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Short communication

Effect of different crop residue vermicompost on growth, nutrient uptake and yield of finger millet

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Among millets, finger millet (*Eleusine coracana* L. Gaertn) has pride place due to highest productivity and nutritional superiority over many cereals (proteins, minerals, iron, vitamins and calcium (8-10 times more than wheat or rice). Higher fibre in grain gives a feeling of fullness that controls excessive food consumption and thus, cuts down the excessive calories (Patel *et al.,* 2018). In the recent past, demand for organic foods is increasing due to health benefits. There is huge scarcity of organic manures owing to decrease in maintenance of farm animals. In addition to this, farmers are burning valuable crop residues particularly cotton, pigeon pea and castor due to hardiness apart from facilitating timely sowing of succeeding crops. Composting of agricultural wastes is a viable and simple technology to convert organic wastes in to valuable manure, rich in nutrients duly following 3R concept (Reduce, recycle and reuse) apart from reducing environmental pollution due to burning of the residues. Keeping these points in view the present experiment was initiated in two seasons (*kharif,* 2018 and *rabi*, 2018-19). Crop residue vermicompost (cotton and red gram stubbles) was prepared during *kharif,* 2018 at Student Farm, College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Hyderabad, geographically located at 17°19′19.2″N lat., 78°24′39.2″E long. and altitude of 542.3 m msl. On 6th June, 2018, four pits (P1, P2, P3 and P4) of 1m^3 dimensions were excavated, filled with chaffed crop residues @ 40 kg per pit, *viz.* red gram (P1), cotton (P2), red gram + rock phosphate @ 2% (P3) and cotton + rock phosphate @ 2% (P4) and pedal with thatched roof was provided for protection from direct sunlight to earthworms and rainfall. About 25% of well-decomposed FYM (10 kg) per pit and earthworms (*Eusinea foetida* @ 2 kg equivalent to 550–600 No.) were added and optimum moisture and temperature were maintained. Vermicompost was harvested after 85 days (6thSept, 2018).

A field experiment was carried out with finger millet at student farm near to the compost pits during *rabi*, 2018-19 to test the effect of different enriched crop residue compost in terms of growth, yield and nutrient uptake. The soil of the experimental site was sandy clay loam with soil pH (7.46), Electrical conductivity (0.36dS m^{-1}) and Organic carbon (0.67%). The soil was low in available nitrogen (260.0 kg ha^{-1}), medium in available phosphorus (45.1 kg ha^{-1}) and high in available potassium (521.0 kg ha^{-1}). This experiment was laid out in a randomized block design with eight treatments and replicated thrice. The experiment consisted of eight treatments *viz*; T_1- 100% RDF (60:30:30 - N: P_2O_5: K_2O kg ha^{-1}), T_2- control (No -N), T_3- 75% RDN + 25% N through FYM, T_4-75% RDN + 25% N through red gram stubbles vermicompost, T_5- 75% RDN + 25% N through cotton stubbles vermicompost, T_6- 75% RDN + 25% N through red gram stubbles vermicompost + 2% rock phosphate, T_7- 75% RDN +25% N through cotton stubbles vermicompost + 2% rock phosphate, T_8- 75% RDN +25% N through farmers practice vermicompost. Crop was sown directly on 29th September, 2018 adopting a spacing of 30 cm x 10 cm. The RDF for finger millet was 60:30:30 N, P and K kg ha^{-1}. Entire P (SSP) and K (MOP) fertilizer were applied as basal and N (Urea) was applied in two equal splits, 50% as basal and remaining 50% at 30 DAS. In integrated nutrient management treatments (T_3, T_4, T_5, T_6, T_7 & T_8), 25% nitrogen was applied through organic manures as basal and remaining as that of recommended dose of fertilizers (100% RDF). The nutrient content of organics is furnished in (Table 1). A total rainfall of 96.8 mm was received in 7 rainy days during

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crop growth period. Pre emergence herbicide (Pendimethalin 30 % EC) @ 1.0 kg a.i. ha^{-1} was sprayed one day after sowing in optimum soil moisture to prevent the growth of weeds followed by one hand weeding at 20 days after sowing (DAS). The insecticide acephate @ 1.5 g l^{-1} of water was sprayed at 50 DAS to control stemborer incidence. The crop was harvested at physiological maturity when all the ear heads turned to brown and seeds were easily detachable. The crop was harvested on 30th January, 2019. Bio-metric observations were taken on tagged five representative plants selected at random from each treatment of net plot and the mean values are presented. The analysis of variance (ANOVA) of different variables of different treatments was statistically analysed (Gomez and Gomez, 1984).

Table 1 Nutrient content of different vermicompost

Types of composts	N%	P%	K%
Red gram stubbles vermicompost	2.20	2.15	0.98
Red gram stubbles vermicompost + rock phosphate @ 2 %	2.35	2.60	1.08
Cotton stubbles vermicompost	2.00	1.08	0.99
Cotton stubbles compost + rock phosphate @2%	2.10	1.32	0.98
Farmer's practice of vermicompost	1.68	0.44	0.40
FYM	0.50	0.22	0.41

Dry matter production at maximum tillering and flowering varied significantly among the treatments (Table 2). Treatment 75% RDN + 25% N through cotton stubbles vermicompost + 2% rock phosphate (T_7) recorded significantly higher dry matter at maximum tillering and flowering (618.9 and 2960.0 kg ha^{-1}, respectively) but, it was at par with the treatments 75% RDN + 25% N through cotton stubbles vermicompost (612.2 and 2873.3kg ha^{-1}) T5 and 75% RDN + 25% N through red gram stubbles vermicompost + 2% rock phosphate (598.7 and 2784.4 kg ha^{-1}) T6 respectively. The lowest dry matter was accumulated with control plot (211.9 and 1722.2kg ha^{-1}). Improved dry matter with cotton and red gram crop residue vermicompost might be ascribed to complete decomposition of organic matter in treatments consisting of 25% N substitution and resulted in the release of nutrients in available form and adequate amount due to the narrow C:N ratio that matched well with the crop nutrient requirement at critical stages Ramalaxmi *et al.* (2013).

