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ASSESSMENT OF FORAGE NUTRITIONAL QUALITY OF B X N HYBRIDS BETWEEN GIANT BAJRA AND NAPIER GRASS

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SUMMERY

The present investigation was carried out to study forage nutritional quality of ten bajra x Napier hybrids (B x N hybrids) along with their eleven parents and four checks, in relation to dry matter, crude protein, cell wall constituent's *viz*., acid detergent fibre, neutral detergent fibre, hemi-cellulose, lignin and *in-vitro* dry matter digestibility. Out of ten crosses four hybrids were found statistically superior for various parameters studied *viz*., GB x GBN-2001-4-2, GB x FD-444, GB x GBN-2001-8 and GB x GBN-2001-10. The highest per cent dry matter was recorded in hybrids such as GB x FD-444, and GB x FD-436, whereas GB x GBN-2001-4-2 was higher for *in vitro* dry matter digestibility within the hybrids. A female parent Giant bajara recorded overall the lowest neutral detergent fibre, acid detergent fibre and the highest *in vitro* dry matter digestibility, whereas male parent TNCN-011 recorded the highest per cent crude protein.

Key words : Nutritional quality, dry matter digestibility, B x N hybrids

At present, the country faces a net deficit of 61.1% green fodder, 21.9% dry crop residues and 64% concentrate feeds. India assists 20% of the livestock population of the world covering 2.3% geographical area. Recent population trends of India is not matching with the required trend of livestock growth rate due to various reason and signifying that India have to import milk by 2021. Animals needs green fodder all the year round, the forage crops are season based (*rabi* and *Kharif*) and there is gap between seasons, which designated as lean period with respect to availability of green forage. Shortage of green forage especially in May-June and Oct-Nov, affects the performance of both milch and dry stock adversely (Pandey and Mange, 1991). In order to bridge this gap, efforts are to be intensified to increase the yield per unit area, nutritional quality and time with maximum returns per rupee investment. Moreover, growing of perennial source of green fodder is less expensive and ensures continuous supply of green fodder. To maximize the milk production, it is essential to feed the animals with quality green fodder and as a consequence high yielding perennial forages have been introduced for cultivation. Bajra x Napier hybrid (B x N hybrid) is one of the principle forage crop, which gives frequent cuttings and supplies green forage continuously for 3-5 years with high yield potential, which save expenses on labour, preparatory tillage and planting material. B x N hybrid require optimum temperature for excellent growth is usually 25-40°C and crop gives better performance in bright sunlight. This crop is best suited to high rainfall areas, drought-tolerant and grows well almost in tropical and subtropical areas of the world.

The Mahatma Phule Krishi Vidyapeeth (M.P.K.V.), Rahuri has made breeding efforts and released BxN hybrids, RBN-9 (Yashwant), RBN-13 (Phule Jaywant) and RBN 2011-12 (Phule Gunwant), which are important perennial source of green fodder and best suited under irrigated conditions as well as responsive to higher doses of fertilizers. These varieties are becoming popular among dairy farmers due to continuous supply of high green forage. It is more acceptable by the animals because of its non-hairiness nature, better palatability, and high nutritive value and resistance to anthracnose disease and defoliators. There is vast scope to increase the production potential and quality of B x N hybrid. Such B x N hybrids synthesized by using bajra as female parent have less hairiness and Napier grass as male parent have multi-cut ability. Thus hybrid developed from these two different species has integration of both good characters. Looking to this breeding aim, various crosses were made between these two different species

i.e. inter species breeding gives population having variable forage quality parameters. Thus, present research work was conducted to find out forage nutritional quality in newly developed B x N hybrids and compared with their parents and national checks for their superiority.

