka district in the Brazzaville department. The climate of the study area is Bacongolean humid tropical type (Samba, 2020), characterized by two seasons: a rainy season (October to May) and the dry season (June to September).

Plant Material

The plant material consisted of the seeds of the RDC cultivar of Cajanus cajan crushed into flour for incorporation into the food (figure 1).

Figure 1: Seeds of the RDC cultivar of *Cajanus cajan* uncrushed (left) and crushed (right)

Collection and Processing of *Cajanus Cajan* Seeds (DRC Cultivar)

The seeds of the Cajanus cajan cultivar DRC were collected mainly in the Bouenza department, precisely in Bellevue near the SONOCC in the urban community of Loutété, particularly in the fields of the Group for the Study and Conservation of Biodiversity for the Development (GECOBIDE).

Pods carrying the seeds were peeled and transported to ENSAF where they were spread evenly and thinly for 1 to 2 days under a semi-open and well-equipped building. These were then transformed into flour using a 4mm diameter mesh grinder. The seed flour is packaged in a bag of approximately 25 kg to be kept until use. Other ordinary raw materials (yellow corn, soybean meal, wheat bran, limestone, and others) were purchased at local markets. Figure 2 below shows the pods and seeds of the RDC cultivar of Cajanus cajan.

Figure 2: Pods (left) and seeds (right) of the RDC cultivar of *Cajanus cajan*

ANIMAL MATERIAL

Experimental Herd: Arrival and batching of piglets

Before installation, the piglets underwent a physical examination to ensure their physical abilities. They were identified using an identification loop attached to the ear (figure 3). The piglets were then distributed (figure 4) according to a random arrangement into four (4) batches each containing 5 subjects corresponding to the four (4) dietary treatments (CC0%, CC25%, CC50%, CC75%).

Figure 3: Piglet curling

Figure 4: Piglets from batch 1 (CC0)

METHODES

Preparation of the Building, Experimental Setup and Performance Monitoring

The building used for the experiment was emptied, cleaned with soapy water and disinfected with bleach two weeks before the placement of the subjects, i.e. just before the piglets were weaned. On the eve of the placement of the subjects, a second disinfection of the boxes was carried out; a thermo-hygrometer was installed in each box to control the temperature and hygrometry. The performance control materials (scale, identification ring and data collection sheets) were placed in the different boxes. Before the installation of the subjects, a physical examination was carried out to ensure the physical fitness of the animals then an identification was made using identification marks (ring).

The subjects were randomly distributed into 4 groups of 5 piglets each of approximately equal weight and corresponding to the four dietary treatments (GCC0%; GCC25%; GCC50% and GCC75%).

Formulation of Experimental Rations

From the raw materials (Table 1) four experimental growth-type feeds for piglets were formulated. This is a ration containing 0% (GCC0%) of the seed flour of the RDC cultivar of Cajanus cajan and three other rations containing respectively 25% (GCC25%), 50% (GCC50%) and 75% (GCC75). %) of the seed flour of the DRC cultivar of *Cajanus cajan*.

Table 1: Feed formulas for growth type pigs (CC0, CC25, CC50, and CC75)

Raw materials used	Dietary treatments			
	CC0%	CC25%	CC50%	CC75%
Corn	45	45	45	45
Wheat bran	32,5	32,5	32,5	32,5
Soybean meal	20	15	10	5
Cajanus cajan	0	5	10	15
CMAV	1	1	1	1
Limestone	1	1	1	1
Salt	0,5	0,5	0,5	0,5
Total	100	100	100	100

Each ration was distributed to the corresponding batches according to the experimental setup. Food was served in the concrete feeders at a rate of twice per day (morning and evening). Drinking water was distributed freely in the concrete troughs. These were cleaned at a rate of once a day.

DATA COLLECTION

Food Consumption and Ambient Parameter

Daily food consumption was obtained by weighing the quantities of food distributed and refused per day. These data were recorded on a food data collection and monitoring sheet.

