MILK PRODUCTION AND FEED CONVERSION RATIO OF SOKOTO GUDALI COWS FED MORINGA LEAVES ENSILED WITH CASSAVA PEELS

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Abstract
Ruminant feeding during the dry season is limited by low protein levels in available forage. Moringa Leaf (ML) contain high level of Crude Protein (CP) that could be used to upgrade low nitrogen ingredients and ensiled for dry season feeding of animals. The use of ML as silage mixture with Cassava Peels (CSP) for feeding cattle is not adequately documented. Therefore, this study was carried out to evaluate the use of ML and CSP silages for milk production in Sokoto Gudali cows.Silage mixtures of ML-CSPwere made in ratios 80:20, 60:40 and 40:60. Average daily intake (ADI), milk yield (MY) and feed conversion ratio (FCR) in cows offered ML-CSP silages were determined using three lactating Sokoto Gudali cows in a 28 daycross-over design and a wear out period of 7 days. Data were analysed using descriptive statistics and ANOVA, p = 0.05 taken as level of significance.The ADI of cows fed MLCSP (80:20, 60:40, 40:60) silages were 8.38, 10.08and 11.36kgDM; MY of 4.80, 4.40 and 5.30L/day and FCR 1.78, 1.94 and 2.63 respectively.The ADI, MY and FCR differed significantly (P>0.05) among dietary treatments. The ADI was highest for ML-CSP (40:60) silage while the least consumption was in ML-CSP (80:20). Cows fed ML-CSP (60:40) diet had the highest MY while ML-CSP (40:60) had the lowest. The best FCR was however obtained with ML-CSP (80:20) while ML-CSP (40:60) silage was the least.Moringa oleifera/cassava peels mixture of 60:40 improved the milk yield of Sokoto Gudali cow.

Introduction

Demand for milk and its products is rising in Nigeria (Olorunnisomo 2013)Increasing local milk production is therefore imperative. Zebu cattle are by far the most common cattle type found and they provide the bulk of locally produced milk (RIM, 1992).). Milk production from Sokoto Gudali is low with lactation yields varying from 295 to 650 kg under extensive management, and 800 to 1300 kg with high nutrient intake (Ngere, 1985; Das, 1999; Boly *et al.*, 2001; Bayemi *et al.*, 2005; Yilma *et al.*, 2006; Idris *et al.*, 2011). Although opinions differ on the genetic potential of zebu cows for milk production, high yields of 1183 - 2585 kg/lactation from the Sahiwal cow (Bajwa *et al.*, 2004; Zafar *et al.*, 2008; Dongre *et al.*, 2011), indicate that zebu breeds can be managed for higher milk production with proper selection, adequate nutrition and improved management practices.

Native pastures in Nigeria are grass-dominated and nutritional problems encountered by zebu cattle are associated with low protein intake, poor digestibility of tropical grasses and scarcity of forage during the dry season (Crowder and Chedda, 1982; Adamu *et al.*, 1993; Pamo and Pieper, 2000). The resultant effect is that grazing cattle are unable to meet their protein and energy needs from pasture, leading to low milk production. Since scarcity of forage during the dry season poses a serious limitation to cattle production, ensiling excess forage during the wet season should enhance productivity of these animals on a year-round basis.

Moringa leaves contain higher protein than cassava peels and have greater potentials to improve nutrition of grazing animals (Wilkins 2001). Use of Moringa leaves as silage materials is expected to improve protein supply to dairy cattle. Cassava peels on its own has readily fermentable carbohydrate but is limited in crude protein content. Addition of cassava peels, a cheap source of readily fermentable carbohydrate in Nigeria, has been shown to improve the ensiling quality of tropical grass and legumes (Olorunnisomo, 2011; Olorunnisomo and Fayomi, 2012). This study was aimed at evaluating the milk yield and feed conversion ratio of Sokoto Gudali cattle fed Moringa leaves ensiled with cassava peels.

Materials and methods

Study area: The experiment was conducted at the Dairy Unit of the Teaching and Research Farm, University of Ibadan, Ibadan, Nigeria (3°45′E, 7°27′N; at 220m above sea level). Annual rainfall ranges from 1150 - 1500mm.

