Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 6 Special issue [3] 2017: 645-648

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.533
Universal Impact Factor 0.9804
NAAS Rating 4.95

FULL LENGTH ARTICLE **OPEN ACCESS**

Response of Sorghum (*Sorghum bicolor*) to Combined Use of Organic and Inorganic Nutrient Sources

Sameerkumar, D., Shridhara, B. Nagoli, Hiremath, K. A. And Shivanand, N. Honnali
College of Agriculture, Bheemarayanagudi, Yadgir Karnataka

ABSTRACT

A field experiment was conducted at College of Agriculture, Bheemarayanagudi, Yadgir to know the response of rabi sorghum (Sorghum bicolor) to the application of organic and inorganic nutrient sources. The experimental site was clay loam in texture, slightly alkaline in reaction, low in organic carbon as well as low available nitrogen, medium in the available phosphorus and medium to high in available potassium. The experiment was laid out in randomised complete block design with seven treatments which were replicated thrice. The treatment details comprised of organic and inorganic nutrients and an absolute control was taken for the study. The present investigation revealed that application of 100 % RDF + Vermicompost + Azospirillum(T_7) has recorded significantly higher plant height of 207.3 cm, leaf area of 412.6 cm^2, ear head length of 33.9 cm, 1101 number of grain/ head, 28.5 g of 1000-seed weight and grain yield of 1826 kg/ha and stover yield of 2342 kg/ha over all other treatments except application of 100 % RDF alone (T_6) which has recorded on par results with T_7 viz., plant height of 198.7cm, leaf area of 402.3 cm^2, ear head length 32.1 cm, 1058 number of grain/ head, 27.6 g of 1000-seed weight and grain yield of 1708 kg/ha and stover yield of 2212 kg/ha. No significant difference was noticed among the treatments with respect to harvest index. Application of 100 % RDF alone (T_6) has recorded higher B:C ratio (1.90), net returns (INR 13,756) over all other treatments.

Received 24.07.2017 Revised 12.08.2017 Accepted 21.08. 2017

INTRODUCTION

Sorghum (*Sorghum bicolor* L.) is one of the major staple food crop for the world's poorest and most food-insecure people. Sorghum is truly a dual-purpose crop which is valued both for its grain and stoverin most of the countries (Ahmed *et al*., 2007). Sorghum belongs to the family Gramineae. India stands first rank in acreage of sorghum with 6.32 m.ha area, annual production being 6.03 m. t and with an average annual productivity of 954 kg/ha(2011-12).In India sorghum is commonly known as Jowar which is mainly cultivated for food, feed, fodder and more recently for bio-fuel and sugar production. It is being considered as the second largest grain crop and presently occupies third place among the food in terms of acreage and production (Anonymous, 2010).India being a food surplus with about 264.8 million tonnes of food grain production per annum (2014-15), it will require about 4-5 million tonnes of additional food grains each year, if the trend in rising population persists (Anonymous, 2010). It is anticipated that in India in the year 2025, total food grain demand will reach 291 million tonnes comprising 109 million tonnes of rice, 91 million tonnes of wheat, 73 million tonnes of coarse grains and 15 million tonnes of pulses against the limitation of expansion of the cultivable land area (Kumar and Shivay, 2010). To meet the food grain demands of growing population theexcessive use of fertilizers is being practised after the green revolution. The intensive crop rotation and imbalanced fertilizer use have resulted in a wide range of nutrient deficiency in fields, which is gradually deteorating the health of soil. Therefore, improving and maintaining soil quality for enhancing and sustaining agricultural production is the present need of hour in India.In this regard the use of organic nutrient sources may be one of the option to achieve the sustained growth of the crop production as the organic nutrient sources continuously supplies nutrients to the crop in a slow-release form which enables the sustained growth of the crop. Hence, the recommendation of combined use of organic and inorganic nutrient sources for the crop production is one of the alternatives to raise crop productivity and sustain soil fertilityin the crop production system. With the view of all these points the present study was carried out to know the response of *rabi* sorghum to the combined use of organic and inorganic nutrient sources in the rain fed condition.

