EVALUATION OF F_1 B X N HYBRIDS BETWEEN GIANT BAJARA AND NAPIER GRASS FOR SUGARS, MINERALS AND OXALIC ACID

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ABSTRACT

In the present investigation, ten bajra x napier hybrids along with their eleven parents and four checks were evaluated for reducing, non-reducing and total sugars, minerals such as calcium, magnesium and anti-nutritional factors, silica and oxalic acid. The highest dry matter, total sugars, non-reducing sugars, calcium and lowest silica content were recorded in hybrids, whereas their parents with higher total minerals content. Among the male parents, GBN-2001-4-2, FD-482-1, FD-444, FD-436 and TNCN-011 and female parent Giant bajara were found better for various nutritional parameters. The hybrid GB x FD-444 found better for higher dry matter and calcium, GB xFD-477-2-2 for higher total sugars and reducing sugars and lower oxalic acid, GB x FD-482-1 for higher total minerals, calcium and lower silica content, GB x FD-436 for higher dry matter and lower oxalic acid.

KEY WORDS: Anti-nutritional factors, B x N hybrids, Minerals, Nutritional quality, Sugars

INTRODUCTION

India has a net deficit of 61.1 per cent green fodder, 21.9 per cent dry crop residues and 64 per cent concentrate feeds. India has 20 per cent of the livestock population of the world. Looking to growing trends of population and livestock growth rate, India has to import milk. Better productivity of milk could be achieved by supplying green forage supply throughout the year particularly during gaps between seasons. In order to bridge this gap, growing of perennial source of green fodder is necessary. Bajra x Napier hybrid (B x N hybrid) is one of the such principle forage crop, gives frequent cuttings, supplies green forage continuously for 3-5 years with high yield potential, save expenses on labour, preparatory tillage and planting material. 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 (MPKV), Rahuri has made breeding efforts, released B x N hybrids *viz.*, RBN-9, RBN-13 and RBN 2011-12 (Phule Gunwant). These varieties are becoming popular among dairy farmers. The B x N hybrids synthesized by using bajra as female parent have less hairiness and Napier grass as male parent have multi-cut ability. 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 some of the specific nutritional parameters apart from routine work 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 a female parent and ten male parents. These ten crosses along with its female and male parents and four check varieties were grown at Grass Breeding Scheme, MPKV, Rahuri. The representative forage samples were oven dried until constant weight to calculate dry matter per cent (DM). The dried plant samples were ground to pass through 1 mm sieve used for estimation of all quality parameters. The reducing, non-reducing and total sugars in B x N hybrids, their parents and check varieties were estimated by the method described by Nelson (1944). Total minerals were analyzed according to AOAC (1990). The calcium and magnesium content were determined on atomic absorption spectrophotometer after diacid digestion of plant sample by H_2SO_4 and H_2O_2. The silica determination was done as per the method of Dai *et al.* (2005) and oxalic acid by method described by Abaza *et al.* (1968).

RESULTS AND DISCUSSION

The data on nutritional evaluation of parameters studied significantly differed among F_1 bajra x Napier hybrids, their parents and checks are reported in Table 1 and promising B x N hybrids and parents are reported in Table 2.

Dry matter content

Dry matter content was ranged between 14.46 to 24.98 per cent. Among the hybrids synthesized, GB x FD-444 recorded the highest dry matter content of 24.98 per cent followed by GB x FD-436 with 24.38 per cent and it was at par with check Phule Jaywant recording 24.12 per cent. Among the parents of B x N hybrids, the female parent Giant Bajra recorded the highest dry matter of 24.19 per cent, which was at par with check variety Phule Jaywant.

The dry matter is main parameter considered while selecting the hybrid. Similar observations were made by several investigators. Chandra *et al.* (2012) reported 21.12 per cent dry matter in NB-21 variety of hybrid Napier, wherea, Premaratne and Premalal (2006) reported 18 to 20 per cent dry matter in B x N hybrid var. CO-3. In present study, female parent Giant bajara recorded much higher dry matter than male parents. It indicates that dry matter content is influenced mainly by female parent than male. The hybrids, GB x FD-444 and GB x FD-436 recorded the highest dry matter content than female and it's male parents.