The ambient parameters (temperature and hygrometry) were recorded daily using a thermo-hygrometer three times per day (morning, noon and evening).

Live Weight at Typical Age

Weekly and individual weighings of the subjects were carried out throughout the experiment using a TCS brand electronic scale with a range of 1000 kg with an accuracy of ±1 kg. This operation made it possible to determine the live weight of the animals which was subsequently recorded in the animal weighing sheets.

Calculation of Zootechnical Parameters

Individual Food Consumption

It was determined according to the following formula:

$$\text{IFC (g/subject/day)} = \frac{\text{Quantity of Food Distributed (g)} - \text{Quantity of Food Refused (g)}}{\text{Length of period (d)} \times \text{number of subjects}}$$

Average Daily Gain

The weekly live weight measurements of the subjects made it possible to calculate the ADG according to the formula below:

$$\text{ADG (g/day)} = \frac{\text{Weight gain (g) during a period}}{\text{Length of period (d)}}$$

Consumption INDEX

It was determined according to the following formula:

$$\text{CI} = \frac{\text{Quantity of food consumed during a period (g)}}{\text{Weight gain during the same period (g)}}$$

Mortality Rate

The mortality rate, expressed as a percentage, was calculated from the data collected on the mortality sheet according to the following formula:

$$\text{MR} = \frac{\text{Number of subjects who died during a period}}{\text{Number at start of period}} \times 100$$

Data Processing and Analysis

The analysis of the results obtained and the comparison of the means between the different treatments were carried out by the analysis of variance test (ANOVA) using the Statistical Package for the Social Science (SPSS) software and completed by the test of Duncan when the ANOVA test showed a significant difference.

RESULT

Effects on Live Weight

The effect of including Cajanus cajan leaf meal in the ration on the weight evolution of piglets as a function of age is illustrated in Figure 5. From the 1st week to the 6th week of age, the piglets from the four groups presented approximately identical live weights, but with a non-significant advantage in the subjects of the T50% treatment. From the 7th week of age until the end of the experiment, an improvement in weight was observed in piglets from seed-based treatments, significantly for the subjects of the 25% batch compared to the other batches (0%, 50% and 75%) where no significant difference was observed between the weights of the subjects. Live weights at the 9th week were 15.8525kg; 17.0775kg; 15.7580kg and 15.1160kg respectively for the 0%, 25%, 50% and 75% batches. No significant difference (P > 0.05) was observed between the control, 50% and 75% batches at the end of the experiment.

