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Cultivating Rice (*Oryza sativa* L.) with Urban Waste Compost – A Scientific Study

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Abstract

A field experiment was conducted to study the impact of urban waste compost (UWC) on rice (*Oryza sativa* L.) at College Farm, School of Agricultural Sciences, Mallareddy University, Maisammaguda, Hyderabad, Telangana state during *Rabi*, 2020–21. Two treatments (T_1: RDF and T_2: RDF+ UWC 28 t ha^{-1}) have been imposed to study the yield and yield attributes of Chintu variety of rice crop. The results revealed that rice crop treated with RDF+UWC (T_2) produced maximum number of tillers (265 m^{-2}) and total dry matter (80.10 g $plant^{-1}$), thus, higher grain yield (5250 kg ha^{-1}) as compared to that of untreated plot (T_1: RDF alone) (194 tillers m^{-2}, 73.68 g $plant^{-1}$, 4125 kg ha^{-1}). Further, the same treatment recorded higher gross (Rs. 1,20,750 ha^{-1}) and net returns (Rs. 75,406 ha^{-1}) and B:C ratio (2.66) vis-a-vis untreated plot (Rs. 50,644 ha^{-1}; 2.14).

1. Introduction

A major challenge to modern intensive agriculture is to achieve enhanced productivity while sustaining soil health and biodiversity. The intensive use of synthetic fertilizers, especially nitrogen (N) to achieve high yield often leads to soil degradation and acidification, which, in turn, deteriorates soil fertility and decreases crop yield (Ju et al., 2009). Low-input agricultural system which relies on the input of organic materials hold great promise not only to minimize the use of synthetic fertilizer, but also, to improve crop productivity besides ensuring ecosystem sustainability against nutrient mining and degradation of soil and water resources (Tilman et al., 2002; Kravchenko et al., 2017). Among the organic amendments, UWC, cattle and swine manure have been widely used in agricultural fields and mainly in the composted form of this manure is preferred.

Rice (*Oryza sativa* L.) is considered as "global grain". It is the major staple food for more than half of the global population. Rice production in the country has to continue to fulfill the needs of ever increasing population even under severe macro and micro weather differences. India ranks second in rice production next to

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China. The rice crop is grown in almost all the states of the country. With ever increasing urbanization, there is significant urban waste increase is also recorded. Efforts are on in India to produce compost of urban waste which is a valuable manure for use in Agriculture. Further, there is a need to test the impact of UWC application on various field and vegetable crops. In view of this, the present study was undertaken to assess the response of rice crop to urban waste compost (UWC) under field conditions.

2. Methodology

A field trial was conducted at College Farm, School of Agricultural Sciences, Mallareddy University, Maisammaguda, Hyderabad, Telangana state during *Rabi*, 2020-21. The experimental soil was medium black having moderate infiltration rate, non-saline (0.124 dS m^{-1}), neutral in reaction (pH: 7.07) and sufficient in all the available micronutrients. The fertility status of the experimental soil was low in available N (113 kg ha^{-1}), medium in both phosphorus (33 kg ha^{-1}) and potassium (151 kg ha^{-1}). A recommended fertilizer dose (RDF: 150:75:75 kg N:P2O5:K2O ha^{-1}) has been applied to both the treatments under study. Two treatments (T_1: RDF and T_2: RDF + UWC 28 t ha^{-1}) have been imposed to study the yield and yield attributes of Chintu variety of rice crop. The compost had 1.06, 0.40 and 0.39 % of N, P_2O_5 and K_2O, respectively and also micronutrients like Cu (239 ppm), Mn (168 ppm), Fe (1455 ppm), Zn (231 ppm) etc., The source of N, P_2O_5 and K_2O were urea (46%), SSP (16%) and MOP (60%), respectively. The crop was transplanted at a spacing of 20 cm x 10 cm on 26- 01-2021 and harvested on 27-05-2021.

3. Results and Discussion

The results in Table 1 revealed that rice crop nourished with RDF+UWC (T_2) produced maximum number of tillers (265 m^{-2}) and total dry matter (80.10 g $plant^{-1}$) thus higher grain yield (5,250 kg ha^{-1}) as compared to that of untreated plot (T_1) (194 tillers m^{-2}, 73.68 g $plant^{-1}$, 4,125 kg ha^{-1}). The increase in yield attributes and yield in T2 plot can be attributed to the addition of UWC. Rice crop treated with UWC besides RDF (T_2) recorded significantly higher gross returns (Rs. 1,20,750 ha^{-1}), net returns (Rs. 75,406 ha^{-1}) and B:C ratio of (2.66) as compared to that of T_1 (RDF) which recorded gross returns (Rs. 94,875 ha^{-1}), net returns (Rs. 50,644 ha^{-1}) and B:C ratio of 2.14 (Table 2). Li et al. (2017) reported that the application of NPK + cattle manure and NPK + swine manure increased total organic carbon (TOC) by 143.4 and 54.7%, TN by 134.0% and 78.3% and crop yield by 48.9% and 39.6%, respectively, compared to NPK fertilization. The livestock waste composts with minimum inorganic fertilizer as a soil amendment in low- input intensive farming has been well recognized as a vital agricultural practice to improve soil fertility and productivity (Tilman et al., 2002; Kravchenko et al., 2017).

Table 1: Number of tillers, total dry matter and grain yield of rice as influenced by urban waste compost

Treatments	No. of tillers m^{-2}	Total dry matter (g $plant^{-1}$)	Grain yield (kg ha^{-1})
T_1 (Control: RDF alone)	194	73.68	4125
T_2 (Urban Waste Compost)	265	80.10	5250

Table 2: Gross returns and net returns and B:C ratio of rice as influenced by urban waste compost

Treatments	Gross returns (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B:C ratio
T_1 (Control: RDF alone)	94,875	50,644	2.14
T_2 (Urban Waste Compost)	120,750	75,406	2.66

Market rate of rice grain: Rs. 23 kg^{-1}; urban waste compost: Rs. 10 kg^{-1}

Figure 1: Urban waste compost

Figure 2: Rice crop grown without urban waste compost (Vegetative stage) (T_1)

Figure 4: Rice crop grown without urban waste compost (Panicle development stage) (T1)

4. Conclusion

Addition of urban waste compost besides recommended dose of fertilizers improved the yield attributes and grain yield of rice substantially. Further, rice crop treated with urban waste compost recorded significantly higher economic returns and B:C ratio over that of untreated plot.

Figure 3: Rice crop grown with urban waste compost (Vegetative stage) (T_2)

Figure 5: Rice crop grown with urban waste compost (Panicle development stage) (T_2)

5. Future Perspectives

Further studies are to be conducted to find out the heavy metals in urban compost and their impact on crop, livestock, human beings and environment thus total ecosystem with a view not to jeopardize the health of the planet.

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