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Impact of Integrated Nutrient Management in Tapping the Production Potential of Sorghum

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ABSTRACT

Sorghum is the coarse cereal crop of semi-arid tropical regions which is genetically suited to hot and dry agro-ecologies which have the potential of adoption to adverse climatic conditions. To harness the yield potential of sorghum new sound management practices must be identified and tested and the complimentary role of organics as supplements to chemical fertilizers is important for keeping the soil health in order to tap the production potential of sorghum. Field experiment was conducted at Pudanchandai village, Puduchatram block, Namakkal district, Tamil Nadu to ascertain the sustainability of integrated nutrient management practices on sorghum during *Rabi* season of 2020-2021. The results of the experiment showed that among the integrated nutrient management practices application of 50% N through fertilizer + balance 50% N through vermicompost + 100% P and K as fertilizers (T_4) proved its excellence by registering superior growth characters, yield components and a thumping grain yield of 3310 kg ha^{-1}. Considering the above results of the above investigation, it can be concluded that integrated application of 50% N through fertilizer + balance 50% N through vermicompost + 100% P and K as fertilizers registered the highest values in growth parameters, yield attributes and yields of sorghum in tapping the production potential of sorghum.

Key words: Integrated nutrient management, Production potential, Coirpith, Pressmud, Vermicompost

Sorghum is the most important coarse grain crop in the world and an important staple food grain for millions of the world's poorest and food-insecure people. To sustain present food sufficiency and to harness the yield potential of sorghum to meet future food requirements, new sound management practices must be identified and tested to increase crop productivity. Globally sorghum is grown in an area of 40.74 million hectares with a total production of 59.25 million tonnes with an average productivity of 1454 kg ha^{-1}. In India, sorghum is cultivated over an area of 4.82 million hectares with an annual production of 4.77 million tons with an average productivity of 990 kg ha^{-1} [1]. In Tamil Nadu sorghum is cultivated over an area of 3.86 lakh hectares with an annual production of 4.65 lakh tonnes with an average productivity of 1205 kg ha^{-1}.

Integrated nutrient management aims at an efficient and judicious use of the major sources of plant nutrients in an integrated approach so as to get maximum economic yield without any deleterious effect on physico-chemical and biological properties of the soil [2]. Sustainable production could be achieved only when factors leading to the continued maintenance of soil health are taken care of. Hence, the complementary role of organics as supplements to chemical fertilizers is important for keeping the soil health in order to harness the potential yield in sorghum [3]. Because of its high nutrient demand and its productivity largely dependent upon nutrient management system, it is difficult to maintain the yield levels of sorghum with the application of major nutrients alone due to increased deficiency of secondary and micronutrients, which are unfavorable for crop growth.

Moreover, continuous and indiscriminate use of chemical fertilizers in intensive cropping system leading to imbalance of nutrients in soil, environmental pollution which has an adverse effect on soil health, ecological hazards and also on crop yields. Organic manures along with recommended dose of fertilizers increased soil organic carbon, nutrient turn over, enhancing microbial biomass, thereby improvement in availability of nutrients in soil [3]. To explore the potentiality of sustainable use of organic and inorganic nutrient sources, the urgent need is to test locally available alternative sources of energy such as vermicompost, pressmud compost, bone sludge and coirpith compost for increasing production of sorghum and soil health as well [4].

MATERIALS AND METHODS

The field experiment was conducted in farmer's field, Pudanchandai village, Puduchatram block, Namakkal district, Tamil Nadu, India during 2020-21. The experimental site is

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situated at 11°21' N latitude and 78°10' E longitude with an altitude of +270 m above mean sea level in the southern part of India. The soil of the experimental field is red soil, sandy clay in texture with neutral reaction (pH = 7.1), low in soluble salts (EC = 0.39 dSm^{-1}), low in available N, medium in available P_2O_5 and high in available K_2O. Namakkal district comes under north western agro climatic zone and western agro climatic zone. The mean maximum and minimum temperature recorded during the growing season were 27.46°C and 25.73°C. The average relative humidity was 79.18 % and total rainfall of 180.1 mm was received during the cropping period. The field experiment was laid out in randomized block design (RBD) with seven treatments replicated three times. Sorghum variety CO 30 was grown during the course of study. The integrated nutrient management carried out as required quantities of well decomposed organic manures were incorporated in the soil as per the treatment schedule before sowing. Nitrogen and K_2O were applied in two equal splits one at basal and other at top dressing 30 DAS. The entire dose of P_2O_5 applied basally as per the treatment schedule.

