Forage Res., **45** (1) : pp. 43-46 (2019) **http://forageresearch.in**

INFLUENCE OF DIFFERENT NITROGEN LEVELS ON GROWTH, YIELD AND QUALITY OF FORAGE PEARL MILLET (*PENNISETUM GLAUCUM* L.) GENOTYPES

MANINDER KAUR* AND MEENAKSHI GOYAL

Forage and Millet Section,
Department of Plant Breeding and Genetics
Punjab Agricultural University, Ludhiana 141003, Punjab, India
**(e-mail : maninder.sindhu@yahoo.com)*

(Received : 26 March 2019 ; Accepted : 9 May 2019)

SUMMARY

A field experiment was conducted at Punjab Agricultural University, Ludhiana during *kharif* season of 2018 to study the effect of different nitrogen levels on growth, yield and quality of pearl millet (*Pennisetum glaucum* L.) genotypes. The experiment was laid out in factorial randomized block design with four pearl millet genotypes (TSFB-15-8, TSFB-15-4, Giant Bajra and AFB-3) and four nitrogen levels (0, 30, 60 and 90 kg N/ha) with three replications. The results revealed that among the genotypes, AFB-3 (Zonal check) proved significantly superior over the remaining genotypes for green fodder (765.1 q/ha) as well as in dry matter (119.0 q/ha) yield. It also recorded tallest plants (281.8 cm) and maximum number of tillers per m2 (52.8). However, the genotype TSFB-15-8 recorded significantly lowest green fodder and dry matter yield but was found superior among the tested genotypes for quality aspect and had significantly highest crude protein content (8.3%). But, due to lowest dry matter yield, it fared poorly with regard to crude protein yield. The increasing levels of nitrogen from 0 to 90 kg/ha significantly increased the green fodder and dry matter yield over their lower levels. The application of 90 kg N/ha recorded an increase of 59.5, 22.4 and 7.4 per cent in green fodder and 23.4, 15.5 and 4.6 per cent in dry matter over 0, 30 and 60 kg N/ha, respectively.

Key words : Pearl millet, genotypes, fodder yield, nitrogen, crude protein

Pearl millet (*Pennisetum glaucum* L.) is traditionally a dryland crop, known by various common names such as bajra, bajri, sajja, combo or kambam cultivated mostly in arid or semi arid regions, characterized by low rainfall, sandy soils with low fertility (Singh and Chhabra, 2018) where other coarse cereals such as maize and sorghum fail to produce assured yields. This crop is not only cultivated for grain but is also valued for its stover and fodder purpose. The stover of pearl millet forms an important source of fodder particularly in dry regions accounting for 40-50% of the dry matter intake and is often the only source of feed in dry months. The dual purpose nature of pearl millet offers both food and fodder security in arid and semi-arid regions of the country (Ramesh *et al*., 2006). Pearl millet as fodder crop has an edge over sorghum and maize because its green fodder has more crude protein content and its green fodder can be safely fed to cattle at all stages of growth because of absence of hydrocyanic acid. The cultivation of pearl millet for fodder purpose is recently being emphasized due to its profuse tillering, multicut nature, absence of poisonous prussic acid and good performance even on poor soils. Although pearl millet is grown on low fertility soils but being an exhaustive cereal crop, it responds well to nitrogen fertilization (Sheoran *et al*., 2016). Besides, the development of high yielding varieties/hybrids of pearl millet has necessitated the application of nitrogenous fertilizer for realizing the full yield potential of these varieties/hybrids. Nitrogen is an essential nutrient for vegetative growth of fodder crops and plays a pivotal role in increasing the productivity and quality of forage production. Since many new improved cultivars of fodder pearl millet are being developed, therefore, it is essential to study their response to fertilizers particularly nitrogen to realize their full yield potential. Keeping these points in view, the present investigation was undertaken to study the response of new promising genotypes of fodder pearl millet to nitrogen fertilizer.

