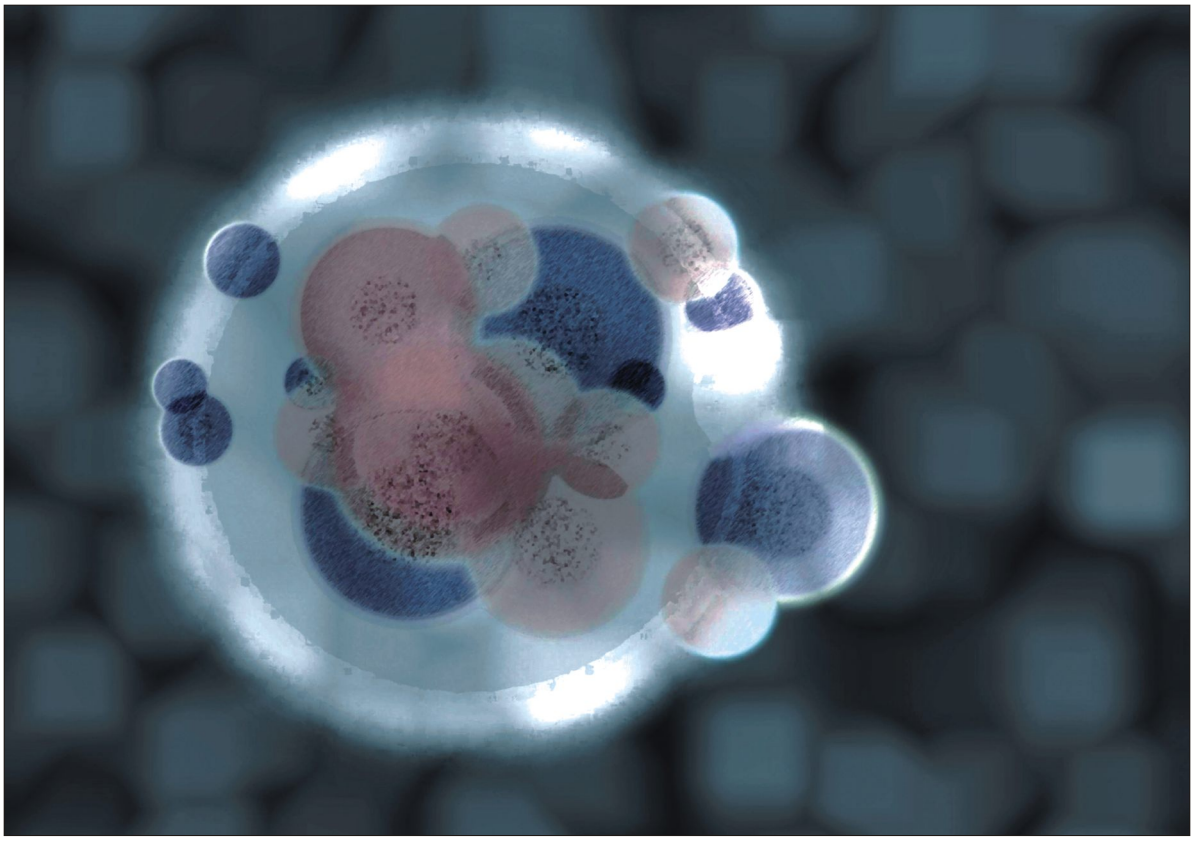

Journal of Biological Sciences

ISSN 1727-3048

science alert

ANSInet
an open access publisher
http://ansinet.com

OnLine Journal of Biological Sciences 1 (5): 348-349, 2001

Effect of Different Nitrogen Levels and Time of Irrigation on the Fodder Yield of Sorghum (*Sorghum bicolor* L.)

Ihtisham-ul-Haq and Aman-Ullah Jan
Department of Agronomy, NWFP Agricultural University, Peshawar, Pakistan

Abstract: All nitrogen levels positively affected leaf area per plant, leaf area index, stem thickness and plant height while irrigation timing only significantly ($p \leq 0.01$) affected stem thickness and plant height. Maximum leaf area per plant (508.64 cm^2), leaf area index (317.50), stem thickness (1.314 cm) and plant height (237.30 cm) were observed at the highest nitrogen level (120 kg kg N ha^{-1}). Similarly the irrigation applied 15 days after sowing resulted maximum stem thickness (1.075cm) and plant height (225.90 cm) when compared with other treatments. The combination between 120 kg N ha^{-1} and irrigation applied 15 days after sowing resulted significant increase in plant height (261.87cm) as compared to other interactions. It can be concluded from this study that 120 kg ha^{-1} nitrogen and irrigation applied 15 days after sowing is the best combination in regard to yield parameters.

