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Growth and Quality of Fodder Sorghum as Influenced by Nitrogen Fertilization and Time of Harvesting

P Swathi, A V Nagavani, N Sunitha, J VRamana and G Prabhakara Reddy
Department of Agronomy, S VAgricultural College, Tirupati 517 502, Andhra Pradesh

ABSTRACT

A field experiment was conducted during *kharif,* 2013 to study the effect of different nitrogen levels and time of harvesting on forage yield and quality of fodder sorghum. The experiment was laid out in randomized block design with factorial concept replicated thrice and the treatments consisted of four nitrogen levels *i.e*, 75, 100, 125 and 150 kg ha^{-1} and four times of harvesting*i.e*, 45, 60, 75 and 90 days after sowing. The results revealed that the growth parameters of plant height,stem diameter, green forage yield and quality parameters were increased significantly with the increase in nitrogen upto 150 kg ha^{-1}.where as the crude fibre was decreased. Delay in harvest beyond 75 days in fodder sorghum reduced the crude protein, crude fat and total ash and increased the crude fibre content.

Key words : Fodder Sorghum,Green Forage Yield, Stem diameter, Quality Attributes.

Sorghum is one of the important fodder crop cultivated in India and characterized by quick growth, leafiness, high green herbage yield and better palatability. Fodder sorghum occupies around 30 per cent of the cultivated area under forages and therefore attracts greater attention of the researcher for improvement in herbage productivity and quality. The productivity and availability of good quality herbage is most important to fulfill the feeding requirement of dairy cattle. Among the various agronomic factors, proper crop nutrition and appropriate time of harvesting are of prime importance in getting higher forage yield of better quality. Nitrogen has special significance in increasing green biomass yield and its quality. Hence, the present study was taken up.

MATERIAL AND METHODS

A field experiment was conducted during *kharif*, 2013 at the S.V. Agricultural College Farm, Tirupation sandy loam soil withpH 7.1, low in organic carbon (0.42 %), low in available N(235 kg ha^{-1}), medium in available P_2O_5 (23.7 kg ha^{-1}) and medium in available K_2O (191 kg ha^{-1}). The experiment was laidout in randomized block design with factorial concept comprising of 16 treatment combinations replicated thrice. The treatment details are different nitrogen levels N_1: 75 kg ha^{-1}, N_2: 100 kg ha^{-1}, N_3: 125 kg ha^{-1}, N_4: 150 kg ha^{-1} and different times ofharvesting T_1:45 DAS, T_2: 60 DAS, T_3: 75 DAS, T_4:90 DAS. Fodder sorghum Pusachari-23 was taken as the variety. The recommended dose of 40 kg P_2O_5 and 30 kg K_2O ha^{-1} was applied through single super phosphate and muriate of potash, respectively to all the plots. As per the treatment schedule,nitrogen was applied in two equal splits, half dose of nitrogen along with full dose of phosphorus and potassium were applied as basal at the time of sowing. The remaining quantity of nitrogen was top dressed at 30 DAS. Recommended package of practices and plant protection measures were followed. The data on growth parameters, quality parameters and green fodder yield were recorded and was subjected to statistical scrutiny by the method of analysis of variance by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

The different levels of nitrogen and time of harvesting exerted significant effect on growth parameters, green fodder yield and quality parametersof fodder sorghum (Table 1). Application of nitrogen @ 150 kg ha^{-1}produced maximum plant height, stem diameteras well asgreen forage yield followed by application of 125 kg ha^{-1} and the lowest was with 75 kgha^{-1}. Increase in plant height with higher levels of nitrogen application might be due toadequate supply of nitrogen associated with high photosynthetic activity and vigorous growth. These results are in

Table 1. Effect of different nitrogen levels and time of harvesting on growth, yield and quality of fodder sorghum.