Sugars

Total sugars

The total sugars were ranged between 2.24 to 6.46 per cent. Among the hybrids, total sugars was recorded the highest in hybrid GB x FD-477-2-2 with 6.46 per cent followed by GB x GBN-2001-8 with 5.20 per cent. Among the parents, FD-444-2-2 recorded the highest total sugars of 5.11 per cent. Among the check varieties, NB-21 recorded the highest total sugars of 5.60 per cent, which was the followed by CO-3 with 5.10 per cent.

Wadi *et al*. (2004) reported similar values for total sugars content of King grass, Napier grass and hybrid Napier grass with 13.4, 11.6 and 16.6 per cent, respectively. Budiman *et al.* (2011) reported total sugars in Taiwan, King and Mott hybrid Napier were 2.64, 1.72 and 1.75 per cent at vegetative and 7.2, 6.34 and 3.36 per cent at reproductive stage, respectively on dry weight basis.

Reducing sugars

It was observed that the reducing sugar content was ranged between 1.72 to 3.38 per cent among the hybrids, parents and check varieties.Among the F_1 hybrids evaluated, the highest reducing sugars was recorded in GB x FD-477-2-2 hybrid with 2.89 per cent followed by GB x GBN-2001-

8 with 2.37 per cent. Among the parents, FD-444 recorded the highest the reducing sugars of 2.44 per cent. Among the check varieties, NB-21 recorded the highest reducing sugars of 3.28 per cent followed by Phule Jaywant with 2.35 per cent.

Non-reducing sugars

Overall the non-reducing sugars were ranged between 0.10 to 3.57 per cent. Among the F_1 B x N hybrids, the non-reducing sugars was significantly the highest in hybrid GB x FD-477-2-2 containing 3.57 per cent followed by GB x FD-482-1 with 2.76 per cent. Among the parents of B x N hybrids, the FD-477-2-2 recorded the highest non-reducing sugars of 2.72 per cent. Among the check varieties, CO-3 recorded the highest non-reducing sugars of 3.31 per cent followed by NB-21 with 2.32 per cent.

Minerals

Total minerals

Total minerals content was ranged between 7.90 to 15.60 per cent in B x N hybrids, parents and check varieties.The total minerals content was found the highest in GB x FD-482-1 containing 14.70 per cent followed by GB x GBN-2001-8 with 13.70 per cent. Among the parents of B x N hybrids, GBN-2001-4-2 recorded the highest total minerals of 15.60 per cent, which was at par with check DNH-6 containing 14.80 per cent.

Antony and Thomas (2014) reported ash content in leaves ranged between 6.57 to 9.70 per cent and in stem ranged between 5.20 to 8.47 per cent in 11 popular cultivars of hybrid Napier. Alagudurai and Muthukrishnan (2014) reported ash content up to 13.70 per cent, while Chandra *et al.* (2012) reported 8.56 per cent ash in NB-21. The female parent Giant Bajra recorded the lowest mineral content than all male parents, it indicates female parent had not contributed for ash content in any hybrid.The superior male parents were GBN-2001-4-2 and FD-468-2 could be used in breeding programme for ash content.

Calcium

Calcium content was ranged between 110 to 230 mg/100g in B x N hybrids parents and check varieties.Among the hybrids, the calcium content was the highest in GB x FD-444 hybrid containing 190 mg/100g followed by both GB x FD-476, GB x GBN-2001-4-2 and GB x GBN-2001-8 with 160 mg/100g. Among the parents, the FD-444 recorded the highest calcium content was 190 mg/100g followed by both FD-436 and FD-468-2 with 180 mg/100g.

Chandra *et al.* (2012) reported that calcium content in NB-21 was 490 mg/100g, while Premaratne and Premalal (2006) reported 170 to 110 mg/100g calcium in NB-21 and CO-3, respectively. Alagudurai and Muthukrishnan (2014) showed that calcium content was in the range of 590 to 680 mg/100g. The female parent Giant Bajra recorded the lowest calcium among all parents. It shows that, FD-476, FD-436 and FD-468-2 are superior parent could be utilized in breeding programme. The minimum calcium requirements generally recommended for the maintenance of domestic livestock under range conditions are 320 and beef cattle is 160-600 mg/100g (NRC, 1970). The present values for calcium are slightly below the range.