Preparation of silage: Moringa leaves cut after 45 days of regrowth were cut to 3cm lengths using automated forage chopper. The forages were mixed with chopped cassava peel. Silage materials

were mixed on a wet basis. The mixtures were ensiled inside 4 litre plastic buckets (mini silos) in triplicates for laboratory analysis, and 120 litre plastic drums for the milk production study.

Treatments:

Treatments correspond to the following experimental diets:

Moringa leaves ensiled with 20 % cassava peels (80%ML-20%CSP)

Moringa leaves ensiled with 40 % cassava peels (60%ML-40%CSP)

Moringa leaves ensiled with 60 % cassava peels (40%ML-60%CSP)

Samples were taken for proximate composition using the general procedures of AOAC (2005). DM concentration in the silage was determined using a forced draught oven at 65°C until a constant weight was obtained. The values obtained were corrected for loss of volatile compounds by multiplying with the correction factor of 1.056 (Fox and Fenderson, 1978). Detergent fibre components were determined according to methods of Van Soest and Robertson (1985).

Milk production study: Three multiparous Sokoto Gudali cows weighing between 295 and 350 kg were used for the milk production trial using a cross-over design. All cows used calved within one month of each other. Animals were housed in individual pens and fed one of three experimental diets (silages) for a period of 28 days after which they were switched over to the next diet for another 28 days such that at the end of 84 days all animals had been placed on each of the three diets. Seven days were allowed for adjustment to the new diet at switch-over periods and experimental measurements were taken within 21 days. Animals were exercised daily by walking to the milking shed which was situated at 100m from the experimental shed. Silages were offered twice daily (*ad libitum*). Silage intake was measured by deducting remnants from the quantity served. Fresh water was offered free choice on a daily basis.

Milking was done by hand twice daily at 7am and 4pm in the presence of the calf. Milk let-down was stimulated by the suckling the calf for 5 minutes after which the cow was milked. Weight of the calves was taken before and immediately after suckling to estimate milk intake by the calf. Calves were separated from cows after milking and part of the milk collected was fed back to the calves using a nipple-bottle. Milk yield was calculated as the summation of milk off-take and intake by the calf.

Experimental design/statistical analysis: The experimental design adopted for this study was the cross-over design. Data obtained were subjected to analysis of variance and significant means were separated by Duncan's multiple range tests using the procedures of SAS (1995).

Results and discussion

Table 1 shows the chemical composition of silages and concentrate fed to Gudali cows in an 84-day feeding trial. Dry matter content of 40%ML-60%CSP silage was higher than 60%ML-40%CSP silage. 80%ML-20%CSP silage had the least DM content indicating that DM increased with increasing levels of CSP. As expected, crude protein content of the silages increased with increasing levels of Moringa apparently due to the higher protein content of Moringa leaves. Fibre and ether extract were higher at higher levels of Moringa. From the chemical composition of the silages, there is a clear advantage in ensiling Moringa leaves with cassava peels as the Moringa leaves make up for the protein deficiency of cassava peels while the cassava peel also enhanced the available energy as indicated by the higher values of the ether extract and nitrogen free extract with increasing levels of cassava peels.

Milk yield and feed conversion ratio (FCR) of Sokoto Gudali cows fed Moringa leaf silage are presented in Table 2. DM intake of silage varied significantly ($P < 0.05$) among the dietary treatments. Cows consumed more 40ML+60CSP silage than the other two silages. This is certainly as a result of higher levels of cassava peel in this silage above the other two. This suggests that when silages of Moringa and cassava peels are offered, Sokoto Gudali cows will always choose a cassava peel based diet before a Moringadiet. Since dietary preference of animals is important in formulating practical diets, ensiling Moringa leaves with cassava peels appears to be a veritable means of improving the nutrition of Sokoto Gudali cows.

