

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

Proximate analysis	Whole grain	Defatted		Partial defatted		X [SE]
		Dehulled	Unhulled	Unhulled	dehulled	
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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doi:10.1017/S2040470010000555

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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the characteristics of pasture, their feeding value and livestock production. Appropriate fundamental criteria for effective management related to the animal production and to the value of the pastures need to be developed.

Classical criteria of management considered

Animal liveweight change is the principal parameter usually used to evaluate the effectiveness of various strategies. However, because the consequences of changes in nutrient intake on live weight are usually not evident for at least some weeks, there is usually limited opportunity to progressively correct the grazing management. An alternative is to base the management on the ingestive behaviour of the animals, since this strongly influences the intake of metabolisable energy and thus animal production. The most important components of ingestive behaviour appear to be the intake rate and the bite mass since these appear to be most closely correlated with voluntary intake (Goncalves *et al.*, 2009; Boval *et al.*, 2007). However, bite mass is difficult to measure on commercial farms, and also gives only a short-term evaluation. Management may be based on herbage characteristics such as the height, biomass, chemical composition or leaf content. Any specific nutrient deficiencies of the forage such as of nitrogen, phosphorus or sodium, which are not uncommon, will also be expected to determine voluntary intake of pasture. However knowledge is generally lacking of the selection of the components of tropical pastures by grazing animals, and how selection is influenced by pasture growth and defoliation, and other attributes of the pasture. The digestibility of pasture is often used as a basis for management, but it appears to have a lesser effect on voluntary intake, and therefore metabolisable energy intake, of tropical pastures than of temperate pastures (Fanchone *et al.*, 2010). Because of the heterogeneity of tropical pasture swards, the selectivity of grazing animals and the methodological and experimental difficulties we have a poor understanding of the nutrient intake of ruminants grazing tropical pastures. Based on present knowledge it is difficult to develop general rules between the various herbage characteristics and appropriate management in tropical pastures. Although some criteria such as those described above have the potential to guide management, they are often still not appropriate and easily measured. The best criteria would clearly be knowledge of the amounts of the various pasture components selected by the animal and thus nutrient intake in the short and long term.

Recent methodological progress

This has improved capacity within practical constraints to measure intake of various nutrients by grazing ruminants. Several remote sensing technologies have enhanced evaluation and utilization of pastures. Progress in methods to evaluate the diet selected and nutrient intake include alkanes, faecal NIRS and improved nutritional models to evaluate the grazing ruminant (CSIRO, 2007). NIRS analysis of faeces is an attractive technology (Dixon and Coates, 2009) since it provides reasonably precise, fast and low cost analyses a number of diet attributes (digestibility, ingestion, botanical composition, methane emission) where appropriate calibrations have been developed. The challenge is to develop the co-operation between the researchers of various geographical sectors, to gather databases for the development of robust and applicable calibrations in contrasting situations, in order to have suitable management criteria and to reinforce effective strategies of the management of the pastures.

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doi:10.1017/S2040470010000567

Management of intensive grazing: when grazing behavior and milk yield are modified by an alternative paddock system

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Introduction

Pasture-based animal production has, in the last decade, assumed outstanding importance worldwide (Mannetje, 2007). This fact is mostly related to economic advantages, animal welfare, and ecological issues (Murphy *et al.*, 1996). The viability of small family farms, through

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