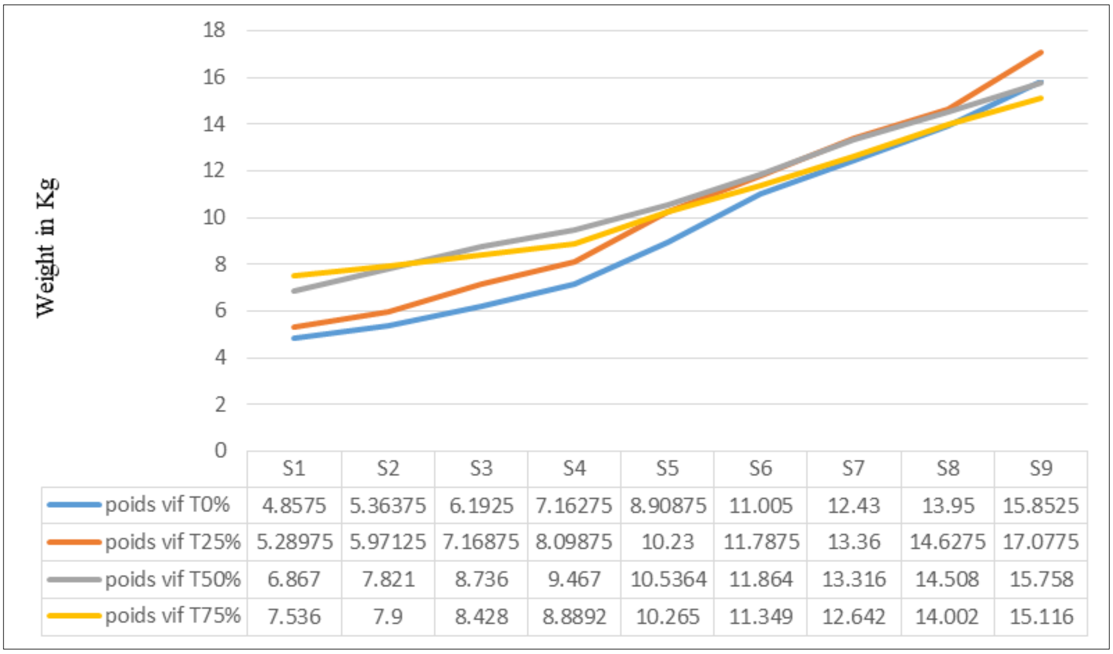

Figure 5: Evolution of live weight of piglets fed rations containing 0%, 25%, 50% and 75% *Cajanus cajan* seed meal depending on age

Effect on Average Daily Gain (ADG) of Piglets

The average daily gains (ADG) obtained by dietary treatment from the beginning to the end of the experiment are reported in Table 2. It appears that the incorporation of seed meal from the DRC cultivar *Cajanus cajan* in the piglets' diet has significantly improved the ADG (P < 0.05) of animals from the 4th to the 9th week of age, particularly in piglets from the T50% batch followed by the T25% and T0% batch with respective values of 428.57± 526.72; 287.14±188.33 and 261.43±45.68. However, no significant difference was observed between the 1st and 3rd week of age between treatments.

Table 2: Effect of incorporating seed meal from the RDC cultivar of *Cajanus cajan* into the ration on the average daily gain (ADG) of piglets

Settings	Age in week	Dietary treatments			
		$T_{0\ \%}$	$T_{25\%}$	$T_{50\ \%}$	$T_{75\ \%}$
Average Daily Gain as a function of time (g/d)	S0-S1	85,43±17,27^{a}	75,68± 39,79^{a}	81,00± 43,00^{a}	76,57±49,74^{a}
	S1-S2	89,29±28,39^{a}	82,36±42,35^{a}	136,29± 41,68^{a}	52,00±64,59^{a}
	S2-S3	95,71±34,02^{a}	174,29± 50,36^{abc}	130,71±92,83^{a}	75,43±54,85^{a}
	S3-S4	223,60±156,33^{bcd}	136,61±38,25^{ab}	104,43± 66,68^{a}	65,89±54,05^{a}
	S4-S5	152,28± 24,77^{ab}	253,75±76,65^{c}	152,77± 32,04^{a}	196,54±35,81^{b}
	S5-S6	306,43± 60,24^{d}	251,25± 59,75^{c}	189,66± 80,63^{ab}	154,86±38,61^{b}
	S6-S7	233,04±54,95^{bcd}	224,64±32,55^{bc}	207,43±102,41^{ab}	184,71±44,35^{b}
	S7-S8	213,93±24,65^{bc}	226,79± 53,67^{bc}	170,29± 42,56^{ab}	194,29±45,01^{b}
	S8-S9	261,43±45,68^{cd}	287,14± 188,33^{c}	428,57± 526,72^{b}	159,14±60,87^{b}

a, b, c: Means followed by different letters within the same line are significantly different at the threshold of 5 %

Effects on Feed Consumption (FC) of Piglets

The effect of the experimental rations on the evolution of food consumption as a function of time is presented in Table 3. Daily food consumption is lower in the control group than in the experimental groups (25%; 50% and 75%). In these three batches, food consumption increased regularly from the beginning to the end of the experiment. Generally speaking, it appears that the incorporation of seed meal from the DRC cultivar of *Cajanus cajan* in the piglets' diet improved the animals' food consumption and this in a non-significant manner (P > 0.05) from the beginning to the end of the experiment.