Magnesium

Magnesium content was ranged between 200 to 380 mg/100g in B x N hybrids, parents and check varieties. Among the hybrids, it was the highest in hybrid GB x FD-476 containing 370 mg/100g, which was at par with check CO-3 followed by GB x TNCN-011. Among the parents of hybrids, the FD-482-1 and TNCN-011 recorded the highest magnesium content of 380 and 360 mg/100g, respectively, which were at par with check CO-3.

Antony and Thomas (2014) reported magnesium content in range of 0.187 to

0.313 per cent in leaves and 0.147 to 0.243 per cent in stem of 11 popular cultivars of hybrid Napier. Ekemini (2013) analyzed F_1 interspecific hybrids of *Pennisetum* species. The magnesium content was in the range of 300 to 120 mg/100g. Garg *et al.* (2008) reported hybrid Napier as good sources of magnesium (340 mg/100g). The male parents FD-482-1, TNCN-011 and FD-477-2-2, and check variety CO-3 recorded appreciable amount magnesium could be used in the breeding programme.

Anti-nutritional factors

Silica

Silica content was ranged between 4.84 to 8.78 per cent in B x N hybrids parents and check varieties. Among the hybrids, the silica content was the lowest in hybrid GB x FD-482-1 containing 4.84 per cent followed by GB x FD-476 with 5.74 per cent. Among the parents of B x N hybrids, the Giant bajra recorded the lowest silica of 4.95 per cent, which was at par with all check varieties.

Kumar *et al*. (2015) observed silica content of CO-4 variety of hybrid Napier was 6.40 per cent. The silica content in B x N hybrids reported by Pathan *et al*. (2012) in the range of 2.23 to 2.90 per cent. The hybrid GB x FD-477-2-2 found promising as it recorded appreciably the lower silica content than all checks and parents.

Oxalic acid

Oxalic acid content was ranged between 2.11 to 2.75 per cent in B x N hybrids parents and check varieties. Among the hybrids, the oxalic acid content was the lowest in hybrids GB x FD-477-2-2, GB x FD-436 and GB x FD-476 containing 2.13 per cent. Among the parents, female parent Giant Bajra and male parent TNCN-011 recorded the lowest oxalic acid of 2.13 per cent. Also check Phule Jaywant recorded the lowest oxalic acid of 2.11 per cent.

Antony and Thomas (2014) reported oxalic acid in 11 cultivars of hybrid Napier. Leaves contained 2.40 to 3.63 per cent and stem with 2.70 to 4.13 per cent oxalalic acid. Satpute *et al*. (2014) evaluated 32 derivatives of B x N hybrids reported that oxalic acid was ranged from 1.97 to 2.72 per cent. Results shows that variety Phuke Jaywant and hybrids GB x FD-477-2-2, GB x FD-436, GB x FD-476 and GB x GBN-200110 recorded the lowest oxalic acid. Whereas, female parent Giant Bajra and male parent TNCN-011 exhibited the lowest oxalic acid.

CONCLUSION

The hybrid GB x FD-444 found better for higher dry matter and calcium, GB xFD-477-2-2 for higher total sugars and reducing sugars and lower oxalic acid, GB x FD-482-1 for higher total minerals, calcium and lower silica content, GB x FD-436 for higher dry matter and lower oxalic acid. Among the male parents, GBN-2001-4-2, FD-482-1, FD-444, FD-436 and TNCN-011 and female parent Giant bajara were found better for to various nutritional parameters. Thus, these male and female parents can be used in breeding programme for improvement of specific character.

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Table 1: Nutritional variation in sugars, minerals and oxalic acid in F_1 Bajara X Napier hybrids and their parents

