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Influence of Rock Phosphate-Enriched Compost on Soil Physical Properties, Nutrient Status and Dehydrogenase Activity of Finger Millet (*Eleusine coracana* L. Gaertn.) - French Bean (*Phaseolus vulgaris* L.) Cropping System in Phosphorus Rich Soils of Eastern Dry Zone of Karnataka

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Abstract

Despite sufficient phosphorus levels in the soil, excessive application by farmers leads to phosphorus buildup. Application of rock phosphate-enriched compost to optimize phosphorus availability and minimize the P fertilizers in two out of three crops. This study examines the impact of phosphorus-enriched compost on the productivity of the finger millet (*Eleusine coracana*) and French bean (*Phaseolus vulgaris*) cropping system in phosphorus-rich soils. Field experiments were conducted at two locations in Karnataka, India, Arasana Halli, Chikkaballapur (L_1) and Integrated Farming System (IFS) GKVK, Bengaluru (L_2), during the *kharif* and summer of 2018-19 and 2023-24. The study involved phosphorus-enriched composts, including urban solid waste compost (USWC), poultry manure (PM), FYM and vermicompost enriched with rock phosphate (RP) and phosphate-solubilizing bacteria (PSB). The experiment followed a randomized complete block design (RCBD) with 14 treatments to assess the effects of phosphorus-enriched organic amendments on soil fertility and crop productivity. The results indicated that the application of phosphorus-enriched poultry manure with PSB (T_{11}) significantly affected post-harvest soil properties. After the harvest of finger millet, T_{11} recorded a significantly lower soil pH (6.57 at L_2 and 7.52 at L_1), organic carbon content (0.50% at L_1 and 0.52% at L_2), electrical conductivity (0.25 dS m^{-1} at L_1 and 0.41 dS m^{-1} at L_2) and maximum water holding capacity (35.19% at L_1 and 36.81% at L_2). While, After the harvest of French bean, T_{11} recorded higher organic carbon (0.49% at L_1 and 0.51% at L_2), pH (7.56 at L_1 and 6.78 at L_2), bulk density (1.31 and 1.32 mg m^{-3}), and maximum water holding capacity (38.01 and 39.6%). T_{14} recorded higher electrical conductivity (0.23 and 0.37 dS m^{-1}). Furthermore, T_{11} recorded significantly higher available N (153.87 and 281.01 kg ha^{-1} at L_1 and L_2), available P_2O_5 (84.46 and 76.04 kg ha^{-1}) and available K_2O (132.34 and 252.43 kg ha^{-1}) and DTPA Zn (2.16 mg kg^{-1} at L_1 and 3.22 mg kg^{-1} at L_2), while T_{14} recorded higher Cu and Fe content. In French bean, T_{14} recorded higher DTPA Cu and Fe, while T_{11} showed higher DTPA Zn and Mn. In both cropping seasons, T_{11} recorded significantly higher dehydrogenase activity (µg TPF g^{-1} soil 24 hr^{-1}) in soil with values of 20.83 at L_1 and 35.91 at L_2 for finger millet and 18.76 at L_1 and 33.57 at L_2 for French bean.

Keywords : Rock phosphate, Phosphate-solubilizing bacteria, Urban solid waste compost, Poultry manure, Dehydrogenase activity, Finger millet-French bean cropping system

The finger millet-french bean cropping system is a prominent agricultural practice in Karnataka's Eastern Dry Zone, cultivation of cereal-legume farming. French bean, rich in amino acids, proteins, vitamins, and minerals, plays a key role in improving soil fertility, especially in organic farming systems.

This leguminous crop is essential not only for nutrition but also for sustainable agriculture, enhancing soil quality while offering economic benefits through high market prices. However, the excessive use of inorganic fertilizers in the region has led to concerns about soil health and phosphorus build-up. To address these challenges, Integrated Nutrient Management (INM) with enriched manures and mineral fertilizers provides a sustainable solution. Enriched compost, made from urban solid waste and organic manures like poultry manure, vermicompost and farmyard manure, enhances soil properties and mitigates environmental risks. It reduces the reliance on inorganic fertilizers by up to 50 per cent, improving soil structure and promoting long-term soil health. Urban solid waste composting is increasingly recognized as a cost-effective and environmentally friendly alternative to traditional chemical fertilizers. As the cost of industrial phosphorus fertilizers rises, the use of rock phosphate as an alternative is gaining traction, especially in developing countries like India. However, rock phosphate's low solubility in neutral to alkaline soils limits its effectiveness. The integration of organic manures like poultry manure and vermicompost with rock phosphate can enhance phosphorus availability and improve crop yields. This study explores the potential of rock phosphate-enriched compost in improving soil fertility and crop productivity, contributing to sustainable nutrient management and food security.

