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Effect of *Mucuna pruriens* seeds fed to piglets

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Abstract

Pig farming is a high-potential activity with a relatively short production cycle. It provides farmers with a better income. The pigs encountered are of the local type or imported advanced breeds, but the breeding of these local or mixed breeds is still very traditional in Madagascar. The food problem is still present.

FOFIFA in partnership with CIRAD is initiating Agriculture-Livestock Integration. They produce a high biomass in highland conditions.

Mucuna, a legume, is one of the cover crops used in the Support Project for the Dissemination of Agroecological Techniques in Madagascar.

The study of the nutritional value and the valorization of the seeds of *Mucuna* in complementation with the piglet food on various proportions (8%; 13% and 18%) were conducted. The seeds have a nutritional quality of a rather high protein content with an average of about 43.71% DM. These roasted seeds reduce the anti-nutritional factors present. The weight gain of piglets is significantly positive (p<0.005). A concentration of roasted *Mucuna* seeds incorporated at 18% gave the best performance.

Feeding these pigs with these seeds (not in competition with human food) accelerates growth, facilitates market profitability and improves real per capita income. The future of peasant agriculture may well lie in the integration of agriculture and livestock: the use of cover crops fed to animals.

Keywords: *Mucuna*, pig, weight gain, profitability, market, income

Introduction

Pig farming is an activity with high potential and a relatively short production and fattening cycle (IFAD Programme Support Unit, 2008). It provides farmers with a better income. The pigs encountered are of the local type or imported advanced breeds, but the breeding of these local or mixed breeds is still very traditional in Madagascar (Capo-Chichi, 2008) [2]. Sometimes the animals live in semi-liberty around the villages. There is always the problem of feeding, no particular ration (Capo-Chichi, 2008) [2]. The rearing time remains quite long.

Recently, research centres such as FOFIFA in partnership with CIRAD have started to integrate agriculture and livestock. They are producing a high biomass in highland conditions. This production has enabled them to define some interesting systems for biomass production that fulfil a double function of mulch/fodder with good fodder value. The effect on the improvement of the environment through ecological functions, their impact on the development of livestock is considered.

Mucuna, a legume, is one of the cover crops used in the Support Project for the Dissemination of Agroecological Techniques in Madagascar. The market for *Mucuna* seeds is becoming saturated at the farmer level, which leads to a low valuation of its plantation surfaces. The use of *Mucuna* seeds in "overproduction", locally available raw material (Dahouda *et al*., 2009) [5], known to be rich in protein (Farougou *et al*., 2006) [7] in animal feed could solve the feeding problem. The nutritional value is studied and its valorization in piglet feed supplementation was conducted. The weight evolution of piglets on different proportions of 0, 8, 13 and 18% seeds was monitored. Roasting of these seeds is the heat treatment process to reduce the antinutritional factors present such as L-Dopamine (Bell *et al*., 1971) (3,4-dihydroxyphenylalanine is a non-protein amino acid) (Siddhuraju, Becker and Makkar, 2000) [9]. These seeds have a fairly high protein content with an average of about 43.71% DM when raw, it is 36.1% DM when roasted. Piglets fed the feed supplemented with these roasted seeds had a significantly positive weight gain (p<0.005) with the 18% seed supplementation being the most effective.

Materials and Methods

The trials took place in the Zootechnical and Fodder Research Centre of Kianjasoa. It is located in the Bongolava region, 190 km from Antananarivo, at an altitude of 950 m and its surface area is 4200 ha. The rainfall is distributed from November to April reaching an average height of 1500mm. The average temperature of the two seasons is as follows:

- Rainy season: about 31 °C
- Dry season: about 25 °C

The seeds of *Mucuna pruriens IRZ* constitute the study material. At the stage of maturity, the pods are harvested

and dried. After hulling, the seeds are roasted and ground.
9 experimental piglets are divided into 4 batches of 2 piglets each and housed in 4 compartments in a 1 m high brick barn with a tin roof and cement floor. One batch of these 4 batches is taken as a control. In the control lot and lot 4, one of the pigs in each lot is a 10-month-old sow. In fact, the control lot is composed of two 40-day-old piglets of different sexes plus a 10-month old sow (Figure 1).