Treatment	Plant height (cm)	Stem diameter (cm)	Greenfodder yield (qha^{-1})	Crude protein (%)	Crude fat (%)	Total ash (%)	Crude fibre (%)
Nitrogen levels (kg N ha^{-1})							
75	136.1	0.84	13.97	6.24	1.94	7.10	31.32
100	155.2	0.99	16.31	7.65	2.41	7.55	30.29
125	170.3	1.13	17.39	8.71	2.96	8.65	26.93
150	196.5	1.33	18.98	9.98	3.13	9.81	23.70
SEm±	4.1	0.02	0.37	0.09	0.04	0.2	0.53
CD (P = 0.05)	11.7	0.06	1.09	0.26	0.10	0.63	1.53
Time of harvesting (DAS)							
45 DAS	129.8	0.73	14.36	10.30	3.50	10.59	22.01
60 DAS	139.3	1.02	15.94	8.96	2.79	8.82	25.87
75 DAS	164.4	1.19	17.39	7.44	2.32	7.75	30.50
90 DAS	224.4	1.36	18.95	5.88	1.85	5.96	33.86
SEm±	4.1	0.02	0.37	0.09	0.04	0.20	0.53
CD (P = 0.05)	11.73	0.06	1.09	0.26	0.10	0.63	1.53

conformity with the findings of Karwasraand Dahiya(1997),Ayub *et al*. (2002) and Ayub*et al.*(2009). The increase in stem diameter due to the application of nitrogen can be explained by the fact that nitrogen promotes plants growth (Ali, 2000). The highest green fodder yield with the application of nitrogen @ 150 kg ha^{-1}might be due to improved growth stature with the increase in levels of nitrogen. Nitrogen is an essential component of amino acids and related proteins which are critical not only as building blocks for plant tissue but also in cell nuclei and protoplasm. Nitrogen encourages above ground vegetative growth and resulted in taller plants, more number of leaves, higher total chlorophyll content, more tillers and higher dry matter accumulation which inturnreflected in terms of higher green fodder yields. Similar reports were given by Bhilare*et al.* (2002) and Bishanoi*et al.* (2005).

An increase in the plant height, stem diameter with delayed harvesting has also been reported by Bukhari (2009) and Maqsood and Shehzad (2013). Increase in fodder yield with delayed harvesting was mainly due to taller plants and thicker stems. Longer duration might have increased the growth parameters due to more nutrients available for the synthesis of metabolites (Balasubrramanian and ramamoorthy, 1996).

Quality parameters like crude protein, crude fat and total ash percentage of fodder sorghum were significantly influenced by the nitrogen levels and varied time of harvesting. Application of nitrogen @150 kg ha^{-1} recorded the highest crude protein, crude fat content and total ash percentage than the other two levels. Lowest values were recorded with application of 75 kg N ha^{-1}.The improved quality of fodder sorghum with increase in nitrogen level might be due to that application of nitrogen resulted in better physiological and bio-chemical activity of plants under comfortable level and also enhanced the amino acid formation. Findings of the present investigation are in agreement with those ofAyub*et al.* (2002).The significant decrease in crude fibre content with increase in nitrogen wasobserved dueto the synthesized carbohydrates are might have converted in to proteins and therefore smaller portion accumulated in the cell wall. (Ayub*et al.,* 2002).

The quality of fodder sorghum was significantly influenced by thetime of harvesting. Harvesting of the crop at 45 DAS increased the crude protein, crude fat, total ash per cent and it was the lowest with 90 DAS. The superior in fodder quality in the early stage might be ascribed to the higher amount of chloroplast and other pigments at early age of the plant resulted in higher crude fat, crude protein and total ash content.Similar results

have been reported by Ayub*et al.* (2002), Bukhari (2009).The lower crude fibre content at early stages of harvesting may be ascribed to younger and succulent plants with higher nitrogen content (Ram and Bhagwan Singh, 2001). The increase in crude fibre content with advancement in plant age was due to more synthesis of structural carbohydrates and deposition of fibrous material in plant at early stages (Amandeep*et al.,* 2010).

Harvesting the fodder sorghum is not recommended either at 45 DAS or at 90 DAS. At 45 DAS, the prussic acid poisoning is the major constraint for harvesting the fodder (Wheeler *et al.*, 1990) and green fodder yield is also less. At 90 DAS, crop recorded the highest green fodder yield with poor quality. As age of the crop growth progresses, the crude fibre content increases as it reduces the palatability of the fodder.

It was revealed that harvesting of the fodder sorghum at 75 DAS coupled with application of 150 kg N ha^{-1} is the best combination for obtaining highest qualitative green fodder yield.

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