Table 1 Impact of integrated nutrient management on the growth traits of sorghum

Treatments	Plant height at harvest (cm)	Leaf area index	Dry matter production (kg ha^{-1})
T_1: Control (No Nutrient supply)	155.12	6487	3.16
T_2: 50% N through fertilizer + balance 50% N through Coirpith compost + 100% P and K as fertilizers	173.59	11223	3.53
T_3: 50% N through fertilizer + balance 50% N through Pressmud compost + 100% P and K as fertilizers	186.29	13262	3.85
T_4: 50% N through fertilizer + balance 50% N through Vermicompost + 100% P and K as fertilizers	192.34	14966	3.99
T_5: 50% N through fertilizer + balance 50% N through FYM compost + 100% P and K as fertilizers	175.29	11427	3.56
T_6: 50% N through fertilizer + balance 50% N through Bone sludge compost + 100% P and K as fertilizers	181.27	12755	3.68
T_7: 100% recommended NPK through fertilizers	165.00	9832	3.33
Sem ±	1.56	115.16	0.02
CD (P=0.05)	4.84	357	0.08

RESULTS AND DISCUSSION

Growth attributes

The INM (Integrated Nutrient Management) practices exerted significant influence on plant height, DMP and LAI due to adoption of different INM practices marked variations on the plant height of sorghum at different growth stages. Among the treatments tested in the experiment, application of 50% N through fertilizer + balance 50% N through vermicompost + 100% P and K as fertilizers (T_4) is recorded higher plant height of 192.34 cm, dry matter production of 14966 kg ha^{-1} and leaf area index of 3.99. This treatment was followed by the application of 50% N through fertilizer + balance 50 % N through pressmud compost + 100% P and K as fertilizers (T_3). Growth characters that could be influenced to great extent by INM practices. Thus, excellent vegetative growth and development resulted in combined application of vermicompost with inorganic fertilizers which led to beneficial effects on elongation, cell division and photosynthetic parameter (leaf area) thereby providing an opportunity for the plants to increase the plant height, higher accumulation of dry matter and leaf area index [5-6].

Table 2 Impact of integrated nutrient management on the yield attributes and yield of sorghum

Treatments	No. of ear heads m^{-2}	No. of grains $earhead^{-1}$	Weight of filled grains $earhead^{-1}$ (g)	Thousand grain weight (g)	Grain yield (kg ha^{-1})
T_1: Control (No Nutrient supply)	13.0	756	13.36	20.92	1216
T_2: 50% N through fertilizer + balance 50% N through Coirpith compost + 100% P and K as fertilizers	14.0	961	18.95	21.51	2249
T_3: 50% N through fertilizer + balance 50% N through Pressmud compost + 100% P and K as fertilizers	15.0	1155	22.66	22.47	2897
T_4: 50% N through fertilizer + balance 50% N through Vermicompost + 100% P and K as fertilizers	15.0	1238	25.53	22.95	3310
T_5: 50% N through fertilizer + balance 50% N through FYM compost + 100% P and K as fertilizers	15.0	979	19.87	21.98	2271
T_6: 50% N through fertilizer + balance 50% N through Bone sludge compost + 100% P and K as fertilizers	14.0	1076	21.79	22.30	2589
T_7: 100% recommended NPK through fertilizers	14.0	853	16.01	21.10	1939
Sem ±	0.11	23.23	0.30	0.11	99.78
CD (P=0.05)	NS	72	0.93	NS	309.32

Yield attributes

Significant impact was noticed on yield attributes due to integrated nutrient management practices of sorghum viz., number of earheads m^{-2}, numbers of grains $earhead^{-1}$, weight of filled grains $earhead^{-1}$ and thousand grain weight. Among the treatments, application of 50% N through fertilizer + balance 50% N through vermicompost + 100% P and K as fertilizers (T_4) recorded with the higher number of ear heads m^{-2} of 15, numbers of grains $earhead^{-1}$ of 1238, weight of filled grains $earhead^{-1}$ of 25.53 g and thousand grain weight of 22.95 g. This treatment was followed by the application of 50% N through fertilizer + balance 50% N through pressmud compost + 100% P and K as fertilizers (T_3). The least yield components were recorded in the control treatment (T_1). Further, the macro and micro nutrient availability resulting in higher uptake of nutrients better growth components which ultimately led to better translocation of photosynthesis from source to sink resulting in number of earheads m^{-2}, number of grains $earhead^{-1}$ and number of filled grains $earhead^{-1}$ [7-8].

