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EFFECT OF NITROGEN FERTILIZATION AND TIME OF HARVESTING ON GROWTH AND YIELD OF FODDER SORGHUM

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ABSTRACT

A field experiment was conducted during *kharif,* 2013 to study the effect of different nitrogen levels and time of harvesting on 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 leaves per plant, leaf area index and green forage yield were increased significantly with the increase in nitrogen upto 150 kg ha^{-1}. Delay in harvest of fodder sorghum upto 90 days increased the leaves per plant, leaf area index and green forage yield.

KEYWORDS: Fodder sorghum, Leaves per plant, Leaf area index, Green forage yield

Sorghum is one of the important fodder crop cultivated in India and characterized by quick growth, leafiness, high green herbage yield with better palatability (George Thomas, 2003). 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. The productivity and availability of good quality herbage is most important to fulfill the feeding requirement of dairy cattle. However, information on its agronomic aspects, especially location specific requirements is meagre. 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. Of the major nutrient elements, nitrogen has special significance in increasing the green biomass yield and its quality.

MATERIAL AND METHODS

The field experiment was conducted during *kharif*, 2013 at the S.V. Agricultural College Farm, Tirupati on sandy loam soil with pH 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 laid out in randomized block design with factorial concept comprising of 16 treatment combinations and replicated thrice. The treatments were 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 of harvesting T_1: 45 DAS, T_2: 60 DAS, T_3: 75 DAS, T_4: 90 DAS. Fodder sorghum Pusa chari-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 agronomic practices and plant protection measures were followed. The data on growth 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 and green fodder yield of fodder sorghum. Addition of nitrogen increased the number of leaves and total leaf area per plant and their effect on enlargement of leaf cells, which resulted in assimilation of photosynthates that would ultimately result in good performance of the crop in LAI (Table 1). These findings were in conformity with the results of Verma *et al.* (2005). All harvest intervals also differed significantly from one another, plots harvested 90 DAS produced more LAI as compared to others. Increase in leaf area per plant at 90 DAS may be

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Table 1. Leaf area index of fodder sorghum as influenced by nitrogen levels and time of harvesting

Treatments	Nitrogen levels				
Time of harvesting	**75 kg ha^{-1}**	**100 kg ha^{-1}**	**125 kg ha^{-1}**	**150 kg ha^{-1}**	**Mean**
45 DAS	3.21	4.60	5.80	6.30	4.98
60 DAS	3.80	4.70	6.07	6.80	5.34
75 DAS	4.10	5.10	6.40	6.70	5.58
90 DAS	4.90	5.50	6.80	7.40	6.15
Mean	4.00	4.97	6.27	6.80	
		SEm±		**CD (P=0.05)**	
Nitrogen levels		0.08		0.23	
Time of harvesting		0.08		0.23	
Nitrogen levels × Time of harvesting		0.16		NS	

Table 2. Number of leaves per plant of fodder sorghum as influenced by nitrogen levels and time of harvesting

Treatments	Nitrogen levels				
Time of harvesting	**75 kg ha^{-1}**	**100 kg ha^{-1}**	**125 kg ha^{-1}**	**150 kg ha^{-1}**	**Mean**
45 DAS	8.78	8.30	8.97	10.02	10.55
60 DAS	9.87	12.15	12.74	15.55	12.09
75 DAS	11.37	13.45	16.31	17.23	13.57
90 DAS	12.19	14.45	16.25	15.05	14.49
Mean	9.02	12.28	14.59	14.46	
		SEm±		**CD (P=0.05)**	
Nitrogen levels		0.31		0.90	
Time of harvesting		0.31		0.90	
Nitrogen levels × Time of harvesting		0.63		2.00	

Table 3. Green fodder yield (t ha^{-1}) of fodder sorghum as influenced by nitrogen levels and time of harvesting

Treatments	Nitrogen levels				
Time of harvesting	**75 kg ha^{-1}**	**100 kg ha^{-1}**	**125 kg ha^{-1}**	**150 kg ha^{-1}**	**Mean**
45 DAS	11.60	12.81	14.89	16.56	14.36
60 DAS	13.70	15.92	17.25	18.36	15.94
75 DAS	15.54	16.44	18.41	19.15	17.39
90 DAS	16.58	18.59	19.00	21.74	18.95
Mean	13.97	16.31	17.39	18.98	
		SEm±		**CD (P=0.05)**	
Nitrogen levels		0.37		1.09	
Time of harvesting		0.37		1.09	
Nitrogen levels × Time of harvesting		0.76		2.18	

due to taking the more growing days as compared to other treatments at each delay in harvesting times. Increase in leaf area with delayed harvesting has been reported by Bukhari (2009). There was no interaction effect between nitrogen levels and time of harvesting on LAI.

Leaves have more nutritive values as compared to the stem of the plant, so, number of leaves per plant is very important parameter for calculating the growth and forage yield (Ibrahim *et al*., 2014). Total number of leaves per plant were increased with the increment in the dose of nitrogen. Maximum number and minimum number of leaves recorded with the application of nitrogen at 150 kg N ha^{-1} and with nitrogen at 75 kg N ha^{-1}, respectively (Table 2). The effect of nitrogen application on number of leaves $plant^{-1}$ showed significant effect on forage sorghum. The increase in number of leaves $plant^{-1}$ could be attributed to the fact that nitrogen is an integral part of chlorophyll, which is the primary absorber of light energy needed for photosynthesis (Tisdale *et al.,* 1995). Further, the increase in number of leaves $plant^{-1}$ might be attributed to the fact that photosynthesis depends largely on enzymes in which nitrogen is a major constituent. Under adequate nitrogen fertilization, fodder sorghum growth rate and the photosynthetic rate per unit area were increased and consequently higher leaf area (Nelson *et al.,* 1992). Further, nitrogen is involved in increasing the protoplasmic constituents and accelerating the process of cell division which in turn results in luxuriant vegetative growth (El-Murtada and Amin 2011). Number of leaves per plant was increased with delayed harvesting. The crop harvested at 90 DAS and 45 DAS produced maximum and minimum number of leaves, respectively. The reason of having maximum number leaves with delay in harvesting may be the increase in nodes due to more growth and plant height with time. Significant increase in number of leaves with delayed harvesting was also reported by Ayub *et al.* (2009) and Bukhari (2009). There was an interaction effect between nitrogen levels and time of harvesting. The crop fertilized with 150 kg N ha^{-1} and harvested at 90 DAS produced maximum number of leaves per plant.

