

RESEARCH ARTICLE

Effect of Coffee Husk Compost on Growth and Yield of Paddy

D. Sekhar*, P.B. Pradeep Kumar and K. Tejeswara Rao

Regional Agricultural Research Station, Chintapalli -531111, Visakhapatnam District, AP, India
sekhardesagiri@gmail.com*; +91 9490628777

Abstract

A field experiment was conducted for three consecutive years during *kharif* seasons of 2009, 2010 and 2011 at Regional Agricultural Research Station, Chintapalli. The soil of the experimental site was sandy clay loam having pH 6.8, organic carbon 0.65%, available nitrogen 245 kg ha⁻¹, available P₂O₅ 25.8 kg ha⁻¹ and K₂O 295 kg ha⁻¹. The trial was laid out in randomized block design with three replications consists of seven treatments with organic source (coffee husk compost) along with the chemical fertilizers in different doses viz., T₁-80:60:50 kg NPK ha⁻¹, T₂-60:45:37.5 kg NPK ha⁻¹ + coffee husk compost (1 t ha⁻¹), T₃-40:30:25 kg NPK ha⁻¹ + coffee husk compost (2 t ha⁻¹), T₄-20:15:12.5 kg NPK ha⁻¹ + coffee husk compost (3 t ha⁻¹), T₅-80:60:50 kg NPK ha⁻¹ + coffee husk compost (4 t ha⁻¹), T₆-Coffee husk compost (4 t ha⁻¹) and T₇-control (No fertilizer/manure). The results revealed that application of coffee husk compost @ 4 t ha⁻¹ + 80-60-50 kg NPK ha⁻¹ recorded highest grain (6252 kg ha⁻¹), straw yield (5416 t ha⁻¹) and nutrient uptake (99.4 kg N ha⁻¹). However, the above treatment (T₅) was on a par with the T₃ and T₁ treatments.

Keywords: Rice, Kharif, coffee husk compost, treatments, growth characters, grain yield, nitrogen uptake.

Introduction

In recent past, emphasis on use of organic manures has assumed increased importance as it finds a place in organic farming and as well in integrated nutrient system. Traditional source of manures like farm yard manure, vermicompost, poultry manure, manures from sheep and goat are being used scarcely. Coffee occupies an area of 1.00 lakh ha among the plantation crops and paddy being grown in area of 2.94 lakh ha in high altitude zone of Andhra Pradesh. Coffee processing units that are located in coffee growing areas pose threat to the environment because of unsafe disposal of coffee pulp, husk and effluents leading to pollution of water and land around the processing units. Large potentialities exist for recycling of both pulp and husk of coffee that can be composted and used as manure for several crops. Farmers of high altitude area of Andhra Pradesh are utilizing the composted coffee husk as manure in their paddy fields as blanket application and realizing the increased yields. Since the coffee husk compost containing plant nutrients of 2.07 N, 0.55% P₂O₅ and 2.87 K₂O, it influences the crop yields (Dzung *et al.*, 2013). The Coffee guide (2000) reports that the fruit skin/pulp obtained after pulping 6000 kg of fruits to get a tone of coffee returns 14-15 kg N, 3-3.7 kg P₂O₅ and 29-37 kg K₂O to the soil if properly decomposed and recycled. They also report that nearly 84-95 kg N, 40-42 kg P₂O₅ and 108-123 kg K₂O are available for recycling in the coffee field in a ha per year. The present investigation was undertaken to utilize the coffee husk compost in integrated supply of nutrients on growth and yield of paddy.

Materials and methods

Study area: The present experiment was carried out at Regional Agricultural Research Station, Chintapalli, Visakhapatnam district of Andhra Pradesh during *kharif* season of 2009, 2010 and 2011. The soil of the experimental site was sandy clay loam, having pH 6.8, organic carbon 0.65% and available nitrogen (245.0 kg ha⁻¹), available phosphorus (25.8 kg ha⁻¹) and available potassium (295.0 kg ha⁻¹).

Experimental design: Treatments consisted of organic source (coffee husk compost) and chemical fertilizers viz., T₁: 100% recommended dose of fertilizers i.e., 80:60:50 kg NPK ha⁻¹, T₂: 75% recommended dose of fertilizers + Coffee husk compost @ 1 t ha⁻¹, T₃: 50% recommended dose of fertilizers + coffee husk compost @ 2 t ha⁻¹, T₄: 25% recommended dose of fertilizers + coffee husk compost @ 3 t ha⁻¹, T₅: 100% recommended dose of fertilizers + coffee husk compost @ 4 t ha⁻¹, T₆: Coffee husk compost @ 4 t ha⁻¹ and T₇: Control. The experiment was laid out in randomized block design with three replications. Rice variety MTU 1010 was transplanted during third week of July with a spacing of 20 cm X 10 cm. Recommended dose of phosphorus (P) was applied at the time of transplanting wherein recommended potassium (K) was applied in two splits viz., 50% as basal and 50% at 60 d after transplanting. Nitrogen (N) was applied in three split doses viz., 50% as basal, 25% each at 30 and 60 d after transplanting as top dressing. The NPK fertilizers were used in the form of urea, single super phosphate and muriate of potash.

