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EFFECT OF EFFICIENT NUTRIENT MANAGEMENT STRATEGIES IN ACHIEVING PRODUCTION POTENTIAL OF SORGHUM

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Abstract

Sorghum is genetically suited to hot and dry agro ecologies which have the potential of adoption to adverse climatic conditions. To sustain present food sufficiency and to harness the full yield potential of sorghum, new sound management practices must be identified and tested to increase crop productivity. Sustainable production could be achieved only when factors leading to continued maintenance of soil health are taken care of. Hence, the complimentary role of organics as supplements to chemical fertilizers is important for keeping the soil health in order to harness the potential yield in sorghum. Field experiment was conducted at the experimental farm, Department Agronomy, Faculty of Agriculture, Annamalai University to ascertain the suitability and sustainability of integrated nutrient management practices on sorghum. The results of the experiment showed that application of vermicompost @ 5 t ha^{-1} + recommended dose of NPK ha^{-1} (T_8) proved its excellence by registering higher yield attributes of sorghum *viz.,* Number of ear heads m^{-2}, number of grains $earhead^{-1,}$ number of filled grains $earhead^{-1}$, weight of filled grains $earhead^{-1}$ and thousand grain weight and a thumping yield of 2935kg ha^{-1}. Considering the above results of the above investigation, it can be concluded that integrated application of vermicompost @ 5 t ha^{-1} + recommended dose of NPK ha^{-1} imposed to sorghum have tapped the production potential of sorghum by registering the highest values in growth parameters, yield attributes and yields of sorghum in increasing production potential of sorghum.

Key words : Sustainable Agriculture, Production potential, Coirpith and Vermicompost.

Introduction

Sorghum is the fourth most important coarse cereal crop in the world after wheat, rice and maize of semi – arid tropical regions of India and an important staple food grain for millions of world's poorest and most food-insecure people. Suitable nutrient management aims at intelligent use of an efficient and judicious use of all the major sources of plant nutrients from organic and inorganic resources to get spectacular yields.

To get potential yield in sorghum the present productivity level of sorghum could be doubled. Nutrient management is considered as an essential input in sorghum production (Deshmukh *et al.,* 2013).

With its high nutrient demand and its productivity mainly depends upon nutrient management system, it is difficult to sustain the yield levels of sorghum with the application of major nutrients alone due to increased deficiency of secondary and micronutrients unfavourable for crop growth. To explore the potentiality of sustainable use of organic and inorganic nutrient sources, the urgent need is to test easily available alternative sources of energy such as vermicompost, pressmud compost and coirpith compost for increasing production potential of sorghum (Faiza Sharif *et al.,* 2016).

Hence, the present investigation was carried out to develop an efficient sustainable nutrient management practice for sorghum using locally available organic sources along with inorganic fertilizers for increasing production potential of sorghum.

Materials and Methods

The trial was conducted in the Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University and Annamalainagar. The geographical location of Annamalai Nagar is 11º24' N latitude and 79º44' E longitude at an altitude of + 5.79 m above mean sea level. The soil of the trial field is classified as Udic chromustert (clay) according to FAO / UNESCO

