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Utilization of sweet potato as a forage supplement to a maize stover diet by West African Dwarf sheep

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Target audience: Ruminant Nutritionists, Sheep Farmers, Livestock Extensionists

Abstract

In a growth and digestibility trial with West African dwarf sheep (WAD) the effects of supplementing maize stover with four levels of sweet potato forage (0, 1, 2 and 3% of body weight) on intake and growth rate of the animals; and digestibility of maize stover, sweet potato forage and their mixture were determined using a randomized complete block and completely randomized design, respectively. The dry matter (DM) intake and growth rate of the animals improved significantly ($P < 0.01$) with increasing level of sweet potato forage in the diet. DM intake was highest at the highest level (3% BW) of sweet potato inclusion and was 140% of the sole maize stover diet. Growth rate of animals at 3% (BW) level of sweet potato supplementation was 195% better than that of animals on sole maize stover. Digestibility of sheep diet improved significantly ($P < 0.05$) when sweet potato forage formed whole or part of the diet. Addition of sweet potato forage to a basal diet of maize stover improved animal productivity from this fibrous crop residue.

Key words: Sweet potato, maize stover, digestibility, growth, WAD sheep

Description of Problem

Maize stover and sweet potato vines are two crop residues commonly generated in the southwest of Nigeria. These residues are usually left on the field after the grain and root have been harvested. Maize stover and sweet potato vines constitute a huge feed resource that can be converted into useful animal products (1, 2).

Although maize stover is produced in large quantities, its utilization in ruminant diets is limited by its poor nutritive value, low dry matter intake and consequently poor animal performance (3).

Several methods such as grinding, alkali treatment and addition of urea have been adopted to improve the nutritive value of low quality roughages (4, 5). However, these methods have not been widely accepted by farmers due to the cost and risk involved (2).

Sweet potato vine is relished by ruminants and has been shown to have a high nutritive value (6, 7, 8). The aim of this study was to examine the effects of supplementing maize stover with sweet potato forage on performance of West African dwarf sheep.

Materials and Methods

In a growth trial, sixteen ram lambs (7.55 - 8.68kg) were randomly assigned to four treatments which consisted of four levels (0, 1, 2, 3% body weight) of sweet potato supplementation, using a randomized complete block design.

Maize stover was collected from a farmer's field after the grain harvest, chopped, sprayed with a 20% urea solution at the rate of 100g/kg of stover and sundried. Sweet potato vines were collected from an experimental area after the root harvest, chopped and sundried.

The growth trial was conducted in 98 days with 14 days as adaptation period and 84 days for experimental measurements. Animals were penned individually and offered maize stover *ad-libitum* and sweet potato forage at 0, 1, 2, and 3% of body weight. Animals had access to water and mineral-salt lick. Intake of the diet components were recorded daily, animals were weighed on a

weekly basis and average daily gain determined for each treatment.

At the conclusion of the growth trial nine animals from the trial were selected and randomly assigned to one of three diets (maize stover, maize stover-sweet potato mixture, and sweet potato forage) for digestibility trial, using a completely randomized design. The animals were housed in individual pens with floors adapted for faecal collection. Diets and water were offered *ad-libitum* for 14 days. Total faeces and feed refused were collected and weighed in the last seven days. Ten per cent of faeces was collected and kept for chemical analysis.

Data obtained in both trials were subjected to analysis of variance and treatment means were compared by Duncan's multiple range test using the procedures of (9).

Results and Discussion

The chemical composition of the diet components are presented in Table 1.

Table 1. Proximate composition of maize stover and sweet potato vine

Constituent (%, DM)	Maize stover	Sweet potato forage
Dry matter	86.85	87.20
Crude protein	6.30	19.40
Ether extract	2.60	3.25
Crude fibre	32.90	18.50
Ash	6.34	10.25
NFE	51.86	48.60
Neutral detergent fibre	68.50	49.00
Acid detergent fibre	49.00	30.50
Lignin	12.00	8.00
Gross energy (kcal/g)	4.27	4.26

Total dry matter intake from the diets increased significantly with increasing level of sweet potato forage (Table 2). This agrees with results obtained by (6) and (7) when sweet potato forage was fed as a supplement to sugarcane-based diets for cattle.

Intake of maize stover was fairly constant across the treatments, showing that addition of sweet potato forage to the diet did not improve the intake of maize stover. However, the total DM intake increased significantly ($P < 0.01$) with higher levels of sweet potato offered. The intake (DM) at the highest level of sweet potato supplementation was 140% higher than the sole maize stover diet. Animals consumed all the sweet potato offered before eating the maize stover, showing that sweet potato forage was highly preferred to maize stover by sheep. This is similar to the results obtained by (6).

Table 3 shows the growth rate and feed conversion efficiency of WAD sheep in the various treatments.

The growth rate of the animals improved significantly ($P < 0.01$) when sweet potato forage was added to the basal diet with the highest gain recorded at the highest level of sweet potato inclusion. The growth rate of animals supplemented with 3% (BW) of sweet potato was 195% higher than that of animals on maize stover alone.

There was indication that feed was more efficiently converted to animal product when sweet potato was added to the basal diet of maize stover. However, feed conversion efficiency was not enhanced ($P > 0.05$) when the level of sweet potato increased from 1 - 3% BW in the diet.

