RESEARCH ARTICLE

EFFECT OF TOP-DRESSING OF NITROGEN ON SORGHUM FORAGE YIELD AND QUALITY UNDER DIFFERENT AGRONOMIC PRACTICES

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Abstracts: A field experiment was conducted during summer season. The effect of various agronomic factors on the growth, forage yield, quality and economics of summer sown forage sorghum at IGKV, Raipur. A Field experiment was laid out in randomized block design with 12 treatments. The treatment T_{11} was found better with regards to plant height, dry mater production, No. of leaves and crop growth rate as campared to other treatments.The crop irrigated at an interval of 10 days and top-dressing of nitrogen @ 30kg ha^{-1} given at 30 DAS recorded maximum green and dry forage yield, protein yield and net returns as compared to rest of the treatments. The sorghum yielded more fodder during first cutting.Treatment T_{11} was found to be more remunerative and economical as compared to other treatments under study.

Keywords: Forage yield, Quality of forage, Sorghum

INTRODUCTION

Sorghum forage is the basic feed for live stock and especially valuable for feeding in all regions of the world. Cured sorghum fodder, with a little protein supplement, maintains cattle in good condition throughout the winter with little or no gain supplement. Sorghum fodder contains 70% carbohydrates, minerals, crude fat and nitrogen free extract (Chaudhry, 1994). Green forage demands for rapidly expanding livestock industry is increasing day by day in India. Cutting of sorghum is capable of producing high-quality forage in mid to late summer when cool-season perennials have low production (Undersander *et al*., 1990). Forage sorghum grass is an important livestock feed, often used to produced silage, hay or pasture during summer when adequate supply of moisture is available for the production of other crops (Fribourg, 1995). Timing and placement of N fertilizer have a major effect on the efficiency of N management systems. Nitrogen is the key element of plant growth and is the most liminting nutrient. It promotes shoot elongation, tillering and regeneration after defoliation. The present study was therefore planned with the object to determine the effects of different agronomic practices for obtaining maximum fodder yield of sorghum.

To manage the sorghum crop for achievement of maximum forage production, the farmer should be concerned about nitrogen requirement (Vanderlip, 2012). Although sorghum is a C4 crop and uses nitrogen in a more efficient way compared to most C3 crops, nitrogen is the most essential nutrient for sorghum growth, which is still one of the major factors limiting its yield (Young and Long, 2000). On the other hand, while nitrogen fertilization increases growth of sorghum and its yield, inappropriate amount of fertilizer during cultivation leads to lower plant performance and reduction in efficiency of the applied fertilizer compared to the actual potential of fertilizer use efficiency (Zhao et al., 2005).

MATERIAL AND METHOD

The research was carried out at the Research cum Instructional Farm, IGKV, Raipur (C.G.) during *Summer* season. Raipur is situated in mid-eastern part of Chhattisgarh state and lies at 210 16' North Latitude and 810 36' East Longitude with an altitude of 314.15 above the mean sea level. The soil of experimental field was sandy loam in texture and neutral in reactions. It is deep and hence, has good water holding capacity. It was neutral in reaction, low in nitrogen, medium in available phosphorus and medium exchangeable potassium.The crop received about 90 mm rains during the growth periods. The experiment was laid out in Randomized Block Design with 3 replications. The treatment compare of 12 combination T_1(cut at 8$\pm$2cm, CH+Inter.+Irri. At 15 DI), T_2(cut at 8$\pm$2cm, CH+Inter.+Irri. At 15 DI), T_3(cut at 8$\pm$2cm, CH+2,4-D +Irr. At 15 DI), T_4(cut at 8$\pm$2cm, CH+2,4-D +Irri. At 15 DI), T_5(cut at 8$\pm$2cm, CH+Inter.+N_{30} +Irri. At 15 DI), T_6(cut at 8$\pm$2cm, CH+2,4-D +Irri. At 15 DI), T_7(cut at 8$\pm$2cm, CH+Inter +Irri. At 10 DI), T_8(cut at 8$\pm$2cm, CH+Inter +Irri. At 10 DI), T_9(cut at 8$\pm$2cm, CH+2,4-D +Irri. At 10 DI), T_{10}(cut at 8$\pm$2cm, CH+2,4-D +Irri. At 10 DI), T_{11}(cut at 8$\pm$2cm, CH+Inter+N_{30} +Irri. At 10 DI), T_{12}(cut at 8$\pm$2cm, CH+Inter +N_{30}+Irri. At10 DI).

RESULT AND DISCUSSION

Growth and yield attributes

Plant height plays an important role in the final yield of fodder crops. Plant height indicated that T_{11} affect

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the plant height significantly.The treatment T_{11} produced the tallest plants followed by others.

