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Preparation of nutrient enriched compost and its effect on nutrient uptake and nutrient use efficiency by chickpea

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Abstract
The present investigation in relation to **"**Preparation of nutrient enriched compost and its effect on growth, nutrient dynamics, yield and yield attributes in chickpea.**"** The field experiment was conducted during *Rabi* season 2022-2023 at Research Farm, Department of Soil Science and Agricultural chemistry, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. Application of 75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost showed highest value of N, P, K, S, Fe, Mn, Zn and Cu uptake in seed, straw and total uptake followed by 75% RDF (N: P_2O_5: K_2O) + @ 25% Nutrient Enriched Compost. Whereas lowest value was recorded in absolute control. The maximum nutrient use efficiency was recorded with application of 75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost followed by application of 75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost. Whereas lowest value was recorded in absolute control.

Keywords: Nutrient enriched compost, nutrient uptake

Introduction
Chickpea (*Cicer arietinum* L.) is the crop belonging to legume family and third most important pulse crop in the world after dry bean and dry peels. Among the leguminous crops, chickpea occupies an important position due to its nutritious value (17-23% protein) in large vegetarian population of the country (Kumar *et al.* 2014) [6]. Nutrient enriched composting is basically a microbiological process accomplished by the combined activity of bacteria, actinomycetes, fungi and protozoa which are either present in the composting material or are introduced externally to speed up composting and enrich the compost. Under proper moisture and aeration conditions, the diverse micro-flora attacks the organic matter to derive their energy, carbon and other nutrients. The result of substrate is broken down to form an amorphous brown to dark brown mixture known as compost. The waste material with adequate water content undergoes intensive decomposition from low to high temperature in heaps or pits for around 4 to 8 months. Nutrient enriched compost is considered a valuable organic fertilizer, supplying nutrients for the crop and hence saving substantial amount if mineral fertilizes (Erhart *et al.* 2005) [4].

Materials and Methods
The present investigation was carried out during *Rabi* season 2022-23 at Research Farm, Department of Soil Science and Agricultural Chemistry, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani on the "Preparation of nutrient enriched compost and its effect on growth, nutrient dynamics, yield and yield attributes in chickpea.". Total twenty-seven soil samples were collected after harvest of chickpea crop. The experiment was conducted in Randomized Block Design with Nine treatments each were replicated three times. The treatment consists of T_1 (Absolute Control), T_2 (RDF 25:50:25 (N: P_2O_5: K_2O kg ha^{-1})), T_3 (75% RDF (N: P_2O_5: K_2O kg ha^{-1}) + @ 50% Nutrient Enriched Compost), T_4 (75% RDF (N: P_2O_5: K_2O kg ha^{-1}) + @ 25% Nutrient Enriched Compost), T_5 (50% RDF (N: P_2O_5: K_2O kg ha^{-1}) + @ 50% Nutrient Enriched Compost), T_6 (50% RDF (N: P_2O_5: K_2O kg ha^{-1}) + @ 75% Nutrient Enriched Compost), T_7 (25% RDF (N: P_2O_5: K_2O kg ha^{-1}) + @ 75% Nutrient Enriched Compost) , T_8 (25% RDF (N: P_2O_5: K_2O kg ha^{-1}) + @ 100% Nutrient Enriched Compost), T_8 (Nutrient Enriched Compost @ 100% (S) Soil Application).
For the determination of nutrient content in plants, the plant samples from each treatment at critical growth stages were washed with tap water and in detergent solution followed by

distilled water. After cleaning, plants were dried in shade and subsequently in oven at 70ºc. The oven dried samples were grinded in electrically operated grinder with stainless steel blade up to maximum fineness. The powdered samples were stored in polythene bags with proper labelling and used for nutrient analysis. Fine powdered plant sample (0.5 gram) was taken in 100 ml conical flask. 5 ml of concentrated nitric acid was added to it and kept for overnight. On next day, 10 ml of diacid mixture (HNO_3 and $HClO_4$, 9:4) was added and digested on hot plate as described by Piper (1966) [10]. After digestion, known volume was prepared with glass distilled water. The same extract was used for estimation of phosphorus and potassium content.

