Forage Res., **39** (2) : pp. 93-95 (2013) **http://forageresearch.in**

EFFECT OF DIFFERENT NITROGEN LEVELS ON NUTRITIONAL QUALITY AND NITRATE NIROGEN ACCUMULATION IN FORAGE PEARLMILLET GENOTYPES GROWN UNDER RAINFED CONDITIONS

S. V. DAMAME*, R. N. BHINGARDE AND S. H. PATHAN

AICRP on Forage Crops
Mahatma Phule Krishi Vidyapeeth,
Rahuri-413 722 (M. S.), India
**(e-mail : shivajidamame@gmail.com)*
(Received : 6 January 2014; Accepted : 26 January 2014)

SUMMARY

The application of nitrogen levels on pearlmillet genotype produced significantly higher green forage yield of 447.82 q/ha and crude protein yield of 6.60 q/ha in BAIF bajra. Whereas the genotype Gaint bajra recorded the highest dry matter yield of 75.88 q/ha and Raj bajra chari-2 with the highest crude protein content of 9.33 per cent. The application of 100 kg N/ha noticed significantly higher green forage yield of 400.32 q/ha, dry matter yield of 75.34 q/ha and crude protein yield of 6.98 q/ha. The application of 100 kg N/ha recorded significantly higher and toxic level of nitrate-N in case of BAIF bajra, JHPM-05-1 and NDFB-02 than all other genotypes. The genotype Giant bajra recorded non-toxic level of nitrate-N on application of 100 kg N/ha with the highest dry matter yield and green forage yield of 447.72 q/ha which was at par with BAIF bajra.

Key words : Forage pearlmillet, nitrogen levels, nitrate nitrogen, yield, quality

The availability of fodder resources is around 60 per cent of the requirement and area under fodder crops in India is around 8.6 M ha. To meet the fodder shortage for the growing animal population, the fodder growing area should ideally be around 20 M ha, by 2020 AD, but this appears to be rather difficult to achieve (Hazra and Tripathi,1998), only way is to look for increasing productivity per unit area either under irrigated or rainfed conditions through balanced nutrition to fodder crops. Pearlmillet (*Pennisetum glaucum* L.) is one of the most widely adapted cereal forage crops under rainfed condition and gaining more popularity in Maharashtra state due to its quick growing habit, high quality forage and better palatability. Nitrogen is an essential primary nutrient for profuse plant growth and plays a pivotal role in productivity of forage production. The application of nitrogen at various growth stages is one of the ways to increase forage productivity of crops. Although the optimization of nitrogen level is an important aspect on cost effective management of N fertilizers, the excessive use of nitrogen also leads to deteriorate soil health and accumulation of nitrate-N in fodder which is toxic to animals. The toxic effects of nitrate on ruminants are well known (Bradley *et al*., 1940). Nitrate is reduced to highly toxic nitrite by bacterial nitrate reductase in the rumen (Lewis, 1951). The primary source of nitrate exposure to ruminants is from the plants they consume (Wright and Davison, 1964). Now-a-days many new improved genotypes of pearlmillet are coming up as forage varieties and need to standardize the dose of nitrogen for better forage yield and quality with non-toxic accumulation of nitrate-N. Therefore, the present investigation was undertaken to find out whether increased doses of N application lead to increase in fodder production and nutritional quality along with the lowest toxicity levels caused by nitrate accumulation in fodder pearlmillet grown under rainfed conditions.

MATERIALS AND METHODS

The field experiment was conducted at Forage Crops Research Project, MPKV, Rahuri under rainfed conditions during **kharif** season of 2007-08. The experiment was laid out in a factorial randomization block design with three replications. Twenty-four treatment combinations formulated due to eight varieties and three

nitrogen levels of 50,75 and 100 kg N/ha (Table 1). The soil of the experimental field was clayey in texture, low in available nitrogen (209 kg/ha), medium in phosphorus (10.11 kg/ha) and high in potash (436 kg/ha). The crop was fertilized with 30 kg each of P_2O_5 and K_2O/ha. The half quantity of nitrogen was applied at the time of sowing and remaining half quantity was top dressed at 30 days after sowing as per the treatments. The crops were harvested at 50 per cent flowering. There was good and well distributed rainfall during the crop season. The crude protein content was determined on dry weight basis according to standard A. O. A. C. (1990) method and nitrate-N was estimated spectrophotometrically according to hydrazine sulphate reduction method (Sawicki and Scaringelli,1971).

