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Estimation of biomass yield, chemical composition of five commonly used varieties of non-leguminous fodder

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Abstract
This research was carried out to find out the biomass yield, chemical composition and gas production of five commonly used non leguminous fodders *i.e.* BHN-18 (Bangalore Hybrid Napier), CO-5 (Coimbatore-5), Phule-1, Bundel guinea (Guinea grass) and COFS-31 (Coimbatore fodder sorghum). These fodders were grown in veterinary college hebbal, Bengaluru, Karnataka. The grown fodders samples were collected and analyzed for DM (Dry Matter), CP (Crude Protein), Ash, EE (Ether extract), NDF (Neutral Detergent Fibre), ADF (Acid Detergent Fiber), ME (Metabolizable energy), DOMDM and protein yield as well as biomass yield was analyzed. In this study biomass yield of BHN-18, CO-5, Phule-1, Bundel guinea and COFS-31 were 189.74, 353.08, 224.57, 252.75 and 289.19 t/ha/yr respectively. Proximate analysis showed that bundel guinea and COFS-31 has higher DM and organic matter respectively. BHN-18 has higher CP, EE and TA among the experimental fodders. Higher level NDF and ADF was found in COFS-31.

Keywords: ether extract, biomass yield, proximate principle, acid detergent fiber, dry matter

Introduction
Fodder production forms a major component of dairy cattle and sheep production management. The quality and quantity of fodder are influenced by the type of soil and stage of growth (Yar and Waheed, 1991; Kim *et al*., 2001) [17, 7]. The current status of the deficit of green and dry fodder were 63.50 and 23.56 per cent, respectively in India and the projected deficit of CP and TDN were 45.76 and 33.71 million tones analyzed at 2015 (IGFRI, 2013). To overcome this deficit dairy farmers resort to the enhanced use of costly concentrate feeds, which ultimately increase the cost of production. To control the cost of feeding one has to go towards feeding of different fodder sources like Non-leguminous fodders which are usually tall growing crops with heavy foliage and higher biomass yield compared to leguminous fodder crops having an average of 5-8% of crude protein requiring higher amount of fertilizers as compared to leguminous fodders as they do not have the capability to fix the atmospheric nitrogen (Rao, 2004) [12].
Fodders available for feeding livestock differ in their chemical composition depending on factors such as the variety of fodder, composition of soil, type of fertilizer, irrigation pattern, harvesting pattern and stage of maturity at the time of harvest.

Materials and Methods
Location and climate
The study area is Bengaluru, which is located in the eastern dry zone region at an elevation of 900 m above mean sea level with an annual rainfall of about 679 to 889 mm. The type of soil is been red loamy in major areas with lateritic in remaining areas. The main crops cultivated being Ragi, Rice, Pulses, Maize and Oil seeds.

Study area and sample collection
The study was conducted in the fodder museum maintained under department of livestock production management, Veterinary College, Hebbal, Bengaluru. Representative samples been taken, grounded passing in the mesh size of 1mm and stored in plastic bottles for laboratory analysis.

Biomass yield
The biomass yields of five leguminous fodders were recorded for the period of one year in a

Growing area of 450 sq. ft. Which is then extrapolated to per hectare by doing simple multiplication.

Chemical analysis

Proximate principles

The Samples of different fodders grown in the Fodder Museum, Veterinary College, Hebbal was analyzed for proximate/chemical composition. The dry matter content of feed samples was analyzed by drying the samples to a constant weight in a forced hot air oven at 105 °C. The ash content in the samples will be estimated as residue obtained after incineration of samples at 600 °C for 3 hours. Crude protein (N × 6.25) was analyzed using Gerhardt digestion and distillation unit that agrees with Kjeldahl standards (A.O.A.C, 1995) [1]. The ether extract (EE) content in the feed samples was analyzed after extraction with petroleum ether using the procedure of A.O.A.C. (1995) [1].

Fiber fractions

The neutral detergent fiber (NDF) and acid detergent fiber (ADF) was determined according to the methods described by Van Soest *et al*. (1991) [15].

***In vitro* evaluation**

All the fodder varieties were subjected to rumen in vitro incubation for gas production (RIVIGP) and the ME (MJ/kg DM) was estimated by using procedures of Menke and Steingass (1988) as follows.

Digestible organic matter in dry matter

The digestible organic matter in dry matter (DOMDM) is comparable to the total digestible nutrient (TDN), an expression of energy in ruminant feedstuffs (Van Soest, 1994) [15]. The DOMDM could be therefore considered as the most vital parameter to evaluate the nutritional value of fodders. DOMDM is calculated as a product of OM content (percent) and the digestibility of OM (percent). The yield of DOMDM (per ha) can therefore be considered as yield of energy in fodders.

