

## Material and methods

**Pods yield;** Pods falling from eight trees of *E. cyclocarpum* available at two commercial livestock farms were manually collected and weighed weekly until pod production stopped to obtain productivity and availability. **In vivo dry matter digestibility;** Five male Pelibuey sheep of 32 kg live weight housed in metabolic crates were fed increasing levels of *E. cyclocarpum* ground pods in the ration in a 5 × 5 Latin Square design. Levels of incorporation of *E. cyclocarpum* pods were 0 (control; concentrate based ration), 20, 30, 40 and 50% of ration dry matter. The rest of the ration was composed of sorghum grain, soybean meal, cane molasses and minerals. **Animal performance;** In a commercial sheep farm forty male Pelibuey sheep of 20.6 kg live weight were allocated randomly to one of two groups of 20 sheep each and fed either a 1) commercial concentrate ration (pelleted; 17% CP), or 2) ration containing 50% dry matter as ground pods of *E. cyclocarpum* mixed with ground corn, soybean meal, cane molasses and minerals. Sheep were fed *ad libitum* for 42 days and weight gain was recorded every 14 days after 18 h fast.

## Results

*Enterolobium cyclocarpum* pods had 16% crude protein, 35% neutral detergent fibre and 1.5% ether extract. Average pod production from *E. cyclocarpum* trees was 86 kg per production cycle. The production of pods from *E. cyclocarpum* was markedly seasonal, mostly involving the months of April-May. **In vitro dry matter digestibility (67%)** of *E. cyclocarpum* pods matched reasonably well with the *in vivo* dry matter digestibility (71%) of rations fed to sheep containing 40–50% of the DM as ground pods of *E. cyclocarpum*. No significant differences ( $P > 0.05$ ) were found for dry matter intake and dry matter digestibility when ground pods of *E. cyclocarpum* were increased in the ration of hair sheep from 0 to 50% of ration dry matter. No significant differences were found for daily DM intake (776 vs 923 g<sup>-1</sup> head<sup>-1</sup> d<sup>-1</sup>), weight gain (251 vs 239 g<sup>-1</sup> head<sup>-1</sup> d<sup>-1</sup>) and feed conversion efficiency (4.3 vs 4.6 intake gain<sup>-1</sup>) for the concentrate (pelleted) and the *E. cyclocarpum* (50% of DM) ration fed to Pelibuey sheep in a commercial farm. Weight gain of hair sheep was comparable to that found by Moscoso *et al.*, (1995) in hair sheep (223 g d<sup>-1</sup>) fed 36% of the ration DM as ground pods of *E. cyclocarpum*. *E. cyclocarpum* pods have good chemical composition (15–16% CP, 30–35% NDF). Rumen degradability (a + b) of DM of *E. cyclocarpum* pods was high (86%). DM intake (1.2–1.4 kg sheep<sup>-1</sup> d<sup>-1</sup>) and DM digestibility (71%) of rations containing *E. cyclocarpum* pods (50% of DM) are relatively high for hair sheep. Weight gain (239 g/day) and feed conversion efficiency (4.6:1) of rations containing high levels (50% of DM) of pods are reasonable good in hair sheep. Secondary metabolites (saponins) in *E. cyclocarpum* may reduce protozoa numbers in the rumen and exert a beneficial effect on efficiency of microbial protein synthesis in the rumen (Koenig *et al.*, 2007).

## Conclusions

The availability of *E. cyclocarpum* pods during the dry season (April-May), and their good nutritional value have potential for sheep feeding under conditions faced by small commercial mutton producers in South Mexico.

## References

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# Valorisation of mango peels and seed kernels in animal feeding: Nutritive value and voluntary feed intake by sheep

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## Introduction

The spreading of industries that process fruits and vegetables produce enormous quantity of waste that is mostly unexploited and only occasionally used for animal feeding. The processing of dried mango is an emerging activity in Burkina Faso. It is undertaken by many individual processors or in socio-professional cooperatives to produce organic dried mangos especially for export. Mangoes are peeled and sliced by hand; the slices are then dried while the peel and seed are thrown away which constitutes various nuisances to the environment as the waste equates to 50 to 65% of mango weight depending on variety of mango. The peelings and seeds could be used as unconventional

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feed to improve the nutritional status of animals. This study aimed to estimate the chemical composition of mango peelings and seed kernels, and to determine the voluntary feed intake by sheep and the digestibility characteristics of these by-products.