MATERIAL AND METHODS

The field experiment was conducted in black cotton soil in *rabi* season of 2015 at College of Agriculture, Bheemarayanagudi, Yadgir, situated in the North-Eastern dry zone of Karnataka (Region II, Zone 2). The farm is located between 160^0 43^lN and 760^0 51^l E longitude at an elevation of 411.75 meters above MSL characterized by dry climate with an average annual rainfall of 774.1 mm. Experimental site was clay loam in texture, slightly alkaline in reaction (pH), low in organic carbon (O.C) as well as low available nitrogen, medium in the available phosphorus and medium to high in available potassium.M-35-1 variety was used with a spacing of 45 cm X 15 cm at recommended seed rate. The experiment was laid out in randomised complete bock design with seven treatments which were replicated thrice. The treatment details are as follows :T_1- Absolute control; T_2- 50 %RDF alone; T_3- 50 %RDF + Vermicompost + *Azospirillum*; T_4- 75 %RDF alone; T_5- 75 %RDF + Vermicompost + *Azospirillum*; T_6- 100 %RDF alone; T_7- 100 %RDF + Vermicompost + *Azospirillum*. The fertilizers were applied as per the recommendations of UAS, Raichur *i.e.*60:75:40 kg NPK/haandvermicompost was applied as the recommended dose @ 2.5 t/ha. The *Azospirillum brasilences*inoculants (bio fertilizer) are used for the seed treatment as per the treatments combinations.

RESULTS AND DISCUSSION:

The results of the present investigation revealed that combined application of organic and inorganic nutrient sources showed higher yields as compared to application of RDF alone. The results of research findings are discussed below along with the possible reasons behind themwith the support of available scientific research findings to derive valid conclusions.

Table No. 1: Effect of combined use of organic and inorganic nutrient sources on growth and yield of sorghum at harvest

Treatments	Plant height (cm)	No. of leaves	Leaf area (cm2)	Dry matter		Ear head length (cm)	Grains / ear head	1000 seed wt (g)	Grain yield (kg/ha)	Stover yield (kg/ha)	H.I
				Seed (g)	Stover (g)						
T1- Absolute control	148.2	6.3	304.2	33.6	63.3	22.1	654	22.7	937	1353	0.41
T2- 50 %RDF alone	165.6	7.5	343.8	38.4	76.6	24.2	769	24.2	1158	1598	0.42
T3- 50 %RDF + VC + Azospirillum	174.5	7.8	358.2	40.8	80.7	25.8	823	24.8	1302	1770	0.42
T4- 75 %RDF alone	181.0	8.1	375.2	43.8	89.1	27.4	894	25.9	1448	1887	0.43
T5- 75 %RDF + VC + Azospirillum	188.4	8.5	389.3	46.2	94.3	29.7	977	26.5	1573	2049	0.43
T6- 100 %RDF alone	198.7	9.0	402.3	52.5	104.3	32.1	1058	27.6	1708	2212	0.44
T7- 100 %RDF + VC +Azospirillum	207.3	9.4	412.6	54.2	111.1	33.9	1101	28.5	1826	2342	0.44
SEm	4.1	0.3	7.20	1.83	4.27	0.85	32.1	0.44	52.3	71.78	NS
CD (0.05)	12.3	0.9	21.3	5.4	12.7	2.5	94.21	1.31	153.2	212.4	NS

Growth Parameters : Application of 100 %RDF + Vermicompost +*Azosprillum*(T_7) recoded significantly higher growth parameters *viz.,*plant height (207.3 cm), number of leaves (9.4), leaf area (412.6 cm^2) as compared to all other treatments at harvest. However, it was on par with application of 100 % RDF alone (T_6) (198.7 cm, 9.0, 402.3 cm^2 of plant height, number of branches and leaf area, respectively). The treatment $T_6$was on parwith application of 75 % RDF+ Vermicompost +*Azosprillum* (T_5) which has recorded 188.4 cm, 8.4, 389.3 cm^2 of plant height, number of leaves and leaf area, respectively. Significantly least growth parameters*viz.,* plant height (148.2), number of leaves (6.3) and leaf area (304.2) were recorded in absolute control (T_1:No application of fertilizers). The increased growth attributes in treatments with combined application of organic and inorganic nutrient sources might bedue to abundant supply of nutrients in the easily available form to the crops, which lead to the increased elongation of internodes of the sorghum stem, number of leaves in turn leaf area. Similar results were reported by Abdelmuniemand Madhavi (2015)in maize. They also reported that the application of vermicompost stimulated shoot growth in maize.

