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PERFORMANCE OF FODDER PEARL MILLET GENOTYPES TO DIFFERENT LEVELS OF NITROGEN

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SUMMARY

A field experiments was carried out at Zonal Agricultural Research Station, Vishweswaraiah Canal Farm, Mandya, University of Agricultural Sciences, Bangalore, Karnataka, under All India Coordinated Research Project on Forage Crops during *kharif* season of 2017 to study the response of pearl millet genotypes to nitrogen levels. The research results revealed that national check Giant Bajra recorded significantly higher green forage, dry matter, crude protein yield and total digestible crude protein yield (326.5 q, 75.4 q, 5.8 q and 4.9 q/ha, respectively). Application of nitrogen 90 kg/ha significantly recorded higher green forage, dry matter, crude protein yield and total digestible crude protein yield (367.7 q, 92.9 q, 6.1 q and 5.2 q/ha, respectively). The Agronomic efficiency of nitrogen was higher (192 kg green fodder kg^{-1} of Nitrogen) with application of nitrogen 30 kg/ha. The net monetary returns (Rs 16,652/ha) and B : C ratio was higher (1.83) with application of nitrogen 90 kg/ha.

Key words : Pearl millet, green forage yield, dry matter yield, nitrogen use efficiency

Pearl millet (*Pennisetum glaucum* L.) is extensively cultivated dual purpose crop over large part Africa, Asia and Australia. India and Africa together accounts for 92.3 per cent of world pearlmillet production. It is the fourth most important food crop grown in arid and semi-arid regions (Anonymous, 2011). It is highly palatable cereal fodder with good nutritional profiles, rich in tryptophan and cysteine and free from anti-nutritional factor compared to sorghum. The toxic component HCN is less as compared to sorghum. It is most widely adopted cereal crop under rainfed ecosystem, its gaining popularity in Karnataka due to its quick growing habit, short duration, superior in quality and better palatability. After varietal improvement nutrition plays a prime role in enhancing yield and quality especially nitrogen, it is primary essential nutrient which increases vegetative growth of plant and contributing for higher herbage yield ad quality which is highly desirable for green forage yield and dry matter accumulation (Kumar *et al.,* 1997). It is a non-leguminous crop, definitely will respond to nitrogenous fertilizer. Hence, the present study was undertaken to assess the optimum level of nitrogen for higher green fodder yield and quality.

MATERIALS AND METHODS

The present investigation was carried out at Zonal Agricultural Research station, Vishweswaraiah Canal Farm, Mandya, University of Agricultural sciences, Bangalore, Karnataka, under all India coordinated Research project on forage crops during *kharif* season of 2017 under rainfed ecosystem. The experiment was laid out in factorial randomized block design with three replications. The experiment is consisted of 24 treatment combinations, including six pearlmillet genotypes (TSFB-10-5, RBB-6, TSFB-14-10, TSFB-13-12, Moti Bajra, Giant Bajra and four nitrogen levels (0, 30, 60 and 90 kg N/ha). The texture of the soil is red sandy loam with pH 7.16 and low in available nitrogen, (212.20 kg/ha), medium in available phosphorus (25.65 kg/ha) and potassium (165.05 kg ha^{-1}). The crop was sown during 1st week of July at a row spacing of 30 cm. The nitrogen was applied in the form of urea as per the treatment. Whereas, recommended dose of phosphorus (60 kg/ha) and potassium (40 kg/ha) was applied as a basal dose in the form of single super phosphate and murate of potash respectively at the time of sowing. The cultural operations and other production practices were followed as per local recommendations. The known quantity of sample was taken and oven dried till attain constant weight in thermo statistically controlled oven at 70 + 2°C temperature for the estimation of dry matter content and yield and as well as other quality parameters. The agronomic efficiency of nitrogen was worked out using following formula suggested by Nova and Lomis (1981) and expressed in kg green fodder per kg nitrogen applied. The total digestible crude protein yield (TDCPY) was calculated using following equation adopted by Iqbal *et al.* (2013). The economics was worked out with prevailing market price and data was statistical analyzed for interpretation of results and draw conclusion.

$$\text{Agronomic Efficiency of Nitrogen (Kg GFY/Kg N)} = \frac{\text{“Green forage yield in Nitrogen applied plot - green forage yield in No Nitrogen plot” (kg)}}{\text{Amount of Nitrogen applied (Kg)}}$$

$$\text{Dry matter yield (q/ha)} = \frac{\text{Dry matter \%} \times \text{Green forage yield (q/ha)}}{100}$$

$$\text{Crude protein yield (q/ha)} = \frac{\text{Crude protein \%} \times \text{Dry matter yield (q/ha)}}{100}$$