(1974). The initial analysis of the experimental soil concluded that heavy clay with neutral in reaction (pH = 7.5), with low soluble salts (EC = 0.33 dSm^{-1} medium in available nitrogen (227 kg ha^{-1}), low in available phosphorus (19.00 kg ha^{-1}) and high in available potassium (323.50 kg ha^{-1}). The experiment was laid out in randomized block design with 3 replications. There were altogether 8 treatments *viz*., T_1 - Control, T_2 - Farmers practices (90:45:45 kgs of N, P_2O_5 and K_2O ha^{-1}), T_3 - Coirpith compost @ 2.5 t ha^{-1} + recommended dose of NPK ha^{-1}, T_4 - Pressmud compost @ 2.5 t ha^{-1} + recommended dose of NPK ha^{-1}, T_5 - Vermicompost @ 2.5 t ha^{-1} + recommended dose of NPK ha^{-1}, T_6 - Coir pith compost @ 5 t ha^{-1} + recommended dose of NPK ha^{-1}, T_7 - Press mud compost @ 5 t ha^{-1} + recommended dose of NPK ha^{-1}, T_8 - Vermicompost @ 5 t ha^{-1} + recommended dose of NPK ha^{-1}. Sorghum variety K-11 was chosen as test crop for the investigation. The pressmud compost used in the study was obtained from MRK Co-operative sugar factory, Sethiathope, Tamil Nadu. Vermicompost and coirpith compost were obtained from Experimental farm, Department of Agronomy, Annamalai University used for the experiment. The nutrient content of industrial wastes viz., vermicompost, pressmud compost and coir pith compost are N-2.75%, 2.63 % and 1.24 %, P- 0.95%, 0.76% and 0.262% and K- 1.80%, 1.64 % and 1.20 % respectively. The recommended set of practices for sorghum was adopted and the crop was harvested. For the estimation of dry matter production, five plants were removed randomly at harvest stage. These samples were first air dried in shade and then oven dried at 80 ± 5°C till a constant weight was obtained and the weight was recorded. The mean dry weight was expressed in kg $ha^{-1.}$ The yields and economic analysis of each treatment were recorded separately and analyzed statistically with Analysis of Variance.

Results and Discussion

Growth components

The sustainable nutrient management practices significantly influenced the growth characters of sorghum *viz*., plant height, leaf area index and dry matter production. Among the treatments, application of vermicompost @ 5 t ha^{-1} + recommended dose of NPK ha^{-1} (T_8) significantly registered the highest plant height of 185.24 c.m, dry matter production of 15428 kg ha^{-1} and leaf area index of 3.93.

The excellent vegetative growth and development resulted in maximum plant height which might be due to the availability of nutrients at early crop growth stages and elongation of internodes of the sorghum stem.

Vermicompost which contains high amount of macro and micro nutrients enhanced the nutritional status of soil when applied to the soil in combination with inorganic fertilizers primarily NO_3, PO_4, Ca, K, Mg, S and other essential nutrients in the forms that are readily taken up by the plants which led to higher leaf area index of sorghum thereby providing an opportunity for the plants to increase the photosynthetic rate which in turn resulted in higher accumulation of dry matter. The studies done by Sudhanshu (2013) tends to support the present finding.

Yield attributes

The yield attributes of sorghum *viz*., number of earheads m^{-2}, number of grains $earhead^{-1}$ and number of filled grains $earhead^{-1}$, weight of filled grains $earhead^{-1}$ and thousand grain weight were favourably influenced by the effective combination of organic and inorganic nutrient sources (Table 1).

Among the different combinations combined application of vermicompost @ 5 t ha^{-1} + recommended dose of NPK ha^{-1} (T_8) recorded the highest filled grains number of 1197 $earhead^{-1}$ and weight of filled grains of 23.94 g $earhead^{-1}$. This treatment was closely followed by the application of vermicompost @ 2.5 t ha^{-1} + recommended dose of NPK ha^{-1} (T_5) and application of pressmud compost @ 5 t ha^{-1} + recommended dose of NPK ha^{-1} (T_7) and they were on par among themselves.

The combined application of inorganic fertilizers along with organic manure sources could have helped in balanced supply and distribution of nutrients at all along the growth stages of sorghum. Further, vermicompost which contains higher amount of macro and micro nutrients enhanced the nutritional quantum of soil when applied to the soil in combination with inorganic fertilizers primarily NO_3, PO_4, Ca, K, Mg, S and other essential nutrients (Meena *et al*., 2013) in the forms that are readily taken up by the sorghum plants which led to higher number of earheads (m^{-2}) thereby providing an opportunity for the plants to increase the number of filled grains $earhead^{-1}$ which in turn resulted in higher weight of filled grains $earhead^{-1}$ The results are in conformity with the earlier findings of (Kausadikar *et al*., 2014).

Sorghum yield

Integrated application of organic and inorganic nutrients significantly influenced the grain yield of sorghum. Application of vermicompost @ 5 t ha^{-1} + recommended dose of NPK ha^{-1} (T_8) significantly registered the highest sorghum grain yield of 2935 kg ha^{-1}. This treatment was closely followed by the application of vermicompost @ 2.5 t ha^{-1} + recommended dose of

Table 1: Effect of efficient nutrient management strategies on growth components of sorghum (kg ha^{-1}).

