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Green Forage Yield, Nutritional Value and Economics of Dinanath Grass Genotypes as Influenced by Nitrogen Levels

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Abstract

The field experiment was conducted during *kharif* season of 2021 at Zonal Agricultural Research Station, Vishwesharaiah Canal Farm, Mandya, University of Agricultural Sciences, Bangalore, Karnataka to assess the performance of Dinanath grass genotypes under different nitrogen levels. The experiment was laid out in randomized complete design with factorial concept with 30 treatment combinations and replicated thrice. Among genotypes, JHD-19-4 recorded significantly higher green forage (305.1 q ha^{-1}), dry matter (73.2 q ha^{-1}), crude protein (4.50 q ha^{-1}), total digestible crude protein (3.7 q ha^{-1}), crude fibre yield (19.0 q ha^{-1}) and nitrogen use efficiency (572.8 kg GFY/kg of nitrogen) over rest of the genotypes. Application of nitrogen 90 Kg ha^{-1} recorded significantly higher green forage (296.7 q ha^{-1}), dry matter (78.7 q ha^{-1}), crude protein (5.6 q ha^{-1}), total digestible crude protein (4.8 q ha^{-1}), crude fibre yield (19.1 q ha^{-1}) and net monetary returns (Rs.34870 ha^{-1}). The higher nitrogen use efficiency was noticed with nitrogen @ 30 kg ha^{-1} (666.8 kg GFY/kg nitrogen).

Keywords : Dinanath grass, Nitrogen levels, Green fodder yield, Dry matter yield, Crude protein yield and total digestible crude protein

Dinanath grass (*Pennisetum pedicellatum* Trin.) is annual tufted grass, quick growing, leafy, luscious, thin stem grows well in poor and eroded soil and tolerance to drought conditions (Noitsakis *et al.,* 1994). The grass belongs to family Poaceae and widely distributed in West Africa and India. In India, it is cultivated in Karnataka, Maharashtra, Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand, Odisha and West Bengal (Nayar *et al.,* 2009 and Upadhyaya *et al.,* 2014). Dinanath grass is widely used as green fodder for animal feed, as hay and silage making and also providing good quality forage for maintaining nutritional security in animals health during lean situations. Besides, as forage crop, it is also used as ornamental, soil erosion control and bio-energy crop and improve the physical and chemical properties of the soil (Kumar & Jena, 1996 and Kumar & Ghosh, 2018).

Dinanath grass is also rich in sodium, potassium, phosphorus and calcium. It has potential to be used in alleviating macro and micro-nutrients deficiencies in animals (Mustapha *et al.,* 2018; Suleiman *et al.,* 2020). The quality depends upon the stage of harvest (Asmare *et al.,* 2017 and Tilahun *et al.,* 2017) and nutrient management. Among nutrients nitrogen management plays a pivotal role in enhancing quantity and quality of the fodder crop. The Nitrogen promotes vegetative growth and improves the quality by increasing the crude protein content. Since, it is a constituent of amino acid, the deficiency of this in fodder crops may cause severe disorders in animal health (Midha *et al.,* 2015). Keeping these things in view, it is essential to find out the optimum dose of nitrogen for fetching both quantitative and qualitative fodder. Hence, the present investigation was undertaken to study the response of Dinanath grass genotypes to varied nitrogen levels for enhancing the green forage yield and quality.

