Contents

Effect of cassava hay supplementation on milk production in lactating goats

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Summary

Twenty-four lactating goats (F1 of Bachthao*Jamnapary or Barbary) were used to investigate supplementation with cassava foliage hay *(Manihot esculenta* Crantz) to a diet based on rice straw sprayed with urea, a molasses urea block (MUB) and dried cassava root. The treatments were 0 g (control treatment), 100, 200, 300, 400 and 500 g dry matter (DM) cassava hay supplementation. The milk yields increased linearly up to 400 g/day cassava hay (882, 979, 1164, 1327 and 1532 g/day respectively) with a slight reduction (1381 g/day) at 500 g/day of cassava hay. Feed conversion ratios were 1.37, 1.30, 1.05, 0.98, 0.88 and 0.86 kg DM/kg milk, and feed costs: 2570, 2418, 2068, 1815, 1744 and 1700 Vietnamese Dong/kg milk (1 USD~15400 Dong), respectively. Increasing levels of cassava hay supplementation increased milk yield and decreased feed conversion ratio and feed cost.

Keywords: Cassava hay, feed conversion, goats, intake, milk yield, supplementation

Introduction

Cassava or tapioca (*Manihot esculenta*, Crantz) is a highly productive tropical crop. Besides the root each hectare of cassava can produce a large amount of leaves. The potential yields of cassava leaves as by-products at root harvesting may amount to as much as 4.64 tonnes dry matter (DM) per hectare and fresh cassava forage, including tender stems, can be utilized directly for ruminant feeding (Ravindran and Rajaguru, 1988). Cassava foliage has been made into cassava hay which was palatable to ruminants and was proved to be an excellent feed either as the sole diet or as a supplement in diets based on crop residues (eg. urea-treated straws/sugarcane tops) (Wanapat et al., 1997). Intake and degradability of cassava leaves have been reported to be low due to high levels of condensed tannins (Wanapat et al., 1995). Condensed tannins are known to have negative effects on the nutritive value of the feed at concentrations of more than 6% of diet DM (Windham et al., 1990).

The objective of the present study was to evaluate cassava hay as a source of protein in diets based on rice straw sprayed with urea, a molasses-urea block and dried cassava root for lactating goats

Materials and methods

The study was conducted at the Goat and Rabbit Research Centre, Sontay, Hatay, Vietnam. The feeds used in the experiment were rice straw, molasses-urea block (MUB), dried cassava root and cassava hay. The rice straw was chopped and sprayed with urea before feeding. MUB was made with 45% rice bran, 40% molasses, 6% urea, 3% lime, 4% minerals and 2% salt. The cassava hay was made from cassava foliage of local varieties harvested at an average age of 56 days. The foliage was chopped into small pieces mechanically (1 to 2 cm) and dried in the sun. In addition a mineral block with a composition of 70% $Ca_3(PO_4)_2$, 15% NaCl and 15% cement as a binding agent was supplied to each pen. The feeds were offered in separate feed troughs. The animals had free access to fresh water.

Twenty-four lactating goats, F1 between Bachthao and Barbary or Jumnapary, with initial weights between 30 and 35 kg were used as experimental animals with four lactating goats in each of 6 treatment groups. The amount of feed offered was calculated according to Devendra and McLeroy (1982). All animals were fed 125 g MUB and 600 g cassava root. Amount of cassava hay was planned to be 0, 100, 200, 300, 400 or 500 g DM per doe and day,

respectively while the corresponding amounts of urea sprayed rice straw was 700, 600, 500, 400, 300 or 200 g per doe and day, respectively. The animals were fed the cassava hay and the urea sprayed rice straw *ad libitum* at a level of 115% and 130% of the planned intake. The goats were hand-milked twice daily 07.00 h and 17.00 h followed by restricted suckling of the kids for 1 hour after each milking. The milk yield was estimated as the milk obtained by hand milking plus the quantity consumed by the kids. The experimental period started at the 5^{th} week of lactation and finished after the 12^{th} week, a total of 8 weeks.

Feeds offered and feed refusals were analyzed with standard methods (AOAC, 1990). Condensed tannins were analysed by the Vanillin-HCl method (Burns, 1971) and HCN by the method of Ikediobi et al. (1980). The data from the experiment was analysed as a Completely Randomised Design by using the General Linear Model option of the MINITAB software (Minitab, 2000)

Results and discussion

The chemical composition of the feeds is shown in Table 1. The cassava hay had a high CP content, 19.1% of DM.

The intakes of dried cassava root and MUB were similar in all treatments (Table 2). The rice straw sprayed with urea was not consumed completely, around 43 to 52% of the amount offered. Increasing the level of cassava hay in the diet led to decreased rice straw intake, and to increases in total DM up to the level of 300 g/day of cassava hay. In the treatments with 400 and 500g cassava hay, the DM intake of cassava hay was considerably lower than planned.

There was a positive effect on milk yield and live weight gain of the kids with increasing level of cassava hay supplementation. The highest milk yield (Table 3) was obtained in the treatment with 400 g cassava hay supplementation. Cassava hay supplementation significantly increased the percentage of milk solids, milk fat and milk protein, but had no effect on the casein content. Feed conversion ratio expressed as kg feed DM/kg milk decreased and economic returns were improved by cassava hay supplementation. The CP content of the cassava hay used was similar to the figures shown by Ravindran and Rajaguru (1988) but lower than the 20.1 to 25.6% reported by Mui (1994) and Wanapat et al. (1997). The content of CP depends on the proportion of leaves and stem and in this case some stems were included.

