Table 3 *Average consumption index evolution*

	Week 1	Week 2	Week 3	Week 4
R1	2.03	2.28	2.47	3.02
R2	1.91	2.38	2.47	3.02
SPC standard for "hubbard" breed	1.69	1.87	2.04	2.22

Conclusions

The results obtained in this experiment show that cow meat meal could efficiently be substituted by E. eugeniae meal in broiler's diet. However further investigation is needed to optimize earthworm production techniques and the level of earthworm meal required to improve consumption index.

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Nutrient Analysis of *Moringa Oliefera* as a High Protein Supplement for Animals

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Introduction

Sustainable small livestock production in the Caribbean experience many challenges including: nutrition, health and management. Nutritional limitations include poor feed quality and cost of feed and forage resulting in deficiencies in both energy and protein. Small farmers who practice mixed agriculture are more likely to graze their animals and use feed as a supplement. Forage production is challenged by the vagaries of the dry-season, inherent low protein and available energy content. The aim of this paper is to present an evaluation of *moringa* as a sustainable high crude protein supplement for animal.

Materials and Methods

This study was conducted at the Waterloo Research Facilities, University of Trinidad and Tobago, during the period April, 2008 to May 2010. Dry pods of *moringa* were harvested, the seeds sun-dried (72 hrs to achieve 12 to 14% Moisture Content (MC)], and then dehulled and aspirated manually and separated into 3 categories viz: Whole grain – [whole kernel not crushed]; De-hulled – [kernel subjected to full or partial crushing]; Un-hulled – [testa retained and subjected to crushing]. The seeds [1 kg at 10% MC] were de-fatted or the oils extracted by press method (Weiss, 1971) or hot water treatment. The two press extraction methods are : Hydraulic Press [Carver Laboratory Equipment, Model #3925 @ 2500psi], and Screw Press [Electrolux Extruder with heater, Model#N24@ 400W]. The hot water extraction was conducted on both dehulled and unhulled seed (250 g), and the ground treatment done using a hand mill (1.0 mm particle size). The material was boiled in 1 *l* of water for 5 minutes, and then strained. The extractant was chilled at 5°C for 72 hrs and the solid residue oven-dried at 100°C for 72 hrs for nutrient analysis. All extractions were done in 3 replicates. Proximate analyses were conducted according to AOAC for DM, ash, CP, crude fibre (CF) and ether extract, for NDF (Goering and van Soest, 1970), and for ADF (Van Soest *et al.*, 1991). The Amino Acid Profile (Spackman *et al.*, 1959) was conducted using the Technicon Sequential Multi-sample (TSM) amino acid analyzer(DNA0209). Both analyses were conducted at the University of West Virginia, USA. All data were subject to preliminary statistical analysis.

Results

The CP content varied between 32 and 45% for hulled and defatted seed, respectively.The energy content from the expressed oil was 24 to 38%. The oil cake meal [48.9% CP] yield was 6.42 $t.ha^{-1}$. The seed contained 18 essential amino acids and no anti- nutritional factors were present.

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Table 1 *Proximate analysis of moringa seeds (w/w%) under varying treatments*

		Defatted		Partial defatted		
Proximate analysis	Whole grain	Dehulled	Unhulled	Unhulled	dehulled	X [SE]
Crude Protein	37.24	45.28	39.86	33.65	32.36	35.7 [4.98]
Moisture	5.43	7.22	6.95	6.46	9.99	7.31 [1.30]
Crude Fat	38.19	24.64	17.15	21.53	29.57	25.6 [6.90]
Crude Fiber	2.56	3.01	24.20	16.00	17.86	12.6 [8.81]
Ash	3.68	4.33	4.32	5.41	5.26	4.60 [0.75]

Conclusions

The analysis revealed that *moringa* can be a good CP source with all of essential amino acids present in appreciable quantities. Based on CP requirements it could be used for chickens [22% CP], fattening pigs [12–14% CP], and lactating cows [16–18% CP]. *Moringa* seed cake is a good alternative source of protein for both ruminant and non ruminant and could be used to supplement diets based on poor forages. The crop is ecologically adapted to the humid tropics, requires low levels of farm inputs and management and provides a good substitute for imported soya-bean meal.

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Pastures for animal production in the Tropics: importance, management, criteria and methodological progress

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Introduction

Most ruminant livestock production in the tropics is based on pastures. Tropical pastures need to be better managed to meet increasing demands for livestock products while improving environmental and social impacts such as for biodiversity and carbon sequestration. This is challenging, especially given the diversity of agroecological contexts, plant species and animal production constraints. It has long been recognized that knowledge developed in temperate pastures may not be applicable in the tropics. The integrated information needed to understand and manage tropical pastoral ecosystems is generally lacking. Management of pastures for defined production, environmental and social targets requires inventories and assessments of pastures and grazing animals and knowledge of the important herbage-animal relationships. Criteria are needed to (i) evaluate the pastoral system, and (ii) decide suitable rules for management, and which are suitable for continual re-examination and adaptation. This paper will focus on some of the principal concepts which have been developed for management of tropical pastures, on the various criteria considered necessary to improve management, and on the need to better define and especially to measure them in pasture systems.

General rules for the management of tropical pastures

These have been developed for continuously grazed or rotationally grazed pastures, and encompass variation associated with stocking rate, fertilization and regrowth (Edouard, submitted). Each study refers to given species of animal or pasture, in specific conditions, and which are variable in time. Thus, management procedures which are generally similar may have different consequences in specific pasture situations on

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