**Material and methods**

Samples of dried mango peel and seed kernel were analysed for dry matter, minerals and nitrogen according to standard procedures. The voluntary feed intake and in vivo digestibility trials involved sheep of 12–18 months old, weighing on average 18.6 kg. Five groups of 6 sheep were allocated randomly to 5 diets in the intake trial consisting of: diet 1: mango peels; diet 2: mango seed kernels; diet 3: mango peels + seed kernels; diet 4: mango peels + seed kernels + urea block and diet 5: control group with rice straw. The mango by-products were fed to animals with rice straw and all feeds were served ad libitum to allow free selection. A two week period of adaptation was observed, followed by 7 days of feed intake measurement. At the end of the intake trial, four animals per diet were allocated to digestibility cages with the same diet and fed at maintenance level for the estimation of the digestibility coefficients. The measurements of feed intake and faeces output lasted 5 days after 3 days of adaptation of the animals in the digestibility cages.

**Results**

The CP content of mango peel and seed kernel were relatively low 5.6 and 6.2% respectively and similar to the value of rice straw. The content in energy (not analysed) should be important with regard to the level of sugar for the peel and starch for kernel which also contains lipids.

There was no significant difference in the total intake of the three first diets containing mango by-products; but the animal receiving the diet 4 which contained a urea block, had a higher intake value (741 g). The intake of peel in the diet 4 was significantly higher (476 g) than the value in diet 3 (364 g) and similar to the value of diet 1 (407 g). Overall, the peel consumed accounted for 60, 61 and 64% of the diet 3, 1 and 4 respectively. The intake of seed kernels was higher in diet 2 (244 g), where this ingredient was fed with rice straw only. In the presence of peels (diet 3 and 4), very little kernel was eaten by the sheep; 7 and 8% of the diet 3 and 4 respectively against 43% for diet 2. The intakes of rice straw were similar in all diets containing mango by-products and significantly lower than the control diet (527 g). In total the animals in the control diet had lower feed intakes. The feed intake per body weight was significantly lower in the diet 5 and 2 (2.5 and 2.7 respectively) compared to diets 4 and 5 (3.6 and 4 respectively); the diet 1 (3.2) was intermediary.

The DM digestibility was not different among the diets containing mango peels and seed kernels, where the value varied between 0.61 and 0.65. The digestibility of mango peels and seed kernels calculated by difference were higher, 0.74 and 0.70 respectively and different from that of rice straw.

**Table 1** Voluntary feed intake & digestibility of diet with mango peels and seek kernels

	Diets					SE	P
	MP	MSK	MP + MSK	MP + MSK + UB	Control		
Voluntary feed intake							
Mango peels	407 <sup>a</sup>	–	364 <sup>a</sup>	476 <sup>b</sup>	–	21	0,04
Mango seed kernel		244 <sup>a</sup>	45 <sup>b</sup>	62 <sup>b</sup>		10	0,00
Rice straw	262 <sup>a</sup>	323 <sup>a</sup>	208 <sup>a</sup>	204 <sup>a</sup>	527 <sup>b</sup>	38	0,00
Total intake	669 <sup>ab</sup>	567 <sup>ab</sup>	617 <sup>ab</sup>	741 <sup>a</sup>	527 <sup>b</sup>	38	NS
DM digestibility	0,61 <sup>a</sup>	0,62 <sup>a</sup>	0,62 <sup>a</sup>	0,65 <sup>a</sup>	0,53 <sup>b</sup>	0,03	0,05

MP: mango peels; MSK: mango seed kernels; UB: urea block.

**Conclusion**

Mango peels from dried mango processing units can be a useful feed for animals with regard to its nutritive value and intake characteristics by sheep. The addition of a source of protein is necessary to allow efficient utilisation of the energy present in these ingredients. The mango seed kernels showed low palatability probably due to the tannin content. It could however be incorporated in a diet in limited amounts with the peels and a protein source. Further study is needed to test the effect of these by-products in animal growth performance.