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Seasonal Influence on the Relative Productivity of Bajra Napier Hybrid Grasses Under Different Spacings

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ABSTRACT: *A field experiment was carried out to study the influence of plant spacing on the relative productivity of Bajra Napier hybrid grass in the lowlands of coastal region of Karaikal. The experiment was conducted for one year from February 2011 to February 2012. The treatments consisted of five Bajra Napier hybrids viz., CO 3, CO 4, KKM 1, IGFR1 7 and IGFRI 10 and three different plant spacingsviz.,60 cm x 45 cm, 60 cm x 30 cm and 45 cm x 45 cm, replicated thrice in a randomized block design. Among the hybrids, CO 3 was better than others in terms of growth and yield attributes and resulted in the highest green fodder yield of 177.28 t ha^{-1}year^{-1} as well as dry fodder yield of 31.20 tha^{-1}year^{-1}and crude protein yield 2.61 t ha^{-1} year^{-1}.Among the spacings, 45 cm x 45 cm registered higher growth and yield components and produced the highest green fodder yield 175.61 t ha^{-1} year^{-1}, dry fodder yield 30.90 t ha^{-1} year^{-1} and crude protein yield 2.70 t ha^{-1} year^{-1}as compared to other spacings. Seasonal effect was very prominent on the uptake of nutrients. The N uptake was more during summer (56.59 kg ha^{-1}) than kharif (54.21 kg ha^{-1}) and rabi (50.25 kg ha^{-1}). The P uptake was more during kharif (15.64 kg ha^{-1}) than summer (11.37 kg ha^{-1}) and rabi (9.81 kg ha^{-1}).The uptake of K was more during kharif (93.72 kg ha^{-1}) than summer (85.60 kg ha^{-1}) and rabi (81.17 kg ha^{-1}).*

Key words: *Bajra Napier hybrid grass, Nutrient uptake, Spacing*

INTRODUCTIN

The livestock rearing is taken up as a subsidiary or supporting activity for the supply of milk, meat, wool and manure besides using them as work or draught animals. It is the major source of income for the people living in drought prone, hilly, tribal and other specific areas where crop production is uncertain. Irrespective of land forms, animal rearing is a supporting means which enhances the earning capacity of the landless, marginal and small farmers. Napier grass (*Pennisetumpurpureum* Schum.) is native of Zimbabwe in tropical Africa. Napier grass is a tall clumped grass with thick growth. It is also known as elephant grass. Its peculiarity is its high herbage yield. The interspecific hybrid between Napier grass and bajra crop was first developed in South Africa and was named as "Bakala Napier hybrid" or "Bana grass". Hybridisation works were started in India at Coimbatore in 1953 and then at New Delhi in 1961, resulting in the release of Cumbu Napier hybrid grasses and Pusa giant hybrid grass, respectively. The hybrids were sterile triploids and are superior to both Napier and Bajra possessing the beneficial qualities of both parents. Giant Napier or Hybrid *Pennisetum* is synonymously used to refer the Bajra Napier grass hybrids. Compared to Napier grass, hybrid Napier produces more tillers and has numerous persistent hairs on leaf blades and sheaths with less sharper leaf edges. Therefore introduction and evaluation of new hybrid Napier grass with improved agronomic practices is the right approach to augment the supply of green fodder. Studies on these aspects are meagre in the coastal region of Union Territory of Pondicherry. Hence an attempt has been made in the present investigation to study the seasonal influence on the relative productivity of Bajra Napier hybrid grass under different plant spacings in the lowlands of coastal region of Karaikal.