The nitrogen content in plant samples was determined by Micro Kjeldahl's method as described in A.O.A.C (1975) [1]. The phosphorus was estimated by Vanadomolybdo phosphoric acid yellow colour method with spectrophotometer as given by Jackson (1973) [5]. The diacid extract was used for potassium determination. It was determined with flame photometer as described by Jackson (1973) [5]. It was estimated from diacid digested sample by turbidimetric method as described by Tabatabai and Bremner (1970) [12]. The Zn, Fe, Mn and Cu content in plant was determined from the extract obtained from digestion of plant samples with HNO_3 and $HClO_4$ using Atomic Absorption Spectrophotometer, as described by Lindsay and Norvell (1978) [8].

Results and Discussion

Nutrient uptake

Nitrogen and phosphorus uptake

The highest nitrogen uptake was recorded with treatment T_3 [75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost (68.23, 57.80, 126.03) in seed, straw and total N uptake, respectively. Lowest N uptake was obtained in T_1 *i.e.*, Absolute control. Our results are in conformity with the reports of Jakhar *et al.* (2020) that the Significantly higher nitrogen uptake by seed (71.46 kg ha^{-1}) and straw (29.09 kg ha^{-1}) of chickpea was recorded by the application of 75% RDF + vermicompost at 2.5 t ha^{-1} + PSB.

The highest P uptake was recorded with treatment T_3 (14.83, 17.94 and 32.77 kg ha^{-1}) in seed, straw and total P uptake, respectively receiving 75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost. Minimum value was obtained with treatment T_1 *i.e.*, Absolute control (5.77, 4.55 and 10.32 kg ha^{-1}) in seed, straw and total P uptake, respectively. Similar result found by Dixit *et al.* (2015) [3] who reported that the Application of 50% of RDN through chemical fertilizers + 5 t FYM/ha gave significantly higher nitrogen, phosphorus, potassium and sulphur uptake by chickpea.

Table 1: Effect of nutrient enriched compost on nitrogen and phosphorus uptake in chickpea after harvest of crop

No.	Treatment	N uptake (Kg ha^{-1})		Total N Uptake (Kg ha^{-1})	P uptake (Kg ha^{-1})		Total P Uptake (Kg ha^{-1})
		Seed	Straw		Seed	Straw	
T_1	Absolute control	33.67	27.26	60.93	5.77	4.55	10.32
T_2	RDF 25:50:25 (N: P_2O_5: K_2O Kg/ha)	37.42	34.92	72.34	6.54	6.72	13.26
T_3	75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost	68.23	57.80	126.03	14.83	17.94	32.77
T_4	75% RDF (N: P_2O_5: K_2O) + @ 25% Nutrient Enriched Compost	56.43	51.40	107.83	11.75	12.38	24.13
T_5	50% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost	49.52	42.00	91.53	9.69	9.49	19.18
T_6	50% RDF (N: P_2O_5: K_2O) + @ 75% Nutrient Enriched Compost	52.57	44.08	96.65	10.59	10.43	21.03
T_7	25% RDF (N: P_2O_5: K_2O) + @ 75% Nutrient Enriched Compost	44.70	38.75	83.45	8.28	8.23	16.51
T_8	25% RDF (N: P_2O_5: K_2O) + @ 100% Nutrient Enriched Compost	48.33	40.05	88.37	9.10	8.85	17.94
T_9	Nutrient Enriched Compost @ 100% (S) Soil Application	41.05	37.84	78.89	7.45	7.89	15.34
	SE m±	1.00	0.69	1.37	0.25	0.45	0.46
	CD at 5%	3.00	2.08	4.11	0.74	1.34	1.38
	CV	3.61	2.89	2.65	4.58	8.03	4.20
	Grand mean	47.99	41.57	89.56	9.33	9.60	18.94

Potassium and sulphur uptake

The potassium uptake was found significantly highest with treatment T_3 (18.59, 55.74, and 74.33 kg ha^{-1}) in seed, straw and total K uptake, respectively receiving 75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost. Whereas, minimum value was registered with treatment T_1 *i.e.*, Absolute control (6.85, 24.41 and 31.27 kg ha^{-1}) in seed, straw and total potassium uptake, respectively.

The sulphur uptake was found significantly highest with treatment T_3 (5.26, 5.22, and 10.48 kg ha^{-1}) in seed, straw and total K uptake, respectively receiving 75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost. Whereas, minimum value was registered with treatment T_1 *i.e.*, Absolute control (1.54, 1.65 and 3.18 kg ha^{-1}) in seed, straw and total potassium uptake, respectively. Similar result found by Dixit *et al.* (2015) [3] who reported that the Application of 50% of RDN through chemical fertilizers + 5 t FYM/ha gave significantly higher nitrogen, phosphorus, potassium and sulphur uptake by chickpea.

