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FORAGE YIELD AND NUTRITIVE VALUE OF SWEET POTATO VINES CUT AT DIFFERENT INTERVALS

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Introduction

Under improved cultivation practices, sweet potato (*Ipomoea batatas* (L.) Lam.) is capable of very high dry matter (DM) yield per unit area of land. Sweet potato vine has a high crude protein content (18-30%) which is comparable to many leguminous forages (An *et al.,* 2003, Mupangwa *et al.*, 1997). The root DM consists mainly of starch and is considered a good energy source in livestock diets (An *et al.,* 2003). With a crude fibre content of 18% and DM digestibility above 70% (Ffoulkes *et al.,* 1978), sweet potato vine is an ideal forage for ruminants. Fresh sweet potato vines have been fed to ruminants as a forage supplement to low quality roughages (Meyreles and Preston, 1978; Ffoulkes *et al.*, 1978) while the root has formed part of the concentrate diet (Tewe *et al.,* 1978). Sweet potato top and root have also been reported to have good silage characteristics for animal feeding (Giang *et al.*, 2004; Ruiz *et al.*, 1981).
There is however little available information on the effects of cutting frequency on forage and root yield, and nutritive value of sweet potato top for ruminants. This study was designed to examine these effects.

Materials and methods

Sweet potato vines were subjected to four cutting regimes using a randomized complete block design (RCBD). The treatments consisted of 4, 6. 8 weeks cutting interval and cutting at harvest (Hc). Sweet potato vines (30cm long) were planted in field plots measuring 4 x 6m in size, at a spacing of 50 x 80cm. Each treatment was replicated three times and randomly assigned to plots within the block. Fertilizer was applied to each plot as 300kg/ha of NPK-15-15-15, at planting; 75kg/ha of urea, 90 days after planting (DAP); and 75kg/ha of urea, 120DAP. Forage was harvested from the Hc plots at 150 DAP while other plots (4, 6, 8weeks) were initially cut at 90 DAP, to allow for tuber bulking, and subsequently at the specified intervals. Forage and roots harvested from each plot were weighed and recorded. Samples of the forage were taken from each plot. bulked for each treatment for chemical analysis. Freshly harvested forage were chopped using a locally fabricated cutter, sundried and stored for the digestibility trial.

Twelve male WAD sheep aged approximately one year and weighing between 11.5 and 13.8 kg were used to estimate the digestibility of sweet potato forage cut at the different intervals. The animals were placed in individual pens with floors adapted for faecal collection. Sundried sweet potato top and fresh water were offered ad libitum for 14 days. Animals also had access to salt lick. Total faeces and feed refused were collected and weighed in the last 7 days. Ten percent of faeces collected were kept for analysis. Forage, root and faecal samples were dried in the oven at 65°C to constant weight, milled, and stored in airtight containers until required for analysis.
Crude protein content of samples was determined as N x 6.25 using the Kjeldahl method (AOAC 1990) while fibre and lignin fractions was determined by methods of Van Soest and Robertson (1985). The gross energy of the forage and faeces was calculated from organic matter components of the material by the relationship described by Nehring and Haenlein (1973). Data obtained were subjected to analysis of variance and Duncan's multiple range tests using the SAS (1995) procedures.

Results and discussion

Dry matter yield: The cumulative DM yield of sweet potato top and root from each treatment is shown in Table 1. Frequent cutting at 4 weeks interval did not significantly ($P>0.05$) improve forage yield of sweet potato when compared to control (Hc); however, the root and total biomass yield were significantly ($P<0.05$) depressed.
Frequent defoliation of sweet potato plant disrupted the photosynthetic process, leading to a reduced leaf, root and biomass production. This result agrees with earlier reports that defoliation had a negative influence on root production in sweet potato (An et al., 2003; Kiozya et al., 2001 and Ruiz et al., 1980). At longer cutting intervals (6-8 weeks) yield of sweet potato forage increased significantly ($P<0.05$) when compared to control while the root yield was significantly ($P<0.05$) depressed. However, biomass production of sweet potato cut at 6 and 8 weeks interval were not significantly ($P>0.05$) different from control. Increasing the interval between cuttings gave the plant sufficient time to recover

from the previous cutting. Since biomass production among these treatments was not significantly different, it may be inferred that cutting did not influence biomass production in sweet potato but re-partitioned dry matter accumulation to favour leaf production at the expense of the root. This is in agreement with the findings of Mannan et al. (1992).