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MATERIALS AND METHODS

A field experiment was conducted at Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA&RI), Karaikal, Union Territory of Puducherry, to study the Influence of plant spacing on the relative productivity of Bajra Napier hybrid grass in the lowlands of coastal region of Karaikal. The experiment was conducted for one year (February 2011 to February 2012).It was laid out in field number 'D11' of Eastern farm of PAJANCOA & RI, Karaikal. The farm is situated between 10˚49' and 11˚01' N latitude and 78˚43' and 79˚52' E longitude and at an altitude of four meters above mean sea level.Five Bajra Napier hybrid grasses *viz*., CO 3, CO 4, KKM 1, IGFRI 7 and IGFRI 10 were planted under three different plant spacings (60 cm x 45 cm, 60 cm x 30 cm and 45 cm x 45 cm), laid out in Randomized Block Design (RBD) with three replications The root slips of 30 cm length of the five hybrid grasses were planted in each plot with three different spacings as per the treatment. Basal application of FYM @ 10 t ha^{-1} was applied. Recommended fertilizer dose of 150: 50: 40 kg N:P_2O_5:K_2O ha^{-1} was applied. Full dose of P and K and 50 per cent N were applied as basal and the remaining 50 per cent N was applied as top dress on 45 days after planting. After every cut, a common dose of 75 kg N ha^{-1} was applied up to 7th cut.The first cut of Bajra Napier hybrid grasses was made at 90 days after planting and the subsequent cuts were made at 45 days interval up to 7thcut leaving the stubbles of 15 cm height from the ground level. The green fodder yield was recorded in the net plot and expressed in t ha^{-1}.The various biometric observations, the analytical data of soil and plant samples and the computed data were subjected to statistical scrutiny as per the procedures given by Gomez and Gomez (2010).

RESULTS

There was significant difference in green fodder yield among the hybrids. This significance was noticed throughout the year and seasons. The hybrid CO 3 recorded the highest green fodder yield of (25.32 t ha^{-1} cut^{-1}), followed by IGFRI 7 (23.71 t ha^{-1} cut^{-1}), IGFRI 10 (22.73 t ha^{-1} cut^{-1}) and CO 4 (21.70 t ha^{-1} cut^{-1}) and the lowest yield was recorded by the hybrid KKM 1 (21.03 t ha^{-1} cut^{-1}) as evident from the mean of seven cuts.

The seasonal influence was very conspicuous in respect of green fodder yield. The highest green fodder yield of 27.57 t ha^{-1} cut^{-1} was registered during *kharif* season, followed by summer (25.05 t ha^{-1} cut^{-1}) and the lowest yield was recorded during *rabi* (18.34 t ha^{-1} cut^{-1}), by the hybrids irrespective of plant spacings.

The total annual green fodder yield of all the seven cuts spread over the three seasons was the highest in CO 3 hybrid (177.28 t ha^{-1} $year^{-1}$) followed by IGFRI 7 (165.98 t ha^{-1} $year^{-1}$), IGFRI 10 (159.17 t ha^{-1} $year^{-1}$) and CO 4 (151.90 t ha^{-1} $year^{-1}$). The lowest green fodder yield 147.24 t ha^{-1} $year^{-1}$ was recorded in KKM 1 hybrid.

The annual total green fodder yield spread over the three seasons was significantly influenced by the plant spacings. Planting at 45 cm x 45 cm produced the highest total green fodder yield of 175.61 t ha^{-1} $year^{-1}$, followed by 158.79 t ha^{-1} $year^{-1}$ at 60 cm x 45 cm spacing. The lowest yield of 146. 54 t ha^{-1} $year^{-1}$ was registered by spacing of 60 cm x 30 cm.

Dry fodder yield

There was significant variation in dry fodder yield of the hybrids throughout the crop growth. The trend of dry fodder yield was like that of green fodder yield. The mean of seven cuts revealed that CO 3 recorded the highest dry fodder yield, whereas KKM registered the lowest dry fodder yield.

Seasonal influence on dry fodder yield was prominent. Among the seasons, *kharif* registered the highest dry fodder, yield followed by summer and *rabi*, in all the hybrids across the plant spacings.

Growth components

When looking into the seasonal effect, *kharif* recorded the tallest plants (163.20 cm), followed by *rabi* (159.19 cm) and summer (154.11 cm) in all the hybrids irrespective of plant spacings. The seasonal effect was conspicuous, longer leaves were observed during *kharif* than during *rabi* and summer for all the hybrids, irrespective of spacings. The leaf length during *kharif*, *rabi* and summer were 99.84 cm, 81.98 cm and 89.42cm, respectively. With respect to the seasons, summer recorded broader leaves (2.81cm), followed by *kharif* (2.44cm) and *rabi* (2.30cm), as observed in all the hybrids irrespective of the spacings.

