Forage Res., **45** (4) : pp. 281-284 (2020) **http://forageresearch.in**

DEVELOPMENT AND EVALUATION OF NEW BAJRA × NAPIER GRASS HYBRIDS FOR GREEN FODDER YIELD AND QUALITY TRAITS

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(Received : 31 December 2019; Accepted : 7 March 2020)

SUMMARY

In the present investigation, twenty four Bajra×Napier hybrids were developed and evaluated with four checks for 13 morphological traits planted in RBD with two replications in the Department of Agricultural Botany, Mahatma Phule Krishi Vidyapeeth, Rahuri. Analysis of variance revealed that mean squares due to genotypes were highly significant for all characters. Wide variations were observed for dry matter yield, crude protein yield, green forage yield, number of tillers/plant, average number of internodes/tiller and L: S ratio. The variation in green forage yield ranged between 1.78 kg/plant in RBN-16-55 to 8.26 kg/plant in PYT-13-391 with mean performance of 4.90 kg/plant. The genotype PYT-13-391(8.26) showed significantly higher green forage yield over the best check *i.e*. Phule Gunwant (6.88). Variation in crude protein (%) ranges between 7.01 per cent (RBN-17-38 and PYT-13-391) to 10.11 per cent (RBN-17-35) with mean performance of 8.53 per cent. Two genotypes *viz.*, RBN-17-35 (10.11 %) and RBN-16-55 (9.98 %) recorded significantly higher crude protein per cent over best check *i.e*. Phule Jaywant (9.44).

Key words : Bajra×Napier hybrid, genetic variability, green forage yield and protein

Napier grass, Elephant grass or King grass is a multipurpose forage crop is vigorous, hardy and high yielding perennial grass. It has strong, extensive fibrous system which enables the plant to become quickly established in the soil. Napier grass tiller freely and a single clump may produce up to 50 tillers under favourable climatic conditions. It has ability to withstand repeated cutting and will rapidly regenerate, producing palatable leafy shoots. Unfortunately, the napier grass is coarse textured, the leaf blade and sheaths are hairy, leaf margins sharply toothed and stems less juicy and fibrous. In 1953, the cross was made in India between tetraploid Napier grass [*Pennisetum purpurem* (K.) Schum] (2n= 4x =28) and diploid Pearl millet/Bajra [*Pennisetum glaucum* (L.) R. Br.] (2n= 2x =14). The inter-specific hybrid is a triploid with 2n= 3x =21 chromosomes was more succulent, leafy, fine textured, palatable, fast growing and drought resistant than napier. It combines fodder quality of bajra with high yielding potential and perenniality of napier grass. It produces more tillers and numerous leaves, grows faster and produces more herbage of good quality (Lokhande, 2015). Because of the dissimilar genomic constitution, the triploid hybrids are completely sterile. The triploid hybrids resulting from inter-specific cross are usually highly variable because of the heterozygosity of napier grass even though the pearl millet parent is an inbred. The hybrids have extra vigour in overall morphological characters and green forage yield. An attempt was, therefore, made to potential of different hybrids for green forage yield and its associated traits.

MATERIALS AND METHODS

The crossing between selected different gaint bajra and napier plants was carried to develop 24 new bajra-napier hybrids (Table 1) during June 2017 and seeds of F_1 hybrids were harvested in December 2018 and evaluated from June 2018 to December 2018 at Grass Breeding Scheme, Mahatma Phule Krishi Vidhyapeeth, Rahuri with 24 new Bajra-Napier hybrids along with four check and the material was grown in randomized block design, where each entry was planted in two rows of 6 m length and spacing of 90 × 60 cm. List of 24 genotypes along with four check and their pedigree is given in table 1. After planting, one irrigation was given and subsequent irrigations were given at an interval of 10-12 days. Total dose of fertilizer 150:50:40 kg/ha out of which, 50 kg of 'N' per ha, 50 kg 'P' per ha and 40 kg 'K' per ha were applied as a basal dose. For top dressing, 25 kg of 'N'