The DM intake on the optimum level of cassava hay in the present study (4.0 % of BW) is in agreement with the reports of Devendra and McLeroy (1982), who stated that lactating goats in the tropics seldom exceed an intake of 4 to 5% of live weight. The CP intakes obtained in the present study were in the range for protein requirements of goats in the tropics (Devendra and McLeroy, 1982).

Barry (1985) considered the ideal concentration of condensed tannins was from 2 to 3% of DM, since tannins can have a beneficial effect by protecting the protein degraded in the rumen by forming protein-tannin complexes. In the present studies total condensed tannins varied from 0.19 to 0.74% of DM intake which is probably too low to have any negative effect on the nutritive value of the diets.

Increasing levels of cassava hay supplementation in the diet resulted in increased milk yield, probably due to a higher intake of proteins as well as possible effects of bypass protein from the cassava hay as claimed by Wanapat et al. (1997). Supplementation with cassava hay can lower concentrate use and improve milk yield and milk composition.

Conclusions

Cassava hay is a valuable supplement for lactating goats fed a basal diet of rice straw, molasses-urea block and cassava root and using cassava hay in the diet will increase the economic return for the farmer.

Table 1. Chemical composition of the experimental feeds (means and SE)

Treatment	Rice straw + Urea	Cassava hay	Cassava root	MUB*
Number of samples	6	6	4	4
DM, g/kg	477±.8.9	914±11.1	887±14.1	545±23.1
g/ kg DM				
N*6.25	158±3.2	191±5.1	24±1.6	216±12.4
Ash	118±7.3	98±2.3	15±1.1	178±8.3
NDF	717±14.2	402±6.6	55±3.6	-
ADF	487±13.1	307±12.6	25±3.2	-
Ether extract	17±1.6	103±3.4	22±4.3	-
Condensed tannins	-	24±2.6	-	-
HCN (mg/kg DM)	-	128±9.4	-	-

*Molasses urea block: rice bran:45%; molasses:40%; urea:6%; lime:3%; mineral:4%; salt:2%

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Table 2. Effect of cassava hay supplementation on feed intake (least squares means and SE)

Treatments	CH0	Planned supplementation with cassava hay CH100	CH200	CH300	CH400	CH500	SE
Feed offered, g DM/day							
Cassava hay	0	116	231	351	471	582	
Rice straw+5% urea	859	749	639	524	405	277	
MUB	125	125	125	125	125	125	
Dried cassava root	603	603	603	603	603	603	
Feed intake, g DM/day							
Cassava hay	0^{f}	99^{e}	186^{d}	270^{c}	308^{b}	332^{a}	3.3
Rice straw+5% urea	421^{a}	347^{b}	322^{c}	275^{d}	181^{e}	122^{f}	7.2
MUB	102	101	98	104	100	101	2.0
Dried cassava root	600	599	600	597	598	598	1.2
DM intake total, g	1124^{b}	1147^{b}	1207^{ab}	1248^{a}	1188^{ab}	1154^{b}	8.7
DM intake, % of BW	3.53^{d}	3.61^{cd}	3.83^{b}	4.04^{a}	3.90^{ab}	3.72^{bc}	0.027
CP intake, g/day	108^{d}	114^{c}	126^{b}	134^{a}	132^{a}	131^{a}	1.3
CT* intake, g/day	0^{f}	2.5^{e}	4.3^{d}	6.2^{c}	7.5^{b}	8.4^{e}	0.05
CT intake g/kg DM intake	0^{f}	1.9^{e}	3.6^{d}	4.9^{c}	6.5^{e}	7.4^{a}	0.06
HCN mg/kg DM intake	0	11^{e}	20^{d}	29^{c}	32^{b}	35^{a}	0.3

CT=condensed tannins; $^{a,b,c,d\,e}$ Means within rows with different superscripts differ significantly (P<0.05)

Table 3. Effect of cassava hay supplementation on the live weight change of does and kids, milk production, feed conversion ratio (FCR) and feed cost (least squares means and SE)

Treatments	Planned supplementation with cassava hay CH0	CH100	CH200	CH300	CH400	CH500	SE
Initial BW does, kg	31.2	31.9	33.5	33.8	32.1	34.5	
Weight changes does, kg	-3.1^{a}	-2.0^{c}	-2.2^{b}	-1.4^{d}	-0.5^{f}	-0.7^{e}	0.35
LWG kids, g/day	80^{c}	81^{c}	83^{c}	83^{c}	93^{b}	99^{a}	6.1
Milk yield, g/day	882^{e}	979^{d}	1164^{c}	1327^{b}	1532^{a}	1381^{ab}	20.3
FCM, g/day	885^{f}	992^{e}	1187^{d}	1361^{c}	1578^{a}	1439^{b}	21.1
Milk composition, %							
Total solids	17.4^{b}	17.9^{ab}	18.1^{a}	18.3^{a}	18.3^{a}	18.2^{a}	0.21
Protein	4.24^{b}	4.27^{b}	4.39^{ab}	4.42^{ab}	4.50^{a}	4.48^{a}	0.14
Casein	3.20	3.19	3.19	3.22	3.19	3.18	0.081
Fat	4.02^{b}	4.09^{ab}	4.13^{ab}	4.17^{ab}	4.24^{a}	4.28^{a}	0.091
Feed conversion ratio for milk production							
FCR (kg DM/kg milk)	1.37^{a}	1.30^{b}	1.05^{c}	0.98^{c}	0.88^{d}	0.86^{d}	0.024
FCR (kg CP/kg milk)	0.136^{a}	0.134^{a}	0.108^{b}	0.106^{b}	0.098^{c}	0.095^{c}	0.0027

^{a,b,c,d,e,f} Means within rows with different superscripts differ significantly (P<0.05)

* 4% Fat Corrected Milk= (0.4)(kg of milk) + 15 (kg of fat)