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Effect of cassava root ensiled with cassava top or legumes on feed intake and digestibility of dairy cows

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ABSTRACT

The effect of cassava root ensiled with cassava top or legumeson voluntary feed intake and digestibility were determined in 12 dairy cows using change-over design. Experimental period were 30 days long and consisted of 14 days of adaptation and 5 days of sampling. Cows were allotted at random to receive *ad libitum* one of four rations: T1) control, T2) cassava root +cassava top-silages, T3) cassava root +hamata - silages and T4) cassava root +Thapra stylo-silages.

The dry matter intake ($BW^{0.75}$) increased ($P< 0.05$) in cow fed with T2. The CP and NDF digestibility was higher in cow fed with T4 compared with the other diets.(**Key Words:** cassava, hamata, Thapra stylo, silage, dairy cow)

INTRODUCTION

Cassava (*Manihot esculenta* Crantz) is a tropical crop widely cultivated in tropical and sub-tropical area. Cassava root and leave have potential as energy source and protein source for ruminant ration, respectively (Wanapat, 2009). Additionally, the roots and leaves need to have the cyanogenic glucocides reduced to a level which is acceptable and safe for consumption. The reduction method is simply slicing or cutting the roots leaves into pieces and drying them in the sun. Cassava roots are easily fermented due to high sugar and carbohydrate contents. Therefore, ensiling is alternative way in region where weather conditions do not favor for sun drying. Moreover, several studied have indicated that ensiling is more effective than sun drying for reducing HCN concentrations in root peel (Smith, 1992). Cassava roots are low in protein, lipids, and vitamins (Smith, 1992). Another one problems in feeding cassava roots are protein supplementation. Cassava leaves contain more protein and fiber than roots. Ravindran (1995) suggested that alternating layers of leaves and roots in the silo will produce a feed that well balanced for energy and protein. However, the managing of increasing cassava leaves yields without reducing root yield is still difficult. Ensiling roots with other plant protein sources such as legume forages may be considered. McDonald (1991) suggested that the combinations between cassava root and legume have been reported to improve feed intake and nutrient digestion .This study was aimed to study the effect of cassava root ensiled with cassava top and legumes silages on voluntary feed intake and nutrient digestibly in dairy cows.

MATERIALS AND METHODS

Silage preparation

FJLB was prepared from cassava leaves, hamata (*Stylosanthes hamata*)and Thapra stylo (*Stylosanthes guianensis CIAT 184*) before making silage (Bureenok et al., 2005). Cassava root and cassava top were collected from the field immediately after root harvesting. Whole cassava root was sliced into approximately 0.5-cm thickness. The cassava top, 30 to 50 cm from the top including leaves, petioles and young stems, were collected, and mechanically chopped into 2-3 -cm pieces.Hamata and Thapra stylo were harvested at 60 d after planting and chopped into 2- to 3-cm lengths. Cassava root were mixed with cassava top or legumes at ratio 60:40. The mixed portion were treated with 1% FJLB (FJLB) which prepared from the same plant, then packed tightly in 100-kg plastic drums and stored at room temperature (27–30°C) until feeding experiment start.

Animals, Feeding

Twelve Holstein Friesian crossbred cows (mean body weight, 484 ±41 kg) were individually housed in metabolic cages. The cows were randomly allocated in a 4×3 change-over design to receive 1 of 4 *ad libitum* diets: T1) control, T2) cassava root+ cassava top silage, T3) cassava root +hamata silage, or T4) cassava root +Thapra stylo silage. The 30-d experimental period consisted of a 30 d of feed intake and 5 d of sampling. Feed was offered twice daily at 08:00 and 15:00 h, and the refused portions were weighed daily before the morning feeding. BW was measured before the morning feeding at the beginning and end of each experimental period. The daily dry matter (DM) intake per unit of metabolic BW was calculated with the mean value of initial BW and final BW of each period. During the last 5 d of each period, the feces samples were collected daily for each cow in the morning before feeding.

Chemical Analyses

The DM content of the silages and feces were determined by oven drying at 70°C for 48 h. The dried sample was milled to pass through a 1.0 mm sieve. The nitrogen was determined by the Kjeldahl procedure (AOAC, 1995). The NDF and ADF concentrations were determined by methods described by Van Soest et al. (1991). Diet and fecal samples were analyzed for acid-insoluble ash (AIA) using a modification of procedure by Van Keulen and Young (1977).Digestibility by AIA was calculated as the ratio of acid-insoluble ash in feed and feces.

Statistical analyses

Statistical analyses were performed using the general linear models (GLM) procedure of SAS (SAS Institute Inc., Cary, NC). For silage quality, group means were compared by Duncan's multiple range test (DMRT), all data were analyzed using the procedures of SAS for a 4×3 change-over design.

