Prececal and Cecal *In-vitro* Digestibility of Tropical Double Purpose Legume Grains for Pig Nutrition

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Introduction

Double purpose legumes are a valuable source of protein (20-40% of DM) and carbohydrates (50-60% of DM) for human and animal nutrition in the tropics. Due to its high protein soybean meal is most widely used for manufacturing animal feed. However, varying costs and sometimes limited availability of soybean meal for animal diet formulation limits productivity for small farmers. Thus, the potential use of grains of alternative double purpose legumes pig production was assessed, with particular attention to digestibility of protein, sulfuric amino acid content and the presence of antinutritional factors (ANF).

Objective

To study the nutritional composition, *in- vitro* hydrolysis of proteins and *in-vitro* intestinal fermentation of tropical double purpose legume grains as alternative protein source for pigs.

Materials and Methods

Legume grains evaluated: *Canavalia brasiliensis* (CB), *Lablab purpureus* (LP), *Vigna unguiculata* (WVU white, pink PVU, red VUR) using extruded soybean meal (SB) *Glycine max* as control. We evaluated the nutritional composition including trypsin inhibitory activity (TIA). For enzymatic hydrolysis, legume grains were incubated in buffer solution at 39 °C with pepsin for 120 min, followed by 240 min of pancreatin. Aliquots were taken from the incubation medium before (0 min), at the end of pepsin (120 min) and pepsin-pancreatin (360 min) addition. The degree of hydrolysis (DHCP) was calculated on the basis of trichloroacetic acid soluble N, 7.5% as a percentage of total N. Aliquots were also taken at 360 min to determine the degree of starch hydrolysis (DHS). To measure final gas production (PG_f), prececal hydrolysis was performed *in-vitro* (Boudri *et al.,* 2003) and production of short chain acids (SCFA) quantified by High Performance Liquid Chromatography, "HPLC" (Hartemin *et al.,* 1997) after 72 hours of fermentation.

Results and Discussion

Table 1. Nutritional composition of soybean meal and tropical legume grains

Legume	CB	LP	PVU	RVU	WVU	SB
Composition (g/kg DM)						
Dry matter (g/kg)	898	897	895	878	906	939
Crude protein (N x 6.25)	291	235	212	216	208	367
Ether extract	17	55	15	15	18	263
Ash	30	39	38	38	39	48
Starch	316	403	537	482	563	-
NDF	275	234	210	260	143	177
ADF	174	131	52	75	22	68
Dietary fibre	313	290	138	213	129	244
Gross energy (MJ/kg DM)	15.9	17.8	16.0	15.7	16.5	19.9
TIA (TUI/g protein*g DM)	4.1	6.1	4.5	4.8	5.0	2.6

- The crude protein is high in CB and SB as compared to the other double purpose legumes (Table 1).
- Cowpea contains a high concentration of starch.
- The trypsin inhibitory activity (TIA) is lower in the SB and CB and higher for LP and Vignas.

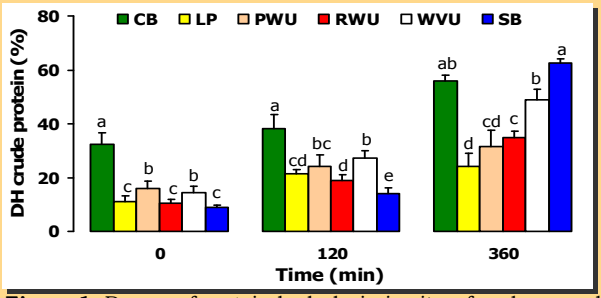

Figure 1. Degree of protein hydrolysis *in-vitro* of soybean and double purpose legume grains at 120 min (pepsin) and 360 min (120 min pepsin + 240 min pancreatin).

- There were differences in soluble nitrogen at 0 and 120 min between the raw legume grains (P <0.001). CB had a higher amount of soluble N (37.2 and 38.9%) which was lowest in soybean (11.3 and 15.8%) (Figure 1).
- At 360 min of hydrolysis, the protein digestibility of SB, CB and WVU had the highest DHCP (P <0.001). However, a correction for the initial soluble N (at time 0), suggests greater DHCP for SB. In CB high DHCP is influenced by the high amounts of soluble N at 0 min. Also, the DHCP was negatively correlated to TIA (R^2 = 0.64, P <0.05).

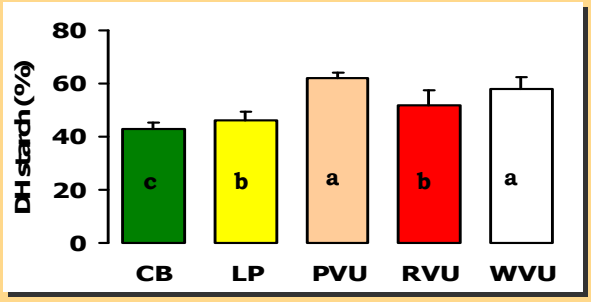

Figure 2. Degree of starch hydrolysis of grain legumes at 360 min (120 min pepsin + 240 min pancreatin) of *in-vitro* hydrolysis.

- The DH_S was higher (P<0.001) for cowpeas as compared to the other tropical legume grains (Figure 2). DH_S was negatively correlated with NDF content (R^2=0.72, P<0.01).

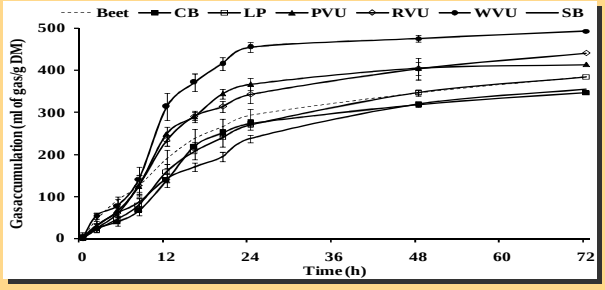

Figure 3. Kinetics of *in-vitro* gas production of legume and SB residues after hydrolysis by pepsin and pancreatin.

- The gas production was higher for WVU and UVR (P <0.001) and lowest in CB and SB (Figure 3). There were no differences (P> 0.05) in the production of acetic, propionic and isobutyric acid. The butyric acid was higher (P <0.001) in Vigna and low in SB.

Conclusion

The superiority in protein and starch digestibility and the distinct volatile fatty acids production suggests that *Vigna unguiculata*, especially as white grain, is an interesting alternative to soybean meal for small farmers in the tropics, which can be produced locally.