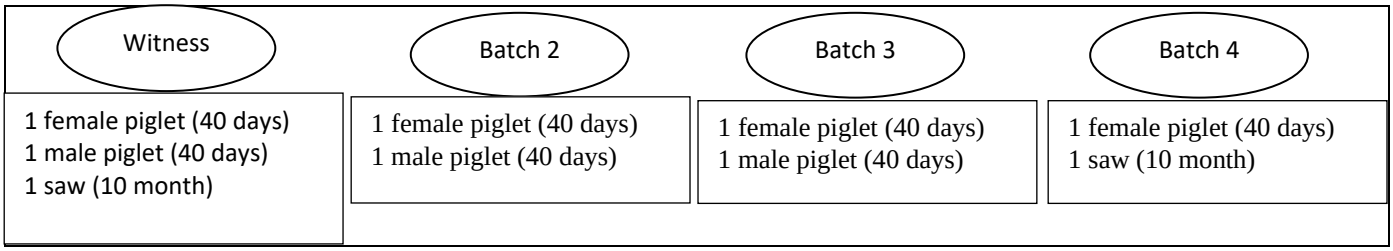

Fig 1: Distribution of animals tested

The animals were dewormed at the beginning of the experiment. Four types of feed were considered, *Mucuna* meal was incorporated into the ration at different rates 0%, 8%, 13% and 18%. These types of feed are analyzed bromatologically. The formulas were elaborated from the theoretical requirements listed in the European food tables. The experimental set-up is presented in Table 1.

Table 1: Feed formulation for piglets

Food type	Fine Rice Bran (kg)	Peanut cake (kg)	Corn (kg)	Fish meal (kg)	Mucuna (kg)	Salt (kg)	Total (kg)
Witnesses	43	15	30	11	0	1	100
8%	43	0	35	13	8	1	100
13%	43	0	31	12	13	1	100
18%	43	0	27	11	18	1	100

These animals were fed according to their weight requirements. Water was available *ad libitum* during the experiment.
The experiment focuses on the evolution of the growth of pigs under the effect of the supplementation of *Mucuna* meal and according to the rate of incorporation in their diet.

Results and Discussion

The results of chemical composition of *Mucuna pruriens IRZ* seeds are recorded in Table 2.

Table 2: Chemical composition of *Mucuna pruriens IRZ* seeds (in % DM)

Analytical determinations (% DM)	Raw *Mucuna* seed	Roasted *Mucuna* seed
Dry Matter	95,1	94,6
Mineral matter	3,6	4,4
Oily Matter	3,2	3,0
Gross Protein	43,7	36,3
Gross Cellulose	5,8	5,9
Calcium	0.28	0,15
Phosphorus	1,00	0,97
Insoluble ash	0,1	0,1

Mucuna pruriens IRZ seeds are rich in Crude Protein but after treatment it decreases due to denaturation of proteins by heat, shown in figure 2.

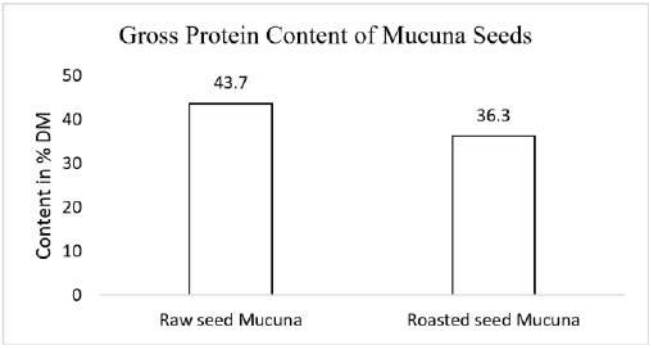

Fig 2: Comparison of protein content of raw and roasted *Mucuna pruriens IRZ* seeds

As the seeds are roasted, organic matter is removed so the mineral content increased from 3.6% DM to 4.4% DM.
After the analyses of the *Mucuna* seeds incorporated in the feed given to the piglets, table 3 shows the nutrient contents of the different types of feed given to the pigs.

Table 3: Chemical composition of feeds (% DM) at different incorporation rates

Type of food	MS	PB	MG	CB	It	P
Witness	88,7	19,9	10,8	5,5	0,83	0,77
Mucuna flour 8%.	89,1	20,3	9,8	5,3	0,84	0,72
Mucuna flour 13%.	89,4	21,4	8,6	5,2	0,90	0,69
Mucuna flour 18	89,7	21,5	8,5	5,2	0,85	0,70

CP: Crude Protein; FM: Fat; BC: Crude Cellulose; Ca: Calcium; P: Phosphorus; DM: Dry Matter

As *Mucuna* is rich in Protein, the PB content of the feed increases proportionally with the rate of *Mucuna* meal. In addition, the MG content decreases inversely with the incorporation rate of the seeds.

The effect of these feeds on the piglets is shown in figure 2 illustrating the evolution of their weight.

