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Effect of top dressing and foliar appliaction of organic nutrient sources on growth of sorghum

Agriculture

KEYWORDS :

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ABSTRACT

A field experiment was conducted on "Effect of top dressing and foliar application of organic nutrient sources on growth and yield of Sorghum" at student farm, college of Agriculture, Rajendranagar, Hyderabad during kharif, season of 2012 with an objective to find out different organic nutrient sources on growth, yield, quality, nutrient uptake and economics of sorghum. The results of the experiment indicated significant influence of organic nutrient management on plant growth and yield attributes. Maximum growth in terms of plant height, dry matter production and leaf area index with application of Foliar spray of fulvic acid @ 1% (T8).

Introduction

Sorghum is the fifth most important cereal crop and is the dietary staple of more than 500 million people in 30 countries. It is grown in an area of 40 million ha in 105 countries of which USA, India, México, Nigeria, Sudan and Ethiopia are the major sorghum producers. Its stover is an increasingly important source of dry season fodder for livestock, especially in Asia. Global sorghum area trends indicate that area increased from 45 million ha in 1970s to 51 million ha in 1980s. Later there was fluctuation in area by 4 to 10 million ha and it declined to 40 million ha by 2009. Grain yields have increased from 1200 kg ha^{-1} in 1970s to 1400 kg ha^{-1} in 2009.

The sorghum area in India was more than 16 million ha in 1981, but has gradually decreased to 7.8 million ha in 2007-08 (still 20 % of the world's sorghum area). Of this, 3.5 million ha was grown in the rainy (*kharif*) season and 4.3 million ha in the post-rainy (*Rabi*) season. Production increased from 9 million tonnes in early 1970s to 12 million tonnes in early 1980s and maintained this level for over a decade until early 1990s, followed by a steep decline to 7.3 million tonnes. Despite the decrease in area over the years, production has been sustained at 7.3 million tonnes (2009) mainly due to adoption of improved varieties and hybrids. Sorghum grain yields in India have averaged 1170 kg ha^{-1} in the rainy season and 880 kg ha^{-1} in the post-rainy season in recent years. (www.icrisat.org/sorghum.htm).

Organic agriculture is one of the ways that can produce high quality crops (Higa, 1994). Organic manures also play an important role in maintaining a high level of soil fertility. The positive influence of organic fertilizers on soil fertility, crop yield and quality has been demonstrated in the works of many researchers (Naeem *et al., 2006*).

Among the organic fertilizers vermicompost is rich in all essential plant nutrients and provides excellent effect on overall plant growth encourages growth of new shoots/leaves and improves the quality and shelf life of the produce (en.wikipedia.org./vermicompost).

Natural organic substances such as humic and fulvic acids play an essential role in ensuring soil fertility and plant nutrition. Addition of such molecules either to the soil or through foliar spray along with adequate amount of conventional fertilizers improves the efficiency of applied fertilizers apart from promoting the conversion of unavailable form of nutrients to available forms. The organic compounds prepared from humic and fulvic substances have chelating, plant growth stimulating effects and positive effect on the growth of various groups of microorganisms.

Material and Methods

The investigation "Effect of top dressing and foliar application of organic nutrient sources on growth and yield of Sorghum" was conducted during *kharif*, 2012 at student farm, College of Agriculture, Rajendranagar, Hyderabad, Southern Telangana climatic Zone of Andhra Pradesh. The soil of experimental site was sandy clay loam with pH of 7.6, Electrical conductivity 0.65 dSm^{-1}, low in organic carbon (0.69 %), low in available nitrogen (276 kg ha^{-1}) and high in phosphorus (149.32 kg ha^{-1}) and high in potassium (411.26 kg ha^{-1}). The experiment was laid out in randomized block design of nine treatments and three replications. T_1 - Top dressing of vermicompost @ 2.5 t ha^{-1},T_2 - Top dressing of vermicompost @ 5 t ha^{-1}, T_3 - Foliar spray of vermiwash @ 1%, T_4 - Foliar spray of vermiwash @ 2%, T_5 – Foliar spray of humic acid @ 0.5%, T_6 – Foliar spray of humic acid @ 1%, T_7 - Foliar spray of fulvic acid @ 0.5%, T_8 - Foliar spray of fulvic acid @ 1%, T_9 - Control (80:40:40 N, P_2O_5 and K_2O kg ha^{-1} through fertilizers). *Insitu* Green manuring with sunhemp and basal application of FYM @ 3 t ha^{-1} and neem cake @ 0.5 t ha^{-1} is done commonly to all treatments except control. Top dressing of vermicompost and foliar spray of organic nutrient sources are done in two splits i.e at maximum vegetative stage (40-45 DAS) and flowering stage (60- 65 DAS). Sorghum hybrid (CSH-9) was sown on 27th of June adopting a spacing 45 x 15 cm. In general the climatic conditions were congenial during crop growth period and incidence of pest and disease attack was not noticed to a greater extent. The salient findings of the experiment are summarized here under.

The observations on plant growth parameters *viz.,* plant height, leaf area index, dry matter accumulation at 30, 60, 90 DAS and at harvest and days to 50% flowering were taken.