Table 1. Chemical nutrient composition of the coffee husk compost after three months composting.

Nutrient data	Composition of coffee husk	Composition of the coffee husk compost
Moisture (%)	17.3	22.3
OC %	50.8	28.2
N%	1.27	2.07
P%	0.06	0.55
K%	2.46	2.87
Ca%	0.37	0.77
Mg%	0.42	1.01
C/N ratio	40.02	13.6

Source: Dzung *et al.* (2013).

Coffee husk compost was applied at 15 d before transplanting in the rice field. Observations on growth parameters and yield components were recorded. Standard procedures were followed to determine the nutrient contents.

Statistical analysis: The data obtained were subjected to statistical analysis and were tested at 5% level of significance to interpret the treatment differences.

Results and discussion

Total dry matter accumulation at 90 d after transplanting (Table 1) and at harvest showed significant differences due to application of coffee husk compost. Application of coffee husk compost @ 4 t ha⁻¹ + 100% RDF recorded highest total dry matter accumulation (9950 kg ha⁻¹), which was on par with the treatments such as coffee husk compost @ 2 t ha⁻¹ + 50% RDF (9890 kg ha⁻¹) and application at 100% RDF (9560 kg ha⁻¹). In general, the increase in dry matter with coffee husk compost treatments may be attributed to the positive effect of these components on soil properties and consequently reflected on yield components. Many research workers have reported the advantage of using high quality organic manure for better crop growth and biomass accumulation (Preetu, 2004; Vijaya Krishna, 2007). The different yield parameters observed differed significantly due to application of coffee husk compost along with inorganic fertilizers (Table 2). The real boost in yield parameters were noticed when organic treatments (coffee husk compost) were combined with chemical fertilizers. Maximum number of panicles (12.7), panicle length (25.6 cm), number of filled grains panicle⁻¹ (118) and 1000-grain weight (23.3 g) were recorded with application of coffee husk compost @ 4 t ha⁻¹ + 100% RDF which was followed by 100% RDF and coffee husk compost @ 2 t ha⁻¹ + 50% RDF. The data on nutrient uptake is presented in Table 2. The NPK uptake of the crop was significantly higher in the plots that received coffee husk compost along with chemical fertilizer as compared to application of organic manures alone. The application of coffee husk compost @ 4 t ha⁻¹ + 100% RDF was significantly superior in recording nitrogen uptake (99.4 kg ha⁻¹), followed by treatments received coffee husk compost @ 2 t ha⁻¹ + 50% RDF (95.2 kg ha⁻¹) and 100% RDF (87.0 kg ha⁻¹). Higher P and K uptake was recorded in the treatments received 50% RDF + coffee husk compost @ 2 t ha⁻¹.

The increased uptake of nutrients was mainly due to continuous availability of N, P and K nutrients throughout the crop growth period as the nutrients from inorganic sources were available to the crop in the early stages and the nutrients released from organic sources become available in the later stages of crop growth. Further addition of organic sources is known to improve soil environment that encourage the proliferation of roots resulting in more absorption of water and nutrients from larger area and depth (Singh *et al.*, 2001). The increased uptake may be ascribed to more availability of the nutrients from the added sources and the solubility action of organic acids produced during the decomposition of organic matter applied resulting in more release of native and as well applied nutrients (Bellakki *et al.*, 1998). The grain and straw yield of rice differed significantly due to application of coffee husk compost. Application of coffee husk compost @ 4 t ha⁻¹ along with 100% RDF (6252 kg ha⁻¹) recorded 28.6% higher grain yield over application of coffee husk compost @ 4 t ha⁻¹ (4463 kg ha⁻¹) alone. Again, application of coffee husk compost @ 2 t ha⁻¹ along with 50% RDF (5731 kg ha⁻¹) recorded 22.1% higher grain yield over application of coffee husk compost @ 4 t ha⁻¹ alone. In the similar lines, application of 100% RDF (5401 kg ha⁻¹) and coffee husk compost @ 1 t ha⁻¹ + 75% RDF (5014 kg ha⁻¹) and coffee husk compost @ 3 t ha⁻¹ + 25% RDF (4562 kg ha⁻¹) recorded 10.9 and 2.17% higher than their organic manure application alone. Application of coffee husk compost @ 4 t ha⁻¹ + 100% RDF recorded highest yield and was found to be 13.6% higher than 100% RDF. Statistically, treatments of coffee husk compost @ 4 t ha⁻¹ + 100% RDF (6252 kg ha⁻¹), coffee husk compost @ 2 t ha⁻¹ + 50% RDF (5731 kg ha⁻¹), 100% RDF (5401 kg ha⁻¹), coffee husk compost @ 1 t ha⁻¹ + 75% RDF (5014 kg ha⁻¹) performed superior. These integrated nutrient systems provided nutrients apart from better physical and biological environment. Nutrient supply might be in synonym to plant need and supported growth in a better way. These results could be supported by the findings of Prakash *et al.* (2002), Vijaya Krishna (2007) and Ghosh (2007) and Application of coffee pulp compost @ 5 t ha⁻¹ + rice hull ash @ 2 t ha⁻¹ + 50% RDF earned net returns of Rs. 35,389 ha⁻¹ followed by application of coffee pulp compost @ 2.5 t ha⁻¹ + rice hull ash @ 2 t ha⁻¹ + 100% RDF (Rs. 33,378 ha⁻¹) and recorded highest benefit cost ratio of 2.73 and 2.48 respectively (Yankaraddi *et al.*, 2009).