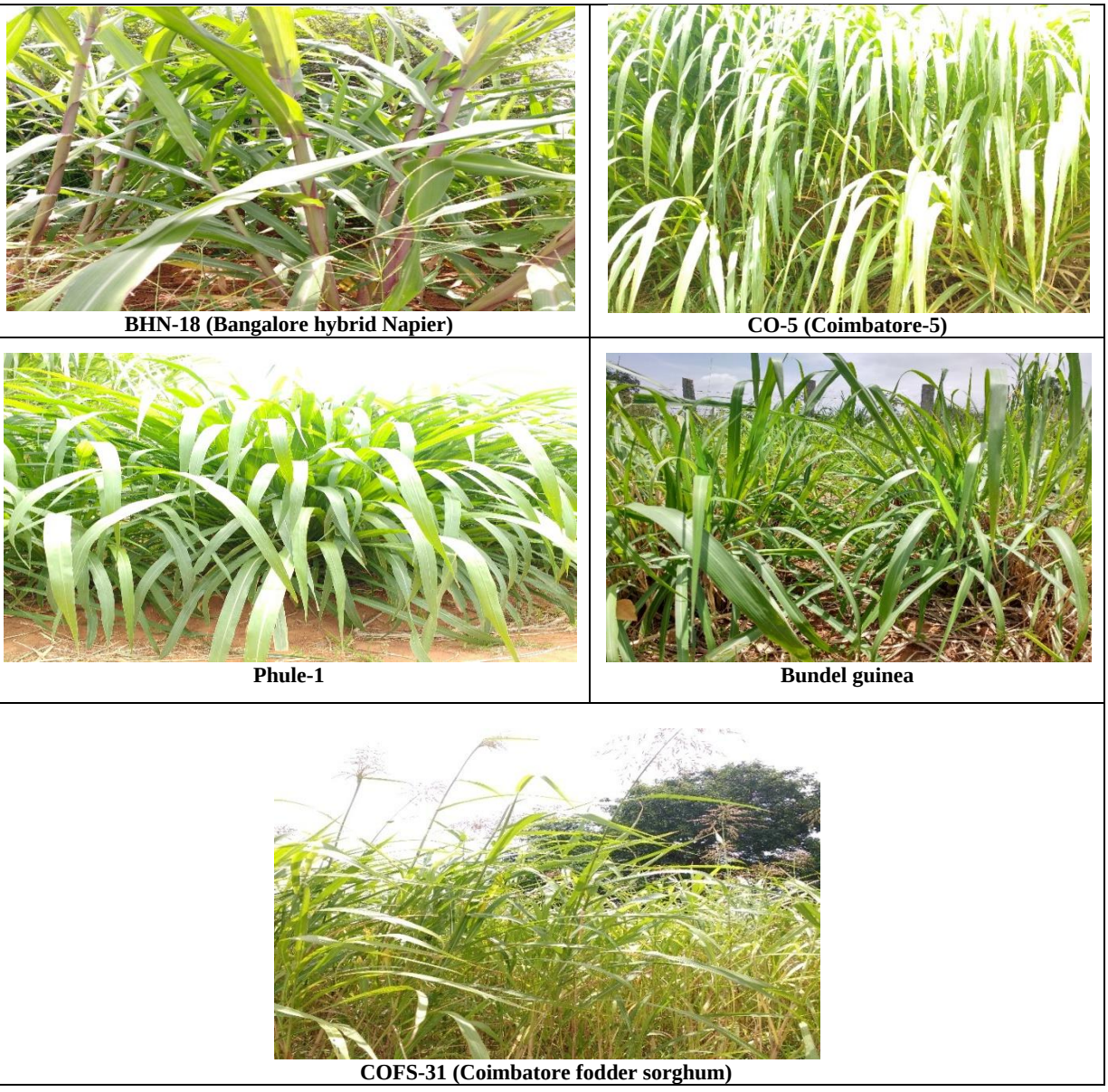

Fig 1: Five varieties of non-leguminous fodders

Results and Discussion

Biomass yield

The biomass yield of non-leguminous fodders were 189.74, 353.08, 224.57, 252.75 and 289.19 t/ha/yr obtained for BHN-18, CO-5, Phule-1, Bundel guinea and COFS-31 respectively. The results obtained are in agreement with Narayana and Dabadghao (1972) [10] for hybrid napiers, Jayanthi (2003) [6] for CO-3 with reported values of 135 to 215 and 375.3 t/ha/yr, respectively. Whereas lower yields of 201.1 and 150 t/ha/yr were noticed by Iyanar *et al.* (2015) [4] for fodder COFS-31 and Wasnik *et al.* (2014) [16] for fodder Bundel guinea, respectively. The difference in the biomass yield of non-leguminous fodder varieties might be due to climatic condition, nature of soil, type of fertilizer, irrigation pattern, agronomical practices and harvesting time (Reddy *et al.*, 2003) [13].

Proximate composition

Crude protein content for fodder BHN-18, CO-5, Phule-1, Bundel guinea and COFS-31 were 8.83, 5.93, 6.26, 5.03 and 5.30 percent, respectively. The results of present study are in concurrence with the study conducted by Jagadamba (2008) [5] for BHN-18, Rao (2004) [12] for guinea variety and Iyanar *et al.* (2015) [4] for COFS-31 were 5.48, 5.20 and 9.86 percent, respectively.