RESULTS AND DISCUSSION

The chemical composition of the ingredient in the rations was shown in Table 1. The dry matter intake ($BW^{0.75}$) was higher ($P< 0.05$) in cow fed with cassava root +cassava top-silages (T2) compared with the other silages (Table 2). Cows fed control diet was higher in dry matter intake compared with cows fed cassava + legumes silages groups. The apparent CP, NDF and ADF digestibility were higher in cow fed with T4 than those fed with the other diets. Digestible intake of DM, OM and CP were higher in cow fed with control diets and T2. However, digestible intake of NDF and ADF of control diet was the lowest. Conclusion, the cassava root combined with its cassava top was higher in dry matter intake but was lower in CP, NDF and ADF digestibility compared with the combined Thapra stylo silages.

Table 1.Ingredients and chemical compositions of the rations

Ingredient (%)	T1	T2	T3	T4
cassava chip	20.00	0.00	0.00	0.00
soybean meal	17.61	17.61	17.61	17.61
Rice bran	5.50	5.50	5.50	5.50
Whole cotton seed	21.89	21.89	21.89	21.89
urea	1.50	0.85	1.00	1.20
molasses	7.00	7.00	7.00	7.00
sulfer	0.30	0.30	0.30	0.30
premix	0.50	0.50	0.50	0.50
Calcium carbonate	0.60	0.60	0.60	0.60
Dicalcium phosphate	0.60	0.60	0.60	0.60
Bicarbonate	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50
Tallow	3.00	3.00	3.00	3.00
Rice straw	20.00	20.00	20.00	20.00
Cassava root + cassava top silage	-	20.65	-	-
Cassava root + hamata silage	-	-	20.50	-
Cassava root + Thapra stylo silage	-	-	-	20.30
Total	100.00	100.00	100.00	100.00
Chemical composition				
DM, g/kg	76.63	61.42	57.60	56.48
OM, g/kg DM	91.68	90.77	90.81	90.46
CP, g/kg DM	16.83	16.69	16.88	16.92
EE, g/kg DM	7.44	8.21	7.67	7.25
NDF, g/kg DM	62.94	70.60	76.06	76.92
ADF, g/kg DM	29.21	32.04	35.49	36.92

T1 = control, T2 = cassava root +cassava top-silages, T3 = cassava root +hamata - silages and T4 = cassava root +Thapra stylo-silages

Table 2.Feed intakes and digestibility in cows fed with different silage- based diet

Item	T1	T2	T3	T4	SEM	P-value
Total intake						
kg DM/d	12.98 [a]	13.85 [a]	11.30 [b]	11.48 [b]	0.449	0.0123
%BW	2.67 [ab]	2.89 [a]	2.44 [b]	2.36 [b]	0.098	0.0198
g/kg $BW^{0.75}$	125.48 [ab]	135.30 [a]	110.75 [b]	113.43 [b]	4.506	0.0203
Apparent Digestibility, g/kg						
DM	648.1	651.42	639.43	656.4	12.710	0.4206
OM	667.67	670.15	660.87	674.9	13.700	0.5536
CP	768.48 [ab]	756.53 [b]	773.15 [ab]	786.63 [a]	6.304	0.033
EE	906.85	889.92	901.77	871.78	13.722	0.3319
NDF	630.3 [b]	657.1 [b]	664.5 [b]	706.5 [a]	11.663	0.0103
ADF	432.4 [b]	444.22 [b]	488.63 [ab]	522.4 [a]	22.347	0.0488
Digestible intake, g/kg $BW^{0.75}$						
DDMI	81.23 [ab]	88.13 [a]	72.03 [b]	72.96 [b]	3.742	0.0889
DOMI	76.67 [ab]	82.3 [a]	67.72 [b]	67.85 [b]	3.552	0.1662
DCPI	16.22 [ab]	17.03 [a]	14.75 [b]	14.76 [b]	0.611	0.0397
DEEI	8.46 [b]	9.95 [a]	8.05 [bc]	6.96 [c]	0.355	0.0207
DNDFI	49.68 [b]	61.87 [a]	56.95 [a]	60.48 [a]	2.246	0.0129
DADFI	15.83 [b]	18.93 [ab]	19.17 [ab]	21.66 [a]	1.258	0.0491

Values in the same row followed by different letters are significantly different ($p<0.05$). SEM = standard error of the mean. T1 = control, T2 = cassava root +cassava top-silages, T3 = cassava root +hamata -silages and T4 = cassava root +Thapra stylo-silages.

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