Green fodder yield per hectare was improved significantly as nitrogen level was increased from 75 to 150 kg ha^{-1}. The highest green fodder yield was produced with the application of nitrogen at 150 kg ha^{-1} which was significantly superior to other nitrogen levels tried (Table 3). This may be due to greater plant height and stem diameter with the increase in levels of nitrogen. Nitrogen is an integral part of chlorophyll and also 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. Further, nitrogen is essential for carbohydrates used within the plants and stimulates the growth and development as well as uptake of other nutrients. This element encourages above ground vegetative growth and this favourable impact resulted in taller plants, more number of leaves, higher total chlorophyll content, more tillers and higher dry matter accumulation might have reflected in terms of higher green fodder yields. Similar reports were given by Bishanoi *et al.* (2005). The crop harvested at 90 DAS produced significantly higher green fodder yield which was followed by crop harvested at 75 DAS. The lower green fodder yield was recorded when the crop was at 45 DAS. Increase in fodder yield with delayed harvesting was mainly due to taller plants and thicker stems. (Balasubramanian and Ramamoorthy,1996). This might be due to longer duration which increased the growth parameters due to more sources available for the synthesis of metabolites. The interaction between nitrogen levels and time of harvesting was also significant with respect to green fodder yield. The crop received 150 kg N ha^{-1} and harvested at 90 days after sowing produced the maximum green fodder yield. These results were in strong agreement with the conclusions of Ahmed *et al.* (2001) and Maqsood and Asif (2013).

CONCLUSION

The supply of 150 kg N ha^{-1} and harvesting of fodder sorghum at 75 DAS is the best combination for obtaining the highest qualitative green fodder

REFERENCES

Ahmed, M., Shaheen, M.S and Chaudhry, M.S. 2001. Effect of different seed rates and nitrogen rates on yield and yield composition of maize. *Pakistan Journal Agric. Res.* 41:23-32.

Ayub Muhammad., Ather Nadeem, M., Tahir Muhammad., Ibrahim, M and Aslam, M.N. 2009. Effect of nitrogen application and harvesting intervals on forage yield and quality of pearl millet (*Pennisetum americanum* L.) *Pakistan Journal of Life Social Sciences.* 7(2):185-189.

Balasubramanian, A and Ramamoorthy, K. 1996. Effect of plant geometry, nitrogen levels and time of harvest on the productivity of sweet sorghum. *Madras Agricultural Journal.* 83: 462-463.

Bishanoi, N., Mali, A.L and Sumeriya, H.K. 2005. Fodder quality of dual purpose sorghum genotypes as influenced by varying plant population and nitrogen levels. *Forage Research.* 30(4): 229-230.

*Bukhari, M.A. 2009. Effect of different harvesting intervals on growth, forage yield and quality of pearl millet (*Pennisetum americanum* L.) cultivars. M.Sc., Thesis, University of Agriculture, Faisalabad, Pakistan.

El-Murtada Mohamed and Amin Hassan. 2011. Effect of different nitrogen sources on growth, yield and quality of fodder maize (*Zea mays* L.*). Journal of the Saudi Society of Agricultural Sciences*: 10, 17-23.

George Thomas, C. 2003. Forage crop production in the tropics. Kalyani Publishers, New Delhi. pp: 86.

Ibrahim, M., Maqbool, M. M., Ayub, M., Ahmad, M. I., Tahir, M., Nadeem, M. S., UlHaq, T and Nadeem, M. M. 2014. Evaluating the forage yield and quality potential of different maize cultivars under different harvesting times. *International Journal of Modern Agriculture,* vol 3, no1.

Maqsood Muhammad and Asif Shehzad Muhammad. 2013. Optimizing nitrogen input and harvest time to maximize the maize fodder yield in Punjab, Pakistan. *Pakistan Journal of Agricultural Science.* vol. 50 (1), 75-81.

Nelson, C.J., Sychoi, F., Gastal and Coutts, J.M. 1992. Nitrogen effects on relationship between leaf growth and leaf photosynthesis in N murata (edn.), *Research in photosynthesis* Vol. 4 Boston, MASS: KLUWER pp: 789-792.

Panse, V.G and Sukhatme, P.V. 1985. Statistical methods for agricultural workers. *Indian Council of Agricultural Research,* New Delhi. pp: 100-174.

*Tisdale, S.L., Nelson Wener, L and Beaton James, D. 1995. Soil Fertility and fertilizers, Mac. Millian Publishing Company, New York. pp: 1-754.

Verma, S.S., Navneet Singh., Joshi, Y.P and Vijay Deorari 2005. Effect of nitrogen and zinc on growth characters, herbage yield, nutrient uptake and quality of fodder sorghum. *Indian Journal of Agronomy.* 50 (2):167 -169.

* Original not seen (Source: CAB abstracts, College Library)