Milk yield of the cows varied significantly with dietary treatments. Highest milk yield was recorded when cows were fed 60% ML - 40% CSP silage and least when fed 40% ML-60% CSP silage. Observation in this study shows that milk yield was a response to total DM and protein contents of the diet. Although DM content was highest for 40% ML- 60%CSP, protein content was highest for 80%ML- 20%CSP. Since DM content also represents energy content, the higher milk yield observed in 60%ML-40%CSP than 40%ML-60%CSP and 80%ML-20%CSP proves that energy-protein ratio in cattle feeds has greater influence on milk yield than total DM content.

Table 2 also shows the FCR of the cows fed the various silages. FCR is a measure of efficiency of feed utilization and economic gains expected from livestock feeding (Olorunnisomo, 2007). A low FCR is an indication of efficient feed utilization and higher economic returns while a high FCR indicates poor feed utilization and low economic returns from using a particular feedstuff. Although milk yield was highest when cows were fed 60%ML-40%CSP silage, feed conversion ratio was lowest when 80%ML-20%CSP silage was fed. This shows that feed was more efficiently utilized with 80%ML-20%CSP silage than other silage mixtures. Efficiency of feed utilization was higher when higher levels of Moringa were fed compared to cassava peel. Among the silages, feed utilization efficiency was highest for 80%ML-20%CSP silage and least for 40%ML-60%CSP silage. In spite of the apparent preference of cows to higher levels of cassava peels in the silage, feed efficiency was still higher for 80%ML-20%CSP silage thanthe rest. This shows that Moringa silage with addition of appropriate soluble carbohydrate has greater potential for producing milk economically in Sokoto Gudali cattle.

Conclusion

With the addition of cassava peel, adequate fermentation was achieved in Moringa silages. 60%ML-40%CSP silages had significantly higher protein than the other two silages, while 40%ML-60% CSP apparently had higher energy concentration than the other silages. Voluntary intake in this study suggests that Sokoto Gudali cattle prefer silage with more CSP. Milk yield and feed conversion ratio of these animals however, indicated that animal performance was generally higher with higher levels of Moringa than cassava peels in the silage.

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Table 1: Chemical Composition (%) of Moringa leaves ensiled with Cassava Peel

Components	Silages			SEM
	80%ML-20%CSP	60%ML-40%CSP	40%ML-60%CSP	
Crude protein	18.24[a]	15.88[a]	11.52[c]	2.25
Crude fibre	9.12[a]	9.11[a]	7.86[b]	0.66
Ether extract	6.15[a]	5.55[b]	5.50[b]	0.18
Ash	5.86	5.79	5.70	0.007
Nitrogen free extract	67.61[b]	68.61[a]	68.72[a]	0.64
Neutral detergent fibre	18.25[c]	20.08[a]	21.55[b]	0.99
Acid detergent fibre	10.24[b]	11.42[a]	12.57[a]	0.61
Acid detergent lignin.	1.32[c]	1.99[b]	2.32[a]	0.25

ML: Moringa leaves (*Moringa oleifera)*, CSP: cassava peel.

Table2. Milk yield and feed conversion ratio (FCR) of Sokoto Gudali cows fed Moringa leavesensiled with cassava peels

Parameter	80%ML-20%CSP	60%ML-40%CSP	40%ML-60%CSP	SEM
Intake				
Silage Intake (Kg, wet Basis)	36.24[a]	30.79[a]	28.39[b]	1.41
Silage Intake (Kg, DM)	8.38	10.08	11.36	1.01
Intake (%BW)	3.24[c]	3.90[b]	4.40[a]	0.11
Protein Intake(kg, DM)	1.54[b]	1.87[a]	0.91[c]	0.07
Milk yield				
Milk off take (L/day)	4.00[a]	4.20[a]	3.40[b]	0.09
Milk taken by calf (L/day)	0.80	1.10	1.00	0.06
Total Milk yield,(L/day)	4.80[ab]	5.30[a]	4.40[b]	0.10
Total Milk yield (kg/day)*	4.70b	5.19a	4.31c	-
Feed conversion ratio (intake/milk yield)	1.78[c]	1.94[b]	2.63[a]	0.08

ML: *Moringa leaves,* CSP: cassava peel, EG: Elephant grass (Pennisetum purpureum)
*Milk density = 1.022 at 28°C