Table 3: Effect of incorporating seed meal from the RDC cultivar of *Cajanus cajan* into the ration on feed consumption (FC) of piglets

Settings	Age in week	Dietary treatments			
		$T_{0\ \%}$	$T_{25\%}$	$T_{50\ \%}$	$T_{75\ \%}$
Individual food consumption (kg/week)	S0-S1	1,00±0,00	2,26±0,00	2,22±0,00	1,80±0,00
	S1-S2	2,00±0,00	2,80±0,00	2,87±0,00	2,40±0,00
	S2-S3	3,00±0,00	3,80±0,00	3,73±0,00	3,16±0,00
	S3-S4	4,00±0,00	4,75±0,00	3,99±0,00	3,65±0,00
	S4-S5	4,00±0,00	5,07±0,00	4,78±0,00	4,97±0,00
	S5-S6	5,00±0,00	6,16±0,00	8,60±0,00	8,61±0,00
	S6-S7	6,00±0,00	8,45±0,00	8,72±0,00	8,58±0,00
	S7-S8	7,00±0,00	8,51±0,00	8,73±0,00	8,57±0,00
	S8-S9	8,00±0,00	8,35±0,00	8,75±0,00	8,64±0,00

Effects on the Consumption Index (CI) of Piglets

The effects of incorporating seed meal from the RDC cultivar of *Cajanus cajan* into the piglets' diet on the consumption index (CI) during the experiment are summarized in Table 4. Overall, the The consumption index (CI) did not increase with age. However, these results showed that the inclusion of seed meal from the RDC cultivar of *Cajanus cajan* had no significant adverse effect on the consumption index of piglets from the different dietary treatments compared to the control. Furthermore, from the 3rd to the 7th week of age, the consumption index was significantly improved with the inclusion of seed flour from the RDC cultivar of *Cajanus cajan* (T25%) compared to the control. Finally, the best consumption index is obtained with the T25% batch followed by the control batch at the end of the experiment.

Table 4: Effect of incorporating seed meal from the RDC cultivar of *Cajanus cajan* into the ration on the consumption index (CI) of piglets

Settings	Age in week	Dietary treatments			
		$T_{0\ \%}$	$T_{25\%}$	$T_{50\ \%}$	$T_{75\ \%}$
Consumption Index average	S0-S1	3,03±0,59^{ab}	11,13± 13,65^{ab}	12,44±20,63^{a}	5,69±5,38^{ab}
	S1-S2	6,11±2,61^{d}	6,27± 4,11^{ab}	3,24±0,97^{a}	3,72±9,46^{a}
	S2-S3	4,83±0,53^{cd}	3,48±1,05^{ab}	21,83±39,97^{a}	9,56±6,87^{ab}
	S3-S4	4,33±0,55^{bc}	5,72±2,18^{ab}	8,90±7,84^{a}	12,84±8,38^{b}
	S4-S5	3,09±0,90^{ab}	2,41±0,29^{a}	4,60±0,81^{a}	3,72±0,77^{a}
	S5-S6	2,77±0,51^{a}	4,05±0,58^{ab}	7,63 3,76^{a}	8,44±2,56^{ab}
	S6-S7	4,86±0,35^{cd}	5,49±0,86^{ab}	10,55± 12,18^{a}	6,91±1,48^{ab}
	S7-S8	5,09±0,54^{cd}	12,84±12,34^{b}	7,70±1,96^{a}	6,52±1,16^{ab}
	S8-S9	4,44±0,84^{bc}	3,79± 1,11^{ab}	8,17±3,72^{a}	8,58±6 2,85^{ab}

a, b, c: Means followed by different letters within the same line are significantly different at the threshold of 5 %