TABLE 1
List of 24 genotypes along with four check of Bajra x Napier hybrids and their pedigree

S. No.	Genotype	Pedigree
1.	RBN-17-33	Giant Bajra x PT-1890
2.	RBN-17-34	Giant Bajra x PT-1890
3.	RBN-17-35	Giant Bajra x PT- 1890
4.	RBN-17-36	Giant Bajra x PT-1890
5.	RBN-17-37	Giant Bajra x PT- 1890
6.	RBN-17-38	Giant Bajra x PT-1890
7.	PYT-17-391	Giant Bajra x TNCN-011-2
8.	RBN-14-95/1	Giant Bajra x PT 1890*443
9.	RBN-14-95/2	Giant Bajra x PT 1890*443
10.	RBN-14-95/3	Giant Bajra x PT 1890*443
11.	RBN-14-95/4	Giant Bajra x PT 1890*443
12.	RBN-16-18	Giant Bajra x FD-2-2
13.	RBN-16-22	Giant Bajra x FD-2-3
14.	RBN-16-28	Giant Bajra x FD-2-4
15.	RBN-16-43	Giant Bajra x FD-2-3
16.	RBN-16-53	Giant Bajra x APBN-2
17.	RBN-16-55	Giant Bajra x TNCN-072
18.	RBN-16-58	Giant Bajra x PNB-233
19.	RBN-16-62	Giant Bajra x VTBN-15-1
20.	RBN-17-4/1	Giant Bajra x RBN-2001-5
21.	RBN-17-4/2	Giant Bajra x RBN-2001-5
22.	RBN-17-11/1	Giant Bajra x FD-472-1
23.	RBN-16-265/2	Giant Bajra x TNCN-011-2
24.	RBN-16-265/3	Giant Bajra x TNCN-011-2
25.	Phule Gunwant	Giant Bajra x TD. 473-1
26.	Phule Jaywant	Clonal selection from CN-13
27.	NB-21	-
28.	CO-3	Interspecific hybrid between Cumbu PT. selection from 1697 x Pennisetum purpureum

per ha at every cut was applied. Other cultural practices like weeding were done manually on regular basis. Observations were recorded for three cuts at an interval of 60 days. Observations on character except green forage yield, dry matter yield and crude protein yield were recorded on five randomly selected plants from each replication of each entry at the time of each cut and averages were worked out. Observations on green forage yield, dry matter yield and crude protein yield were recorded for 3 cuts and total expressed in kg/ plant. Nitrogen percentage in dry folder was determined by Micro kjeldahl method (Thimmaiah, 1999). Percent nitrogen was then multiplied by conversion factor of 6.25 to obtain crude protein content. The average data on individual characters were subjected to the method of analysis of variance commonly applicable to the Randomized Block Design (Panse and Sukhatme, 1995).

RESULTS AND DISCUSSION

Analysis of variance

The analysis of variance indicated that the mean sum of squares due to genotypes were highly significant for all the characters and revealed existence of considerable variability in the material studied for the improvement of various traits. Similar results were reported by Kumari *et al.* (2018).

Mean Performance and Range

The mean performances of all the genotypes for different characters studied are presented in Table 3. The variation in plant height ranged between 139.70 cm (RBN-16-55) to 198.33 cm in (RBN-17-11/1) with overall mean performance of 168.99 cm. Two genotypes *viz.,* RBN-17-11/1(198.33) and RBN-16-265/2 (196.10) recorded significantly higher plant height over the tallest check *i.e*. NB-21 (183.37). Number of tillers/plant ranges from 9.93 (RBN-16-265/3) to 31.16 (Phule Gunwant (C)) with overall mean performance of 17.25. None of the entry recorded significantly higher number of tillers/plant over the best check *i.e*. Phule Gunwant (31.16). Among the genotypes the variation in average number of internodes/tiller ranged between 2.43 (RBN-16-55) to

TABLE 2
Monthly average weather parameters data of the field experiment duration obtained from AMFU, Rahuri.