Total digestible crude protein yield (q/ha) = [0.97 × Crude protein yield (q/ha)] – 0.67

RESULTS AND DISCUSSION

Fodder yield

Pearl millet genotypes responded significantly to the varied levels of nitrogen with respect to green fodder and dry matter yield (Table 1). Among genotypes Giant Bajra significantly recorded higher green forage yield (326.5 q/ha) which was on par with rest of genotypes (301.4 q to 320.7 q/ha) except TSFB-10-5 (269.8 q/ha). The same variety recorded higher dry matter yield (75.4 q/ha) which was on par with Moti Bajra (75.3 q/ha) TSFB-13-12 (71.0 q/ha), TSFB-14-10 (68.5 q/ha) and superior over rest of the genotypes. The data indicated that incremental level of nitrogen increase the green fodder and dry matter yield. Application of nitrogen at 90 kg/ha recorded significantly higher green fodder (367.7 q/ha) and dry matter yield (92.9 q/ha) over other levels. The interaction between genotypes and nitrogen levels found non-significant. The increase in green bio-mass yield is due to improved growth parameters *viz.,* plant height (134.9 cm) and leaf stem ratio (0.32). Apart from these nitrogen is directly involved in cell division, cell elongation, formation of nucleo tides and co-enzymes which resulted in increased meristematic activity, since nitrogen integral part of chlorophyll, plays an important role in photosynthesis and produce more of photosynthates, which helped in accumulation and production of more dry matter yield. This is in confirmity with the findings of Damame *et al.* (2013), Rana *et al.* (2009), Suneethadevi and Padmaja (2007) and Sheoran *et al.* (2008). Manjanagouda *et al.* (2017), Shekara *et al.* (2015) and Shekara *et al.* (2020).

TABLE 1
Growth and yield parameters of pearl millet genotypes as influenced by nitrogen levels

Genotypes	Plant height (cm)	Leaf stem ratio	Green forage yield (q/ha)	Dry matter (q/ha)
TSFB-10-5	115.8	0.26	269.8	62.7
RBB-6	108.3	0.23	301.4	68.5
TSFB-14-10	121.9	0.23	307.6	65.6
TSFB-13-12	120.1	0.25	320.7	71.0
Moti Bajra	118.9	0.31	313.6	75.3
Giant Bajra	115.7	0.29	326.5	75.4
S. Em±	2.98	0.01	8.89	2.20
C. D. (P=0.05)	9.39	0.03	28.01	6.94
Nitrogen levels (kg/ha)				
0	90.0	0.21	235.7	45.1
30	116.0	0.25	293.2	64.0
60	126.2	0.28	329.7	77.1
90	134.9	0.32	367.7	92.9
S. Em±	2.71	0.01	6.26	1.69
C. D. (P=0.05)	7.76	0.02	17.95	4.86
Interaction	NS	NS	NS	NS

Fodder quality

The genotypes differed significantly with crude protein content, yield and total digestible crude protein yield (Table 2). Among genotypes Giant bajra recorded significantly higher crude protein content (7.7%), crude protein yield (5.8 q/ha) and total digestible crude protein yield (5.6 q/ha) over rest of the genotypes. Application of nitrogen at 90 kg/ha recorded significantly higher crude protein yield (6.1 q/ha) and total digestible crude protein yield (5.9 q/ha) over other levels. The interaction between genotypes and nitrogen levels found significant. The higher crude protein yield was attributed due to the higher crude protein content and dry matter yield with higher levels of nitrogen. The total digestible crude protein yield with higher level of nitrogen is mainly due to higher crude protein yield. These results are similar with findings of Singh *et al.* (2013), Chouhan *et al.* (2015), Gupta *et al.* (2008), Shekar *et al.* (2009) and Shekara *et al.* (2017).