MATERIALS AND METHODS

The field experiment was conducted during rainy (*kharif*) season at research farm of Punjab Agricultural University, Ludhiana (Punjab). Ludhiana is situated at 30°54?N latitude and 75°48?E longitude with an altitude of 247 meters above the mean sea level. The experimental site has semi-arid and sub-tropical climate with hot dry summer and severe cold winter. The meteorological data for the crop season on standard meteorological week basis, as obtained from meteorological observatory of the Punjab Agricultural University are presented in Figure1. The crop received a total rainfall of 1055.2 mm. The soil of the experimental field was sandy loam in texture with pH of 7.8, low in available nitrogen (184 kg/ha), medium in available phosphorus (16.8 kg/ha) and high in available potassium (246 kg/ha). The experiment consisted of 16 treatment combinations comprising of four pearl millet genotypes (TSFB-15-8, TSFB-15-4, Giant Bajra, AFB-3) and four nitrogen levels (0, 30, 60 and 90 kg N/ha). The experiment was planned in a factorial randomized block design and each treatment was replicated thrice. The pearl millet genotypes were sown on 19-06-2018 in opened furrows at 30 cm apart using seed rate of 15 kg/ha. Half dose of nitrogen was applied as basal according to treatment levels. Remaining half dose of nitrogen was top-dressed after first irrigation (30 days after sowing). Phosphorus and potassium were applied uniformly among all the treatments at 40 kg/ha each. The crop received uniform irrigation as per requirement. All the other standard agronomic practices for the cultivation of forage pearl millet were followed uniformly among all the treatments. The crop was harvested at 50% flowering stage. The data on growth characters *viz*., plant height, number of tillers, leaf-stem ratio and yield (green fodder and dry matter) were recorded at the time of harvest. The harvested green fodder from each plot was weighed *in situ* in kg/plot and then converted into q/ha. A random sample of 500 g was taken from each plot at the time of green fodder harvest, chopped well and put into paper bag. These bags were aerated by making small holes all over. The samples were first dried in the sun for 15 days and then transferred in an electric hot air oven for drying at a temperature of 60±5°C till constant weight was achieved. On the basis of these samples, the green fodder yield was converted into dry matter yield (q/ha). Crude protein content (%) was estimated in dried and grinded samples (2 mm sieve size), collected at 50 per cent flowering stage. The crude protein content was calculated by multiplying the nitrogen percentage with 6.25 by conventional Micro-Kjeldal method (AOAC, 1995). Crude protein yield was calculated by the multiplication of crude protein content (%) with dry matter yield (q/ha). Data was analyzed by using Fisher's analysis of variance technique and the least significant difference (LSD) values at $P = 0.05$ were calculated to determine the significance of differences between treatment means.

RESULTS AND DISCUSSION

Effect of genotypes

The various genotypes differed significantly among themselves for green fodder, dry matter, growth attributes *viz*., plant height, number of tillers per m^2, leaf : stem ratio, days to 50% flowering and crude protein. The results revealed that the zonal check AFB-3 proved its superiority over other genotypes and recorded significantly highest green fodder yield

TABLE 1

Weekly weather data pertaining to temperature (°C), relative humidity (%) and rainfall (mm) during the crop season of 2018

Standard week	Dates	Temperature (°C)		Relative humidity (%)		Rainfall (mm)
		Max.	Min.	AM	PM	
25	18 June-24 June	38.3	26.3	61	36	0.0
26	25 June-30 June	37.6	27.2	64	41	141.8
27	2 July-8 July	33.9	26.0	85	62	52.8
28	9 July-15 July	35.5	28.1	79	58	64.0
29	16 July-22 July	33.4	25.9	84	77	167.8
30	23 July-29 July	33.9	26.6	85	65	91.4
31	30 July-5 August	34.3	26.6	83	64	376.6
32	6 August-12 August	32.7	26.5	86	72	53.8
33	13 August-19 August	33.9	26.8	84	69	13.0
34	20 August-26 August	34.2	27.3	83	68	0.0
35	27 August-2 September	34.1	27.3	84	67	74.0
36	3 September-9 September	33.4	26.1	88	64	20.0
37	10 September-16 September	33.4	25.2	86	60	0.0