Sr. No.	B x N Hybrids /Parents/Checks	Dry Matter (%)	Reducing Sugars (%)	Non-Reducing Sugars (%)	Total Sugars (%)	Calcium (mg/100g)	Magnesium (mg/ 100g)	Total Minerals (%)	Silica (%)	Oxalic Acid (%)
I	**B x N Hybrids**									
1	GB x FD- 477-2-2	20.45	2.89	3.57	6.46	110	210	12.30	5.83	2.13
2	GB x FD-482-1	18.17	2.04	2.76	4.80	170	280	14.70	4.84	2.38
3	GB x FD-436	24.38	1.81	2.59	4.40	140	270	8.30	6.22	2.13
4	GB x FD-476	23.82	2.09	1.48	3.57	160	370	12.80	5.74	2.13
5	GB x GBN-2001-4-2	24.04	2.18	0.10	2.28	160	220	10.70	7.06	2.25
6	GB x FD-444	24.98	2.13	1.33	3.46	190	230	10.70	6.93	2.38
7	GB x FD-468-2	22.23	2.03	0.33	2.36	150	210	11.50	7.02	2.38
8	GB x GBN-2001-8	23.63	2.37	2.83	5.20	160	280	13.70	6.68	2.50
9	GB x GBN-2001-10	23.31	2.15	1.61	3.76	110	270	12.40	6.96	2.63
10	GB x TNCN-011	21.41	1.72	0.52	2.24	130	320	9.40	7.08	2.38
II.	**Parents**									
11	Giant Bajra	24.19	2.26	1.51	3.77	110	310	8.50	4.95	2.13
12	FD- 477-2-2	16.68	2.39	2.72	5.11	130	350	12.30	7.13	2.63
13	FD-482-1	15.16	2.42	0.52	2.94	140	380	12.80	6.26	2.50
14	FD-436	16.44	2.34	0.18	2.52	180	310	11.30	5.95	2.75
15	FD-476	19.36	2.03	0.44	2.47	190	220	11.80	8.33	2.63
16	GBN-2001-4-2	20.66	2.32	0.73	3.05	170	290	15.60	7.06	2.38
17	FD-444	21.25	2.44	1.28	3.72	110	280	9.80	6.36	2.50
18	FD-468-2	17.23	2.06	1.39	3.45	180	230	14.60	7.27	2.63
19	GBN-2001-8	20.46	1.79	0.57	2.36	150	240	7.90	6.43	2.38
20	GBN-2001-10	14.46	2.21	0.23	2.44	170	270	13.80	7.06	2.38
21	TNCN-011	16.33	1.76	0.83	2.59	160	360	12.80	8.78	2.13
III.	**Check varieties**									
22	Phule Jaywant (C)	24.12	2.35	1.36	3.71	170	310	13.60	6.30	2.11
23	DNH-6 (C)	19.10	2.24	0.15	2.39	190	210	14.80	5.84	2.38
24	NB-21 (C)	23.42	3.28	2.32	5.60	230	200	14.40	5.17	2.25
25	CO-3 (C)	17.98	1.79	3.31	5.10	170	360	14.40	6.02	2.25
	Range	14.46-24.98	1.72-3.28	0.10-3.57	2.24-6.46	110-230	200-380	7.90-15.60	4.84-8.78	2.11-2.73
	Mean	20.53	2.20	1.39	3.59	157	279	12.20	6.53	2.37
	SE ±	0.68	0.64	0.01	0.64	15.28	23.71	0.50	0.56	0.09
	CD @ 5 %	1.92	43.39	67.35	1.60	1.79	NS	1.41	0.04	0.27

Table 2: Promising B x N hybrids and parents

Sr. No.	Parameters	Mean	Range	Promising Hybrids	Promising Male/ Female Parents
1.	Dry matter (%)	20.53	14.46-24.98	GB x FD-444, GB x FD-436	Giant bajara
2.	Total sugars (%)	3.59	2.24-6.46	GB x FD-477-2-2	FD- 477-2-2 Giant bajara
3.	Reducing sugars (%)	2.20	1.72-3.28	GB xFD-477-2-2	FD-482-1
4.	Total minerals (%)	12.2	7.90-15.60	GB x FD-482-1, GB x GBN-2001-8	GBN-2001-4-2
5.	Calcium (mg/100g)	157.0	110-230	GB x FD-444, GB x FD-482-1	FD-476
6.	Magnesium (mg/100g)	279.0	200-380	GB x FD-476	FD-482-1
7.	Silica (%)	6.53	4.84-8.78	GB x FD-482-1	Giant bajara
8.	Oxalic acid (%)	2.37	2.11-2.75	GB x FD-477-2-2, GB x FD-436, GB x FD-476	TNCN-011, Giant bajara,

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