Table 2: Effect of nutrient enriched compost on potassium and sulphur uptake in chickpea after harvest of crop

No.	Treatment	K uptake (Kg ha^{-1})		Total K Uptake (Kg ha^{-1})	S uptake (Kg ha^{-1})		Total S uptake (Kg ha^{-1})
		Seed	Straw		Seed	Straw	
T_1	Absolute control	6.85	24.41	31.27	1.54	1.65	3.18
T_2	RDF 25:50:25 (N: P_2O_5: K_2O Kg/ha)	8.12	30.98	39.09	1.84	2.14	3.98
T_3	75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost	18.59	55.74	74.33	5.26	5.22	10.48
T_4	75% RDF (N: P_2O_5: K_2O) + @ 25% Nutrient Enriched Compost	15.41	49.28	64.69	4.09	4.57	8.67
T_5	50% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost	12.78	37.84	50.62	3.18	3.39	6.57
T_6	50% RDF (N: P_2O_5: K_2O) + @ 75% Nutrient Enriched Compost	14.07	40.71	54.78	3.62	3.75	7.37
T_7	25% RDF (N: P_2O_5: K_2O) + @ 75% Nutrient Enriched Compost	10.66	35.09	45.74	2.58	2.62	5.20
T_8	25% RDF (N: P_2O_5: K_2O) + @ 100% Nutrient Enriched Compost	12.18	36.41	48.59	3.03	3.05	6.08
T_9	Nutrient Enriched Compost @ 100% (S) Soil Application	9.40	34.09	43.49	2.20	2.44	4.64
	SE m±	0.31	0.84	0.98	0.11	0.30	0.34
	CD at 5%	0.94	2.52	2.95	0.32	0.89	1.02
	CV	4.50	3.81	3.39	6.03	16.10	9.48
	Grand mean	12.00	38.28	50.28	3.04	3.20	6.24

Iron and Manganese uptake

The iron uptake was higher (850.64, 2068.32 and 2918.95 g ha^{-1}) in seed, straw and total iron uptake, respectively under 75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost and lower value was registered with treatment T_1 *i.e.,* Absolute control (251.26, 896.29 and 1147.55 g ha^{-1}).

Table 3: Effect of nutrient enriched compost on iron and manganese uptake in chickpea after harvest of crop

No.	Treatment	Fe uptake (g ha^{-1})		Total Fe uptake (g ha^{-1})	Mn uptake (g ha^{-1})		Total Mn uptake (g ha^{-1})
		Seed	Straw		Seed	Straw	
T_1	Absolute control	251.26	896.29	1147.55	195.55	430.83	626.37
T_2	RDF 25:50:25 (N: P_2O_5: K_2O Kg/ha)	319.14	1136.04	1455.18	263.03	626.26	889.29
T_3	75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost	850.64	2068.32	2918.95	731.31	1709.33	2440.64
T_4	75% RDF (N: P_2O_5: K_2O) + @ 25% Nutrient Enriched Compost	653.49	1784.29	2437.79	563.01	1313.00	1876.01
T_5	50% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost	503.01	1444.74	1947.75	459.09	1054.20	1513.29
T_6	50% RDF (N: P_2O_5: K_2O) + @ 75% Nutrient Enriched Compost	532.28	1520.92	2053.20	493.01	1103.74	1596.75
T_7	25% RDF (N: P_2O_5: K_2O) + @ 75% Nutrient Enriched Compost	420.18	1288.55	1708.73	381.39	926.50	1307.89
T_8	25% RDF (N: P_2O_5: K_2O) + @ 100% Nutrient Enriched Compost	480.12	1358.35	1838.47	421.24	967.17	1388.41
T_9	Nutrient Enriched Compost @ 100% (S) Soil Application	373.13	1226.69	1599.82	335.63	841.91	1177.54
	SE m±	21.83	79.14	93.98	12.74	42.58	46.09
	CD at 5%	65.44	237.26	281.75	38.18	127.66	138.18
	CV	7.76	9.70	8.56	5.17	7.40	5.61
	Grand mean	487.02	1413.79	1900.82	427.03	996.99	1424.02

These results are concurred with the findings of Tolanur (2008) [13] who reported that the uptake of iron by grain and straw indicated that iron uptake varied from 6227 to 8764 ppm and 1478 to 2189 ppm by grain and straw respectively. Other studies by Venkatesh Bharadwaj *et al.* (1994) [2] and reported similar results.