MATERIALS AND METHODS

Ten promising B x N hybrids were selected from crosses effected between Giant bajara as female parent and ten male parents. These ten crosses, one female and ten male parents and four check varieties *viz.*, Phule Jaywant, DNH-6, NB-21 and CO-3 were grown at Grass Breeding scheme, MPKV, Rahuri. The representative forage samples were oven dried until constant weight to calculate dry matter (%). The dried plant samples were ground to pass through 1 mm sieve. The samples were analyzed for crude protein (AOAC, 2005), cell wall constituents *viz.*, acid detergent fibre (ADF), neutral detergent fibre (NDF) and hemi-cellulose (HC) (Van Soest *et al.*, 1967) and lignin (Hussain *et al*., 2002). *In vitro* DM digestibility (IVDMD) was carried out (Tilley and Terry, 1963) using goat rumen liquor.

RESULTS AND DISCUSSION

The data on dry matter (%), crude protein, ADF, NDF hemicelluloses and IVDMD in F_1B x N hybrids, their parents and check varieties are depicted in Table 1.

Dry matter content : It was observed that the DM percentage significantly differed among the hybrids, parents and check varieties. Among the hybrids synthesized GB x FD-444 recorded the highest DM of 24.98 per cent, followed by GB x FD-436 with 24.38 per cent, it was at par with check Phule Jaywant recording 24.12 per cent. Among the parents, female parent Giant bajra recorded the highest DM of 24.19 per cent, which was at par with check variety Phule Jaywant. The dry matter content for B x N hybrids varied with genotypes. Similar observations were made by several investigators viz. Datt *et al.* (2009) and Chandra *et al.* (2012). The DM is main parameter considered, while selecting the hybrid. In present study, DM of commonly used female parent is much higher than all male parents. It indicates that DM is influenced mainly by female parent than male parents. The hybrids, GB x FD-444 and GB x FD-436 recorded the highest DM content than both male and female male parents.

Crude protein

Overall crude protein content (CP) was ranged between 6.13 to 9.63 per cent. The hybrid, GB x FD-482-1 recorded the highest CP per cent (8.75) was followed by GB x FD-436 (8.31). Among the parents TNCN-011 and check CO-3 recorded 9.63% of CP. Similar values were reported by Bora *et al.* (2011) and Biradar *et al.* (2014). Crude protein in the NB-21 variety of hybrid Napier contained 11.62 per cent (Chandra *et al.*, 2012), 9.19 per cent (Datt *et al.*, 2009) and 7.1 per cent (Veereswara *et al.*, 1993). In present study check variety CO-3 recorded the highest CP than all genotypes studied. Thus, the values observed are within the range and in agreement with reported by earlier workers. The results clearly indicated that, TNCN-011, Giant bajra and FD-476 are the superior parents, followed by FD-482-1 and FD-436 could exploited further in breeding activities as CP is the most important parameter, while selecting the superior hybrids.

Cell wall constituents

Neutral detergent fibre : The NDF content significantly differed was ranged between 61.40 to 77.60 per cent in B x N hybrids, parents and check varieties. The female parent Giant bajra recorded the lowest NDF of 61.4 per cent, followed by male parent GBN-2001-4-2 with 63.5 per cent. Among the hybrids, the lowest NDF content of was recorded in GB x GBN-2001-4-2, followed by GB x GBN-2001-10 and GB x GBN-2001-8 with 67.0 and 67.9 and 68.2 per cent, respectively. The values are at par with lowest NDF (68.3%) containing check DNH-6. Earlier, Halim *et al.* (2013) reported highest NDF (70.90%) content in common Napier variety. Bora *et al*. (2011) observed NDF values for B x N hybrids in the range of 58.42 to 73.23 per cent. Premaratne and Premalal (2006) reported NDF in B x N hybrid varieties NB-21 and CO-3 in the range of 74 to 78 per cent and 60 to 65 per cent on dry matter basis, respectively. Similar trend for NDF content was observed in NB-21 and CO-3 varieties. The check variety DNH-6 and CO-3 contained the lowest NDF content (68.30, 69.0%). As regards to hybrid, GB x GBN-2001-4-2, NDF content was 66.60 per cent was the lowest than checks. Both parent of the said cross exhibited lowest NDF values. It shows that, Giant bajra is suitable and superior parent in crossing programme for NDF parameter.

