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Effect of Two Cowpea (*Vigna unguiculata*) Fodder Cultivars as Supplements on Voluntary Intake, Milk Yield and Manure Production of Bunaji Cows

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Abstract
The feeding value of fodder from two cowpea cultivars to a basal maize stover diet was investigated using fifteen lactating White Fulani (Zebu) cows. The two cultivars were IT-716 and 994-DP. Diet was constituted as 50g DM/kg live weight and each of the cultivars was supplemented at 50% of the daily dry matter requirement of individual animals. The experimental design was a complete randomize. The parameters measured included feed intake, milk yield and composition and manure production. In a separate trial, dry matter degradation of the fodder was assessed. There were no significant differences in dry matter intake of the supplements. However, the dry matter intake of stover in the control diet was higher than those on the supplemented groups.

The milk yields ranged from 887 to 1378 ml/day. Milk yield differed among treatments. Supplementation did not affect ($P > 0.05$) fat, protein, total solids and ash contents of the milk across the treatments. Manure productions were not significantly different among the treatments. Similarly, content of N, P and K in manure were comparable among the treatments except for N that was lower ($P < 0.05$) in the control group. The dry matter degradation was influenced by the fodder cultivars. The feeding of dual-purpose forage legumes residues could enhance milk production in lactating Zebu cows. This may be further increased by exploring other ways of improving feed residue utilization in the dry season.

Keywords: Lactating Zebu cows, forage legume, milk yield, milk composition, cowpea, Vigna unguiculata

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1 Introduction

Poor nutrition remains the most widespread technical constraint to good animal performance in sub-Saharan Africa (Mohammed Saleem and Fitzhugh, 1995). This becomes more critical during the dry season when feed availability are not only inadequate, but the quality extremely poor. Various options have been advocated as possible solutions to this perennial problem. This includes feeding of treated and, untreated crop residues or integration of forage legumes into the feeding strategies (Nnadi and Haque, 1988). Although feeding of forage legumes has been found easily adoptable, the practice is not attractive to the farmers. This perhaps may be due to their limited immediate benefits that do not go beyond soil maintenance and nitrogen economy of biomass (Ibrahim, 1994). Farmers do not pay particular attention to the planting of pure legume stands rather greater emphasis is on the cultivation of food crops. In an emerged (Jabbar, 1993) integrated crop-livestock farming systems of derived savannah, planting of dual-purpose legumes is gaining popularity. Apart from its grains that yield immediate economic returns, it is a good source of dietary protein. It's fodder is also a good dry season feed supplement to livestock. While ample information are available on the use of forage legumes as supplement (Larbi *et al.*, 1993; Umunna *et al.*, 1983; Said and Adugna Tolera, 1993) information on fodders from cowpea cultivars grown as pure stand after grain harvest as a feed supplement to poor quality crop-residues is very scanty. This study was designed to investigate variation in the quality of fodder from two cowpea cultivars on lactating Bunaji cows fed on poor quality basal diet of maize stover in the dry season.

2 Materials and Methods

2.1 Site

The study was conducted in the dry season between November and February 1997 at the International Livestock Research Institute Sub-humid zone (International Institute of Tropical Agriculture campus) Ibadan, Nigeria (latitude 7° 30'N and longitude 3°4'E). Annual rainfall averages 1250mm and occurs from April to November with a marked dry season from December to March. The wet season can be divided into major-wet (April to July) and minor-wet (September to November) seasons.

2.2 Animal Feeds and Feeding

Fifteen white Fulani (Zebu) cows with a mean body weight of 270kg±2.5 were used for the study. They were selected from a herd of cows synchronized for oestrus using prostaglandin (PGF2α) and bred by a white Fulani bull. The calves were allowed to suckle their dams for the first three weeks post partum. At the start of the experiment, 30 days post partum, the calves were separated from their dams. The cows were randomly allocated to three treatments using a complete randomized design of five animals per treatment. The treatments were 100% maize stover, 50% maize stover + 50% cowpea 716 and 50% maize stover + 50% cowpea 994. Both feeds were offered in the same trough after proper mixing. Feeds were offered twice daily at 08.00h and 14.00h, and orts were removed daily at 07.30h and separated and weighed. Diet was constituted as

50g DM/kg body weight. Salt mineral block and fresh water were provided for the cows in each pen through out the trial.

2.3 Milk and Milking

Milk yield of the cows were measured daily using a calibrated measuring cylinder and recorded. Milking was done twice at 08.00h and 18.00h by manual extraction. Milk samples were taken at each milking, bulked for the number of days and stored in the deep freezer until required for analysis. The calves were fed with part of the extracted milk.

2.4 Manure collection

Animals were kept in individual cubicles with concrete floor covered with wood shavings. Each animal was fitted with harness and bags for manure collection. Manure was collected for two days every week at 7.00h in the morning bofore the feeding. The animals had been previously trained.