Ether extract for fodder BHN-18, CO-5, Phule-1, Bundel guinea and COFS-31 were 3.35, 1.79, 2.33, 1.33 and 1.20 per cent, respectively. The same values are observed by Rao (2004) [12] for guinea variety and Senthilkumar *et al.* (2009) [14] for COFS variety with values of 1.60 and 2.60 respectively whereas BHN-18 noted higher values compared to Jagadamba (2008) [5].

The per cent of total ash for fodder BHN-18, CO-5, Phule-1, Bundel guinea and COFS-31 were 16.60, 14.26, 12.01, 10.10 and 7.92, respectively. The results of present study are in agreement with Jagadamba (2008) [5] for BHN-18, Premaratne and Premalal (2006) [11] for CO-3, Rao (2004) for guinea variety and Senthilkumar *et al.* (2009) [14] for COFS variety with 13.81, 12.8, 12 and 10.86, respectively.

Fibre fractions

The neutral detergent fibre for fodder BHN-18, CO-5, Phule-1, Bundel guinea and COFS-31 were 71.53, 72.01, 74.52, 75.12 and 76.15 percent, respectively. The results of present study were in agreement with Jagadamba (2008) [5] for BHN-18 and guinea variety and Premaratne and Premalal (2006) [11] for CO-3 with values of 73.75, 71.92 and 74 percent respectively. Whereas lower percent of 66.78 was observed by Senthilkumar *et al.* (2009) [14] for COFS variety.

The acid detergent fibre for fodder BHN-18, CO-5, Phule-1, Bundel guinea and COFS-31 were 41.55, 45.08, 47.07, 51.75 and 53.20 per cent, respectively. The results of present study are in agreement with Jagadamba (2008) [5] for BHN-18, Premaratne *et al.* (2006) [11] for CO-3 and Senthilkumar*et al.* (2009) [14] for COFS variety with values of 48.92, 42 and 48.40 percent respectively.

Metabolizable energy and protein yield

Content of metabolizable energy for fodder BHN-18, CO-5, Phule-1, Bundel guinea and COFS-31 were 7.6, 7.8, 7.71, 6.50 and 6.77, respectively. The results of present studies are in concurrence with findings of Garg *et al.*, (2012) for hybrid napiers, Bundel guinea and fodder sorghum variety with values of 7.46 to 7.53, 7.53 and 8.02 MJ/kg, respectively.

The crude protein yield of non-leguminous fodder varieties BHN-18, CO-5, Phule-1, Bundel guinea and COFS-31-2.37, 4.60, 3.15, 3.26 and 5.19 t/ha/yr.

DOMDM

Digestible organic matter digestibility in dry matter for non-leguminous fodders *viz.* BHN-18, CO-5, Phule-1, Bundel guinea and COFS-31are 15853, 50808, 25363, 26527 and 45071 t/ha/yr.

Table 1: Biomass yield and Chemical composition by five commonly used varieties of non-leguminous fodder

	Nutrient	BHN-18	CO-5	Phule-1	Bundel guinea	COFS-31
Total yield (t/ha/yr)		189.74	353.08	224.57	252.75	289.19
Proximate principles (% DMB)	Dry matter	92.60±0.20	93.39±0.05	93.71±0.07	95.21±0.34	94.25±0.27
	Organic matter	83.40±2.23	85.74±0.00	87.99±0.04	89.90±0.20	92.03±0.50
	Crude protein	8.83±0.66	5.93±0.10	6.26±0.17	5.03±0.09	5.30±0.25
	Ether extract	3.35±0.24	1.79±0.04	2.33±0.27	1.33±0.05	1.20±0.00
	Total ash	16.60±1.42	14.26±0.05	12.01±0.04	10.10±0.13	7.972±0.32
	NDF	71.53±0.18	72.01±0.02	74.52±0.40	75.12±0.25	76.15±0.22
	ADF	41.55±0.15	45.08±0.34	47.07±0.26	51.75±0.19	53.20±0.42
2. Honhenhiem gas test (ml/hr)	RIVGP@24hr	41.37±0.04^{a}	59.33±0.26^{b}	36.81±0.53^{ad}	29.17±2.22^{c}	33.44±1.37^{cd}
3. Energy (MJ/kg DM)	ME	7.6±0.06^{a}	7.8±0.04^{b}	7.71±0.07^{c}	6.50±0.30^{d}	6.77±0.15^{d}
4. DOMDM (t/ha/yr)		15853	50808	25363	26527	45071
5. Protein yield (t/ha/yr)		2.37	4.60	3.15	3.26	5.19

Conclusion

Among the selected non-leguminous fodders CO-5 is high yielding (353.08 t/ha/yr), highest DOMDM (50808 t/ha/yr), with 5.93% of CP, 4.60 t/ha/yr of crude protein yield is well suited for feeding and increasing the animal productivity followed by other fodders viz. COFS-31, Bundel guinea, Phule-1 and BHN-18 in decreasing order.

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