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ORIGINAL RESEARCH ARTICLE

Elephant grass silage as dry season feed for goats: effect of cassava peel inclusion on performance and digestibility of the mixture

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ABSTRACT

In an effort to provide quality feed for ruminants during the dry season, elephant grass (Pennisetum purpureum) was ensiled with varying proportions of cassava peel (0, 10, 30 and 50%, on wet basis). The intake, growth rate and feed conversion ratio of sixteen Red Sokoto goats penned individually were determined in 84 days while digestibility of the silage mixtures was measured using twelve goats inside metabolic cages. The dry matter (DM) intake and growth rate of the goats increased significantly ($p < 0.05$) as proportion of cassava peel in the silage increased while FCR reduced. The DM intake of goats in this study was 2.60, 2.83, 3.02 and 3.94% of body weight (BW); growth rate was 30.4, 40.8, 62.3 and 84.6 g/day; and FCR, 11.51, 9.08, 6.98 and 5.68 for 0, 10, 30 and 50% inclusion levels of cassava peel in the grass silage respectively. The DM and crude protein (CP) digestibility of the silage increased with higher inclusion of cassava peel in the grass silage. DM digestibility was 54.7, 56.7, 64.3 and 68.0% while CP digestibility was 44.0, 47.7, 52.7 and 59.0% for grass silage with cassava peel inclusion of 0, 10, 30 and 50% respectively. These results indicate that addition of cassava peel to elephant grass improved the nutritive value the ensiled mixture, and enhanced dry matter intake and growth of Red Sokoto goats fed elephant grass silage.

Keywords: cassava peel, ensiling, nutritive value, *Pennisetum purpureum*, small ruminants

INTRODUCTION

Goats play very important roles in livestock production systems of Nigeria. They provide a significant proportion of the meat and milk consumed in the country (RIM, 1992). Their productivity is however limited by scarcity of forage during the dry season. This gap in feed supply can be filled by making silage from excess forage produced during the wet season (Wong, 2000). Elephant grass is a high yielding tropical grass with great potentials for making silage. It is native to Africa but grown throughout the tropics; especially for cattle. It may be grazed or cut for hay or silage (Skerman and Riveros, 1990). In many parts of Nigeria, forage supply in pasture is generally abundant during the dry season but quality and amount of forage declines as dry season approaches, leading to shortage in feed supply for ruminants during the dry season. This problem can be solved through preservation of forages as hay or silage. Silage production is more relevant in the tropics than hay production because it is less dependent on weather conditions than hay (Wong, 2000). Silage can be stored for months or years and can be used at any time it is required (Koon, 1993). The quality of silage from elephant grass can improve with addition of a readily fermentable carbohydrate like cassava peel which is cheap and available in large quantities. The high starch content in cassava peel (Onua and Okeke, 1999) also has the added advantage of improving energy concentration in the tropical grass silage. This study aimed at evaluating the nutritive value of elephant grass ensiled with different proportions of cassava peel, and performance of Red Sokoto goats fed this silage in the southwest of Nigeria during the dry season.

MATERIALS AND METHODS

The study was carried out at the Dairy Unit of the Teaching and Research Farm, University of Ibadan, Ibadan. The diets which constitute the experimental treatments comprised of:

- Elephant grass alone (EG100)
- Elephant grass + 10% cassava peel (CSP10)
- Elephant grass + 30% cassava peel (CSP30)
- Elephant grass + 50% cassava peel (CSP50)

The grass was chopped to approximately 3 cm length using an automated grass chopper and mixed with chopped cassava peel in the proportions specified above. The mixtures were packed inside 120L plastic drums, compressed,

Table 1. Physical characteristics and pH of elephant grass and cassava peel silage at 21 days of ensiling

Parameter	EG100	CSP10	CSP30	CSP50
Appearance	Pale green	Pale green with little brown and white speckles	Light green with many brown and white speckles	Light green with many brown and white speckles
Smell	Pleasant	Pleasant	Pleasant	Very pleasant
Texture	Firm but slightly wet	Firm but slightly wet	Firm	Very firm
pH	4.70	4.56	4.10	3.75

EG100: elephant grass alone, CSP10: elephant grass + 10% cassava peel, CSP30: elephant grass + 30% cassava peel, CSP50: elephant grass + 50% cassava peel.