Table 2. Influence of coffee husk compost on growth and yield parameters of rice.

Treatment	Dry matter production (kg ha ⁻¹)		No. of panicles Plant ⁻¹	Panicle length (cm)	Filled spikelets panicle ⁻¹	sterility percent
	90 DAT	At harvest				
T ₁	7790	9560	11.6	24.7	109	11.6
T ₂	7440	9290	10.2	24.9	105	11.1
T ₃	7540	9890	11.1	24.3	108	10.7
T ₄	5800	8280	8.3	24.2	92	9.8
T ₅	6880	9950	12.7	25.6	118	7.9
T ₆	6900	9450	8.2	24.6	94	11.4
T ₇	6557	8743	4.2	23.7	81	17.3
<i>SEm</i> _±	78.1	91.4	0.55	1.08	5.97	0.37
<i>CD(P=0.05)</i>	136.3	180.6	1.39	2.36	11.7	0.6

Table 3. Influence of coffee husk compost on yield and nutrient uptake of rice.

Treatment	1000-grain (g)	Grain yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)	N uptake (kg ha ⁻¹)	P uptake (kg ha ⁻¹)	K uptake (kg ha ⁻¹)
T ₁	23.3	5401	5125	87.0	32.5	155.3
T ₂	22.6	5014	5280	86.4	24.4	123.8
T ₃	22.6	5731	5389	95.2	33.7	209.7
T ₄	22.3	4562	4426	76.2	19.9	124.3
T ₅	23.3	6252	5416	99.4	32.2	165.0
T ₆	23.0	4463	4350	75.1	16.7	105.2
T ₇	22.3	4078	3214	57.0	12.5	96.3
<i>SEm</i> _±	0.69	446.0	172.9	1.04	1.21	7.41
<i>CD(P=0.05)</i>	1.51	972.0	338.2	2.03	3.59	22.0

Conclusion

From the study it can be concluded that, application of coffee husk compost @ 4 t ha⁻¹ + 80-60-50 kg NPK ha⁻¹ recorded highest grain (6252 kg ha⁻¹), straw yield (5416 t ha⁻¹) and nutrient uptake (99.4 kg N ha⁻¹). However, the above treatment was on a par with the application of 50% recommended dose of fertilizers + coffee husk compost @ 2 t ha⁻¹ and application of recommended dose of fertilizers i.e., 80:60:50 kg NPK ha⁻¹.

Acknowledgements

Author thanks Dr. T. Ratnasudhakar, Associate Director of Research, RARS, Chintapalli for his support and guidance during the study and thanks to ANGR Agricultural University for providing the funds to conduct the study in successful manner.

References

- Bellakki, M.A., Badnur, V.P. and Shetty, R.A. 1998. Effect of long term integrated nutrient management on some important properties of vertisols. *J. Ind. Soc. Soil Sci.* 46: 176-180.
- Coffee guide. 2000. Central Coffee Research Institute, Coffee Research Station, Chikmagalur District. Karnataka. India.
- Dzung, T., Dzung, T. and Khanh, V.T.P. 2013. Evaluation of coffee husk compost for improving soil fertility and sustainable coffee production in rural central highland of Vietnam. *Res. Environ.* 3(4): 77-82.
- Ghosh, A. 2007. Comparative study on combined and individual effects of farmyard manure and green-manuring with fertilizer N on growth and yield of rice (*Oryza sativa*) under submergence prone situation. *Ind. J. Agron.* 52: 43-45.
- Prakash, N.B., Nagaraj, H., Vasuki, N. and Siddramappa, R. 2002. Effect of nutrient recycling of plant silicon for sustainable rice farming in South India. 17th WCSS, August 14-21, Thailand.
- Preetu. 2004. Evaluation of quality, maturity indices and agronomic efficiency of compost prepared using coffee husk and pulp. M.Sc. (Agri.) Thesis, Univ. Agric. Sci., Bangalore (India).
- Singh, G., Wade, L.J., Singh, R.K., Nayak, R., Singh, B.B and Singh, O.N. 2001. Nutrient management for rainfed lowland rice and its effect on succeeding lentil crop. *Oryza.* 38: 123-126.
- Vijaya Krishna, N. 2007. Effect of coffee pulp effluent on growth and yield of SRI paddy. M. Sc (Agri.) Thesis, Univ. Agric. Sci., Bangalore (India).
- Yankaraddi, H.M., Dinesh Kumar and Madaiah, D. 2009. Effect of coffee pulp compost and rice hull ash on growth, yield and nutrient uptake in rice. *Karnataka J. Agric. Sci.* 22 (4): (751-754).