The digestibility of maize stover and sweet potato hay fed sole or in mixture to WAD sheep is given

Table 2: Mean daily dry matter intake of sheep fed maize stover and sweet potato forage

	Level of sweet potato (% BW)				
Intake (g/day)	0	1	2	3	SEM (±)
Maize stover	198.20	192.30	189.60	186.50	11.25
Sweet potato forage	0.00	97.40	192.80	290.60	9.15
Total DM	198.20^{d}	289.70^{c}	382.40^{b}	477.10^{a}	18.32
Total DM (% BW)	2.04^{d}	2.98^{c}	3.97^{b}	4.93^{a}	0.42

a, b, c, d: Means with different superscripts in a row are significantly different (P < 0.01)

Table 3: Growth rate and feed conversion of WAD sheep fed maize stover and sweet potato forage

	Level of sweet potato (% BW)				
Measurement (g/day)	0	1	2	3	SEM (±)
Total DM intake	198.2^{d}	289.7^{c}	382.4^{b}	477.1^{a}	18.32
Average daily gain	17.2^{de}	31.6^{c}	39.9^{b}	50.7^{a}	3.05
Feed conversion ratio (Intake/gain)	11.5^{d}	9.2^{c}	9.6^{b}	9.4^{b}	1.95

a, b, c, d: Means with different superscripts in a row are significantly different (P < 0.01)

in Table 4.

The DM digestibility of sweet potato forage was significantly (P < 0.05) higher than that of maize stover or maize stover: sweet potato mixture. The DM digestibility of sweet potato forage was 45% higher than that of maize stover diet, while the digestibility of the mixture was 20% higher than the maize stover diet. The CP, NDF, ADF and lignin digestibility in the diets followed the same trend as DM digestibility. The higher digestibility observed when sweet potato formed part or whole of sheep diet was probably due to the higher protein and lower fibre content of sweet potato compared to maize stover. (10) reported a similar

Table 4: Apparent digestibility (%DM) of maize stover, sweet potato forage and their mixture by WAD sheep

	Maize stover: sweet potato forage			
Nutrient	100.00	50:50	0:100	SEM (±)
Dry matter	50.05^{a}	60.09^{b}	72.34^{c}	3.95
Crude protein	47.82^{a}	57.84^{b}	70.25^{c}	3.06
Neutral detergent fibre	42.68^{a}	55.42^{b}	69.01^{c}	2.45
Acid detergent fibre	30.05^{a}	40.83^{b}	65.84^{c}	2.85
Lignin	10.66^{a}	15.55^{b}	29.68^{c}	1.95
Lignin				

a, b, c, d: Means with different superscripts in a row are significantly different (P < 0.01)

result when a basal diet of maize stover was supplemented with a legume forage for sheep. Higher nitrogen content in ruminant diets is known to stimulate rumen function and improve digestibility of the diet (11).

Conclusion and Application

Addition of sweet potato forage to a basal diet of maize stover had a positive influence on dry matter intake, digestibility, growth rate and efficiency of feed conversion by sheep. It is recommended that sweet potato forage be used extensively to improve animal productivity when fibrous crop residues form the bulk of ruminant diets.

References

1. McDonald, P., R.A. Edwards and J.F.D. Greenhalgh (1987). *Animal Nutrition*. 4th edn. Longman Scientific and Technical, U.K.
2. Preston, T.R. and R.A. Leng (1987). *Matching ruminant production with available resources in the tropics and subtropics*. Penambul Books, Armidale, Australia.
3. Chamberlain, A. (1989). *Milk production in the Tropics*. Longman Scientific and Technical, U.K.
4. Jackson, M.G. (1977). Review article: the alkali treatment of straws. *Animal Feed Science and Technology*, 2:105-130.
5. Sundstol, F. and E. Owen (1984)(eds). *Straw and other fibrous by-products as feeds*. Elsevier, Amsterdam.
6. Meyreles, L. and T.R. Preston (1978). Sweet potato forage as cattle feed: effect on voluntary intake different amounts added to a basal diet of chopped sugarcane stalk. *Tropical Animal Production*, 3:244-228.
7. Ffoulkes, D., D. de B. Hovell and T.R. Preston (1978). Sweet potato forage as cattle feed: voluntary intake and digestibility of mixtures of sweet potato forage and sugar cane. *Tropical Animal Production*, 3:140-144.
8. Chen, M.C., C.P. Chen and S.L. Din (1979). The nutritive value of sweet potato vines for cattle. *J. Agric Asso. China. New series* , 107:55-60.
9. SAS Institute (1995). *SAS/STAT User's Guide. Version 6*, 4th ed. Vols. 1 and 2. SAS Inst. Inc., Cary, N.C.
10. Tolera, A. and Sundstol, F. (2000). Supplementation of graded levels of Desmodium intortum hay to sheep feeding on maize stover harvested at three stages of maturity, 1. Feed intake, digestibility and body weight change. *Anim. Feed Sci. Technol.*, 85: 239-257.
11. Olorunnisomo, O.A., M.K. Adewumi and O.J. Babayemi (2005). Effects of nitrogen level on the utilization of maize offal and sorghum brewer's grain in sheep diet. Livestock Research for Rural Development (In Press).