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Digestive utilization of tropical foliages of cassava, sweet potatoes, wild cocoyam and erythrina in Creole growing pigs

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ABSTRACT

Total tract digestive utilization of cassava (*Manihot esculenta*) leaves and leaves + stems, sweet potatoes (*Ipomoea batatas*) leaves and leaves + stems, cocoyam (*Xanthosoma sagittifolium*) leaves, and erythrina (*Erythrina glauca*) leaves was studied in three simultaneous Latin square designs with a total of nine castrated Creole growing pigs. Each dried foliage was included at 200 g/kg in a basal maize-soybean meal diet (MSBM) and the difference method was used to calculate the nutritional value of each of the six foliages. These leaves were characterized by a high fibre content and the presence of some anti-nutritional factors (such as tannins, 0.8–3.1%). Each of the foliage diets was measured on three animals (nine for the MSBM diet). Rate of passage variables of diets were also determined using a pulse dose of ytterbium. Mean retention time in the gastrointestinal tract was shorter ($P<0.01$) for diets including tropical foliages (30.4 h vs. 42.1 h for the MSBM diet) and shorter for the two cassava diets than for the other diets (26.8 h vs. 32.2 h on average; $P<0.05$). The total tract apparent digestibility coefficient (CTTAD) of dietary energy was reduced ($P<0.01$) by the inclusion of tropical foliages (−0.098 on average). Similar results were observed for dietary crude protein (CP) (−0.143 on average; $P<0.05$), except for the cocoyam diet that did not differ from the MSBM diet. For cassava and sweet potatoes, the addition of the stems to the leaves did not affect CTTAD of CP and energy. According to the difference method, the CTTAD was −0.328, 0.112, 0.212 and 0.647 for CP and 0.266, 0.310, 0.434 and 0.466 for energy and the corresponding digestible energy contents were 5.21, 6.22, 7.47 and 8.37 MJ/kg DM for erythrina, cassava, sweet potatoes and cocoyam leaves, respectively. The inclusion of the stem to the leaves fractions did not affect digestibility of energy and nutrients ($P>0.05$) for cassava and sweet potatoes. It is concluded that the high fibre content in addition to the presence of tannins are the main limiting factors of these tropical foliages in pig nutrition with a subsequent low energy value.

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1. Introduction

A majority of livestock production in tropical countries comes from small scale mixed farming systems in which there is a close association between local animal breeds and local feed resources. In these systems, pigs have several important

Abbreviations: BW, body weight; CA_L, cassava leaves; CA_{LS}, cassava leaves and stems; CO_L, cocoyam leaves; CTTAD, coefficient of total tract apparent digestibility; CP, crude protein; DM, dry matter; DF, dietary fibre; ER_L, erythrina leaves; L, leaf; LS, Leaf + stems; MSBM, maize-soybean meal; SP_L, sweet potatoes leaves; SP_{LS}, sweet potatoes leaves and stems; WHC, water holding capacity; yb, ytterbium.

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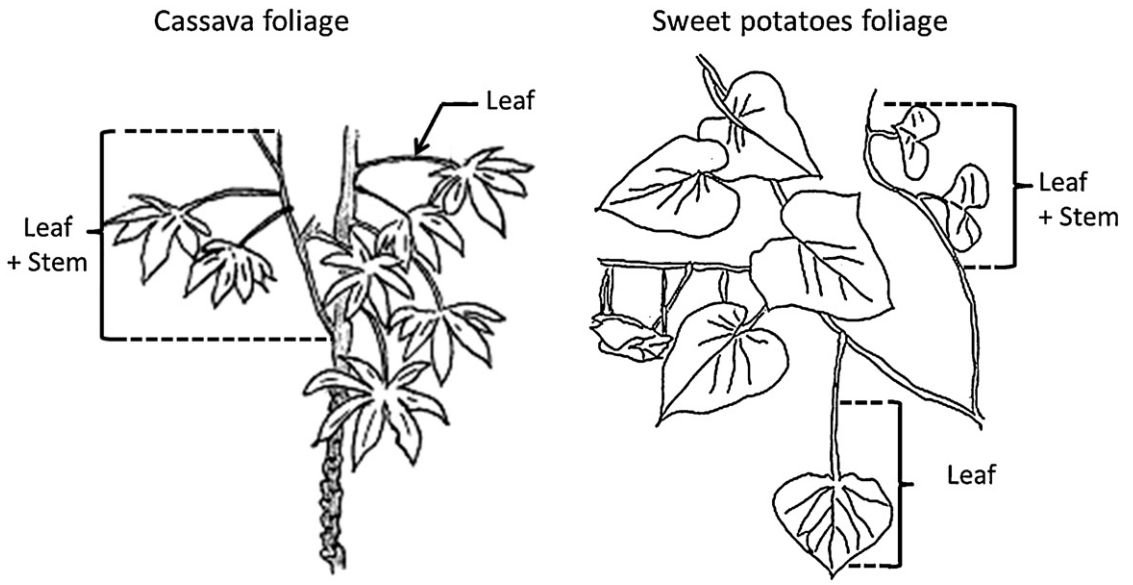