Material and Methods

The experiment was carried out during *kharif* season of 2021 at Zonal Agricultural Research Station, Vishwesharaiah Canal Farm. Mandya, University of Agricultural Sciences, Bangalore, Karnataka to optimise the nitrogen requirement for higher green forage yield and quality in genotypes of Dinanath grass. The soil of the experimental site is red sandy loam in texture with neutral in reaction (pH-7.36) and low in available nitrogen (234 kg N ha^{-1}), medium in available phosphorus (38.7 kg ha^{-1}) and potassium (153.4 K_2O kg ha^{-1}). The experiment is consisted of 15 treatment combinations including five genotypes (V_1- JHD-19-4, V_2- BAU-DN-110-18-2, V_3- BAU-DN-109-8, V_4- BAU-DN-103-18-2, V_5: Bundel Dinanath-2 (National check) and three nitrogen levels (30, 60 and 90 N Kg ha^{-1}) was laid out in factorial randomized block design and replicated thrice. The crop was sown during the second week of July with a row spacing of 30 cm and 10 cm between plants. The recommended dose of phosphorus (60 Kg ha^{-1}) and potassium (40 Kg ha^{-1}) was applied at the time of sowing. The nitrogen was applied in the form of urea as per the treatment and applied 50 per cent as basal at the time of sowing and remaining 50 per cent at 30 days after sowing. The cultural practices were followed as per local recommended package of practices for establishment of crop. The crop was harvested at flowering stage and immediately after the harvest, the green fodder yield was recorded respectively as per treatment. The known quantity of fresh sample was taken and kept in thermo statically controlled oven at 60 ± 2 °C temperature and dried till it attained constant weight for the estimation of dry matter content, yield and as well as other quality parameters. The nitrogen use efficiency (NUE) was worked out using following formula and expressed in Kg green fodder per Kg of nitrogen applied. The total digestible crude protein yield (TDCPY) was

Table 1

Growth and yield of Dinanath grass genotypes as influenced by nitrogen levels recorded at harvest

Genotypes	Plant height (cm)	Leaf Stem ratio	Green Forage yield (q/ha)	Dry matter yield (q/ha)	Green Forage yield (q/ha/day)	Dry Matter yield (q/ha/day)
JHD-19-4	96.0	0.27	305.1	73.2	4.4	1.00
BAU-DN-110-18-2	75.4	0.19	217.9	49.9	3.2	0.73
BAU-DN-109-8	79.7	0.21	224.4	54.2	3.1	0.75
BAU-DN-103-18-2	87.0	0.22	254.1	58.4	3.6	0.89
Bundel Dinanath-2	84.1	0.22	257.6	60.6	3.5	0.82
S.Em±	2.23	0.006	8.03	2.38	0.13	0.04
C.D at 5%	6.49	0.018	23.39	6.94	0.38	0.12
Nitrogen Levels (Kg/ha)						
30	68.6	0.20	200.1	39.6	2.8	0.56
60	87.0	0.22	258.9	60.4	3.7	0.86
90	97.8	0.24	296.7	78.7	4.2	1.10
S. Em±	1.73	0.005	6.22	1.85	0.10	0.03
C.D at 5 %	5.03	0.014	18.12	5.38	0.29	0.08
Interaction						
S. Em±	3.86	0.01	13.91	4.13	0.23	0.06
C.D at 5%	NS	NS	NS	NS	NS	NS

calculated using following equation adopted by Iqbal *et. al.* (2013). The economics was worked out with prevailing market price and input cost. The statistical analysis of data was carried out for interpretation of the results and draw valuable conclusion.

Results and Discussion

Green Forage Yield (q/ha)

The green forage yield of Dinanath grass genotypes was significantly influenced by nitrogen levels (Table 1). Among genotypes significantly higher green forage yield was noticed with JHD-19-4 (305.1 q ha^{-1}) and superior over rest of genotypes. The lower green forage yield was observed with genotype BAU-DN-110-18-2 (217.9 q ha^{-1}). Application of nitrogen at 90 Kg ha^{-1} recorded significantly higher green forage yield (296.7 q ha^{-1}) followed by 60 Kg N ha^{-1} (258.9 q ha^{-1}). The interaction between genotypes and nitrogen levels was found non-significant. Nitrogen is major plant nutrient, plays a pivotal role in cell division, cell elongation and differentiation, which leads to better root proliferation and luxuriant growth it is evidenced by higher plant height and leaf stem ratio and resulted higher green forage yield. The similar results were reported by Abraham *et al.* (1980a), Abraham *et al.* (1980b), Reddy *et al.* (1981), Tyagi & Singh (1986), Yadav & Sharma (1986), Bhagat *et al.* (1986), Tripathi & Singh (1991), Iqbal *et al.* (2013), Midha *et al.* (2015), Shekara *et al.* (2022) and Singh *et al.* (1997).