Yield

Among the treatments, application of 50 % N through fertilizer + balance 50 % N through vermicompost + 100% P and K as fertilizers (T_4) significantly differed with other treatments and recorded higher grain yield of 3310 kg ha^{-1}. This was followed by the application of 50% N through fertilizer + balance 50% N through pressmud compost + 100% P and K as fertilizers (T_3). The least grain yield of 1216 kg ha^{-1} was recorded in the control treatment (T_1). The integrated use of 50% N through fertilizer + balance 50% N through vermicompost + 100% P and K as fertilizers resulted with the prominent beneficial effect on the grain yield. This 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.

Furthermore, the vermicompost relatively added large amount of macro and micro nutrients especially P, Ca and Mg which involved in enzyme activities and 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 yield. Similar findings of balanced supply of nutrients by integrating organic with inorganic for better growth, yield attributes and yield of sorghum were in consonant with the results of [9-10].

CONCLUSION

On the basis of the experiment results, it could be concluded that among the various integrated nutrient management practices, application of 50% N through fertilizer + balance 50% N through vermicompost + 100% P and K as fertilizers was found to be effective in enhancing the plant height, dry matter production and ultimately with highest yield thereby helping in tapping the production potential of sorghum. Further, these practices are economically viable and eco-friendly production technology for yield maximization in sorghum through integration of inorganic and organic sources of plant nutrients.

LITERATURE CITED

1. Anonymous. 2019. Directorate of Economics and Statistics. 2019. Agricultural statistics for 2018-2019 agricultural crop year at a glance. *Ministry of Agriculture.*
2. Lalrintluangi IF, Bisarya D, Kumar V, Singh AK. 2020. Organic sources of plant nutrition for sustainable crop production in India. *European Jr. of Molecular and Clinical Medicine* 7(7): 2754-2763.
3. Katkar RN, Kharche VK, Sonune BA, Wanjari RH, Singh M. 2012. Long term effect of nutrient management on soil quality and sustainable productivity under sorghum-wheat crop sequence in vertisol of Akola, Maharashtra. *Agropedol.* 22(2): 103-114.
4. Singh YV, Singh SK, Deepak, Sharma PK, Meena R. 2020. STCR based fertilizer recommendation with sorghum (*Sorghum bicolor* L.) gradient experiment in alluvial soil. *Jr. of Pharmacognosy and Phytochemistry* 9(1): 484-486.
5. Hashemi SZ, Zakernejad S, Payandeh K. 2019. Integrated effect of nitrogen fertilizer and vermicompost on quantitative and qualitative traits of sorghum (*Sorghum bicolor* L.) under water stress situation. *Jr. of Crop Nutrition Sci.* 5(4): 51-63.
6. Nohang B, Yusuf M. 2020. Influence of different vermicompost levels on growth, yield and quality of forage sorghum (*Sorghum bicolor* L. Monch). *In IOP Series: Earth and Environ. Sci.* 492(1): 012029.
7. De Fatima Esteves G, De Souza KRD, Bressanin LA, Andrade PCC, Junior VV, Dos Reis PE, Da Silva AB, Mantovani JR, Magalhaes PC, Pasqual M, De Souza TC.2020. Vermicompost improves maize, millet and sorghum growth in iron mine tailings. *Jr. of Environ. Mgt.* 264: 110468.
8. Barcelos MN, Camarg R, Lana RMQ, Amaral U, Araujo LC, Teixeira Filho MCM, Nogueira TAR.2019. Use of organo-mineral fertilizers in grain sorghum as reverse logistics of organic residues. *Jr. of Agric. Sci.* 11(2): 435-444.
9. Mule P, Jadhao SD, Patil RJ, Sonune BA, Age AB, Deshmuke DP, Dipti Agarkar. 2019. Soil nutrient status and yield of wheat as influenced by INM under continuous sorghum-wheat cropping sequence in vertisol. *Intl. Jr. of Chemical studies* 7(4): 829-832.
10. Bhatt MK, Labanya R, Joshi HC. 2019. Influence of long-term chemical fertilizers and organic manures on soil fertility-A review. *Univers. Jr. Agric. Res.* 7(5): 177-188.