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Short communication

Nutritive quality of hybrid napier cultivars grown under rainfed ecosystem

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Abstract

An experiment with 11 popular cultivars of hybrid napier *viz.* CO-2, CO-3, CO-4, KKM-1, Suguna, Supriya, IGFRI-3, IGFRI-7, DHN-6, PBN-16, and PTH was conducted for one year during 2011-2012. It studied the nutrient composition and oxalate contents of leaves and stems grown under rainfed conditions. Crude protein in leaves was found higher in the cultivars IGFRI-3, CO-3 and DHN-6 (14.2%, 14.1%. and 13.5%). Crude fibre in leaves and stems was high in IGFRI-7. Among the eleven cultivars, the highest oxalate content was observed in the leaves and stems of Suguna and the lowest in CO-4. Considering the overall nutritional quality, *viz*., percentage content of crude protein and mineral content, CO-3 was rated as superior to all other cultivars.

Key words: Fodder grass, Nutrient composition, Crude protein, Oxalate content

In India, the main source of green fodder for livestock has traditionally been natural grass lands, cultivable waste lands, and fallow lands. However, most grasslands in India are inhabited with grasses of low nutritive quality and poor fodder production potential. Continuous dependence on such low quality forage for feeding may affect the production potential and health of milch animals. An alternative is to use nutrient rich and high yielding, but less resource intensive fodder crops. Hybrid napier (also called bajra-napier hybrid or hybrid pennisetum), the F1 hybrid between bajra (*Pennisetum glaucum* (L.) R. Br.) and napier (*Pennisetum purpureum* Schum.), is one such fodder grass that has gained popularity among dairy farmers because of its heavy yielding potential and high nutritive quality. In recent years, several new cultivars of hybrid napier were released and are becoming popular among farmers. Along with high yielding potential and climatic adaptability, nutritional quality is also a criterion for selection by the farmers. Therefore, a study was undertaken to assess the quality parameters of 11 popular cultivars of hybrid napier under rainfed conditions.

The field experiment was conducted during 2011-2012 at the Agronomy Research Farm of College of Horticulture, Kerala Agricultural University. The soil of the experiment site is sandy clay loam (Order: Ultisol). The treatments comprised of eleven cultivars of hybrid napier planted through rooted slips at a spacing of 60 cm x 60 cm. The experiment was laid out in randomized block design (RBD) with three replications by adopting the recommended package of practices of Kerala Agricultural University (KAU, 2007). The first harvest was taken at 75 days after planting and subsequent harvests at 45 days interval. After the fourth harvest, no more harvesting could be planned because of the non-receipt of rains.

Nutritive contents of the cultivars included in the study were assessed based on proximate analysis, elemental composition (AOAC, 1975), and the

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presence of oxalate content (Burrows, 1950). Plant samples from all the treatments were collected at the third harvest; leaves and stems were separated, chopped, and oven dried at 80 ± 5ºC for 24 hours. The samples after grinding were used to find out calcium, magnesium, oxalate content and the five fractions of proximate analysis such as crude protein, crude fibre, total ash, ether extract and nitrogen free extract and expressed as percentage on dry weight basis. The nitrogen content in the plant was estimated by Microkjeldal digestion and distillation method (Jackson, 1958). The nitrogen content thus obtained was multiplied by 6.25 to get the crude protein content of the sample. For estimating phosphorus content, the plant samples were digested using diacid mixture (HNO_3: $HClO_4$ at 2:1 ratio) and the intensity of colour was read in vanadomolybdo phosphoric yellow colour system (Jackson, 1958). The potassium content in the digested plant sample was estimated by using EEL Flame photometer (Jackson, 1958). The Ca and Mg contents were estimated using diacid mixture, and read by Atomic Absorption Spectrophotometer (AAS) (Jackson, 1958). The crude fibre content was estimated using the acid-alkali digestion method (Sadasivam and Manickam, 1992). The ash content in the samples was determined by igniting a known quantity of plant sample at 600ºC for three hours (AOAC, 1975). The ether extract content, which represents the crude fat fraction of the sample, was estimated by extracting the plant fat using the organic solvent, petroleum benzene (AOAC, 1975). Nitrogen free extract of the plant was estimated by subtracting the per cent crude protein, crude fibre, ether extract and ash content from 100. The oxalate content in the plant sample was analyzed colorimetrically as suggested by Burrows (1950). Analyses of variance were performed on all data collected using the statistical package, 'MSTATC'. Duncan's multiple range test (DMRT) was used to compare means (Duncan, 1955).