DISCUSSION

The incorporation of seed flour from the DRC cultivar of Cajanus cajan reduced the live weight of the subjects for the T50% (15.7580kg) and T75% (15.1160kg) treatment compared to the T25% (17.0775kg) treatment. And control T0% (15.8525kg) in a non-significant manner. This drop in weight could be explained by the higher level of seed incorporation, which would probably lead to a greater ingestion of anti-nutritional factors including tannins which unbalance the absorption of nutrients (Hamad., 2000). Similar observations have been made by many authors using legume seeds as a protein source. Indeed, Traore *et al*., (2018) which, by incorporating the seeds of Cajanus cajan at a rate of 10; 13 and 16% in the local chicken ration in Ivory Coast had obtained a reduction in live weight following an increasing level of incorporation. Likewise, Okandza *et al*., (2017) by incorporating between 0 and 9% faba bean by replacing soybean meal in the broiler ration noted a reduction in weight in the latter. Identical observations were reported by Atakoun (2012) in Senegal during his work on Cobb 500 strain broiler chickens, fed with Bissap seeds (Hibiscus sabdariffa) incorporated between 0 and 15% in the ration.

The average daily gains (ADG) reported in our study were much better for the T 50% treatment followed by the T 25% and T 0% batch. Our results are lower than those reported by Ognika *et al*., (2021) in Congo on the Duroc breed (650g/d). This difference in weight would likely be due to the breed used in the two studies. However, our results are superior to those obtained by Agbohon (1995) in Ivory Coast on the local breed by substituting peanut meal with cotton meal with GMQ (230 and 263g/D) obtained respectively at rates of 25 and 50%. This superiority could be due to race. Indeed, we used cross breeds while the study carried out by Agbohon used local breeds.

The incorporation of seed flour from the DRC cultivar of *Cajanus cajan* into the feed of piglets to improve food consumption, particularly in subjects receiving T25% rations; T50% and T75% compared to T0% control subjects. This improvement in feed consumption could be explained by the lack of homogeneity of the batches. Indeed, the subjects of the experimental rations (T25%; T50% and T75%) were larger compared to the control subjects (T0%) where food consumption was less satisfactory. Our results differ from those of Massengo (2021) who, by working with broiler chickens, obtained a reduction in consumption in subjects receiving T7% rations; T14% and T21% compared to control subjects T0% by gradually substituting the seed meal of the RDC cultivar of *Cajanus Cajan* on growth performance in broiler chickens of Coob 500 strain. Ani and Okeke (2003) showed that the The incorporation of more than 27% of *Cajanus cajan* had a depressing effect on food consumption in broilers. Similar reductions in subjects fed *Cajanus cajan* seed meal were observed by Traore *et al*., (2018). The same observation was made by Atakoun (2012) in broiler chickens by incorporating bissap seed flour into rations at levels ranging from 0 to 15%.

The inclusion of seed meal from the RDC cultivar of *Cajanus cajan* did not significantly influence the consumption index of piglets from the different dietary treatments compared to the control. Furthermore, from the 3rd to the 7th week of age, the consumption index was significantly improved (CI = 3.79) with the inclusion of seed flour from the RDC cultivar of *Cajanus cajan* (T25%) compared to the witness. This result could be explained by the fact that the subjects who received the ration at the 50 and 75% incorporation rate of *Cajanus cajan* did not value their food in the same way as those at the T25% rate and the control subjects. This non-valuation of the ration by the subjects having received rates of 50 to 75% could be explained by the harmful effects of the anti-nutritional factors contained in the seeds of *Cajanus cajan*. Our results (3.79) are higher than those of Agbohon (1995) in Ivory Coast on the local breed by substituting peanut meal with cottonseed meal which had obtained a consumption index of 4.20 at rate of T25%.

CONCLUSION

The cost of purchasing raw materials used in the formulation of rations for pigs directs us towards other alternative sources. This has become a major concern for pig farmers and feed manufacturers for over two decades. This has prompted much research into locally available, protein-rich and cheap food resources to intensify livestock production in general and pig farming in particular. Due to its nutritional qualities, *cajanus cajan* could constitute an alternative to soybean meal in the Republic of Congo.

The substitution of up to 50% of soybean meal with *cajanus cajan* in the feed of growing pigs resulted in an improvement in live weight, feed consumption, and absolute growth. The consumption index was not affected by the incorporation of *cajanus cajan*.

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