Month	Temperature (°C)		RH (%)		Wind Mean level past 24 hr	Sunshine previous day	Rainfall past 24 hr	Evapn. past 24 hr
	Max	Min	Max	Min				
June	34.2	24.0	70.6	48.5	6.9	5.4	3.0	5.4
July	29.8	22.9	76.7	62.7	7.2	2.3	3.4	4.4
Aug	29.1	22.3	76.9	65.0	5.5	2.5	2.9	4.4
Sep	31.9	20.9	70.8	49.0	2.4	6.9	0.1	5.6
Oct	33.8	18.3	53.8	33.2	1.3	8.5	0.0	6.6
Nov	32.0	14.6	56.5	36.0	1.1	8.8	0.1	6.0
Dec	28.2	11.1	56.7	32.9	0.6	8.2	0.0	4.7

6.50 (RBN-17-11/1) with mean performance of 4.06. Five genotypes *viz.*, RBN-17-11/1 (6.50), RBN-17-36 (5.77), RBN-17-42 (5.38), RBN-17-34 (5.16) and RBN-17-37 (5.07) recorded significantly higher average number of internodes over the best check i.e. NB-21(4.26). Above findings were supported by Singh *et al*. (2002) Pattanashetti *et al*. (2015) and Kumari *et al*. (2018).

The minimum number of leaves / tiller recorded in CO-3 (C) (5.33) and that of maximum in RBN-17-36 (9.16) with mean performance of 7.06. Seven genotypes *viz.*, RBN-17-36 (9.16), RBN-17-42 (8.79), RBN-17-11/1 (8.63), RBN-16-58 (8.15), RBN-17-34 (7.90), RBN-16-265/2 (7.83) and RBN-17-37 (7.70) recorded significantly more number of leaves / tiller over the best check *i.e*. NB-21 (6.77). The leaf length ranged from 72.50 cm (RBN-16-28) to 97.86 cm (RBN-16-53) with mean performance of 85.45 cm. None of the entry recorded significantly higher leaf length over best check *i.e*. Phule Jaywant (95.26). Leaf breadth ranged between 2.26 cm (RBN-16-43) to 3.65 cm (RBN-17-34) with mean performance of 2.84 cm. The genotype RBN-17-34 (3.65) recorded significantly higher leaf breadth over the best checks i.e. CO-3 (3.36). Lowest value of L: S ratio recorded in RBN-17-33 (0.56) and that of highest in RBN-17-38 and RBN-16-265/3 (1.39) with mean performance of 1.01. Six genotypes *viz.*, RBN-16-265/3 (1.39), RBN-17-38 (1.39), RBN-17-36 (1.36), PYT-13-391 (1.29), RBN-17-41 (1.26) and RBN-17-34 (1.25) recorded significantly higher L: S ratio over best check *i.e*. Phule Gunwant (1.01). Stem thickness ranged between 2.64 cm (CO-3 (C)) to 4.05 cm (RBN-16-265/2) with mean performance of 3.26 cm. Three genotypes *viz.*, RBN-16-265/2 (4.05), RBN-16-265/3 (4.00) and PYT-13-391(3.92) recorded significantly higher stem thickness over best check *i.e*. Phule Gunwant (3.31). Above findings were supported by Kumari *et al*. (2018).