Nutritive values and oxalate content showed significant differences among the cultivars. Crude protein content which gives an approximate value of protein content in forage crops differed significantly among the cultivars. In general, the percentage content of crude protein was higher in leaves than stems. When crude protein content of both leaves and stems were considered, IGFRI-3 (14.17% and 9.17%) and CO-3 (14.06% and 9.58 %) seem to be superior to others. Vijayakumar et al. (2009) reported that the cultivar CO-3 had an average crude protein content of 10.5 per cent (considering stems and leaves together). The cultivars also differed significantly in terms of crude fibre, which is essential for rumination. More crude fibre was present in stems than leaves. IGFRI-7 has recorded the highest crude fibre in both leaves and stems. Ash content gives an indication of minerals

*Table 1***.** Proximate analysis of hybrid napier leaves and stems (%)

Cultivars	Crude protein		Crude fibre		Ether extract		Nitrogen free extract		Total ash	
	leaf	stem	leaf	stem	leaf	stem	leaf	stem	leaf	stem
CO-2	11.52^{c}	8.33^{bc}	25.43^{d}	34.75^{ab}	2.30^{b}	1.41^{ab}	51.88^{a}	47.44^{d}	8.87^{ab}	8.07^{abc}
CO-3	14.06^{a}	9.58^{a}	26.92^{cd}	28.62^{de}	2.30^{b}	1.26^{bcd}	47.02^{e}	52.21^{b}	9.70^{a}	8.33^{ab}
CO-4	11.46^{c}	7.08^{de}	27.22^{cd}	28.98^{de}	2.80^{a}	1.38^{abc}	49.26^{bcde}	54.29^{ab}	9.27^{ab}	8.27^{ab}
KKM-1	13.23^{ab}	8.19^{bc}	28.50^{bc}	33.67^{b}	2.32^{b}	1.17^{bcd}	47.19^{de}	49.58^{cd}	8.77^{b}	7.40^{c}
Suguna	11.50^{c}	7.92^{cd}	26.67^{cd}	29.87^{cd}	1.85^{cd}	1.34^{abcd}	51.20^{ab}	53.01^{d}	8.87^{ab}	7.87^{abc}
Supriya	12.50^{b}	6.67^{e}	25.55^{d}	28.03^{e}	1.77^{de}	1.10^{d}	50.62^{abc}	55.73^{a}	9.57^{ab}	8.47^{a}
IGFRI-3 (Swethika)	14.17^{a}	9.17^{ab}	26.62^{cd}	31.48^{c}	2.16^{bc}	1.58^{a}	49.52^{abcd}	51.73^{bc}	7.53^{c}	6.03^{d}
IGFRI-7	10.73^{c}	7.71^{cd}	31.05^{a}	36.22^{a}	1.47^{e}	1.13^{cd}	49.22^{bcde}	48.81^{b}	7.53^{c}	6.13^{d}
DHN-6 (Sampoorna)	13.54^{a}	8.52^{bc}	26.18^{d}	31.50^{c}	2.37^{b}	1.42^{ab}	51.34^{ab}	53.06^{b}	6.57^{d}	5.50^{de}
PTH	12.50^{b}	6.15^{e}	29.65^{ab}2	34.33^{b}	1.67^{de}	1.10^{d}	48.68^{cde}	53.22^{b}	7.50^{c}	5.20^{e}
PBN-16	13.54^{a}	8.54^{bc}	8.42^{bc}	30.12^{cd}	1.92^{cd}	1.35^{abcd}	47.39^{de}	52.49^{b}	8.73^{b}	7.50^{bc}

* In a column, means followed by common letters do not differ significantly at 5% level by DMRT

Table 2. Nutrient composition of hybrid napier leaves and stems (%)