Key words: Fodder sorghum, yield parameter, N. levels, irrigation timing

Introduction

The total cultivated area in the country is 21.1 million hectares, out of which 2.7 million hectares are under forages (Anonymous, 1996). Similarly, total production is 57.00 million tonnes with an average national fodder yield of 21.4 t ha^{-1}, which is too low to provide even half of the maintenance ration to the existing livestock population and hence there is a shortage of about 200 million tonnes of fodder in the country. Similarly there is shortage of milk and milk by products and the country is spending a high amount of foreign exchange (about Rs. 807 million annually) for the import of milk and milk by products (Bhatti, 1996). The supply of green fodder to the existing number of animals at present demands increased fodder production.

Sorghum (*Sorghum bicolor* L.) is a quick growing and short duration summer fodder crop but its farmer yield is very low. The green fodder yield of sorghum increased with supplemental irrigation (Stewart, 1989). There had been consistent increase in stalk thickness, leaf number and leaf area of sorghum with the successive increase in nitrogen level (Reiad *et al.*, 1992).

Keeping in view the importance of these two factors, the present study was initiated to determine the effect of different nitrogen levels and time of irrigation on the fodder yield of sorghum so that guidelines can be drawn to assist farmers in Pakistan.

Materials and Methods

An experiment was conducted at Malakandher research Farms, NWFP Agricultural University Peshawar, Pakistan during 1997 to investigate the effect of various nitrogen levels and time of irrigation on the fodder yield of sorghum. The experiment was laid out in Randomized Complete Block Design (RCBD) with split plot arrangements and replicated four times. Each sub plot size was 4x3 m^2 having ten rows (4 m long) spaced with 30 cm. Levels of nitrogen i.e. 0, 40, 80 and 120 kg ha^{-1} were studied during the experiment. Irrigation was applied at four different timings (Just after sowing, 15, 30 and 45 days after sowing). Local strain of sorghum was sown in the third week of June, using a seed rate of 50 kg ha^{-1}. Half dose of nitrogen in the form of urea was applied at the time of sowing and the remaining half was at the time of first irrigation. All other agronomic practices except under trial were uniformly applied during the experiment.

Leaf area (cm^2) per plant, leaf area Index, Stem thickness (cm) and plant height (cm) studied during the course of study.

Data was analyzed statistically and least significant difference test (LSD) was employed for the comparison of treatment means.

Results and Discussion

Leaf area per plant: Data in Table 1 indicated that fertilizer treatments had significantly ($p \leq 0.01$) affected leaf area. While the effect of irrigation timing was non significant. Data also showed that there was a gradual increase in leaf area with every increase in nitrogen levels. Maximum leaf area of 508.64 cm^2 was recorded at 120 kg N ha^{-1} followed by 426.08 cm^2 at 80 kg N ha^{-1}. Minimum leaf area of 297.10 cm^2 was observed in control plots. The maximum leaf area with increasing level of nitrogen showed that nitrogen nutrition increases leaf area mainly due to increase in chlorophyll contents. Similar results were also reported by Malik (1987), Rao and Sinha (1990) and Reiad *et al*. (1992) who concluded that leaf area increased with progressive increase in nitrogen level.

Leaf area index: Data in Table 1 indicated significant ($p \leq 0.01$) differences in leaf area index (LAI) due to the application of nitrogen. The effect of irrigation timing were non significant. Highest leaf area index was 3.39 at 120 kg N ha^{-1} followed by 2.84 at 80 kg N ha^{-1}, where as minimum was 1.89 observed in those plots, which received no nitrogen (control). The possible reason for increase in LAI could be attributed to the encouragement of more green surface of leaves (leaf area), which resulted in assimilation of Photosynthates that would ultimately result in good performance of the crop in LAI. These results are in conformity with those of Han *et al.* (1985) and Singh *et al*. (1988) who reported leaf area index increased with an increase in nitrogen level up to 100 kg ha^{-1}.

Stem thickness: Analysis of the data showed that various levels of nitrogen and irrigation timing were highly significant ($p \leq 0.01$). The probable reason for this increase in stem thickness at 120 kg N ha^{-1} and irrigation 15 days after sowing would be the utilization of more nitrogen as nitrogen is an essential nutrient for growth

Table 1: Sorghum crop as affected by different nitrogen levels and time of irrigation