Results and Discussion

At 30 and 60 DAS there are no significant differences observed due to different treatments with respect to plant height. However at 90 DAS and at harvest there was significant difference among the treatments in terms of plant height. At 90 DAS and at harvest significantly higher plant height was recorded with foliar spray of fulvic acid @ 1% (T_8) which was on par with all treatments except control. The increase in plant height with the application of fulvic substances might be attributed to the role of fulvic materials as suppliers of growth regulators of plant materials and also due to uptake of fulvic substances by crop.

At 30, 60, 90 DAS and at harvest there were significant differences in LAI values due to different treatments.LAI was significant higher with foliar spray of fulvic acid @1% (T_8) compared to all other treatments which was on par with foliar spray of vermiwash @ 2 % (T_4) and foliar spray of humic acid @ 1% (T_6) at 30, 60, 90 DAS and at harvest. Adequate supply of nitrogen had produced larger leaves which in turn, resulted more photosynthetic surface area i.e. LAI. The significant response to fulvic substances application on LAI might be due to addition of fulvic substances that tend to increase the respiration rate metabolism and growth of plants. (Saravanan et al., 1989.) Similarly Kadarrv et al. (2010) reported that application of 100% N through poultry manure along with fulvic acid sprays at 30 and 60 days recorded

significantly higher LAI.

Total dry matter accumulation (Table 3) was significantly higher with control (T_9) compared to all other treatment except foliar spray of fulvic acid @1% (T_8). Control (T_9) was on par with foliar spray of fulvic acid @1% (T_8) and foliar spray of vermiwash @ 1% (T_4). This might be attributed to the increased uptake of available nutrients which caused increased photosynthetic rate resulting in higher dry matter production (Mehta *et al.,* 1994 and Patil, 1995). The increase in dry matter production with fulvic acid might be due to its direct action on plant growth auxin activity, contributing to increase in dry matter as observed by Singaravel *et al.* (1993) and Swayamprabha *et al.* (1989). Days to 50 % flowering was not significantly influenced by the different treatments.

Table 1. Plant height (cm) of sorghum as influenced by different organic nutrient sources

Treatment	30 DAS	60DAS	90 DAS	At harvest
T_1-Top dressing of vermicompost @ 2.5 t ha^{-1}	68	130	168	176
T_2-Top dressing of vermicompost @ 5 t ha^{-1}	72	126	161	169
T_3-Foliar spray of vermiwash @ 1%	59	109	157	170
T_4-Foliar spray of vermiwash @ 2%	59	105	164	172
T_5-Foliar spray of humic acid @ 0.5%	65	112	169	175
T_6-Foliar spray of humic acid @ 1%	75	120	170	174
T_7-Foliar spray of fulvic acid @ 0.5%	70	120	167	175
T_8-Foliar spray of fulvic acid @ 1%	79	129	169	176
T_9-Control	69	115	150	156
S.E.m ±	6.9	9.8	6.0	3.3
C.D (P = 0.05)	NS	NS	13.0	7.0

Table 2.Leaf area index of sorghum as influenced by different organic nutrient sources

Treatment	Leaf area index			
	30 DAS	60DAS	90 DAS	At harvest
T_1-Top dressing of vermicompost @ 2.5 t ha^{-1}	1.34	5.53	3.98	2.84
T_2-Top dressing of vermicompost @ 5 t ha^{-1}	1.38	5.44	4.19	2.84
T_3-Foliar spray of vermiwash @ 1%	1.34	5.41	3.96	2.81
T_4-Foliar spray of vermiwash @ 2%	1.45	5.75	4.52	2.97
T_5-Foliar spray of humic acid @ 0.5%	1.29	5.53	3.89	2.79
T_6-Foliar spray of humic acid @ 1%	1.43	5.80	4.29	2.91
T_7-Foliar spray of fulvic acid @ 0.5%	1.27	5.12	3.87	2.63
T_8-Foliar spray of fulvic acid @ 1%	1.57	6.12	4.69	3.06
T_9-Control	1.33	5.63	4.20	2.83
S.E.m ±	0.05	0.15	0.15	0.09
C.D (P = 0.05)	0.16	0.46	0.46	0.20

Table 3. Total dry matter production (TDMP) (g/plant) of sorghum as influenced by different organic nutrient sources

Treatment	TDMP (g/plant)			
	30 DAS	60DAS	90 DAS	At harvest
T_1-Top dressing of vermicompost @ 2.5 t ha^{-1}	12.1	56.5	149.8	174.7
T_2-Top dressing of vermicompost @ 5 t ha^{-1}	12.9	57.5	152.7	176.1
T_3-Foliar spray of vermiwash @ 1 %	11.8	53.9	146.9	172.0
T_4-Foliar spray of vermiwash @ 2 %	13.2	59.9	155.7	178.5
T_5-Foliar spray of humic acid @ 0.5 %	11.9	55.3	148.9	174.7
T_6-Foliar spray of humic acid @ 1 %	12.3	57.6	150.7	174.7
T_7-Foliar spray of fulvic acid @ 0.5%	11.6	52.7	144.8	169.8
T_8-Foliar spray of fulvic acid @ 1 %	14.1	62.2	160.6	182.4
T_9-Control	15.1	61.5	161.6	183.3
S.E.m ±	0.79	2.04	2.17	2.52
C.D (P = 0.05)	1.7	4.3	4.6	5.3

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