The Manganese uptake was higher (731.31, 1709.33 and 2440.64 g ha^{-1}) in seed, straw and total Manganese uptake, respectively under 75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost and lower value was registered with treatment T_1 *i.e.,* Absolute control (195.55, 430.83 and 626.37 g ha^{-1}). These results are concurred with the findings of Tolanur (2008) [13] who reported that the uptake of manganese by grain and straw indicated that manganese uptake varied from 302 to 429 ppm and 157 to 210 ppm by grain and straw, respectively. These results are in agreement with findings of Anand Swarup (1987) [11].

Zinc and Copper uptake

The highest uptake of zinc in seed (963.77g ha^{-1}), straw (2874.45 g ha^{-1}) and total uptake (3838.22 g ha^{-1}) was registered with the treatment application 75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost and lower value (437.67 g ha^{-1}) in seed, (974.23 g ha^{-1}) in straw and total uptake (1411.90 g ha^{-1}) was recorded with treatment of Absolute control. These results are in agreement with the observations of Tolanur (2008) [13] who reported that the uptake of zinc by grain and straw indicated that zinc uptake varied from 243 to 390 ppm and 185 to 291 ppm by grain and straw, respectively. These observations were in conformity with the results of earlier studies of Anand Swarup (1987) [11] and Nambiar (1989) [9].

The highest copper in seed (369.82 g ha^{-1}), straw (1520.68 g ha^{-1}) and total uptake (1890.51 g ha^{-1}) was recorded with treatment T_3 having 75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost and lower value (120.52 g ha^{-1}) in seed, (425.39 g ha^{-1}) in straw and total uptake (545.91 g ha^{-1}) was recorded with treatment of Absolute control. These results are in agreement with the observations of Tolanur (2008) [13] who reported that the uptake of copper by grain and straw indicted that copper uptake varied from 60 to 105 ppm and 74 to 104 ppm by grain and straw, respectively. These results are in agreement with findings of Venkatesh Bharadwaj *et al.* (1994) [2].

Table 4: Effect of nutrient enriched compost on zinc and copper uptake in chickpea after harvest of crop

No.	Treatment	Zn uptake (g ha^{-1})		Total Zn uptake (g ha^{-1})	Cu uptake (g ha^{-1})		Total Cu uptake (g ha^{-1})
		Seed	Straw		Seed	Straw	
T_1	Absolute control	437.67	974.23	1411.90	120.52	425.39	545.91
T_2	RDF 25:50:25 (N: P_2O_5: K_2O Kg/ha)	476.26	1321.82	1798.07	147.52	588.96	736.47
T_3	75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost	963.77	2874.45	3838.22	369.82	1520.68	1890.51
T_4	75% RDF (N: P_2O_5: K_2O) + @ 25% Nutrient Enriched Compost	795.02	2259.42	3054.44	284.54	1132.85	1417.39
T_5	50% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost	671.72	1724.35	2396.06	232.87	823.45	1056.32
T_6	50% RDF (N: P_2O_5: K_2O) + @ 75% Nutrient Enriched Compost	732.50	1808.17	2540.66	257.04	907.86	1164.90
T_7	25% RDF (N: P_2O_5: K_2O) + @ 75% Nutrient Enriched Compost	585.60	1533.90	2119.50	198.11	691.46	889.57
T_8	25% RDF (N: P_2O_5: K_2O) + @ 100% Nutrient Enriched Compost	646.91	1598.61	2245.52	225.45	738.97	964.42
T_9	Nutrient Enriched Compost @ 100% (S) Soil Application	529.76	1486.19	2015.95	174.84	646.63	821.47
	SE m±	25.93	57.39	74.46	13.06	30.60	40.57
	CD at 5%	77.74	172.05	223.22	39.15	91.72	121.64
	CV	6.92	5.74	5.42	10.12	6.38	6.67
	Grand mean	648.80	1731.24	2380.04	223.41	830.69	1054.11

Nutrient use efficiency

The nutrient (nitrogen, phosphorus, potassium) use efficiency of chickpea was highest with T_3 treatment receiving 75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost at 35 and 55 DAS treatment which was significantly superior over other treatments. These results are concurred with the findings of Laharia *et al.* (2019) [7] who reported that the nutrient use efficiency and nutrient recovery of N, P and K by chickpea were recorded higher by application of phosphorus with PSB.