2.5 Degradation study

The degradation characteristics of the stem and leaf of the fodders were assessed by the nylon bag technique (Orskov *et al.*, 1980). Duplicate bags containing 3g of the samples ground to pass through a 2.5mm sieve were incubated for 6, 12 and 48h in three rumen- fistulated Bunaji castrates.

The animals were individually housed and fed fresh guinea grass (*Panicum maximum*) and wheat bran at a ratio of (3:1) of their daily dry matter requirement as supplement. They had free access to drinking water and salt licks.

2.6 Chemical Analysis

The feed sub samples were ground in a hammer mill to pass through a 1.00mm sieve and oven dried at 60°C for 48h to determine dry matter contents. Protein in feed and milk samples was determined by the Kjeldahl method (AOAC, 1980) while milk fat was measured by the Gerber's method (Davis, 1959). NDF and ADF in the feed were determined by the method described by Goering and Van Soest (1970).

2.7 Statistical Analysis

he experimental design was a complete randomized. Voluntary feed intake, milk yield and composition as well as manure production were subjected to analysis of variance technique using general linear model (GLM) procedure (S.A.S. Institute, 1987). Differences between the treatment means were considered to be significant at $P < 0.05$.

3 Results and Discussion

3.1 Chemical Composition

The nutrient composition of the basal diet (maize stover) and the two supplementary feeds is shown in Table 1.

The crude protein (CP) content of the supplements were generally higher than the basal diet. In contrast, the neutral detergent fibre (NDF) of maize stover was higher than the two supplements.

The neutral detergent fibre (NDF) values of the samples ranged from 635 to 771g/kg DM. Fodder from cultivar 716 had higher CP and lower NDF contents than 994-cowpea cultivar. The ADF values were similar among the supplements but lower in the basal diet.

The CP level in the basal diet was lower than that of the legume supplements partly due to the poor quality maize stover used for the study. The CP value is however typical of matured tropical grasses (PRESTON and LENG, 1987) which limits feed intake (MILFORD and MINSON, 1968).

Table 1: Chemical composition (g/kg DM) of experimental diets.

	Fodders		
Component	*Maize stover*	*994-DP*	*IT-716*
Crude protein	47.8	115.0	137.8
Neutral detergent Fibre (NDF)	771.2	668.0	634.8
Acid Detergent Fibre (ADF)	475.4	533.5	510.8

3.2 Degradation Study

Within each cultivar, leaf was better degraded than the stem (Fig. 1). However, a distinct higher degradation pattern was observed for stem and leaf of the cultivar 716 than that of 994.

In comparing the two cultivars (Fig. 2), the leaf of 716 was better degraded than that of 994. Similarly, stem of 716 showed a higher dry matter degradation value than the stem of 994. The higher DM degradation of leaf than the stem within and between the cultivars was probably due to a higher CP content in the leaf. Higher CP encouraged proliferation of microbes, which led to a better degradation (PRESTON and LENG, 1987). Similarly, the higher DMD of 716 was probably a reflection of differential nutrient quality especially the CP. This agreed with the report (LARBI *et al.*, 1996) that a significant rumen degradation variation occurred among *Calliandra calothyrsus* provenances.

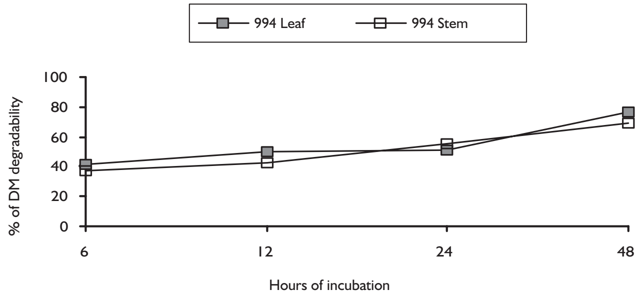
3.3 Manure Production

Manure production was higher for animals on 994-DP fodder than IT-716 and the control group. Except for N, the nutrient contents of manure were higher for 994-DP group. The high nutrient contents probably indicated a low nutrient utilization by animals fed on 994-DP compared with animals on IT-716.

3.4 Feed intake and milk production

There were significant ($P < 0.05$) cultivar effects on voluntary intake, daily milk yield (Table 2) and manure output (Table 3). An inverse relationship between dry matter

Figure 1: Comparative dry matter degradability pattern of leaf and stem within each cowpea cultivar.