Dry Matter Yield

The dry matter yield of Dinanath grass genotypes was significantly influenced by nitrogen levels recorded at harvest (Table 1), Among genotypes, JHD-19-4 recorded significantly higher dry matter yield (73.2 q ha^{-1}) over other genotypes. Application of Nitrogen 90 Kg ha^{-1} recorded higher dry matter yield (78.7 q ha^{-1}) followed by 60 N Kg ha^{-1} (60.4 q ha^{-1}). The interaction between genotypes and nitrogen levels was found to be non-significant. Since, nitrogen is an integral component of chlorophyll and plays a primary role in photosynthesis and helped

Table 2

Quality parameters of Dinanath grass genotypes as influenced by nitrogen levels at harvest

Genotypes	Crude Protein (%)	Crude fibre (%)	Dry Matter (%)
JHD-19-4	6.1	27.7	24.2
BAU-DN-110-18-2	7.0	26.4	22.6
BAU-DN-109-8	6.8	26.8	23.8
BAU-DN-103-18-2	5.3	25.9	22.4
Bundel Dinanath-2	7.2	25.3	23.2
S. Em±	0.14	0.42	0.41
C.D at 5%	0.40	1.21	1.91
Nitrogen Levels (Kg/ha)			
30	5.9	29.1	19.9
60	6.5	25.9	23.4
90	7.2	24.2	26.5
S. Em ±	0.11	0.32	0.32
C.D at 5%	0.31	0.94	0.92
Interaction			
S. Em ±	0.24	0.72	0.71
C.D at 5%	0.70	NS	NS

in accumulation, production and partitioning of photosynthates which resulted higher dry matter content and green forage and led to increased dry matter yield. This is in conformity with the findings of Midha *et al.* (2015), Shekara *et al,* (2020), Singh *et al,* (2021) and Shekara *et al.* (2022).

Fodder Quality

The genotypes differed significantly with crude protein content, crude protein yield, total digestible crude protein yield and crude fibre yield (Table 2 & 3). Among Dinanath grass genotypes crude protein content was higher with check variety Bundel Dinanath-2 (7.2%). Whereas, the crude protein, total digestible crude protein and crude fibre yield were significantly higher with genotype JHD-19-4 (4.5 q ha^{-1}, 3.7 q ha^{-1} and 19.0 q ha^{-1} respectively). Application of nitrogen at 90 kg ha^{-1} significantly recorded higher crude protein content 7.2 (%), crude protein yield (5.6 q ha^{-1}), total digestible crude protein yield (4.8 q ha^{-1}) and crude fiber yield (19.1 q ha^{-1}). The higher crude fiber content was observed with nitrogen at 30 kg ha^{-1} (29.1 %). The interaction between genotypes and nitrogen levels were found significant only with crude protein content and rest of the quality parameters found non-significant. The higher crude protein and total digestible yield was attributed due to the higher crude protein content and dry matter yield with higher level of nitrogen. The results are similar with the findings of Tyagi and Singh (1986), Tripathi and Singh (1991), Rathore and Kumar (1978), Rathore and Kumar (1997b), Asmare *et al.* (2017), Tilahun *et al.* (2017), Mustapha *et al.* (2018), Suleiman *et al.* (2020).