Table 5: Effect of nutrient enriched compost on nutrient use efficiency (%) in soil

No.	Treatment	Nutrient Use Efficiency (%)		
		N	P	K
T_1	Absolute control	-	-	-
T_2	RDF 25:50:25 (N: P_2O_5: K_2O Kg/ha)	20.09	4.42	28.90
T_3	75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost	43.70	11.28	55.74
T_4	75% RDF (N: P_2O_5: K_2O) + @ 25% Nutrient Enriched Compost	34.30	9.46	43.70
T_5	50% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost	28.25	6.96	36.17
T_6	50% RDF (N: P_2O_5: K_2O) + @ 75% Nutrient Enriched Compost	29.41	7.66	37.84
T_7	25% RDF (N: P_2O_5: K_2O) + @ 75% Nutrient Enriched Compost	24.44	6.04	32.59
T_8	25% RDF (N: P_2O_5: K_2O) + @ 100% Nutrient Enriched Compost	26.57	6.70	35.09
T_9	Nutrient Enriched Compost @ 100% (S) Soil Application	22.14	5.98	30.54
	SE m±	1.05	0.66	1.06
	CD at 5%	3.14	1.98	3.17
	CV	7.14	17.60	5.48
	Grand mean	25.43	6.50	33.40

Conclusion

1. The uptake of N, P, K, S, Fe, Mn, Zn and Cu were increased in treatment receiving 75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost.
2. The nutrient use efficiency improved with application of 75% RDF (N: P_2O_5: K_2O) + @ 50% Nutrient Enriched Compost.

References

1. AOAC. Association of official method of analysis Ed.12 Washington, D.C; c1975.
2. Bharadwaj V, Omanwar PK, Sharma RA. Long Term Effects of Continuous Rotational Cropping and Fertilization on Crop Yields and Soil Properties—I. Effects on Crop Yields and Nutrient Uptake. Journal of the Indian Society of Soil Science. 1994;42(2):247-253.
3. Dixit AK, Kumar S, Rai AK, Kumar TK. System productivity, profitability, nutrient uptake and soil health under tillage, nutrient and weed management in rainfed chickpea (*Cicer arietinum*) fodder sorghum (*Sorghum bicolour*) cropping system. Indian Journal of Agronomy. 2015;60(2):205-211.
4. Erhart E, Hartl W, Putz B. Biowaste compost affects yield, nitrogen supply during the vegetation period and crop quality of agricultural crops. European Journal of Agronomy. 2005;23(3):305-314.
5. Jackson ML. Soil chemical analysis, pentice hall of *India Pvt. Ltd.*, New Delhi, India. 1973;498:151-154.
6. Kumar D, Arvadiya LK, Kumawat AK, Desai KL, Patel TU. Yield, protein content, nutrient content and uptake of chickpea (*Cicer arietinum* L.) as influenced by graded levels of fertilizers and bio-fertilizers. Res. J Chem. Environ. Sci. 2014;2(6):60-64.
7. Laharia GS, Apotikar V, Age AB, Gite PA, Deshmukh DP. Effect of phosphorus levels with PSB on yield, nutrient use efficiency and uptake of nutrients by chickpea. Journal of Pharmacognosy and Phytochemistry. 2019;8(3):3182-3185.
8. Lindsay WL, Norvell W. Development of a DTPA soil test for zinc, iron, manganese, and copper. Soil science society of America journal. 1978;42(3):421-428.
9. Nambiar KKM. All India coordinated research project on long term fertiliser experiments and its research achievements. Fertiliser news; c1985.
10. Piper CS. Soil and Plant Analysis, Hans Publishers, Bombay; c1966.

11. Swarup A. Effect of presubmergence and green manuring (Sesbania aculeata) on nutrition and yield of wetland rice (*Oryza sativa* L.) on a sodic soil. Biology and Fertility of Soils. 1987;5:203-208.
12. Tabatabai MA, Bremner JM. A simple turbidimetric methods methods of determination of total plant S in plant. Agro. 1970;62(3):805-806.
13. Tolanur SI. Integrated effect of organic manuring and inorganic fertilizer N on yield and uptake of micronutrients by chickpea in vertisol. Legume Research-An International Journal. 2008;31(3):184-187.