TABLE 2
Effect of nitrogen levels on growth parameters of promising genotypes of forage pearl millet

Treatments	Plant height (cm)	Number of tillers/m^2	Leaf : stem	Days to 50% flowering
Genotypes				
TSFB-15-8	204.7	42.2	0.36	77
TSFB-15-4	174.9	44.6	0.76	83
Giant Bajra	230.0	34.0	0.61	77
AFB-3	281.8	52.8	0.69	71
S. Em±	4.2	1.0	0.01	0.7
C.D. (P=0.05)	12.3	3.0	0.03	2
Nitrogen levels				
0	176.9	40.3	0.51	72
30	221.7	42.5	0.55	72
60	238.1	43.9	0.65	75
90	254.7	46.9	0.72	78
S. Em±	4.2	1.0	0.01	0.7
C. D. (P=0.05)	12.3	3.0	0.03	2

(765.1 q/ha) as compared to the genotype TSFB-15-8 (626.2 q/ha) and national check *i.e.* Giant Bajra (641.8 q/ha) (Table 2). However, AFB-3 remained at par with the genotype TSFB-15-4, which recorded green fodder yield of 737.1 q/ha and was significantly higher as compared to TSFB-15-8 and Giant Bajra. Similarly, significantly highest dry matter yield (119.0 q/ha) was also recorded by AFB-3 over the other three entries which was followed by TSFB-15-4. The other three entries remained at par with each other with respect to dry matter production. Higher green fodder and dry matter yield in AFB-3 may be attributed to significantly more number of tillers per m^2 and significantly highest plant height over the rest of the genotypes (Table 1). The differences in plant height and number of tillers among the tested genotypes might be due to the variation in their genetic character and inter-nodal length. The genotype AFB-3 also recorded significantly highest crude protein yield (9.2 q/ha) over the other three genotypes which remained at par among themselves. The crude protein content (8.3%) was, however, highest in the genotype TSFB-15-8 while TSFB-15-4 had the lowest crude protein content (7.4%) and the remaining two genotypes had similar values for crude protein content (7.6%). The number of days required to 50 % flowering was lowest in genotype AFB-3 and highest in TSFB-15-4 and hence the green fodder productivity was significantly highest

TABLE 3
Effect of nitrogen levels on forage yield and quality of promising genotypes of forage pearl millet

Treatments	Green fodder productivity (q/ha/day)	Green fodder yield (q/ha)	Dry matter yield (q/ha)	Crude protein content (%)	Crude protein yield (q/ha)
Genotypes					
TSFB-15-8	8.1	626.2	88.2	8.3	7.4
TSFB-15-4	8.9	737.1	98.0	7.4	7.3
Giant Bajra	8.3	641.8	94.9	7.6	7.3
AFB-3	10.8	765.1	119.0	7.6	9.2
S. Em±	0.3	25.3	4.8	0.1	0.4
C. D. (P=0.05)	1.0	73.0	13.8	0.2	1.2
Nitrogen levels					
0	6.7	514.8	74.0	7.1	5.2
30	8.7	670.6	93.9	7.5	7.0
60	10.0	764.0	109.6	8.1	8.9
90	10.7	820.8	122.6	8.3	10.2
S. Em±	0.3	25.3	4.8	0.1	0.4
C. D. (P=0.05)	1.0	73.0	13.8	0.2	1.2

in AFB-3. Amodu *et al.*, (2007) and Kumar *et al.* (2013) also evaluated pearl millet genotypes for fodder yield components and nutrient composition and reported varietal differences.