Table 2. Chemical composition (%) of elephant grass and cassava peel silage fed to Red Sokoto goats

Parameter	EG100	CSP10	CSP30	CSP50
Dry matter	18.7	21.8	24.8	28.6
Crude protein	5.61	5.13	4.98	4.90
Ash	7.03	7.83	8.40	8.43
Neutral detergent fibre	69.8	64.7	60.9	57.1
Acid detergent fibre	43.7	39.5	35.8	33.0

EG100: elephant grass alone, CSP10: elephant grass + 10% cassava peel, CSP30: elephant grass + 30% cassava peel, CSP50: elephant grass + 50% cassava peel.

weighted with a sand bag and covered with a plastic lid. Samples of silage were taken after 21 days for chemical composition. Sixteen Red Sokoto goats (12.7 ± 1.4) were confined inside individual pens and fed the experimental silages for 84 days. During this period, a concentrate feed containing 20.1% crude protein was offered to supplement protein supply to the animals. Feed offered and refused were measured and daily feed intake was determined. Animals were weighed weekly to determine growth rate. Twelve goats (16.4 ± 1.2 kg) were selected from the growth trial and placed inside metabolic cages with facility for faecal collection for digestibility trial. Animals were offered experimental diets (silage) *ad libitum* for 21 days. Animals were adapted to cage and feed for 7 days while silage intake was measured in the last 14 days. Fresh water was offered free choice on a daily basis. Total faecal collection was done during the last 7 days and ten percent of faeces collected were taken for analysis and preserved with some drops of 90% diluted sulphuric acid. Chemical composition of the feed and faeces were determined by the methods of AOAC (1995) and Van Soest *et al.* (1991). The experimental design adopted in this study was the completely randomized design. Data obtained were subjected to analysis of variance and significant means were separated by Duncan's multiple range tests using the procedures of SAS (1995).

RESULTS AND DISCUSSION

The physical characteristics and pH of silage mixtures prepared from elephant grass and cassava peels are summarized in Table 1. This result was earlier discussed by Olorunnisomo (2011). The chemical composition of the ensiled mixtures is shown in Table 2. Dry matter content of the silage increased as the proportion of cassava peel in the mixture increased. Although crude protein content in elephant grass silage was slightly higher than those containing cassava peel, all silages had protein content lower than the minimum

Table 3. Ingredient and proximate composition of concentrate diet

Ingredient composition	%	Chemical composition	%
Maize	24	Dry matter	92.35
Wheat offal	40	Crude protein	20.10
Ground nut cake	10	Ash	7.80
Palm kernel cake	20	Neutral detergent fibre	35.50
Fishmeal (72%)	4	Acid detergent fibre	16.40
Salt	1.0		
Dicalcium sulphate	0.5		
*Premix	0.5		

*Premix contained : vitamin A (20 000 000 IU); vitamin D3 (2 000 000 IU); vitamin E (20 g); magnesium (100 g); manganese (50 g); iron (60 g); zinc (50 g); copper (8 g); iodine (2.5 g); cobalt (1 g) per tonne of feed.

Table 4. Dry matter intake, growth rate and feed conversion ratio of Red Sokoto goats fed elephant grass and cassava peel silage

Parameter	EG100	CSP10	CSP30	CSP50	SEM
Dry matter intake					
Silage (g/day)	300.33^{d}	320.64^{c}	384.48^{b}	430.50^{a}	4.01
Concentrate (g/day)	50.0	50.0	50.0	50.0	-
Total (g/day)	350.33	370.64	434.48	480.50	-
Total intake (% BW)	2.60^{d}	2.83^{c}	3.02^{b}	3.94^{a}	0.28
Growth rate (g/day)	30.44^{d}	40.80^{c}	62.25^{b}	84.63^{a}	1.80
Feed conversion ratio	11.51^{a}	9.08^{b}	6.98^{c}	5.68^{d}	0.56

abcd: means with different superscripts within the row are significantly different ($P < 0.05$).