Variation in dry matter (%) ranged between

TABLE 3
Mean performance of twenty-eight Bajra x Napier hybrids

S. No.	Genotype	Plant height (cm)	No. of tillers/ plant	Av. no. of internodes/ tiller	No. of leaves/ tillers	Leaf length (cm)	Leaf breadth (cm)	L : S ratio	Stem thickness (cm)	Dry matter (%)	Crude protein (%)	Dry matter yield (kg/plant)	Crude protein yield (kg/plant)	Green forage yield (kg/plant)
1.	RBN-17-33	162.53	10.53	4.13	7.2	80.10	2.62	0.56	3.44	28.42	9.14	1.13	0.10	3.99
2.	RBN-17-34	170.56	16.27	5.16*	7.90*	79.37	3.65*	1.25*	3.63	26.31	9.21	1.75	0.16	6.65
3.	RBN-17-35	180.20	14.93	4.00	7.26	87.60	2.80	0.97	3.62	28.22	10.11*	1.74	0.18	6.19
4.	RBN-17-36	165.40	11.03	5.77*	9.16*	79.90	2.75	1.36*	3.39	30.62	7.79	1.45	0.11	4.72
5.	RBN-17-37	185.83	16.20	5.07*	7.70*	77.86	2.82	1.21	3.06	27.93	7.43	1.39	0.10	4.99
6.	RBN-17-38	191.23	19.03	4.77	7.30	88.06	3.17	1.39*	3.53	28.08	7.01	2.07	0.15	7.39
7.	PYT-13-391	179.10	13.46	4.33	7.47	85.36	3.06	1.29*	3.92*	27.25	7.01	2.25	0.16	8.26*
8.	RBN-14-95/1	169.66	16.50	2.51	6.33	89.16	2.88	0.85	3.15	27.53	7.11	1.62	0.11	5.89
9.	RBN-14-95/2	162.16	14.76	3.45	6.06	94.26	2.67	0.93	3.21	24.31	8.99	1.45	0.13	6.00
10.	RBN-14-95/3	170.00	15.63	2.63	6.13	90.93	2.38	0.70	3.19	25.64	7.27	1.48	0.10	5.79
11.	RBN-14-95/4	175.20	14.96	3.53	6.40	90.87	2.57	0.73	2.97	24.40	8.70	1.44	0.12	5.92
12.	RBN-16-18	157.33	16.47	4.00	6.86	77.90	2.48	0.88	2.67	32.94	8.16	1.18	0.09	3.59
13.	RBN-16-22	160.70	14.53	4.50	6.86	76.10	2.66	0.88	2.80	29.97	7.66	0.69	0.05	2.30
14.	RBN-16-28	147.83	17.93	3.93	6.30	72.50	3.21	0.79	2.89	30.77	9.92	0.96	0.09	3.13
15.	RBN-16-43	164.26	15.00	4.60	7.06	81.43	2.26	0.97	3.09	29.65	7.68	1.10	0.08	3.71
16.	RBN-16-53	158.10	27.90	3.00	6.06	97.86	2.33	0.83	2.84	28.99	8.16	1.06	0.09	3.67
17.	RBN-16-55	139.70	11.73	2.43	6.53	84.63	2.69	1.05	2.82	25.72	9.98*	0.45	0.04	1.78
18.	RBN-16-58	163.26	22.93	4.67	8.15*	79.76	2.80	1.02	3.33	29.29	9.31	1.26	0.11	4.30
19.	RBN-16-62	175.33	23.23	3.83	7.36	88.10	3.27	1.03	3.58	26.28	8.48	1.57	0.13	6.01
20.	RBN-17-41	157.17	13.40	4.20	7.13	79.16	2.76	1.26*	3.36	24.78	8.63	0.72	0.06	2.91
21.	RBN-17-42	171.55	17.76	5.38*	8.79*	79.85	2.58	1.06	3.38	25.75	8.95	1.08	0.10	4.24
22.	RBN-17-11/1	198.33*	15.63	6.50*	8.63*	93.30	2.49	1.09	3.50	29.34	9.21	1.34	0.12	4.57
23.	RBN-16-265/2	196.10*	12.06	4.53	7.83*	89.73	3.22	1.14	4.05*	25.68	8.09	1.04	0.08	4.05
24.	RBN-16-265/3	163.36	9.93	3.50	7.10	86.71	3.16	1.39*	4.00*	24.90	9.08	0.63	0.06	2.53
25.	Phule Jaywant (C)	163.10	27.56	3.35	6.33	95.26	3.33	0.82	3.07	30.80	9.44	1.82	0.17	5.91
26.	NB-21 (C)	183.37	17.80	4.26	6.77	85.03	2.56	0.92	2.98	27.62	8.34	1.44	0.12	5.24
27.	CO-3 (C)	157.96	24.70	3.13	5.33	88.70	3.36	0.94	2.64	33.10	9.04	2.17	0.19	6.58
28.	Phule Gunwant (C)	162.50	31.16	2.76	5.76	93.23	3.18	1.01	3.31	30.11	9.00	2.07	0.18	6.88
	Mean	168.99	17.25	4.06	7.06	85.45	2.84	1.01	3.26	28.01	8.53	1.37	0.11	4.90
	S. Em±	4.13	1.33	0.23	0.27	2.88	0.09	0.07	0.13	0.65	0.17	0.10	0.00	0.35
	C. D. P=0.05	11.99	3.87	0.67	0.79	8.38	0.26	0.20	0.38	1.89	0.49	0.30	0.02	1.04
	C.V. %	3.45	10.93	8.03	5.49	4.78	4.59	9.99	5.75	3.29	2.83	10.69	11.70	10.34