Irrespective of spacings the seasonal effect was conspicuous. More number of leaves were observed in *kharif* than during *rabi* and summer seasons. The number of leaves per $hill^{-1}$ during *kharif*, *rabi* and summer were 149.56, 134.85 and 122.78, respectively. Seasonal influence on the number of live tillers were observed. In general, the number of tillers per hill were higher during *kharif* (19.21), followed by *rabi* (19.07) and lower in summer (15.24), in all the hybrids

irrespective of plant spacings. When looking into the seasonal effect, summer recorded the lowest number of dead tillers (6.69), followed by *rabi* (11.49) and *kharif* (11.14), at all hybrids irrespective of plant spacings. The seasonal effect was conspicuous in respect of leaf to stem ratio. *Rabi* season registered the highest leaf to stem ratio (2.51), followed by summer (2.40) and *kharif* (2.28) at all hybrids, irrespective of spacings.

DISCUSSION

The weather and season had positive effect on the growth and yield components like plant height, number of live tillers hill^{-1}, number of leaves hill^{-1} and leaf length. All these parameters were higher during *kharif*, Chellamuthu *et al*. (2011) followed by summer due to favorable weather conditions prevailed during cropping period. On the contrary, the cloudy weather

Table 1
Green fodder yield per cut (t ha^{-1}) of Bajra Napier hybrids under different seasons

Treatments	*Cuttings*							*Mean of 7 cuts*	*Seasons*		
	I	*II*	*III*	*IV*	*V*	*VI*	*VII*		*Summer***	*Kharif***	*Rabi****
A. Hybrids (H)											
H_1:CO3	27.56	28.23	24.57	35.54	26.38	17.75	17.62	25.32	27.90	29.85	20.58
H_2:CO4	24.73	24.25	20.34	33.41	18.89	13.24	16.94	21.70	24.49	26.90	16.36
H_3:KKM 1	22.84	22.88	19.91	31.29	24.22	12.68	13.39	21.03	22.86	25.60	16.76
H_4:IGFRI 7	25.16	25.55	22.65	34.96	25.04	15.31	17.28	23.71	25.36	28.81	19.31
H_5:IGFRI 10	24.76	24.54	20.50	32.89	24.67	14.68	17.11	22.73	24.65	26.68	18.82
SEd	0.84	1.06	1.05	1.10	0.64	0.78	0.82	0.30	0.58	0.74	0.43
CD(P=0.05)*	1.73	2.17	2.16	2.26	1.31	1.60	1.69	0.62	1.19	1.52	0.88
B. Spacing (S) (cm)											
S_1:60x45	24.48	25.13	21.76	33.52	22.59	14.35	16.95	22.68	24.80	27.64	17.96
S_2:60x30	23.96	23.48	19.25	31.47	20.73	13.69	13.94	20.93	23.72	25.36	16.12
S_3:45x45	26.60	26.65	23.79	35.66	28.21	16.15	18.52	25.08	26.63	29.72	20.96
SEd	0.65	0.82	0.81	0.85	0.49	0.60	0.64	0.23	0.45	0.57	0.33
CD(P=0.05)*	**1.34**	**1.68**	**1.67**	**1.75**	**1.02**	**1.23**	**1.31**	**0.48**	**0.92**	**1.17**	**0.68**

** Mean of two cuts *** Mean of three cuts

Table 2
Interaction effect of Bajra Napier hybrids and plant spacings on green fodder yield per cut (t ha^{-1}) under different seasons.