Nitrogen Use Efficiency

Nitrogen use efficiency of genotypes was significantly influenced by nitrogen levels (Table 3). Among genotypes, JHD-19-4 recorded significantly higher

TABLE 3

Nutritive value and nitrogen use efficiency of Dinanath grass genotypes as influenced by nitrogen levels at harvest

Genotypes	Crude Protein Yield (q/ha)	Crude fibre Yield (q/ha)	Total Digestible crude protein yield (q/ha)	Nitrogen use efficiency (Kg Green fodder per Kg Nitrogen)
JHD-19-4	4.5	19.0	3.7	572.8
BAU-DN-110-18-2	3.6	13.0	2.8	411.0
BAU-DN-109-8	3.8	14.3	3.0	426.1
BAU-DN-103-18-2	3.4	15.9	2.6	493.4
Bundel Dinanath-2	4.4	15.1	3.6	476.3
S. Em±	0.18	0.75	0.18	16.0
C.D at 5%	0.53	2.18	0.52	46.6
Nitrogen Levels (Kg/ha)				
30	2.3	11.5	1.6	666.8
60	3.9	15.8	3.1	431.3
90	5.6	19.1	4.8	329.7
S. Em ±	0.14	0.58	0.14	12.4
C.D at 5%	0.41	1.69	0.40	36.1
Interaction				
S. Em ±	0.32	1.30	0.31	27.7
C.D at 5%	NS	NS	NS	NS

TABLE 4

Economics of Dinanath grass genotypes as influenced by nitrogen levels recorded at harvest

Genotypes	Total Cost of Cultivation (Rs./ha)	Gross Returns (Rs./ha)	Net returns (Rs./ha)	B:C Ratio
JHD-19-4	23731	61083	37352	2.56
BAU-DN-110-18-2	23637	43588	19951	1.83
BAU-DN-109-8	23686	44886	21199	1.89
BAU-DN-103-18-2	23663	50819	27155	2.14
Bundel Dinanath-2 NC	23656	51515	27858	2.17
S. Em ±	34	1607	1602	0.07
C.D at 5%	NS	4679	4664	0.19
Nitrogen Levels (Kg/ha)				
30	22545	40017	17472	1.77
60	24011	51769	27758	2.16
90	24468	59347	34879	2.43
S. Em ±	27	1245	1241	0.05
C.D at 5%	78	3624	3613	0.15
Interaction				
S. Em ±	59	2783	2774	0.12
C.D at 5%	NS	NS	NS	NS

nitrogen use efficiency (572.8 kg green fodder per kg of nitrogen). Application of lower nitrogen levels of 30 kg ha^{-1} recorded significantly higher nitrogen use efficiency (666.8 kg green fodder per kg of nitrogen). Whereas, higher level of nitrogen (90 Kg ha^{-1}) recorded lower nitrogen use efficiency (329.7 kg green fodder per kg of nitrogen). The nitrogen use efficiency was higher at lower level of nitrogen and decreased with incremental nitrogen levels. This might be due to higher nitrogen levels which might have led to lower utilization of applied nitrogen within short period of growth and also subjected to various forms of nitrogen losses. This is in hormony with the findings of Shekara *et al.* (2008), Devi *et al.* (2014) Joshi *et al.* (2015) and Shekara *et al.* (2022).

Economic Analysis

Among genotypes JHD-19-4 registered higher net monetary returns (Rs.37,352 ha^{-1}) and benefit cost ratio (2.56). Application of nitrogen at 90 Kg ha^{-1} recorded higher net monetary returns (Rs.34,879 ha^{-1}) and benefit cost ratio of 2.43 (Table 4). This is due to better growth attributers which resulted higher green forage yield with a marginal increased cost of nitrogen at higher nitrogen levels. Similar results were reported by Sharma and Bhunia (2001) and Bama *et al.* (2013) and Shekara *et al.* (2022).

Based on the results it can be inferred that Dinanath grass variety JHD-19-4 with nitrogen level of 90 kg ha^{-1} found suitable and economical, which recorded higher green forage, dry matter, crude protein, total digestible crude protein and crude fibre yield. The same variety recorded higher net monetary returns with nitrogen level of 90 kg ha^{-1} in southern dry zone of Karnataka under protective irrigated situation.

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