CHEMICAL COMPOSITION, *IN VITRO* AND *IN-SACCO* DEGRADABILITY OF DRY MATTER OF $APBN_1$

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ABSTRACT

Andhra Pradesh Bajra $Napier_1$ ($APBN_1$) variety of hybrid napier was evaluated for its fodder quality traits using chemical, *in vitro* and in-sacco techniques. OM, CP, EE, total carbohydrates and TA content of $APBN_1$ variety of hybrid napier were 89.38, 14.98, 2.58, 16.17 and 10.62%, respectively on DM basis. Fiber fractions, NDF, ADF, hemi cellulose, cellulose, lignin and silica content were 68.8, 36.2, 32.6, 29.9, 5.7 and 0.63%, respectively. The calcium, phosphorus, content were 0.09, 0.7%, respectively and the trace element, iron, Zinc and molybdenum content in $APBN_1$ were 341.76, 106.38 and 538.51 ppm, respectively. The IVDMD value of $APBN_1$ was 61.4%, when incubated with buffalo rumen liquor. *In-sacco* studies revealed that the effective degradable DM (EDDM) and protein of $APBN_1$ variety of hybrid napier was 57.8 and 34.0%, respectively. This study concluded that $APBN_1$ could be used as a good roughage and alternative to existing green fodders for ruminants.

Keywords: *Bubalus bubalis*, buffaloes, $APBN_1$, chemical composition, IVDMD, EDDM, ERDP

INTRODUCTION

India has a huge livestock population of over 555 millions (FAO, 2011) besides poultry, yet the production of milk and other livestock products were about lowest per animal compared to the world. Situational analysis reveals that one of the main reasons for the low genetic productivity of our livestock is malnutrition, under nutrition or both, besides the low genetic potential so as to meet the milk and meat requirements of an average Indian. The requirement and availability of green fodder is 839.07 and 743.46 million tones, respectively and the deficit is 19.9% (Ravi Kiran *et al*., 2012). Feeding of protein/ energy rich concentrates has been recommended to improve milk and production from ruminants. However, commercial concentrates are too expensive for the farmer and the existing fodder are not available in adequate quantities for livestock production (Mwangi *et al*., 1995). Hence, to increase the green fodder production and to reduce the feed cost, efforts have been intensified to evolve outstanding hybrid forage developed by erstwhile Andra Pradesh Agricultural University is $APBN_1$ (Andhra Pradesh Bajra Napier 1). It is a cross between pearl millet *(Pennisetum*

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americanum) line IPM-12159 (Nigeria) and Napier grass *(Pennisetum purpureum)* kasate-52440 and also it is a non-lodging type fodder more suitable to coastal region where humid and hot climate exists. The green forage yield is 250 to 300 tons/ha in 6 to 7 cuts per year. Literature on nutrient composition and digestibility on $APBN_1$ variety of hybrid napier is scanty. Hence, the present study was conducted to find out the fodder quality traits by *in vitro* and *in sacco* techniques.

MATERIALS AND METHODS

The $APBN_1$ fodder was sown in the university farm following recommended agronomical practices. The samples were collected at pre-flowering stage of 45 days, and then dried in hot air oven at 70°C for 48 h. The samples were analyzed for proximate constituents (AOAC, 2000) and cell wall constituents (Van Soest and Robertson, 1985) after grinding in a Wiley mill using mesh screen of 2 mm. Minerals content were estimated by atomic absorption spectrophotometer (Perkin Elmer, model-2380). Four permanently cannulated graded Murrah buffalo steers were used to determine the dry matter (DM) and protein degradability and Two stage *in- vitro* fermentation technique (Tilley and Terry, 1963) was used keeping the period of incubation during the first stage at 48 h for the determination of *in vitro* DM digestibility (IVDMD) using rumen liquor collected from permanently cannulated graded Murrah buffalo steers. The cannulated Murrah buffalo steers were maintained on ration with 50:50 roughage to concentrate ration and were fed $APBN_1$ *ad-libitum* and 4.5 kg concentrate mixture containing 17.25% CP, respectively to meet the requirement (ICAR, 1998).

Dry matter and protein degradability were determined using nylon bag technique (Kempton, 1980). Nylon bags of 25 to 28 µm mesh size with a bag area of 70 cm^2/g DM were used to incubate the samples. The nylon bags with sample size of 3 g for DM and 5 g for Crude protein (CP) were incubated in duplicate simultaneously in the rumen of 4 fistulated graded Murrah buffalo steers (279±2 kg) for 12, 24, 36, 48 and 72 h for DM disappearance and 3, 6, 9, 15 and 24 h for protein disappearance. The Murrah buffalo steers were maintained on a ration of green $APBN_1$ fodder and conventional concentrate mixture. After each incubation interval the bags were retrieved, washed under tap water and dried at 70°C till constant weight. From the per cent DM and protein disappearance data, constants i.e., a (readily soluble), b (insoluble but degradable with time) and c (rate constant) were derived using computer model (McDonald, 1981). The effective degradable dry matter (EDDM) and effective rumen degradable proteins (ERDP) were determined at an out flow rate of 0.05/h (Orskov and McDonald, 1979).