Table 2: Dry matter production, yield attributes, yield and nutrient uptake of finger millet as influenced by different treatments

Treatment	Dry matter accumulation (kg ha^{-1})		No. of panicles	No. of Fingers/ panicles	Grains per panicle	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Nutrient uptake (kg ha^{-1})								
	MT	F						MT			F			Grain		
								N	P	K	N	P	K	N	P	K
T_1	377.9	2095.6	138	7.3	782	2551	4868	10.4	0.89	3.09	40.0	3.17	29.9	31.2	3.20	11.98
T_2	211.9	1722.2	103	6.2	621	1453	3737	3.2	0.47	1.42	12.0	2.29	21.3	13.7	1.35	6.300
T_3	517.8	2388.8	140	7.8	792	2895	5254	15.2	1.21	4.45	48.9	4.11	35.3	37.9	3.97	14.40
T_4	543.3	2516.7	149	8.1	822	3114	5542	16.8	1.33	5.10	50.2	4.35	42.1	42.6	4.56	16.81
T_5	612.2	2873.3	154	8.4	842	3402	5753	20.1	1.55	5.93	59.1	5.97	54.8	48.4	5.26	20.75
T_6	598.7	2784.4	151	8.2	830	3231	5595	19.1	1.48	5.63	55.4	4.91	48.3	44.9	4.87	18.73
T_7	618.9	2960.0	158	8.5	854	3540	5899	20.7	1.60	6.09	63.7	7.04	57.0	51.0	5.57	21.94
T_8	523.2	2411.1	144	7.8	795	2917	5252	15.5	1.27	4.70	46.3	4.26	39.5	39.4	3.99	15.75
S.E m.±	22.5	109.6	3.6	0.2	21.4	201	312	0.89	0.08	0.26	0.53	0.52	2.25	4.1	0.30	1.38
CD (P=0.05)	56.2	277.4	9.2	0.5	55.6	522	811	2.31	0.17	0.65	1.30	1.30	5.80	10.7	0.70	3.90

MT- Maximum tillering; F-Flowering

Similarly, with respect to yield attributes also, 75% RDN + 25% N through cotton stubbles vermicompost + 2% rock phosphate (T_7) maintained its superiority and recorded significantly higher panicles per hill, fingers per panicle, grains per panicle (138, 7.3 g and 782 respectively) but, was on par with 75% RDN + 25% N through cotton stubbles vermicompost

(T_5) and 75% RDN + 25% N through red gram stubbles vermicompost + 2% rock phosphate (T_6) respectively. Crop residue compost might have created favourable physical environment towards increased mineralization and mobility of nutrients, resulting in higher nutrient uptake and crop growth, and yield attributes. These results are in line with those of Pallavi *et al.,* 2017.

Grain and straw yield varied significantly among treatments. Conjunctive application of 75% RDN + 25% nitrogen through cotton stubbles vermicompost + 2% rock phosphate recorded (T_7) significantly higher grain yield (3450 and 5899 kg ha^{-1}) but, it was on par with treatments 75% RDN + 25% nitrogen through cotton stubbles vermicompost (3402 and 5733 $kgha^{-1}$), 75% RDN + 25% N through red gram stubbles vermicompost + 2% rock phosphate (3231 and 5542 kg ha^{-1}) and 75% RDN + 25% N through red gram stubbles vermicompost (3114 and 5254 kg ha^{-1}). The control plot with no nitrogen application has registered lowest grain and straw yield (1453 and 3737 kg ha^{-1}). The increase in grain yield under treatments T7, T5, T6 was to the tune of 143,134 and 122 % over control. Higher grain and straw yield under conjunctive nutrient management involving crop residue vermicompost (cotton and red gram) might be ascribed to the improved dry matter production and yield attributes (panicles, number of fingers per ear head, and number of grains per panicle). Similar results were documented by Basavaraj Naik *et al*. (2017). With respect to data on nutrient uptake at maximum tillering, flowering and at harvest by grain (Table 2) revealed that 75% RDN +25% nitrogen through cotton stubbles vermicompost + 2% rock phosphate (T_7) recorded highest nutrient uptake (N, P and K) (Table 2). However, treatment T_7 was on par with treatments 75% RDN + 25% nitrogen through cotton stubbles vermicompost (T_5) and 75% RDN + 25% nitrogen through red gram stubbles vermicompost + 2% rock phosphate (T_6). Improved nutrient uptake with conjunctive application of crop residue vermicompost and inorganic was due to the higher nutrient content (Table 1) apart from improved dry matter production and grain yield under these treatments. Shankar *et al.,* (2015). From the results of the present study, it could be concluded that cotton and red gram residues are equally potential in substituting 25 % N and conjunctive application of 75 % RDN + 25 % N through any of these residue compost (based on the availability of preceeding crop residues) is recommended towards improved growth parameters, yield and nutrient uptake of finger millet.

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