Treatments	Plant height at harves t(cm)	Leaf area index	Dry matter production (kg ha^{-1})
T_1 – Control	154.58	3.15	11659
T_2 – Farmers practice (90:45:45 kgs) of NPK ha^{-1}	160.48	3.30	12355
T_3 – Coirpith compost @ 2.5 t ha^{-1} + Rec. NPK ha^{-1}	165.19	3.42	12918
T_4 – Pressmud compost @ 2.5 t ha^{-1} + Rec. NPK ha^{-1}	174.64	3.65	14090
T_5 – Vermicompost @ 2.5 t ha^{-1} + Rec. NPK ha^{-1}	180.44	3.81	14909
T_6 - Coirpith compost @ 5.0 t ha^{-1} + Rec. NPK ha^{-1}	169.84	3.53	13511
T_7 – Pressmud compost @ 5.0 t ha^{-1} + Rec. NPK ha^{-1}	179.24	3.76	14625
T_8 – Vermicompost @ 5.0 t ha^{-1} + Rec. NPK ha^{-1}	185.24	3.93	15428
S.Ed	2.12	0.05	222
C.D (p = 0.05)	4.55	0.10	478

Table 2: Effect of efficient nutrient management strategies on yield attributes and yield of sorghum (kg ha^{-1}).

Treatments	Number of earheads (m^{-2})	Number of filled grains earhead^{-1}	Weight of filled grains earhead^{-1}(g)	Test weight (g)	Grain yield (kg ha^{-1})
T_1 – Control	13.7	705.6	22.98	20.84	718
T_2 – Farmers practice (90:45:45 kgs) of NPK ha^{-1}	13.8	813.6	23.09	21.14	1278
T_3 – Coirpith compost @ 2.5 t ha^{-1} + Rec. NPK ha^{-1}	13.9	894.6	23.20	21.41	1433
T_4 – Pressmud compost @ 2.5 t ha^{-1} + Rec. NPK ha^{-1}	14.0	1031.4	23.57	21.88	2134
T_5 – Vermicompost @ 2.5 t ha^{-1} + Rec. NPK ha^{-1}	14.1	1129.5	23.79	22.24	2584
T_6 - Coirpith compost @ 5.0 t ha^{-1} + Rec. NPK ha^{-1}	13.9	961.2	23.39	21.64	1773
T_7 – Pressmud compost @ 5.0 t ha^{-1} + Rec. NPK ha^{-1}	14.1	1103.4	23.73	22.13	2483
T_8 – Vermicompost @ 5.0 t ha^{-1} + Rec. NPK ha^{-1}	14.1	1197.0	23.94	22.50	2935
S.Ed	0.02	29.93	0.09	0.08	149
C.D (p = 0.05)	NS	64.2	NS	NS	319

NPK ha^{-1} (T_5) and application of pressmud compost @ 5t ha^{-1} + recommended dose of NPK ha^{-1} (T_7) and they were on par among themselves. This treatment was followed by the application of pressmud compost @ 2.5 t ha^{-1} + recommended dose of NPK ha^{-1} (T_4).

The prominent beneficial effect on grain yields of sorghum might be due to the slow and steady release of nutrients by vermicompost that provided nutrients such as available N, soluble K, exchangeable Ca, Mg and P that could be readily taken by the plants in balanced manner. The enzymatic activities of vermicompost which impart physico-chemical and biological activities of soil resulting in more photosynthates assimilation and subsequent conversion of assimilates into yield attributes in larger fraction which ultimately resulted in higher grain yields in sorghum. These findings were in consonant with the results of the study of Nemade *et al.,* (2013).

Conclusion

Based on the results of the investigation, it could be concluded that integrated application of vermicompost @ 5 t ha^{-1} + recommended dose of NPK ha^{-1} (T_8) imposed to sorghum having registered the highest values in growth parameters, yield attributes coupled with highest yield thereby helping in tapping the production potential of sorghum which was highly impressive and appears to be more promising as an efficient and suitable nutrient management system for not only enhancing crop yields in sorghum but also maintaining soil fertility and eco system, a felt need of present day agriculture.

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