The plant height recorded during initial stage of the growth did not differ significantaly but there was progressive increase in the height of sorghum plant during 90 DAS due to various treatments specialy T_{11} was better as compared to other treatment. This indicated that top-dressing of nitrogen was better as compared to basal application. This may be due to the fact that nitrogen enhanced the vegetative growth of the plant, accelerated the elongation of internode by the increased supply of nitrogen to cell sap.The minimum (107.23cm) plant height was observed in T_2. The results indicated that different agronomic practices with top-dressing of nitrogen application has pronounced effect in increasing vegetative growth of crop plants. Significant increase in plant height with nitrogenous fertilizers has also been observed in maize by Desai and Dore (1980), Bajwa *et al.* (1983), Abbas and Al-Younis (1980) Abdel-Gawad (1983), Safdar (1997) and Ahmad (1999).

Table 1. Effect of nitrogen on different growth parameters and yield attributes.

Treatment	Plant ht.(cm) 90 DAS	CGR,(g plant^{-1} day^{-1}) 90 DAS	Total Dry matter yield (q ha^{-1})	Total Green forage yield, (q ha^{-1})	Nitrogen uptake, kg ha^{-1} (100 DAS)	Protein yield (q ha^{-1})	B:C Ratio
T_1	109.31	0.506	164.99	661.72	73.25	4.47	1.70
T_2	107.23	0.505	161.18	655.42	68.62	4.28	1.67
T_3	110.18	0.494	160.10	647.05	67.04	4.18	1.66
T_4	107.32	0.488	158.08	636.94	67.91	4.24	1.62
T_5	118.19	0.530	173.63	671.45	79.26	4.95	1.70
T_6	113.17	0.524	165.81	663.22	73.28	4.57	1.66
T_7	112.12	0.513	170.11	680.54	74.39	4.71	1.47
T_8	108.30	0.510	166.33	661.89	74.08	4.62	1.40
T_9	110.23	0.496	168.40	662.93	74.72	4.66	1.42
T_{10}	108.17	0.494	166.18	653.94	73.00	4.56	1.39
T_{11}	128.26	0.562	184.48	725.41	83.58	5.21	1.57
T_{12}	121.27	0.534	179.12	709.08	80.05	4.99	1.51
SEm±	2.11	0.022	1.77	6.31	1.03	0.04	
CD (0.05)	6.17	0.066	5.18	13.09	3.02	0.20	

The top-dressing of nitrogen in conjunction with increased frequently of irrigation applied at 10 days interval resulted in higher values of CGR and Dry matter during all the stage of crop growth. Dry matter accumulation was directly related with the growth pattern of the crop, which linearly influences the biological yield and increased with the advancement of crop age. The result showed that treatment T_{11} was better than the rest of the treatment.

Fodder yield

Fodder yield is a function of genetic as well as environmental factors which plays a vital role in plant growth and development. All the treatments differed significantly from one another except T_{11}which were statistically at par with each other (Table 1).Green and dry fodder yield of forage sorghum was affected significantaly due to various treatments with regards to green and dry fodder

yields optimum supply of irrigation and top-dressing of nitrogen.The maximum green dry forage yield under the treatment T_{11} might be responsible for handsome net return per hectare.The economics and net returns per hectare showed spectacular variation due to different treatments under study.Maximum net returns per hectare was found under the treatment T_{11}. The benefit:cost ratio was, however greater in the treatment which received irrigation at fortnightly interval because of less cost of cultivation involved in the said treatment. The higher net returns due to adequate supply of irrigation and top dressing of nitrogen was also reported by Patel *et al*.1992.

Dry matter yield

The effect of top-dressing of nitrogen, result was recorded significant on total dry weight(Table 1). Nitrogen application increased total dry weight so that T_{11} treatments resulted in the higher total dry weight.Total dry weight was the second most sensitive trait to nitrogen application along with different agronomic practices, which showed a 184.48 qha^{-1} highest increase as a result of nitrogen application along with irrigation. Accoring to result T_{11} (cut at 8$\pm$2cm, CH+Inter+N_{30} +Irri. At 10 DI) was better as compared to other treatment. Higher nitrogen can cause delay in leaf senescence leading to a larger biomass accumulation. According to Borrell and Hammer (2000).

Qualitative parameters

The nitrogen uptake was also influenced by various treatment, maximum being found under the treatment T_{11}. Sorghum crop draws maximum quantity of nitrogen during its initial stage of growth followed by steady reduction in nitrogen uptake with the advancement of crop age. With regards to protein yield, treatment (T_{11}) again proved significantaly better during 100 DAS resulting maximum protein yield of 5.21 qha^{-1}.Treatment T_{11}(cut at 8$\pm$2cm, CH+Inter+N_{30} +Irri. At 10 DI) was found to be superior with regards to nitrogen uptake and protein yield.

CONCLUSION

In the present study, it was shown that nitrogen could affect most sorghum measured growth and forage parameters. The highest plant height, crop growth rate, dry matter accumulation, total dry weight as well as biological yield were achieved from top-dressing of nitrogen application treatment. Nitrogen could increase physiological indices such as plant height, CGR and Dry matter yield. Overall, the results of this experiment demonstrated that nitrogen could have a positive effect on sorghum growth and yield.It was concluded that although green fodder yield was increased with the application of top-dressing of nitrogen fertilizer, however, green fodder yield obtained with a combination of T_{11}, was as good as compared to other treatment.

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