YieldParameters: Application of 100 % RDF + Vermicompost +*Azosprillum* (T_7) recoded significantly higher yield parameters *viz.,* dry matter (seed and stover of 54.2 g and111.1g /plant, respectively), ear head length (33.9 cm), grains/ear head (1101) and 1000-seed weight (28.5 g.). This was found to be on par with application of 100 % RDF alone (52.5 g, 104.3 g, 32.1 cm, 1058 and 27.6 g of dry matter of seed,

dry matter of stover, ear head length, grains/ear head and 1000-seed weight, respectively). The increasedyield parameterswas observed in combined applicationof organic and inorganic nutrientsources. This might be due to the abundant supply of nutrients by the combined application of organic and in organic sources which might have resulted in high photosynthetic rate, net assimilation rate and continuous metabolic reactions up to physiological maturity stage which attributed to increase in the length of panicle. Similar results were reported by Hugar*et al.,* (2010) in sweet sorghum. The increased dry matter accumulation in the seeds and stover, increased number grains per ear head may be due to the fact that prolonged supply of nutrients through vermicompost which retains nutrients for long time and while the inorganic fertilizers fail to deliver the required amount of vital nutrients (NPK) to plants for such a prolonged period, the vermicompost could deliver nutrients (Hsammermeister*et al*., 2004).

Grain and Stover Yield: Combined application of organic and inorganic nutrient sources has resulted in the higher yields.Application of 100 % RDF + Vermicompost +*Azosprillum* (T_7) recoded significantly higher grain yield of 1826 kg/ha, stover yield of 2342 kg/ha as compared to all other treatments. However, no significant difference was noticed with application of 100 % RDF alone (T_6) (1708 and 2122 kg/ha of grain yield and stover yield, respectively). This was followed by T_4, T_3, T_2 and T_1. However, no significant difference was noticed with application of 75 % RDF + Vermicompost +*Azosprilliuum* (T_5) (1573 and 2043 kg/ha of grain yield and stover yield, respectively). Significantly lower grain yield of 937 kg/ha and stover yield of 1353 kg/ha was recorded in absolute control (T_1:No application of fertilizers).No significant difference was noticed with respect to harvest index, however higher H.I was observed in application of 100 % RDF +Vermmicompost+ *Azospirillum* (T_7)(0.44) and application of 100 % RDF alone(T_6) (0.44). The lower H.I was noticed in absolute control (0.41).

The combined application of organic and inorganic nutrient sources has led to increased growth and yield parameters due to the application of the inorganic fertilizer which was in ready form and easily available for the crop in addition to the effect of the organic nutrient sources which supplies nutrients to the crop for a prolonged period continuously in slow release form, the studies done by Sudhanshu (2013) tends to support the present findings. Elfstrand*et al.* (2007) proved that the incorporated use of organic sources of nutrients not only supply essential nutrients but also has some positive interaction with chemical fertilizers to increase their efficiency.The increased yields of sorghum are also due to the fact that in addition to N fixation by *Azospirillum* improves the plant growth production of phytoharmones leading to better plant growth with greater photosynthates production and its translocation to reproductive parts (Prasad, 2008 and Khan *et al.*2010).

Table 2: Economics of sorghum as influenced by combined application of organic and inorganic nutrient sources

Treatments	Cost of Cultivation (₹/ha)	Gross Returns(₹/ha)	Net Returns (₹/ha)	B:C ratio
T_1- Absolute control	13,000	15,929	2,929	1.23
T_2- 50 %RDF alone	13,570	19,686	6,116	1.45
T_3- 50 %RDF + VC + *Azosprillum*	21,070	22,134	1,064	1.05
T_4- 75 %RDF alone	14,140	24,616	10,476	1.74
T_5- 75 % RDF + VC + *Azosprillum*	21,640	26,741	5,101	1.24
T_6- 100 %RDF alone	15,280	29,036	13,756	1.90
T_7- 100 %RDF + VC + *Azosprillum*	22,780	31,042	8,262	1.36