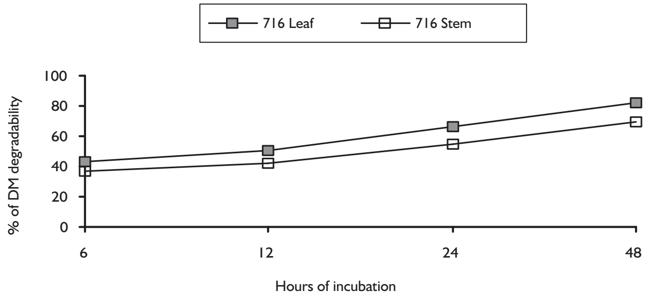
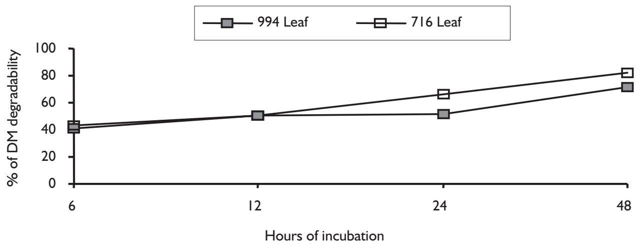
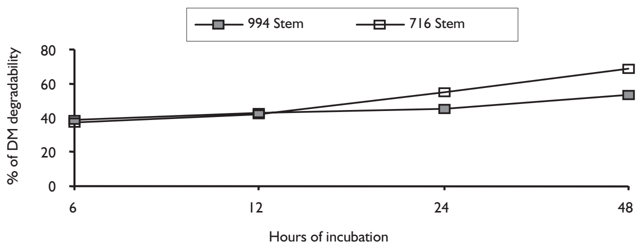


Figure 2: Comparative dry matter degradability pattern of leaf and stem between the two cowpea cultivars.





intake of maize stover and supplement was observed. Basal DM intake by animals in the supplemented groups was more than 48% units lower compared with the control. Animals on cowpea fodder 994-DP cultivar recorded the highest total dry matter intake.

Cultivar influenced ($P < 0.05$) daily milk production. Animals supplemented with 716 produced high milk yield (1.4 l/day), which was 20% units higher than 0.9 l/day recorded in the unsupplemented group.

Generally, consumption of cowpea fodder by lactating Bunaji cows improved ($P < 0.05$) daily milk yield over the control by more than 30%. However, milk quality parameters of protein, total solid, fat and ash contents were not influenced ($P > 0.05$) by the intake of the two cultivars. The trend observed in feed intake of protein from supplemented diets that depressed the dry matter intake from the maize stover was in contrast to the finding of MUINGA *et al.* (1993) who reported that additional feed intake from leucaena foliage did not affect the basal fodder consumption. The higher DMI of the basal diet agreed with the findings of ANINDO and POTTER (1986); KHALILI *et al.* (1992) on protein concentrate supplements. They observed that intake of concentrate supplements depressed voluntary intake of basal forage. The improved daily milk yield from animals on 716 cultivar can be explained by the combination of its higher CP and low NDF relative to the other two diets. This was supported by the report of RUIZ *et al.* (1995) that an increased milk yield was supported by decreased dietary NDF concentration.

Table 2: Voluntary feed intake, milk yield and composition of Bunaji cows given a basal diet of maize stover supplemented with two cultivars of cowpea fodder.

	Treatments			
Parameters	*Control*	*994-DP*	*IT-716*	*SED*
Intake (g/kg $BW^{0.75}$)				
Maize stover	67.9	41.1	34.2	1.3
Supplement	-	42.7	41.8	1.8
Total	67.9	83.8	76.0	4.6
Intake (g/h/d)				
Maize stover	4834	2720	2786	694.8
Supplements	2845	2115	368.7	
Total	4934	5565	4901	233.6
Milk yield (ml/day)	885.8	1049.9	1377.8	74.6
Milk composition (%)				
Fat	3.2	3.2	3.3	0.5
Protein	4.1	4.3	4.2	0.7
Total solid	17.3	15.2	16.5	1.4
Ash	0.9	0.9	0.8	0.1

Table 3: Effect of fodders on manure production and nutrient composition.

	Treatments			
	Control	*994-DP*	*IT-716*	*SED*
Manure production (kg/D/day)	0.89	1.14	0.83	0.32
Nutrient composition (%)				
N	1.39	1.51	1.53	0.10
P	0.46	0.48	0.39	0.13
K	1.18	1.33	1.08	0.32

The milk yield recorded in this study compared favorably to the values obtained in a study by OLALOKU and OYENUGA (1997) in which lactating zebu cows grazed on improved tropical grass/legume pasture mixture. However, the production levels were low compared to supplementing lactating zebu cows with concentrate while grazing natural or sown pasture (SCHUMAN, 1968; ADENEYE, 1993). The low production obtained suggested that the level of nutrients available in the feeds offered could not meet the nutrients required to sustain high milk production. Nevertheless, dry season supplementation of lactating Bunaji cows with dual-purpose legumes could be a sustainable way of improving the feeding values of poor quality crop residue and enhancing the anticipated benefits from crop-livestock integration by poor African smallholder farmers.

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