Effect of sweet potato vine silage and urea-molasses blocks supplementation on nutrient intake, nitrogen balance and microbial protein synthesis of crossbred heifers on a poor-quality diet

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Introduction

- Supplementation of low-quality diets with sweet potato vine silage (SPVS) or urea-molasses blocks (UMB) is considered to improve ruminant production by enhancing microbial fermentation in the rumen and thereby nutrient and energy supply to the host.

Objective

- To quantify the effects of SPVS or UMB supplementation of a low-quality diet on microbial protein synthesis, nitrogen balance and partitioning in urine and feces excretion.

Materials and Methods

- The experiment were conducted at ILRI, Nairobi, Kenya.
- Six Holstein Friesian-Boran crossbred heifers with mean body weight (BW) of 153 kg (standard deviation 16.9).
- Experimental design: 3 × 2 Youden square with 3 dietary treatments and 2 experimental periods (3 weeks for adaptation and 1 week for sampling).
- Dietary treatments:
  - Basal diet (control): wheat straw (61.4 %) and Boma Rhodes grass (38.6 %) offered at 2 % BW (as fed basis).
  - SPVS: control (2 % BW) + SPVS offered at 2.5 % BW (as fed basis).
  - UMB: control (2 % BW) + UMB (*ad libitum*).

Table 1 chemical composition of basal diet, SPVS and UMB (mean ± standard deviation).

Parameter	Control	SPVS	UMB
DM (g/100 g FM)	90.3 ± 0.18	93.7 ± 1.00	89.9
Organic matter (g/100g DM)	89.2 ± 0.45	87.6 ± 0.14	50.2
Crude protein (g/kg DM)	71.2 ± 1.32	144 ± 5.3	373

FM: fresh matter; DM: dry matter; SPVS: sweet potato vine silage (1.8 % molasses, 67 % vine, 31.2% root on DM basis); UMB: urea-molasses blocks (35 % molasses, 19 % CaHPO4, 10 % urea 10 %, 10 % salt, 5 % cotton seed meal).

- Samples of feed, feces and urine were collected and analyzed for proximate composition following standard protocols (AOAC, 1991). Samples of urine were also analyzed for purine derivative (Chen and Gomez, 1992). All data were subjected to the mixed model procedure of SAS.

Figure 1 Crossbred heifers during urine sample collection (own source)

Results and Discussion

Table 2: Nutrient intake, digestibility of dry matter (DM), and excretion and balance of nitrogen in crossbred heifers fed control (basal) diet alone or supplemented with sweet potato vine silage (SPVS) or urea-molasses blocks (UMB) (least square means, standard errors of mean (SEM), n = 4).

Variable	Dietary treatment			SEM	P- value
	Control	SPVS	UMB		
DM intake (kg/d)	3.1	3.4	2.8	0.28	0.40
DM digestibilty (g/100 g)	47.4^{b}	51.0^{a}	47.9^{b}	0.82	0.04
Digestible DM intake (kg/d)	1.4	1.7	1.3	0.13	0.18
Nitrogen balance (g/d)					
Intake	38.5	47.9	36.9	3.94	0.18
Urinary	19.4	21.1	18.9	1.95	0.72
Fecal	25.4	29.6	25.1	2.32	0.37
Balance	-6.3^{b}	-2.8^{a}	-7.2^{b}	0.84	0.02

$^{a\ b}$Least square means within rows with different superscripts differ at P < 0.05.

Table 3: Urinary purine derivatives (PD) excretion and estimated duodenal microbial nitrogen (N) flow in crossbred heifers fed control (basal) diet alone or supplemented with sweet potato vine silage (SPVS) or urea-molasses blocks (UMB) (least square means, standard errors of mean (SEM), n = 4).

Variable	Dietary treatment			SEM	P- value
	Control	SPVS	UMB		
Urine volume (L/d)	4.2^{b}	5.3^{a}	4.2^{b}	0.22	0.02
Creatinine (mmol/d)	30.2^{b}	33.6^{a}	25.7^{b}	1.73	0.05
Total PD (mmol/d)	41.5	50.6	35.7	5.81	0.27
Microbial N flow (g/d)	21.3	28.7	16.8	4.68	0.27
Efficiency[1] (g N/ kg DOMI)	16.5	18.5	13.1	2.69	0.41

$^{a\ b}$Least square means within rows with different superscripts differ at P < 0.05.
[1]Efficiency calculated from daily microbial N flow (g) divided by digestible organic matter intake (DOMI).

Conclusion

- The higher nitrogen balance with SPVS supplementation could be due to higher nitrogen intake and digestibility.
- Supplementation of a low-quality diet with SPVS can improve nutrient utilization and thus ruminant production in the Tropics.

Reference

AOAC (1990): Official Methods of Analysis. Association of Official Analytical Chemists (15th ed). In Washington, DC.USA.

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