TABLE 1
Nutritional quality of forage F_1 bajara x Napier hybrids and their parents

S.	B x N Hybrids/parents/checks	DM	CP	NDF	ADF	HC	Lignin	IVDMD
	Hybrids							
1.	GB x FD- 4-2-2	20.45	7.00	70.30	42.30	28.00	6.30	55.97
2.	GB x FD-482-1	18.17	8.75	74.40	51.30	23.10	7.60	49.05
3.	GB x FD-436	24.38	8.31	74.90	45.80	29.10	7.10	53.28
4.	GB x FD-476	23.82	6.13	73.70	42.30	31.40	4.60	56.97
5.	GB x GBN-2001-4-2	24.04	7.88	66.60	39.20	27.40	6.10	58.36
6.	GB x FD-444	24.98	7.00	71.20	50.20	21.00	4.90	49.90
7.	GB x FD-468-2	22.23	7.00	73.60	45.30	28.30	5.90	53.66
8.	GB x GBN-2001-8	23.63	7.00	68.20	41.10	27.10	6.40	56.89
9.	GB x GBN-2001-10	23.31	7.00	67.90	40.50	27.40	7.74	57.36
10.	GB x TNCN-011	21.41	7.44	72.90	48.10	24.80	6.90	51.51
	Parents							
11.	Giant Bajra	24.19	8.75	61.40	29.80	31.60	7.00	65.58
12.	FD- 477-2-2	16.68	7.00	77.60	46.40	31.20	6.20	52.82
13.	FD-482-1	15.16	8.31	76.20	48.70	27.50	5.70	51.05
14.	FD-436	16.44	8.31	73.90	46.10	27.80	4.10	53.38
15.	FD-476	19.36	8.75	70.80	48.70	22.10	6.20	51.05
16.	GBN-2001-4-2	20.66	7.00	63.50	35.20	28.30	6.70	61.43
17.	FD-444	21.25	7.88	73.40	45.40	28.00	6.33	53.59
18.	FD-468-2	17.23	6.56	72.30	52.30	20.00	5.60	48.28
19.	GBN-2001-8	20.46	6.42	69.70	52.80	16.90	5.30	47.90
20.	GBN-2001-10	14.46	6.56	75.30	47.70	27.60	4.30	51.82
21.	TNCN-011	16.33	9.63	71.20	43.60	27.60	7.96	54.97
	Check varieties							
22.	Phule Jaywant (C)	24.12	8.75	73.50	42.50	31.00	7.40	55.82
23.	DNH-6 (C)	19.10	7.44	68.30	38.20	30.10	4.20	59.12
24.	NB-21 (C)	23.42	7.44	74.20	44.80	29.40	5.90	54.05
25.	CO-3 (C)	17.98	9.63	69.00	43.90	25.10	4.40	54.74
	Range	14.46-24.98	6.13-9.63	61.40-77.60	29.80-52.80	16.90-31.60	4.10-7.96	49.05-65.58
	Mean	20.53	7.67	71.36	44.49	26.87	6.03	54.34
	S. E±	0.68	0.30	1.74	1.09	0.33	0.63	1.70
	C. D. (P=0.05)	1.92	0.86	4.92	3.07	0.93	1.80	4.81

Acid detergent fibre : ADF content was ranged between 29.80 to 52.80 per cent in B x N hybrids, parents and check varieties. Among the hybrids, GB x GBN-2001-4-2 recorded the lowest ADF content of 39.20 per cent. Both the parents were recorded lower ADF content, where the female parent Giant bajra with 29.80 and male GBN-2001-4-2 with 35.20 per cent ADF. The hybrid GB x GBN-2001-10 also recorded lower ADF of 40.50 per cent, it was statistically significant over the lowest ADF containing check DNH-6 (38.20 %). Thus, it indicated that in some crosses, both the parents were contributed ADF character. Various reports indicated similar values for ADF content in hybrid Napier and varieties of elephant grass. Bora *et al*. (2011) reported that ADF content in CO-3 variety was in the range of 40.52 to 50.20 in CO-3, while 38.63 to 42.63 per cent in CO-2 variety at different growth stages. Chandra *et al*. (2012) reported 41.51 per cent ADF in NB-21variety.

