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STUDIES ON *MUCUNA* AS POULTRY AND PIG FEED IN THE REPUBLIC OF GUINEA

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SUMMARY

Sasakawa Global 2000/Guinea in collaboration with the National Departments of Extension and Research has been promoting *Mucuna pruriens* as a cover crop for improving and maintaining soil fertility since 1996. Efforts also continue to promote *Mucuna* as human food and animal feed so that farmers will be encouraged to continue growing it. The possible use of *Mucuna* as animal feed is of high interest to Guinean poultry and pig producers because it can partially or totally substitute fish meal, a nutritious, very expensive and hard to find feed ingredient. Local supplies of fish meal are inadequate and have to be imported at high cost.

Camara *et al*. (2002) reported that a 33% substitution of fish meal by processed crushed *Mucuna* grains in poultry ration resulted in more, heavier (64 g vs 61 g) and less breakable eggs (1.8% vs 3.2%). In addition, it was reported that *Mucuna*-fed chickens picked at each other less, had more colorful plumage, and were healthier, heavier and more active despite a slightly reduced feed consumption.

The studies described here were conducted at three Schools of Agriculture and Livestock on poultry and pigs by substituting fish meal with processed *Mucuna* meal at different levels up to 100%. Some negative effects were noted: slightly higher chick mortality, slowed growth, and reduced feed intake. However, the positive results of substituting fish meal with *Mucuna* meal up to 100% both in poultry and pigs rations far outweigh these negative effects.

Key words: *Mucuna pruriens*, L- Dopa, animal feed, amino acids, fish meal, minerals

INTRODUCTION

The ongoing efforts to promote *Mucuna* as a cover crop by SG2000 and the Departments of Extension and Research of the Ministry of Agriculture in Guinea have been described by Diallo and Berhe (this volume). While *Mucuna*'s positive impact on soil fertility and weed control are clear, farmers need more immediate benefits to encourage the planting and cultivation of *Mucuna*. The use of *Mucuna* as animal feed is of high interest to Guinean poultry and pig producers because of its potential use as a protein source to partially or totally substitute fish meal, a very expensive and hard to find feed ingredient. Local supplies of fish meal are insufficient and additional supplies must be imported at high cost.

The purpose of this study was to investigate ways to substitute fish meal with *Mucuna* in the diets of pigs and broilers.

MATERIALS AND METHODS

Processed seeds of *Mucuna pruriens* var. utilis were tested as poultry and pig feed during 2000-2002 in the Republic of Guinea, West Africa. Seeds for use in poultry or pig rations were soaked in a 4% solution of calcium hydroxide, $Ca(OH)_2$ for 48 h with one change of solution after 24 h as described by Diallo *et al*. (2002). Nine liters of solution per kilogram of *Mucuna* seed were used. After the soaking, the seeds were rinsed several times in clean water, sun dried, milled to desired size, and mixed with the rest of the feed ingredients.

For layers, fish meal substitution level was 33% while for broilers and pigs, four substitution levels were used (0, 50, 75 and 100% and 0, 33, 67 and 100% for broilers and pigs, respectively). High quality protein maize, variety Obatanpa, was used for energy source.

The study on broilers was conducted at three agricultural schools (Macenta, Bordo, and Tolo) in non-replicated trials. Each school started with 150 chicks per treatment, i.e., 600 chicks were used in all. In the case of pigs, the trial was conducted in two schools (Macenta and Tolo) and 5 piglets per treatment were included. Piglets came from the same litter and were of similar age. They were randomly distributed to four groups. Weights were recorded at

weekly intervals for nine weeks for poultry and at monthly intervals for six months for pigs. Other data collected included daily weight gain, mortality rate, feed consumption and cost of ration per animal. Nutritional analyses were conducted at the Poultry Science Department of the University of Arkansas, USA.