Cultivars	N		P		K		Ca		Mg	
	leaf	stem	leaf	stem	leaf	stem	leaf	stem	leaf	stem
CO-2	1.833^{d}	1.333^{bc}	0.250^{ab}	0.233^{a}	1.960^{ab}	1.433^{bcd}	0.267^{a}	0.197^{a}	0.223^{bcd}	0.200^{cde}
CO-3	2.250^{ab}	1.533^{a}	0.234^{ab}	0.220^{ab}	1.900^{ab}	1.700^{ab}	0.213^{ab}	0.207^{a}	0.260^{abc}	0.213^{c}
CO-4	1.833^{d}	1.133^{de}	0.210^{ab}	0.140^{e}	2.000^{a}	1.667^{ab}	0.237^{ab}	0.207^{a}	0.253^{bc}	0.233^{ab}
KKM-1	2.100^{bc}	1.310^{bc}	0.210^{ab}	0.143^{e}	1.510^{c}	1.177^{d}	0.197^{bc}	0.167^{b}	0.207^{cd}	0.190^{de}
Suguna	1.827^{d}	1.267^{cd}	0.270^{a}	0.143^{e}	2.067^{a}	1.333^{cd}	0.203^{bc}	0.200^{a}	0.313^{a}	0.243^{a}
SupriyaI	2.000^{c}	1.067^{e}	0.233^{ab}	0.220^{ab}	1.867^{ab}	1.517^{bc}	0.233^{ab}	0.150^{bc}	0.283^{ab}	0.217^{bc}
GFRI-3(Swethika)	2.267^{a}	1.467^{ab}	0.217^{ab}	0.197^{c}	2.100^{a}	1.700^{ab}	0.223^{ab}	0.137^{cd}	0.217^{cd}	0.207^{cd}
IGFRI-7	1.733^{d}	1.233^{cd}	0.197^{b}	0.147^{e}	1.500^{c}	1.367^{cd}	0.197^{bc}	0.140^{c}	0.223^{cd}	0.170^{f}
DHN-6(Sampoorna)	2.167^{ab}	1.363^{bc}	0.243^{ab}	0.173^{d}	1.643^{bc}	1.467^{bc}	0.143^{c}	0.103^{ef}	0.187^{d}	0.187^{ef}
PTH	2.000^{c}	0.983^{e}	0.247^{ab}	0.203^{bc}	1.990^{a}	1.357^{cd}	0.180^{bc}	0.100^{f}	0.203^{cd}	0.147^{g}
PBN-16	2.167^{ab}	1.367^{bc}	0.243^{ab}	0.207^{bc}	2.143^{a}	1.857^{a}	0.183^{bc}	0.120^{de}	0.260^{abc}	0.203^{cde}

* In a column, means followed by common letters do not differ significantly at 5% level by DMRT

present in the sample. There were significant differences between cultivars with respect to total ash content. The cultivar CO-3 showed the highest ash content in both leaves (9.70%) and stem (8.33%). The ether extract content, which represents crude fat fraction of the sample was found to be higher in leaves than stem and showed significant differences between the cultivars. Crude fat content of leaves ranged from 2.80 per cent (CO-4) to 1.47 per cent (IGFRI-7) and that of stem ranged from 1.10 per cent (Supriya and PTH) to 1.58 per cent (IGFRI-3). Nitrogen free extract (NFE) represents the digestible carbohydrates present in feed. Nitrogen free extract of the leaves was more than the stem. There were significant differences between cultivars with respect to nitrogen free extract. In the leaves, the content ranged from 47.02 per cent (CO-3) to 51.88 per cent (CO-2) and the nitrogen free extract in stems ranged from 53.01 percent (Suguna) to 55.73 per cent (Supriya). All the nutrient elements studied (N, P, K, Ca and Mg) were higher in leaves than stems (Table 2). When the mineral content of both leaves and stem are considered CO-3 was found to be superior to other cultivars.

Oxalate content, which when accumulated to potentially toxic level binds with mineral elements and made it unavailable, was found below the permissible limit (4.0%) in all the 11 cultivars (Table 3). In the leaves, oxalate content ranged from 2.40 per cent (CO-4) to 3.63 per cent (Suguna) and in stem, oxalate content ranged from 2.70 percent (IGFRI-7) to 4.13 per cent (Suguna). Kipnis and Dabush (1988) reported that in hybrid napier, oxalate levels in the leaves were higher than in stem; however, napier grass accumulated more oxalate in stem portions than leaves. Kaur et al. (2009) observed that leaves accumulated higher concentration of oxalate (3.82%) compared to stem (1.95%). The results from the present experiment indicated that conclusive assertion of higher oxalate content in leaf or stem as reported above is not correct. In 11 cultivars studied, leaves of 6 cultivars

Table 3. Oxalate content (%) of hybrid napier cultivars

Cultivars	Oxalate content of leaves	Oxalate content of stems
CO-2	2.87^{d}	3.77^{b}
CO-3	3.60^{ab}	3.13^{cde}
CO-4	2.40^{e}	2.90^{def}
KKM-1	2.97^{d}	3.43^{bc}
Suguna	3.63^{a}	4.13^{a}
Supriya	3.53^{ab}	2.83^{ef}
IGFRI-3(Swethika)	3.80^{a}	2.97^{def}
IGFRI-7	3.50^{ab}	2.70^{f}
DHN-6 (Sampoorna)	3.17^{cd}	2.83^{ef}
PTH	2.91^{d}	3.30^{cd}
PBN-16	3.30^{bc}	3.10^{cdef}

* In a column, means followed by common letters do not differ significantly at 5% level by DMRT

(CO-3, Supriya, IGFRI-3, IGFRI-7, DHN-6 and PBN-16) showed more oxalate content than stem, but in 5 cultivars (CO-2, CO-4, KKM-1, Suguna, and PTH) stem showed more oxalate content than leaves.

In terms of nutritional quality, CO-3 was superior to other cultivars as the percentage content of crude protein content and mineral was high in CO-3 compared to other cultivars. Oxalate content an antinutritive factor, was the lowest in CO-4.

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