RESULTS AND DISCUSSION

Varieties

The differences in green forage, dry matter, crude protein content and crude protein yield differed significantly due to varieties (Table 1). The variety BAIF bajra produced significantly higher green forage yield of 477.82 q/ha than all other varieties. The variety Giant bajra being at par with BAIF bajra recorded statistically higher dry matter yield of 75.88 q/ha as compared to all other varieties under study. The statistically higher crude protein content of 9.33 per cent was recorded in variety Raj bajra chari-2 which was at par with BAIF bajra and PHB-2172 and significant by higher crude protein yield of 6.60 q/ha was registered with variety BAIF bajra which was at par with Giant bajra, PHB-2172 and NDFB-02. Similar results were reported by Verma and Midha (1989), Verma (1993) and Sharma *et al*. (1999).

Nitrogen Levels

Data presented in Table 1 reveal that the application of 100 kg N/ha noticed significantly higher green forage yield (400.32 q/ha), dry matter yield (75.34 q/ha), crude protein content (9.23%), crude protein yield (6.98 q/ha) and nitrate-N (817.3 ppm) than all other levels of nitrogen. Increasing levels of nitrogen

TABLE 1
Green forage yield, dry matter yield, crude protein content, crude protein yield and nitrate-N in pearlmillet genotypes as influenced by nitrogen levels under rainfed conditions

Treatment	Green forage yield (q/ha)	Dry matter yield (q/ha)	Crude protein content (%)	Crude protein yield (q/ha)	Nitrate-N (ppm)
I. Genotypes					
Raj bajra Chari-2	271.89	56.80	9.33	5.53	465.7
Giant bajra	447.72	75.88	7.92	6.17	181.5
PHB-2172	300.49	67.45	8.91	6.04	793.2
JHPM-05-1	377.19	46.44	8.62	4.03	131.4
NDFB-2	327.80	68.38	8.60	5.95	126.5
BAIF bajra	447.82	71.80	9.09	6.60	714.5
JHPM-05-2	406.82	52.29	8.11	4.26	252.8
NDFB-09	329.35	64.04	8.08	5.25	521.6
S. E±	10.27	2.10	0.18	0.25	8.83
C. D. (P=0.05)	29.23	5.98	0.50	0.71	25.12
II. Nitrogen levels (kg/ha)					
50	329.66	48.13	7.93	3.80	143.0
75	372.18	65.19	8.59	5.59	234.9
100	400.32	75.34	9.23	6.98	817.3
S. E±	6.29	1.29	0.11	0.15	5.40
C. D. (P=0.05)	17.90	3.66	0.31	0.43	15.38
III. Interaction					
S. E±	17.79	3.64	0.30	0.43	15.2
C. D. (P=0.05)	NS	NS	NS	NS	43.5
CV (%)	8.39	10.02	6.11	13.70	6.65

NS–Not Significant.

TABLE 2
Interaction effect of pearl millet genotypes and nitrogen levels on nitrate-N under rainfed conditions

Genotype	N levels (kg/ha)			Mean
	50	75	100	
Giant bajra	172.6	398.6	825.8	465.7
Raj bajra chari-2	105.0	122.1	317.2	181.4
BAIF bajra	285.5	309.0	1812.0	793.2
PHB-2172	119.4	124.6	160.0	131.3
JHPM-05-2	68.8	107.9	102.8	126.5
JHPM-05-1	257.3	105.7	1380.6	714.5
NDFB-09	88.7	122.5	547.3	252.8
NDFB-02	83.4	188.9	1292.7	521.6
Mean	143.0	234.9	817.3	-
S. E±			15.2	
C. D. (P=0.05)			43.5	
C. V.			6.65	

Toxic level of nitrate-N : >1000 ppm.

from 50 to 75 and 75 to 100 kg/ha increased the green forage yield by 12.90 and 07.56 per cent and crude protein yield by 35.44 and 15.57 per cent, respectively. Theses results are in agreement with those reported by Reddy and Reddy (1991), Subbian (1991), Karle *et al.* (1996) and Sharma *et al.* (1999).

Nitrate-N

The data presented in Table 1 reveal that nitrate nitrogen content differed significantly in all pearlmillet genotypes and different N levels were found significant. However, no any genotype as well as N level was above the toxic level of nitrate-N (>1000 ppm) (Miyazaki *et al.,* 2003). The interaction effect of genotypes and N levels of nitrate-N was also found significant. The genotype BAIF bajra with 100 kg N/ha recorded significantly highest and toxic level of nitrate-N (1812.0 ppm) and was at par with genotypes JHPM-05-1 (1380.6 ppm) and NDFB-02 (1292.7 ppm) with same N level as compared to other genotypes (Table 2). The interaction effect of all genotypes with 50 and 75 kg N/ha showed non-toxic level of nitrate-nitrogen under rainfed conditions.

The aforesaid results indicated that genotype Giant bajra recorded the non-toxic level of nitrate-N on application of 100 kg N/ha with highest dry matter, crude protein and green forage yields.

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