Effect of nitrogen

The growth parameters *i.e.* green fodder yield, dry matter yield and crude protein yield increased consistently with increasing level of nitrogen up to 90 kg/ha. The application of 90 kg N/ha, increased the green fodder yield by 59.5, 22.4 and 7.4 per cent over 0, 30 and 60 kg N/ha, respectively and the corresponding increase in dry matter yield was 23.4, 15.5 and 4.6 per cent. A further perusal of the data in Table 2 reveals that the maximum productivity of green fodder per day and per ha was observed with the application of 90 kg N/ha followed by 60 kg N/ha. The application of higher doses of nitrogen increased the availability and absorption of nitrogen from the soil which resulted in increased vegetative growth accounted by the increase in plant height and number of tillers due to enlargement of cells and increased photosynthesis. The results are in conformity with the reports of earlier workers (Tiwana and Puri, 2005; Meena and Jain, 2013). The quality of fodder pearl millet was also found to improve with the increase in nitrogen level as there was significant increase in crude protein content up to 90 kg N/ha over the lower fertilizer levels. Increase in crude protein content brought about a significant increase in crude protein yield with increasing rate of nitrogen up to 90 kg N/ha. The increase in crude protein content of fodder pearl millet with increasing levels of nitrogen could be attributed to the fact that nitrogen is the main constituent of protein and involved in the synthesis of amino acids and accumulation of protein in plants. Verma *et al.*, (2005) also reported that crude protein content increased with increase in nitrogen levels. The interaction effect of genotypes and nitrogen levels for different parameters were found to be statistically non-significant. The number of days required to 50 % flowering increased as the rate of N application increased. This might be due to the fact that higher nitrogen application subsequently increased N absorption and enhanced the plant vegetative growth which leads to late flowering. Above results are supported by Kumar *et al.* (2012) and Tiwana *et al.* (2012).

Thus, based on the above mentioned results, it can be concluded from the investigation that the genotype AFB-3 was significantly superior over other genotypes in terms of growth and yield. However, TSFB-15-8 had highest value for crude protein content. Further, the application of 90 kg N/ha gave significantly highest green fodder and dry matter yield over the lower levels.

REFERENCES

Amodu, J. T., I. A. Adeyinka, M. S. Kallah and J. P. Alawa. 2007 : Evaluation of pearl millet accessions for yield and nutrient composition. *J. Biol. Sci.* **7** : 379-383.

AOAC, 1995 : *Association of Official Analytical Chemists,16th edn.* Official Methods of Analysis, Arlington, U. S. A, ID No. 984.13.

Kumar, A., I. S. Yadav and R. K. Arya. 2013 : Combining ability and heterosis for some yield traits and protein conent in pearl millet. *Forage Res.* **39** : 105-113.

Kumar, A., R. K. Arya, S. Kumar, D. Kumar, S. Kumar and R. Panchta. 2012 : Advances in pearl millet fodder yield and quality improvement through breeding and management practices. *Forage Res.* **38** : 1-14.

Meena, S. N. and K. K. Jain. 2013 : Effect of varieties and nitrogen fertilization on fodder pearl millet (*Pennisetum glaucum*) in North Western Rajasthan. *Ind. J. Agron.* **58** : 262-263.

Ramesh, S., P. Santhi and K. Ponnuswamy. 2006 : Photosynthetic attributes and grain yield of pearl millet (*Pennisetum glaucum* L.) as influenced by the application of composted coir pith under rainfed conditions. *Acta Agron. Hung.* **54** : 83-92.

Sheoran, R. S., Satpal, U. N. Joshi, B. S. Duhan and S. Arya. 2016 : Response of forage pearl millet (*Pennisetum glaucum* L.) genotypes to different nitrogen levels. *Forage Res.*, **42** : 115-118.

Singh, J. and A. K. Chhabra. 2018 : Genetic variability & character association in advance inbred lines of pearl millet under optimal and drought condition. *Ekin J.* **4** : 45-51.

Tiwana, U. S. and K. P. Puri 2005 : Effect of nitrogen levels on the fodder yield and quality of pearl millet varieties under rainfed conditions. *Forage Res.*, **31** : 142-143.

Tiwana, U. S., A. Singh and U. Rani. 2012 : Range Mgnt. & Agroforesty **33** : 69-72.

Verma, S. S., N. Singh, Y. P. Joshi and V. Deorari 2005 : Effect of nitrogen and zinc on growth characters, herbage yield, nutrient uptake and quality of fodder [*Sorghum bicolor* (L.) Moench]. *Ind. J. Agron.* **50** : 167-169.