Hemi-cellulose : Hemi-cellulose content was ranged between 16.90 to 31.60 per cent in B x N hybrids parents and check varieties. Mean hemi-cellulose content among the hybrids was the lowest in GB x FD-444 containing 21.00 per cent, followed by GB x FD-482-1 with 23.10 per cent and was found statistically significant over the lowest check CO-3 with 25.10 per cent. Among the parents of B x N hybrids, the GBN-2001-8, FD-476 and FD-468-2 recorded the lowest HC content of 16.90, 20.00 and 22.10 per cent, respectively and were found statistically significant over the lowest check CO-3. The parent Giant bajra recorded the highest HC of 31.60 per cent than other parent. It shows that, male parents, GBN-2001-8, FD-468-2 and FD-476 were superior over female parent as regards to HC. Pathan *et al*. (2012) reported HC content in the range of 24.83 to 25.77 per cent in B x N hybrid. Ansah *et al.* (2010) reported HC content of 19.5, 23.9, 25.2 and 24.5 per cent in four varieties of Napier grass. Bora *et al.* (2011) reported HC content in CO-3 variety ranged from 19.89 to 23.03 per cent.

Lignin : Lignin content was ranged between 4.10 to

7.96 per cent in BN hybrids, parents and check varieties. Among the hybrids, lignin content was the lowest in GB x FD-476 with 4.60, followed by GB x FD-444 with 4.90 per cent. The parents, the FD-436 recorded the lowest lignin content of 4.10 per cent, followed by GBN- 2001-10 with 4.30 per cent. The lignin content in the parents were not reflected in their hybrids, however these parents could be used in breeding for developing low lignin hybrids along with better female parent because the female parent Giant bajara recorded the highest lignin content of 7.0 per cent. Among the checks, DNH-6 recorded the lowest lignin content of 4.20, followed by CO-3 with 4.40 per cent. Various reports indicated that, lignin content of B x N hybrids ranged from 13.0 to 20.7 per cent (Liong *et al*., 2013). Renato *et al.* (2015) reported lignin content in the range of 5.63-6.07 per cent in elephant grass.

***In-vitro* dry matter digestibility :** The IVDMD was ranged between 49.05 to 65.58 per cent in BN hybrids, parents and check varieties. Among the hybrids, the highest IVDMD was recorded in GB x GBN-2001-4-2 containing 58.36 per cent, followed by GB x FD-476 with 56.97 per cent. Among the parents of B x N hybrids, the female parent Giant bajra recorded the highest IVDMD of 65.58 per cent and was found statistically significant over the check DNH-6. The parent GBN-2001-4-2 recorded the highest IVDMD of 61.43 per cent, which was at par with check DNH-6 (59.12 %). As both the parents of hybrid, GB x GBN-2001-4-2 exhibited higher IVDMD could be used in further breeding programme for improvement. Bora *et al.* (2011) reported IVDMD in CO-3 and CO-2 varieties from 54.5 to 49.0 per cent and 47.61 to 44.12 per cent, respectively on DM basis. Deresz *et al*. (2006) reported that, per cent IVDMD in elephant grass was 63.8 per cent.

Based on the forage quality parameters studied, the hybrids found promising are GB x GBN- 2001-4-2 for IVDMD, GB x FD-482-1 for crude protein content and GB x FD-444 for per cent dry matter. The Giant bajra found best suitable female parent due to their lowest NDF, ADF, lignin and highest IVDMD and crude protein, whereas among the male parents, TNCN-011 for crude protein, GBN-2001-4-2 for NDF and ADF, GBN-2001-8 for HC and FD-436 for lignin could be further used in breeding programme.

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