RESULTS AND DISCUSSION

The poultry and pig feeding trials using *Mucuna* as a substitute for fish meal showed that substitution up to 100% can be done but that the best substitution levels, based on economic analyses, were at 50% for broilers and 67% for pigs. Broilers weighed 1.0, 1.5, and 1.6 kg at 100%, 75%, and 50% substitution levels, respectively, as compared to 1.8 kg with the control diet (Table 1). Results of the three different schools were remarkably uniform.

For the pig studies, there was a great disparity in weight gain in treatment groups between the two schools (Macenta and Tolo). Average pig weight from both schools with 100% *Mucuna* was 41.9 kg (Table 2). However, in Macenta, pigs receiving this diet had an extremely poor performance (average weight was 21.8 kg), compared to Tolo (average weight was 62.0 kg). The average weight with 67% substitution levels was intermediate (59.2 kg), and similar between both schools. Final weight of pigs with 33% substitution rate was also disparate (79.5 kg in Macenta; 68.6 kg in Tolo for an average weight gain of 74.1 kg).

Table 1. Final weight of broilers with feeds where *Mucuna* substituted fish meal at different levels in three agricultural schools in Guinea.

Substitution (%)	Macenta	Bordo	Tolo	Average
	- kg a^{-1} -			
100	1.03	1.12	1.10	1.08
75	1.50	1.50	1.30	1.43
50	1.58	1.60	1.50	1.56
0	1.80	2.04	1.60	1.81

Table 2. Final weight of pigs with feeds where *Mucuna* substituted fish meal at different levels in three agricultural schools in Guinea.

Substitution (%)	Macenta	Tolo	Average
	- - - - - - - - kg a^{-1} - - - - - - - -		
100	21.8	62.0	41.9
67	57.2	61.2	59.2
33	79.5	68.6	74.1
0	72.6	71.0	71.8

Various problems, i.e., anorexia, reduced feed intake, reduced growth and reduced final weight, were observed both in poultry and pigs especially at 50% and at higher substitution levels. In addition, higher mortality levels, 21% vs. 13% (in Bordo) and 11% vs. 3% (in Tolo), were reported for poultry at 100% substitution vs. control.

The reasons for such results became clear when the results of the nutritional analysis of the rations were obtained. The results showed that fish meal contains almost twice as much protein and essential amino acids than *Mucuna* meal (Table 3). In the absence of such initial information, no adjustments were made to increase the level of protein and amino acids by the addition of other ingredients. Therefore, *Mucuna* rations used in the trial typically had lower protein content, were deficient in essential amino acids (i.e., lysine, tryptophan, methionine, and cystine) and contained too much energy (Tables 4 and 5; Figures 1 and 2). As a consequence, the *Mucuna* substitutions created unbalanced diets with high energy:protein ratios. In fact, it was surprising that such good results were obtained in spite of this imbalance. This finding may indicate that *Mucuna* protein is of good quality. In addition, high quality protein maize was used in all the rations, which may have corrected for some of the deficiencies.

Mineral analysis of *Mucuna* seeds and pods indicated that they have a higher content of P and K and lower content of Ca, S and Fe when compared to sea shells, an ingredient commonly used as a mineral source in animal feeds in Guinea (Table 6).

Table 3. Content of protein and some essential amino acids in unsoaked *Mucuna*, *Mucuna* soaked in $Ca(OH)_2$, and in fish meal.

Sample	Protein	Lysine	Tryptophan	Methionine	Cystine
			%		
Unsoaked *Mucuna*	28.6	1.76	0.18	0.42	0.48
Mucuna soaked in $Ca(OH)_2$	26.6	1.61	0.18	0.44	0.34
Fish meal	56.0	3.88	0.41	2.12	0.56

* Average of samples from three sites

Table 4. Nutritional content of broiler feed rations at different substitution levels of fish meal by *Mucuna* in three agricultural schools in Guinea.