of 6 -7 % required in ruminant diets for effective rumen function (Milford and Haydock, 1965), hence goats fed these basal diets require protein supplementation which was supplied by the concentrate feed (Table 3). Fibre content of the silage mixtures reduced with increasing proportion of cassava peel in the silage which suggests an improvement in digestibility of the silage mixture. The dry matter intake, growth rate and feed conversion ratio of Red Sokoto goats are presented in Table 4. Intake and growth rate of goats increased significantly ($P < 0.05$) with increasing level of cassava peel in the silage while FCR decreased. This result shows that goats preferred silage with added cassava peel and ate more when cassava peel was added to the silage mixture. This agrees with earlier conclusions reached by the author (Olorunnisomo, 2011) that cassava peel enhanced palatability of elephant grass silage for ruminants. Intake of goats in this study varied from 2.60 - 3.94 % of body weight. This is comparable to 2.18 - 3.78 % reported by Olorunnisomo (2010) for sheep fed maize and amaranth fodders and 3.3 – 3.8 % obtained for West African dwarf goats fed maize offal and sorghum brewer's grains in a total diet (Olorunnisomo and Ososanya, 2002). Backer et al., 1980 reported a mean DM intake of 2.37 % BW for cattle fed different mixtures of sweet potato forage and root.

The higher growth rate observed for goats fed silage with higher proportion of cassava peel may be due to the higher energy concentration in cassava peel which provided more energy for growth. The growth rate of Red Sokoto goats in this study ranged between 30.44 and 84.63 g/day. This is comparable to 44.1- 83.9 g/day reported for sheep by Olorunnisomo (2010). The FCR of goats fed elephant grass ensiled with different proportion of cassava peel ranged from 5.68 – 11.51. FCR reduced with higher inclusion of cassava peel in the silage, indicating that cassava peel enhanced better utilization of the grass silage by Red Sokoto goats. The digestibility of elephant grass ensiled with different proportions of cassava peel by Red Sokoto goats are presented in Table 5. The dry matter and nutrient digestibility of the grass silage varied significantly ($P < 0.05$) with inclusion of cassava peel in the mixture. The highest digestibility was recorded for grass silage with the highest proportion of cassava peel (CSP50). These results show that ensiling elephant grass with cassava peel improved nutrient digestibility and nutritive value of the mixture. This may have been achieved through improved energy utilization in the diet by the addition of cassava peel.

CONCLUSION

Mixing cassava peel with elephant grass had beneficial effects on intake, growth and feed conversion ratio of Red Sokoto goats. The digestibility of the ensiled mixture also improved with higher proportion of cassava peel in the grass silage. Where cassava peel is readily available, it is recommended that it forms at least 30% of silage made from elephant grass to improve productivity of goats in Nigeria during the dry season.

Table 5. Dry matter and nutrient digestibility of elephant grass ensiled with cassava peel by Red Sokoto goats

Parameters	EG100	CSP10	CSP30	CSP50	SEM
DM digestibility (%)	54.67^{b}	56.67^{b}	64.33^{a}	68.00^{a}	3.70
CP digestibility (%)	44.00^{b}	47.67^{b}	52.67^{ab}	59.00^{a}	3.93
NDF digestibility (%)	54.50^{b}	55.17^{b}	62.83^{a}	64.18^{a}	3.65
ADF digestibility (%)	34. 20^{b}	34.76^{b}	39.84^{a}	40.00^{a}	2.20

abcd: means with different superscripts within the row are significantly different ($P< 0.05$), CSP10: elephant grass + 10% cassava peel, CSP30: elephant grass + 30% cassava peel, CSP50: elephant grass + 50% cassava peel.
DM – Dry matter, CP – Crude protein, NDF – Neutra detergent fibre, ADF – Acid detergent fibre

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