TABLE 2
Quality parameters of pearl millet genotypes as influenced by nitrogen levels

Genotypes	Dry matter (%)	Crude protein (%)	Crude protein (q/ha)	Total Digestible CPY (q/ha)
TSFB-10-5	22.9	5.7	3.6	2.8
RBB-6	22.5	5.7	3.8	3.0
TSFB-14-10	21.7	6.2	4.4	3.6
TSFB-13-12	21.9	6.3	4.6	3.8
Moti Bajra	23.7	5.4	4.2	3.4
Giant Bajra	22.7	7.7	5.8	4.9
S. Em±	0.40	0.14	0.17	0.18
C. D. (P=0.05)	1.26	0.44	0.55	0.51
Nitrogen levels (kg/ha)				
0	19.7	5.5	2.5	1.7
30	21.9	5.8	3.7	2.9
60	23.4	7.0	5.4	4.5
90	25.3	6.4	6.1	5.2
S. Em±	0.39	0.13	0.13	0.11
C. D. (P=0.05)	1.11	0.36	0.37	0.32
Interaction	NS	*	*	*

Agronomic efficiency of nitrogen

Nitrogen use efficiency of genotypes was influenced by nitrogen levels (Table 3). Among genotypes Giant Bajra responded well to applied nitrogen and recorded higher agronomic efficiency of nitrogen (205 kg green fodder per kg of nitrogen) and least was observed with genotype TSFB-10-5 (131 kg green fodder per kg of nitrogen). Application of nitrogen 30 kg/ha recorded higher agronomic efficiency of nitrogen (92 kg green fodder per kg of nitrogen) whereas, higher level of nitrogen 90 kg/ha recorded lower AEN (145 kg green fodder per kg of nitrogen). The nitrogen use efficiency was higher at lower level of nitrogen and decreased with increasing N levels. This might be due to higher N levels might have led to lower utilization of applied nitrogen and incremental increase in green fodder yield beyond 30 kg nitrogen/ ha is narrow. This is in harmony with Gunri *et al.* (2004) and Shekara *et al.,* (2009).

TABLE 3
Agronomic efficiency of nitrogen and economics of pearl millet genotypes as influenced by nitrogen levels

Genotypes	Agronomic efficiency of Nitrogen (Kg GFY/Kg 'N')	Gross returns (Rs/ha)	Net returns (Rs/ha)	B : C
TSFB-10-5	131	26980	6748	1.33
RBB-6	141	30140	9908	1.42
TSFB-14-10	171	30760	10528	1.52
TSFB-13-12	151	32070	11838	1.59
Moti Bajra	190	31360	11128	1.55
Giant Bajra	205	32650	12418	1.61
Nitrogen levels (kg/ha)				
0	-	23570	4490	1.24
30	192	29320	9894	1.51
60	157	32970	13198	1.67
90	145	36770	16652	1.83

Economic analysis

Among genotypes Giant Bajra registered higher net monetary returns (12418 Rs/ha) and benefit cost ratio (1.61). Application of nitrogen 90 kg/ha recorded higher net returns (16652 Rs/ha) and benefit cost ratio (1.83). This might be due to better growth attributes which resulted higher green forage yield with higher level of nitrogen. Based on the research results it can be inferred that forage pearl millet genotype Giant Bajra with nitrogen level of 90 kg ha^{-1} found suitable and economical for cultivation in southern dry zone of Karnataka. These results are in conformity with findings of Shekar *et al.,* (2008) and Shekara *et al.* (2019).

TABLE 4
Correlation coefficients (r) between nitrogen levels and growth, yield and quality parameters

	Nitrogen levels	Plant height	Leaf stem ratio	Green forage yield	Dry matter yield	Dry matter	Crude protein	Crude protein
Nitrogen levels	1.00							
Plant height	0.96*	1.00						
Leaf stem ratio	0.99**	0.96*	1.00					
Green forage yield	0.99**	0.99**	0.99**	1.00				
Dry matter yield	0.99**	0.98*	0.99**	0.99**	1.00			
Dry matter	0.99**	0.98*	0.99**	0.99**	1.00**	1.00		
Crude protein	0.76^{NS}	0.78^{NS}	0.73^{NS}	0.76^{NS}	0.74^{NS}	0.74^{NS}	1.00	
Crude protein	0.98*	0.96*	0.98*	0.99**	0.98*	0.98*	0.85^{NS}	1.00

**Indicates highly significance level @ both p = 0.01 and p = 0.05 *Indicates significance level @ p = 0.05 NS= Non Significance.

Correlation coefficients (r) between nitrogen levels and growth, green fodder yield and quality

The correlation coefficients analyses measures relationship between growth, yield and quality with nitrogen levels are depicted in Table 4. The results revealed that traits, plant height (r= 0.96), leaf stem ratio (r= 0.99), green forage yield (r= 0.99), dry matter yield (r= 0.99), Dry matter (r= 0.99), and crude protein (r= 0.98) exhibited significant and positive correlation with incremental nitrogen levels. However crude protein content was exhibited positive but found non-significant (r= 0.76) with nitrogen levels. These results are in close relation with findings of Liu et al. (2019) reported that, there was a significant positive correlation between grain yield and N treatment.

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