C. Interaction (HxS)	*Cuttings*							*Mean of 7 cuts*	*Seasons*		
	I	*II*	*III*	*IV*	*V*	*VI*	*VII*		*Summer***	*Kharif***	*Rabi****
H_1S_1	27.35	28.45	25.22	36.73	24.53	18.25	16.58	25.30	27.90	30.97	19.79
H_1S_2	27.28	26.78	20.95	33.48	24.90	15.14	15.70	23.46	27.03	27.21	18.18
H_1S_3	28.07	29.46	27.55	35.21	29.72	19.86	20.57	27.20	28.76	31.38	23.38
H_2S_1	23.89	25.03	19.74	32.66	18.89	11.98	18.98	21.52	24.46	26.20	16.45
H_2S_2	22.69	22.68	18.81	30.85	18.09	13.49	12.74	19.90	22.68	24.83	14.77
H_2S_3	27.62	25.09	22.47	36.90	19.70	14.77	19.11	23.66	26.33	29.69	17.87
H_3S_1	22.43	23.44	19.69	30.11	21.22	11.34	13.60	20.26	22.93	24.90	15.39
H_3S_2	21.52	20.85	17.92	29.88	20.94	12.56	11.56	19.32	21.18	23.90	15.02
H_3S_3	24.58	24.37	22.13	33.88	30.51	14.14	15.01	23.52	24.47	28.00	19.89
H_4S_1	24.62	25.69	24.02	34.60	24.96	15.36	17.25	23.78	25.15	29.31	19.19
H_4S_2	24.41	24.58	19.07	33.29	21.36	15.06	15.84	21.87	24.49	26.18	17.25
H_4S_3	26.46	26.38	24.87	36.98	28.81	18.80	19.27	25.47	26.42	30.93	21.19
H_5S_1	24.10	23.07	20.11	33.48	23.22	18.34	18.32	22.53	23.58	26.79	18.99
H_5S_2	23.92	22.50	19.48	29.85	18.36	12.22	14.38	20.10	23.23	24.67	14.98
H_5S_3	26.27	28.02	21.91	35.33	32.33	16.48	18.63	25.57	27.14	28.62	22.48
SEd	1.46	1.84	1.82	1.91	1.11	1.35	1.43	0.52	1.00	1.28	0.74
CD(P=0.05)*	2.99	3.77	3.74	NS	2.28	2.77	2.92	1.08	2.06	2.63	1.52
Overall mean to compare the seasonal effect									**25.05**	**27.57**	**18.34**

H_1: CO 3, H_2: CO 4, H_3: KKM 1, H_4: IGFRI 7, H_5: IGFRI 10
S_1: 60cm x 45cm, S_2: 60cm x 30cm, S_3: 45cm x 45cm
** Mean of two cuts
***Mean of three cuts

Table 3
Over all means to compare the seasonal effect on growth and yield components

Growth & Yield Components	*Seasons*		
	*Summer***	*Kharif***	*Rabi****
Plant height	154.11	163.20	159.15
Leaf length	89.42	99.84	81.98
Leaf width	2.81	2.44	2.30
No. of leaves	122.78	149.56	134.85
No. of live tillers	15.24	19.21	19.07
No. of dead tillers	6.69	11.14	11.49
Leaf to stem ratio	2.40	2.28	2.51

** Mean of two cuts *** Mean of three cuts

prevailed during *rabi* with low temperature, was not favourable for growth and yield parameters.

Seasonal influence was found in green and dry fodder yield. Higher green fodder yield per cut was obtained during *kharif* (29.85 t ha^{-1} cut^{-1}), followed by summer (27.90 t $ha^{-1}cut^{-1}$) and the lowest yield was recorded during *rabi* season (20.58 t ha^{-1} cut^{-1}). The highest yield during *kharif* season is attributed to favorable growing environment. During this period, 139.5 mm of rainfall was recorded besides supplemental irrigation and there were good amount bright sunshine hours (514.1 hrs). The weekly mean maximum temperature ranged from 36.0°C to 34.92°C. The bright sunshine hours could have helped to aerate the soil and induce the photosynthetic activity in the presence of sufficient moisture and nutrients, this result is in accordance with Sridevi (2011).The second best green and dry fodder yield was obtained during summer which might be due to the prevalence of bright sunshine hours and relatively high minimum and maximum temperatures which would have increased the number of tillers $hill^{-1}$ thereby it resulted in higher fodder yield due to accumulation of high photosynthates. Khan and Manghatt (1965) and Saeed *et al.* (1996) also reported that green fodder yield of mott grass decreased as plant spacing was increased.

Despite good rainfall (716.00 mm) and more sunshine hours (976.82 hrs), the yield was low during *rabi*. This might be due to prevalence of low maximum temperature (29.88°C to 31.92°C) and minimum temperature (20.54°C to 24.31°C) during *rabi* and occurrence of saturated soil conditions for longer period or inundation of water for shorter period that would have resulted in poor root activity and in turn it could have affected the uptake of nutrients which ultimately would have resulted in relatively low fodder yield during *rabi*. These results are in conformity with the findings of Kumar (2004) who reported similar effect in CO 3 Bajra Napier hybrid grass.

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