*Indicates Significant at 5% level of significance.

24.31 per cent (RBN-14-95/2) to 33.10 per cent (CO-3(C)) with mean performance of 28.01 per cent. None of the entry recorded significantly higher dry matter % over best check *i.e*. CO-3 (33.10). Dry matter yield ranging between 0.45 kg/plant (RBN-16-55) to 2.25 kg/plant (PYT-13-391) with mean performance of 1.37 kg/plant. None of the entry recorded significantly higher dry matter yield over best check i.e. CO-3(2.17). The variation in green forage yield ranged between 1.78 kg/plant in RBN-16-55 to 8.26 kg/plant in PYT-13-391 with mean performance of 4.90 kg/plant. The genotype PYT-13-391(8.26) showed significantly higher green forage yield over the best check *i.e*. Phule Gunwant (6.88). Similar results were also reported by Lokhande (2015) and Kumari *et al*. (2018).

Variation in crude protein (%) ranges between 7.01 per cent (RBN-17-38 and PYT-13-391) to 10.11 per cent (RBN-17-35) with mean performance of 8.53 per cent. Two genotypes *viz.*, RBN-17-35 (10.11 %) and RBN-16-55 (9.98 %) recorded significantly higher crude protein per cent over best check *i.e*. Phule Jaywant (9.44). Among the genotype the variation in crude protein yield ranged between 0.04 kg/plant (RBN-16-55) to 0.19 kg/plant (CO-3 (C)) with mean performance of 0.11 kg/plant. None of the genotype recorded significantly higher crude protein yield over the best check *i.e*. CO-3 (0.19). Above findings were supported by Kumari *et al*. (2018).

REFERENCE

Kumari, A., V. Sood, and R. D. A. Sharma, 2018 : Genetic evaluation of different frost tolerant bajra-napier hybrids for forage yield and quality traits in north western Himalayas. *The Bioscan,* **13** : 77-84.

Lokhande, L. R., 2015 : Selection indices for fodder yield and its components in bajra [*Pennisetum glaucum* (L.) R. Br.] x napier [*Pennisetum purpureum* (K) Schum] hybrid. M.Sc. (Agriculture) thesis submitted to M. P. K. V., Rahuri (Maharashtra). pp. 1-59.

Panse, V. G. and P. V. Sukhatme, 1995 : Statistical Methods for Agricultural Workers. 4th edition, ICAR publication, New Delhi.

Pattanashetti, S. K., H. D. Upadhyaya, M. Blummel, K. N. Reddy, Y. Ramanareddy, V. Kumar, and S. Singh, 2015 : Genetic variability in napier grass (*Pennisetum purpureum*) germplasm conserved at ICRISAT gene bank.

Singh, D., V. Singh, and Y. P. Joshi, 2002 : Herbage yield and yield attributes of napier-bajra hybrid at different cuts as affected by cutting intervals and varying level of nitrogen. *Forage Res.*,**27** : 267-271.

Thimmaiah, S. R., 1999 : Standard Methods of Biochemical analysis. Kalayani Publishers, Ludhiana. pp. 76-82 and 313-315.