RESULTS AND DISCUSSION

Proximate composition and fibre fractions of $APBN_1$ fodder are presented in Table 1. The crude protein (CP) content was 14.98% and it was higher than hybrid napier (10.15%), yeshwant (Kumbhar *et al*., 2003) and napier bajra hybrid varieties (10.9%), PBN-233 and PBN-83 (Singh *et al*., 2001). The higher protein may be due to more leafiness nature of the fodder and increased leaf and stem ratio (VanSoest, 1982; Minson, 1990).

The crude fibre content in $APBN_1$ was 38.10% and, was lesser than the sugarcane (38.44%) among commonly used non- legumes,

Table 1. Chemical composition (DM basis) of $APBN_1$ variety of hybrid Napier grass.

Proximate	%	Cell wall content	%	Macro minerals	%	Micro minerals	ppm
DM	16.70	NDF	68.80	Ca	0.09	Fe	341.7
OM	89.38	ADF	36.20	P	0.70	Mn	-
CP	14.98	Hemicellulose	32.60	Mg	1.18	Co	-
EE	2.84	Cellulose	29.90	K	1.33	Zn	106.4
CF	38.10	ADL	5.70	S	0.20	Mo	538.51
TA	10.62	Silica	0.63	-	-	-	-
NFE	33.46	-	-	-	-	-	-

Table 2. *In-sacco* DM and protein disappearance (%), kinetis and effective degradable DM (EDDM) and protein (ERDP) of $APBN_1$ variety of hybrid Napier grass.

Incubation period	DM degradability	Incubation period	Protein degradability
12	54.26	3	11.75
24	63.75	6	22.90
36	69.63	9	26.64
48	74.99	15	37.92
72	81.18	24	47.05
Degradation kinetics			
a	42.15		1.68
b	46.43		54.16
c	0.0255		0.0737
a + b	88.58		55.84
ED (%)	57.8		34.0

Each value is mean of eight observations.

maize, jowar and hybrid napier in cattle (Kumbhar *et al*., 2003), whereas in napier bajra varieties PBN-233, PBN-83 it was 29.2% and 28.2%, respectively (Singh *et al*., 2001). The DM, OM, NFE, TA and fibre fractions such as NDF, ADF, hemicellulose, cellulose, lignin, silica values were 16.20, 89.38, 33.46, 10.62 and 68.8, 36.2, 32.6, 29.9, 5.7, 0.63, respectively. The higher CP and lower NDF content in the $APBN_1$ variety suggest that it is a better variety for feeding.

The mineral analysis revealed that $APBN_1$ have a high P, Ca, Mg, K and S when compared to commonly utilized forages. Further, the trace element Se, Cu, Co and Mn were not present at detectable levels (<1 µg/g).

The IVDMD value of $APBN_1$ was 61.4% and was higher than Napier bajra variety PBN-233 (57.8%) and PBN-83 (55.5%) as reported by Singh *et al*., 2001. The DM degradability of $APBN_1$ variety increased linearly as its incubation period increased in the rumen. The average DM degradability increased by 9.49, 15.37, 20.73 and 26.92% units, by extending the incubation period in the rumen of buffalo from 12 to 24, 36, 48 and 72 h, respectively (Table 2). The instantly soluble DM fraction (a) and insoluble but degradable fraction with time (b) were almost equal in $APBN_1$ with an effective degradable DM (EDDM) value of 57.80% (Table 3) and the EDDM value of $APBN_1$ was higher than that of Colonial guinea grass (Devasana *et al*., 1994), bajra (Gupta *et al*., 2007) and Co-2 and Co-3 variety (Subhalakshmi *et al*., 2011). Linear increase in the protein disappearance of an $APBN_1$ was also observed with increase in the period of incubation in the rumen. There was 47.05% of protein disappeared by the end of 24 h incubation (Table 3) indicating its moderate solubility in rumen liquor. The a and b fractions of $APBN_1$ were 16.88 and 54.16% (Table 3). The effective rumen degradable protein (ERDP) was 34.0% and was lower than medium maturity and old maturity napier grass (Muia *et al*., 2001). Of the total CP present, nearly 52.95% (7.93 g) was undegradable in the rumen. The RDP and UDP content of $APBN_1$ were 34.0 and 66.0 g per 100 g of protein and 50.93 and 98.86 g/kg DM, respectively and it classified under type C based on protein degradability in the rumen (Wilson and Brigstroke, 1981).

The results of the present study revealed that $APBN_1$ is a potential alternate fodder with high protein, P, Ca and undegradable protein, for feeding of ruminant.

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