Nitrogen Kg ha^{-1}	Irrigations time after sowing				
	Just after sowing	15 days	30 days	45 days	Means
Leaf area per plant (cm^2)					
Control	307.59	305.59	294.48	280.73	297.10C
40	338.90	357.92	357.47	319.03	343.33C
80	443.83	401.30	401.30	375.29	426.08B
120	463.43	508.58	508.58	533.94	508.64A
Means	388.44	390.46	390.46	377.25	
Leaf area Index					
Control	2.05	2.04	1.96	1.87	1.98C
40	2.26	2.39	2.38	2.13	2.29C
80	2.96	3.23	2.68	2.50	2.84B
120	3.39	3.56	3.52	3.29	3.39A
Means	2.59	2.79	2.60	2.52	
Stem thickness (cm)					
Control	0.630	0.707	0.705	0.470	0.628D
40	0.583	0.845	0.707	0.565	0.743C
80	1.280	1.317	1.193	1.047	1.209B
120	1.275	1.430	1.350	1.350	1.314A
Means	1.009A	1.075A	0.989A	0.821B	
Plant height (cm)					
Control	182.25EF	188.99DEF	127.63GH	114.70H	153.39D
40	194.37DEF	205.11D	178.83F	133.87G	178.04C
80	224.42C	247.66AB	234.37BC	205.58D	228.00B
120	245.16AB	261.87A	245.66AB	196.49DE	237.29A
Means	211.54B	225.90A	196.62C	162.66D	

Means followed by different letters are significantly different at $p \leq 0.05$ using LSD test

regulation and helped in synthesis of crude protein which developed stem thickness while irrigation developed a vigorous plant with high leaf surface that had increased the transpiration rate and enhanced the dry weight production which resulted in healthy plants. However irrigation and nitrogen interaction was non significant. These results are strongly supported by Agha *et al*. (1981), Han *et al*. (1985) and Malik (1987) who revealed that diameter of stalks significantly increased by the application of water and nitrogen dose.

Plant height: Data regarding plant height in the Table 1 showed that significant ($p \leq 0.01$) differences in plant height were observed due to the application of various levels of nitrogen and irrigation timing. It can be seen from the data that maximum plant height of 237.29 cm was recorded at 120 kg N ha^{-1} followed by 228.00 cm tall plants at 80 kg N ha^{-1}. Maximum plant height (153.39 cm) was observed in the plots having no nitrogen application. Similarly irrigation when applied 15 days after sowing resulted in maximum plant height (225.90 cm) followed by plant height of 211.54 cm when irrigation was given just after sowing while minimum of 162.66 cm was observed when it applied 45 days after sowing. It is also clear from the data that interaction between nitrogen and irrigation was significant. Plots, which were irrigated 15 days after sowing and fertilized with nitrogen at the rate of 120 kg ha^{-1} resulted in more plant height (261.87 cm). The cogent reason to explain this phenomena could be that, gradual increase in nitrogen fertilizer helped in increasing plant height as its vegetative function or the competition for light among the dense population of crop while the irrigation, 15 days after sowing might contributed water to the extended sorghum roots to absorb more water and nutrients from the soil. Such results have been reported by Gawad *et al*. (1989), Shaik *et al*. (1992) and Reiad *et al*. (1992) who revealed that different fertilizer levels and irrigation significantly influenced plant height.

References

Agha K.H., G.Y. Solangi and F.K. Rajput, 1981. Effect of sowing dates and manures on the yield of green fodder of early sown sorghum. Pak. J. Agric. Res., 2: 107-109.

Anonymous, 1996. Government of Pakistan. Ministry of Food, Agriculture and Cooperatives, Food and Agriculture Division, Economic Wing. Islamabad.

Bhatti, M.B., 1996. A review of fodder research in Pakistan. Pakistan Agricultural Research Council, Food and Agriculture Organization, Islamabad, pp: 11-24.

Gawad, A.F., K.I. Sharaan and A.N. Sadaat, 1989. Water stress and nitrogen fertilization of forage sorghum. Bull. F.A. Cairo. Univ., 44: 587-589.

Han, H.J., M.S. Han and S.B. Alia, 1985. Effect of soil moisture levels on growth and dry matter accumulation of sorghum and maize. J. Korean Soc. Grassland Sci., 5: 143-151.

Malik, A.G., 1987. Effect of nitrogen application and stages of harvest on the forage yield and quality of pearl Millet. M.Sc. Thesis, University of Agriculture, Faisalabad.

Rao, D.G. and S.K. Sinha, 1990. Influence of leaf area on maintenance of water potential in sorghum (*Sorghum bicolor*) hybrid (CSH 6) and its parents under limited soil volume condition. Indian J. Agric. Sci., 60: 533-535.

Reiad, M.S., M.S. Hakeem, M.A. Hamada and S.O.M. Abdullah, 1992. Response of fodder sorghum growth to different nitrogen fertilizers under Siwa oasis conditions. Ann. Agric. Sci. Moshtohor, 33: 637-646.

Shaik, M., M.V. Hassan, B. Baicclan and S. Muhammad, 1992. Response of sorghum of fertility variation in a scarce rainfall B shallow soil ecosystem. Ann. Agric. Res., 16: 369-373.

Singh, I., G.S. Chouhan, L.S. Choudary and I. Singh, 1988. Response of sorghum to nitrogen and phosphate under western Rajasthan condition. Indian J. Agron., 38: 305-306.

Stewart, B.A., 1989. Conjunctive use of rainfall and irrigation in semi-arid regions. ICRISAT., 49: 107-116.