Substitution (%)	Site	Energy (kcal ME* kg^{-1})	Calorie: protein ratio	Protein	Lysine	Tryptophan	Cystine+ Methionine
				%			
0	Macenta	3983	158	25.2	1.21	0.20	1.25
0	Tolo	3853	228	16.9	0.72	0.10	0.84
0	Bordo	3944	161	24.5	1.45	0.23	0.12
50	Macenta	3970	178	22.3	1.07	0.18	1.16
50	Bordo	3824	199	19.2	1.21	0.18	1.00
50	Tolo	3984	248	16.0	0.67	0.10	0.79
75	Macenta	3959	215	18.4	0.86	0.15	0.94
75	Tolo	3899	257	15.2	0.58	0.09	0.75
75	Bordo	3082	195	15.5	0.92	0.18	1.00
100	Macenta	3936	228	17.3	0.77	0.13	0.81
100	Tolo	3943	292	13.5	0.50	0.06	0.73
100	Bordo	3972	230	17.3	0.94	0.16	0.79
Standard**		3200	153	1.20	21.8	0.23	0.90

* ME = Metabolizable Energy
**Source: North *et al*., 1990.

Table 5. Nutritional content of pig feed rations at different substitution levels of fish meal by *Mucuna* in two agricultural schools in Guinea.

Substitution (%)	Site	Energy (kcal ME kg^{-1})	Calorie: protein ratio	Protein	Lysine	Tryptophan	Cystine+ Methionine
				%			
0	Macenta	3861	221	17.5	1.10	0.12	0.94
0	Tolo	3955	198	20.0	0.87	0.13	0.81
33	Macenta	3849	271	14.2	0.79	0.08	0.75
33	Tolo	4081	236	17.3	0.74	0.11	0.72
67	Macenta	3857	292	13.2	0.71	0.07	0.56
67	Tolo	3980	238	16.7	0.74	0.12	0.71
100	Macenta	3850	360	10.7	0.53	0.06	0.44
100	Tolo	3944	263	15.0	0.65	0.11	0.56
	Standard*	3300	153	19.0	0.70	0.14	0.55

* Source: Luc *et al*., 1996.

Table 6. Mineral content (ppm) of different *Mucuna* fractions and sea shells.

Component	P	K	Ca	Mg	S	Na	Fe
Seed	3345	12164	936	1584	1780	24.5	2.3
Seed + Pod	2091	12817	2080	1727	1109	35.5	134.0
Pod (sample 1)	131	13043	3271	1753	209	35.9	53.3
Pod (sample 2)	308	5742	4610	1477	505	39.6	86.0
Sea shells (sample 1)	218	637	311759	2214	5487	3803	16537
Sea shells (sample 2)	179	502	369079	1205	6064	3047	6346