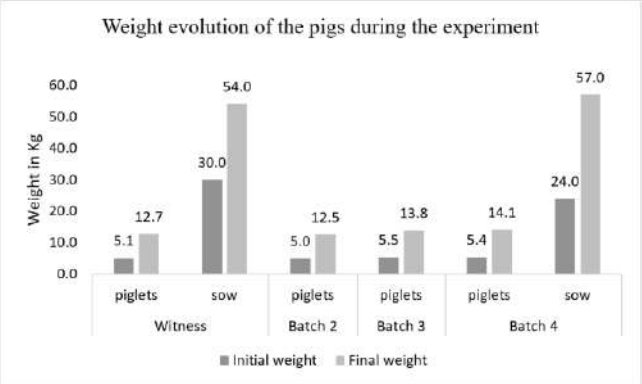

Fig 3: Evolution of pig weights during the experiment

As a general rule, weaning age starts at 28 days of which their weight is approximately between 7.5 to 8kg (EU Directive 2008/120/EEC). The weaning age indeed plays an important role in the piglet's robustness and resistance (Postma *et al*., 2016) [8]. Now, piglets used in the experiment at 40 days of age have just been weaned but their initial weight is only 5.2kg on average. They are over the required age but underweight. During weaning, there are changes associated with it, such as change of diet, relationship (separation from their mother), environment (change of building) and especially feeding (change from milk to solid food) (Postma *et al*., 2016) [8]. Even following the stress generated by these changes, the evolution of the body weight of the animals doubled during 1 month of experiment (figure2). The weight gain of piglets (figure3) ranging from 7.6 to 8.7Kg, is low during the experiment compared to sows that are 10 months old showing high weight gain especially for the one that received *Mucuna* seeds. The weight gain of piglets increased proportionally with the rate of incorporation of *Mucuna* seed in their feed.

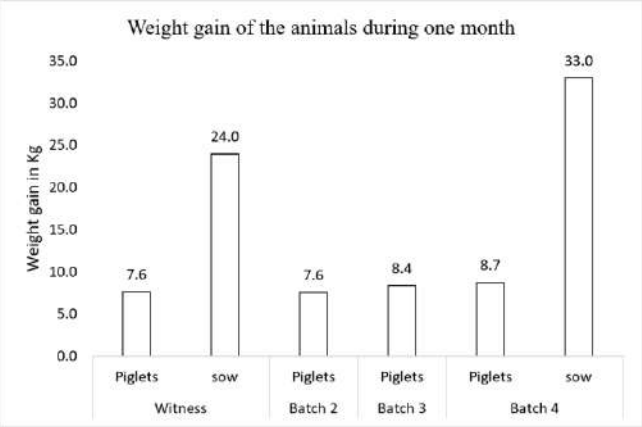

Fig 4: Weight gain of pigs during the experiment

As we have three groups of pigs in this test.
In the first group of 10-month-old sows (Figure 3), one subgroup fed a diet without *Mucuna* seed as a control and the other fed a diet with 18% *Mucuna* seed gained more weight compared to the control.
Our second group of 40 day old female piglets fed an increasing composition of *Mucuna* seed showed an increase in weight gain in parallel with the incorporation rates of these seeds. In the third group of male piglets, the same effects on females were also observed but the weight gain of males was greater than that of females.

Conclusion

Mucuna pruriens IRZ seeds have a good nutritional value. They are rich in protein content. Roasting the seeds reduces anti-nutritional factors, so they can be incorporated into pig feed. It can be recommended to farmers to use roasted *Mucuna* seeds incorporated at 18% in the ration. *Mucuna* is therefore a concrete model of agriculture-livestock integration, because in agriculture it is used to fertilize barren land and in livestock production it is used in animal feed. Thus, the use of roasted *Mucuna* seeds in animal concentrate improves animal feeding. The animals in our experiments are piglets after weaning with a live weight of about 5 kg. However, the good progress of the experiment requires an animal of more than 10kg resistant to the risk of food poisoning so they will support the seeds much more and the weight gain will be faster. In spite of this, during the periods of experimentation, no animal presented abnormal behavior, we did not have any diarrhea nor any death of animals.
Mucuna seeds can be well used in pig feed despite the presence of anti-nutritional factors that can be reduced by heat treatments.
Pigs can very well be produced by small farmers, especially for young people. Feeding the pigs with these seeds (not in competition with food) accelerates growth and may well facilitate a return to the market and improve real per capita income. The future of peasant agriculture may well lie in the integration of livestock: using cover crops to feed animals.

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