Fig. 1. Drawings of the different folliage parts of cassava, and sweet potatoes foliage used to fed pigs.

functions for converting undesirable and low-valued unconventional feed resources into highly desired foods. For feeding the pigs in tropical countries, cereals grains can be replaced by energy resources such as sugar cane, tubers (cassava, sweet potatoes and cocoyam) or oil products (palm) (Preston and Murgueitio, 1992). However, one of the limitations of all these alternative crops as sources of feed for pigs is the presence of anti-nutritional factors and the imbalance of nutrients and specifically their low protein content. In the tropics, the main constraints of conventional protein rich meals (soybean or fish meals) are their high costs. Alternative sources of proteins including tropical peas (Mekbungwan, 2007; Bhat and Karim, 2009) and leaves of tropical trees, shrubs, cultivated plants or water plants could be used to partly meet the protein requirements of the pigs (Rodríguez et al., 2009; Leterme et al., 2010). These products have generally a high biomass productivity and crude protein (CP) content and require low input for cultivation but they contain a high fibre content which could limit digestive and metabolic utilization in monogastric animal species (Wenk, 2001). Among all the tropical rich protein resources, foliages from cassava (*Manihot esculenta*), sweet potatoes (*Ipomoea batatas*), erythrina (*Erythrina glauca*), and cocoyam (*Xantosoma sagittifolium*), are known to be used in animal nutrition according to their relatively high protein content. Cassava, also called yuca or manioc, is a Euphorbiaceae woody shrub grown in tropical countries. The sweet potato is a dicotyledonous plant that belongs to the Convolvulaceae family. *E. glauca* is a flowering tree belonging to the Fabaceae legume family that has been introduced in many tropical countries. Cocoyam is a common name for the corms and tubers of several plants in the Araceae family; *X. sagittifolium* was chosen in the present study. Despite the fact that numerous farmers use these plants for feeding pigs, very limited information is available on their actual nutritional value and how they can be used in pig nutrition.

The objective of the present study was to determine the nutritional value of cassava, sweet potatoes, wild cocoyam and erythrina foliages and to measure the effect of these tropical foliages on the rate of passage of the digesta through the gastrointestinal tract in growing local Caribbean pigs. The amino acid ileal digestibility of these tropical foliages has been reported previously (Regnier et al., 2012). This paper focuses on the composition and energy value in Creole pigs.

2. Materials and methods

2.1. Harvest and treatment of tropical foliages

Cassava and sweet potatoes foliages were harvested at local farms in Guadeloupe, French West Indies (latitude 16°N, longitude. 61°W) about nine and six months after planting, respectively. The fresh cassava and sweet potatoes foliages were then manually prepared in two forms: leaves with petiole (L) or leaves with petiole + stems (LS) (Fig. 1). Wild cocoyam leaves were harvested at the INRA farm in Guadeloupe. Leaves of erythrina trees were obtained from a bananas producer, erythrina trees being used as a windbreaker in the banana plantations in French West Indies. The foliages were sun dried for 24 h before being ground with a hammer mill (Reich hammer mill, Staufen, Germany) through a five mm mesh screen. The sun drying process has been described in detail elsewhere (Regnier et al., 2012). After drying and grinding, the meals obtained from cassava leaves with petiole (CA_L), cassava leaves + stems (CA_{LS}), sweet potato leaves (SP_L) or sweet potato leaves + stems (SP_{LS}), erythrina leaves (ER_L) or cocoyam leaves (CO_L) were stored for a maximum of three months in an air-conditioned room set at 25 °C and 80% of relative humidity, prior to the digestibility trial.