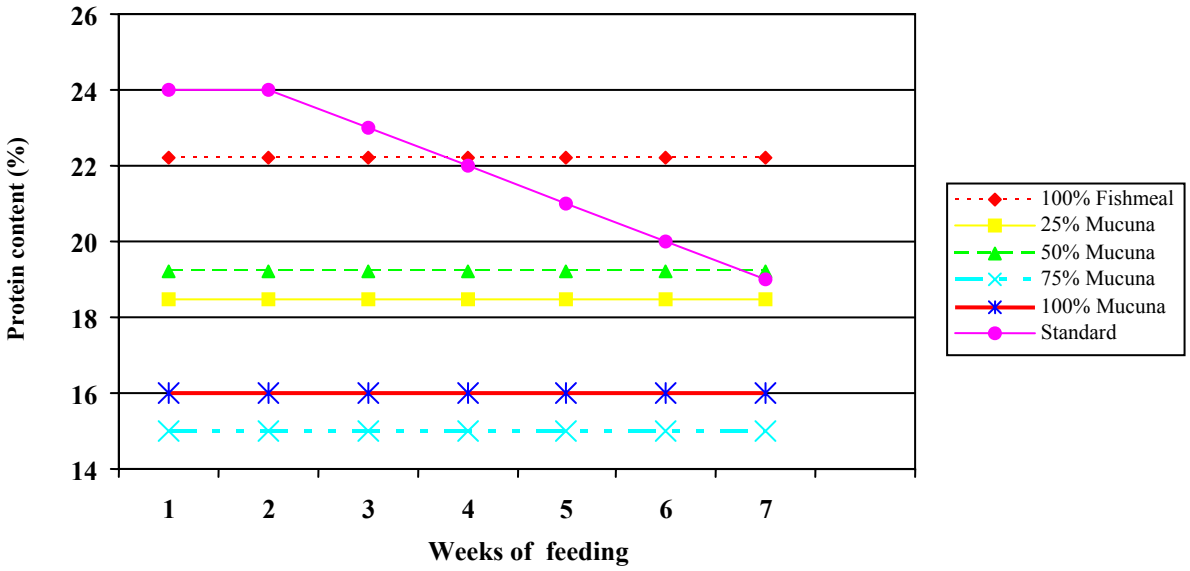

Figure 1. Protein content of Mucuna-based broiler rations as compared to a standard.

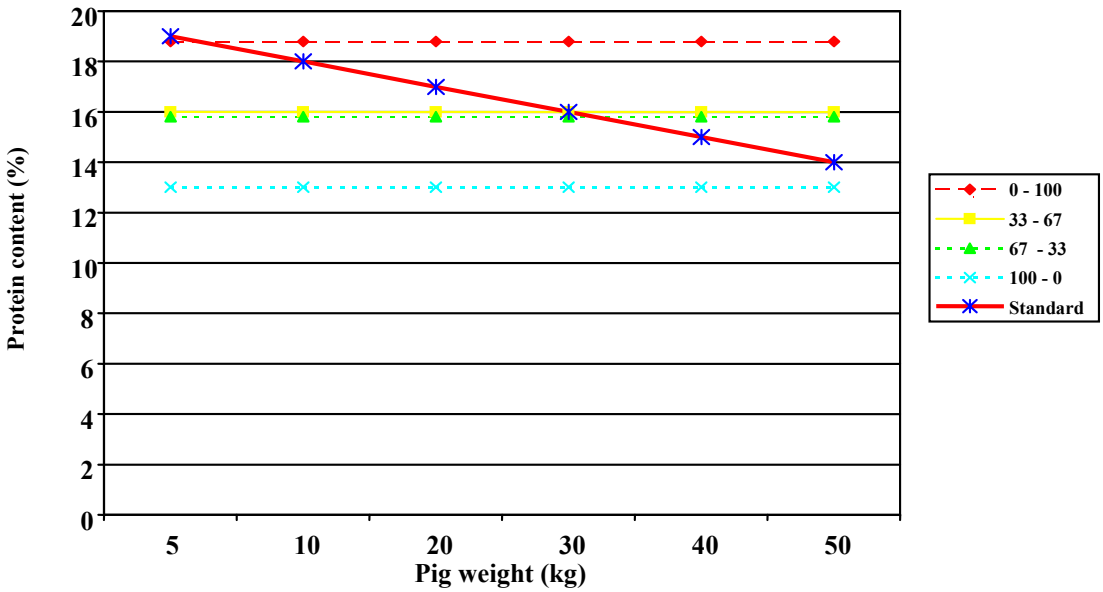

Figure 2. Protein content of *Mucuna*-based pig rations as compared to the standard.

CONCLUSIONS

Results of this study show that *Mucuna* can substitute fish meal as a protein source up to 100%. However, best substitution rates were at 50% for broilers and at 67% for pigs. *Mucuna*-based rations were lower in protein and amino acids and higher in energy in comparison to standard rations used in the USA. These inequalities may have resulted in some negative impacts both in poultry and pigs (i.e., slower growth rate, reduced feed intake and lower final weight) at higher than 50% substitution rates.

The fact that *Mucuna* can substitute for fish meal is good news to Guinean poultry and pig producers. Studies will now proceed to substituting fish meal by combinations of *Mucuna* meal (at levels of 50-75%) and soybean, groundnut, cotton seed or palmnut meal. Ingredients will be analyzed before the start of the experiments so that a balanced ration can be designed. Future trials will also be replicated in each site and a uniform set of data will be collected at all sites. Involvement of the staff from the Livestock Department of the Ministry of Agriculture and large poultry producers will be sought.

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