Chemical composition: The DM content of the forage and fibre components decreased as cutting frequency increased (Table 2) while the CP content increased.

Table 1: Cumulative dry matter yield (tonnes/ha) of sweet potato cut at different intervals

Cutting Interval (weeks)	Tops (vine)	Root	Total Biomass
4	8.58 b	4.34c	12.92b
6	11.95a	5.08b	17.03a
8	12.16a	5.96b	18.12a
Hc	8.06b	8.68a	16.74a
SEM	±0.68	±0.50	±0.73

a.b.c Means with the same letters within the column are not significantly different (P>0.05)
Hc: cutting at harvest

Table 2: Chemical composition of sweet potato top cut at different intervals

Cutting interval (weeks)	DM	CP	NDF	ADF	Lignin	Gross energy (Kcal/g)
	--------	--------	%	--------	--------	
4	18.20	26.65	44.50	25.50	5.00	4.35
6	18.50	24.96	46.00	25.00	7.50	4.34
8	19.20	21.78	48.00	29.00	7.50	4.34
Hc	20.00	20.05	49.00	30.50	8.00	4.31

Hc: cutting at harvest; DM: dry matter; CP: crude protein; NDF: neutral detergent fibre; ADF: acid detergent fibre

This is in agreement with the findings of Ruiz et al (1980) who also reported an increase in CP content of sweet potato forage and a reduction in fibre components when the vine was cut more frequently. The gross energy content however remained constant across the cutting frequencies. This suggests that cutting stimulated dry matter partitioning to favour protein accumulation at the expense of fibre but did not alter the gross energy content of the forage.

Digestibility: The whole tract digestibility of sweet potato forage cut at different intervals using sheep is presented in Table 3. Dry matter digestibility improved significantly (P<0.05) when forage was cut at 4 and 6 weeks interval, however there was no significant (P>0.05) difference in DM digestibility of forage cut at 8 weeks and at harvest (control).

Table 3: Apparent digestibility (%) of sweet potato top cut at different intervals by WAD sheep

Cutting intervals (weeks)	DM	CP	NDF	ADF	Lignin	Gross energy
4	75.72a	71.56a	69.38a	65.89a	29.79a	76.98a
6	68.73b	64.93b	62.20b	58.34b	27.96a	70.47b
8	65.25c	60.21c	57.34c	51.96c	19.55b	66.93bc
Hc	64.01c	58.95c	56.65c	40.55d	16.03c	64.50c
SEM	±1.95	±1.85	±1.80	±1.76	±0.84	±1.90

a.b.c,d: Means with same letters within the column are not significantly different (P>0.05)

The digestibility of CP, NDF, and gross energy followed the same trend as DM digestibility. The DM digestibility of sweet potato forage ranged from 64.01 – 75.72 %. The forage cut at 4 weeks showed the highest digestibility while the control (Hc), showed the least digestibility. The digestibility of ADF, lignin, and gross energy followed a general trend in which digestibility increased as the cutting interval became shorter. Improved digestibility of the forage is associated with higher protein and reduced fibre in the forage as frequency of cutting increased (An et al., 2003;Meyreles and Preston,1978).

Conclusion

Cutting sweet potato vines at intervals improved forage production at the expense of root yield. Forage yield and biomass production from sweet potato were highest at 8 weeks cutting interval while the quality of the forage was highest at 4 weeks interval. When sweet potato is cultivated for forage production, cutting at 6 weeks interval is recommended to optimize the yield and quality of the forage.

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