Application of 100 % RDF alone (T_6) has recorded higher B:C ratio(1.90), net returns (₹.13,756) over all other treatments. This was followed by application of 75 % RDF alone (T_4) with B:C ratio of 1.74 and net returns of ₹.10,476. Application of 100 % RDF + Vermicompost + *Azosprillum* recorded B:C ratio of 1.36, net returns of ₹.8,262 and highest gross returns of ₹. 31,042.The lowest gross returns (₹. 15,929) and net returns(₹. 2,929) was noticed in absolute control (T_1). The lower net returns and B:C ratio in the treatments with combined application of organic and inorganic nutrient sources is due to higher cost incurred on vermicompost application. The findings are similar with Jat and Ahlawat (2010) who reported that the crop without FYM recorded higher B:C ratio as compared to crop with FYM application. The value of increased yield on FYM application was nullified due to higher cost on production of FYM, which led to lower B:C ratio in the treatment with FYM application.

The combined application of organic and inorganic nutrient sources recorded higher yields as compared to sole application of inorganic nutrient sources. However, no significant difference was noticed with application of organic nutrient sources. Application of inorganic nutrient sources as per recommended dose along with application of organic nutrient sources sustains the health of the soil, besides maintaining the optimized crop yields. This could be profitable to the farmer, provided if the vermicompost is been produced in his own farm. Thus, combined application of organic and inorganic nutrient sources could recommended for increasing the sorghum production, provided the cost on vermicompost is minimised.

REFERENCES

1. Abdelmuniem,Y. E and Madhavi, K., 2015.Influence of Integrated Nutrient Management on Growth and Yield parameters of kharif Sorghum (*Sorghum bicolor* L. Moench). *American J. Scientific and Industrial Res*., 6 (5):90-96.
2. Ahmed, M.A., Nabila, M.Z and Hassanein, M.S., 2007. Response of grain sorghum to different nitrogen sources. *Res. J. Agric. and Biological Sci.* (3): 1002-1008.
3. Anonymous, 2010. Monthly Review of the Indian Economy (CMIE), *Economic Intelligence Service. August, 2010.*
4. Jat, R. A. and Ahlawat (2010), Effect of organic manure and sulphur fertilization in pigeon pea (*Cajanuscajan*) + groundnut (*Arachis hypogea*) intercropping system. Indian J. Agronomy, **55** (4):276-281
5. Hsammermeister, A.M., Warman, P.R,Jeliakova, E.A and Martin, R.C. 2004. Nutrient Supply and Lettuce Growth in Response to Vermicomposted and Composted Cattle Manure. *J. Bioresource Tech.,* (Quoted in Munroe, 2007).
6. Hugar, A.Y., Jayadeva, H.M., Rangaswamy, B.R., Shivanna, S and Chandrappa, H. 2010. Assessing the effect of nitrogen and harvesting stages on yield and yield attributes of sweet sorghum (Sorghum bicolor (L.) Moench) genotypes. Agriculture Science Digest 30 (2): 139-141.
7. Khan, A., Rajmani K. and Reddy, P. K. A., 2010, Effect of integrated nutrient management on yield, quality, nutrient content and uptake of sweet sorghum in Pongamia based Agrisilviculture system.*Indian J. Agril. Develop*. 25:95-99
8. Kumar, V. and Shivay, Y.S. 2010. Integrated nutrient management: An ideal approach for enhancing agricultural production and productivity. *Indian J. Ferti*. 6(5):41-57.
9. Sudhanshu, S.K. 2013. Effect of IN-SITU soil moisture conservation practices and different nitrogen sources on rain fed sorghum (Sorghum biocolor L. Moensh) and soil properties *Ph.D. Thesis Andhra Pradesh, Acharya N. G. Ranga Agricultural University, Hyderabad, Rajendranagar.*

CITATION OF THIS ARTICLE

Sameerkumar, D., Shridhara, B. Nagoli, Hiremath, K. A. And Shivanand, N. Honnali. Response of Sorghum (*Sorghum bicolor*) to Combined Use of Organic and Inorganic Nutrient Sources. Bull. Env. Pharmacol. Life Sci., Vol 6 Special issue [3] 2017: 645-648