Material and Methods

The experiment followed a randomized complete block design (RCBD) with fourteen treatments and three replications. Each plot size was 4 m x 3 m. The finger millet variety GPU-48 and French bean variety Arka Sharat were used and cultural practices were followed according to the package of practices (POP). The study aimed to assess the impact of phosphorus-enriched compost on the productivity of the finger millet (*Eleusine coracana)* - French bean (*Phaseolus vulgaris*) cropping system in phosphorus-rich soils. Field experiments were conducted at two locations: Arasana Halli in Chikkaballapur, Karnataka, during the *kharif* and summer of 2018-19 and in the Integrated Farming System (IFS) GKVK during the *kharif* and summer of 2023-24. The field experiments were carried out at both locations in the Eastern Dry Zone of Karnataka at with the 13°24'14.0"N latitude, 77°42'41.0"E longitude, at an altitude of 929 meters above mean sea level at location -1 and 13°08'51.49"N latitude 77°58'21.48"E longitude at location-2. Four types of compost-urban solid waste compost (USWC), poultry manure, vermicompost and farmyard manure (FYM)-were enriched with rock phosphate and phosphorus-solubilizing bacteria (PSB) to study their effects on soil nutrient availability and crop performance.

Preparation of Phosphorus-enriched Compost

Hundred kg of each compost type was mixed with 5 kg rock phosphate (33.4% P_2O_5) and incubated for 15 days with 60 per cent moisture, ensuring regular mixing. At the end of the incubation, 1 kg of PSB (*Aspergillus awamori*) was added to each compost (Meena and Biswas, 2014). The enriched compost was applied at different phosphorus levels (25, 50 and 75% of the recommended P dose).

Results and Discussion

Main Crop (Finger Millet)

Soil Properties After the Harvest of Finger Millet

The highest organic carbon content in the soil after the harvest of finger millet was observed in treatment T_{11} (100% NK + 75% P enriched poultry manure + PSB), with values of 0.50% at L_1 and 0.52% at L_2. This was closely followed by treatment T_{14} (100% NK + 75% P enriched urban solid waste compost + PSB), which also showed 0.50% and 0.52% at L_1 and L_2, respectively. The increase in Organic Carbon (OC) content might be attributed to the application of P rich poultry manure and USWC, which supplied carbonaceous materials for decomposition. Additionally, the presence of inorganic nitrogenous fertilizers likely enhanced soil microbial activity, accelerating the decomposition of organic matter due to an optimal C:N ratio. Which helps to converts organic matter into mineralized organic colloids, thus enriching the soil reserves.

TABLE 1

Selective initial physicochemical properties of soil at the experimental sites

Soil Properties	Arasana Halli (Chikkaballapur)	IFS, GKVK
	Location-1	Location-2
Physical properties		
Sand (%)	66.57	63.86
Silt (%)	8.1	6.8
Clay (%)	25.33	29.34
Textural class	Sandy Clay Loam	Sandy Loam
soil type	Black Soil	Red Soil
Bulk density (Mg m^{-3})	1.37	1.45
MWHC (%)	28.6	30.05
Chemical properties		
pH (1:2.5 soil water extract)	7.41	6.38
EC (1:2.5 soil water extract) (dS m^{-1})	0.24	0.37
OC (%)	0.41	0.47
Available N (kg ha^{-1})	128.73	238.7
Available P_2O_5 (kg ha^{-1})	76.4	62.55
Available K_2O (kg ha^{-1})	115.8	225.4
Exch. Ca [c mol (P^+) kg^{-1}]	4.11	4.96
Exch. Mg [c mol (P^+) kg^{-1}]	1.86	2.31
Available S (mg kg^{-1})	11.3	16.82
DTPA extractable Cu (mg kg^{-1})	0.19	0.56
DTPA extractable Zn (mg kg^{-1})	1.26	1.92
DTPA extractable Fe (mg kg^{-1})	38.55	27.14
DTPA extractable Mn (mg kg^{-1})	20.25	19.48

However, higher electrical conductivity (EC) in the soil after harvest of finger millet was observed in T_{11} (100% NK + 75% P enriched poultry manure + PSB) (0.25 and 0.41 dS m^{-1} at L_1 and L_2, respectively) and followed by the T_{14} (100% NK + 75% P enriched urban solid waste compost + PSB) (0.24 and 0.39 dS m^{-1} at L_1 and L_2, respectively). Increase might be attributed to the decomposition of the manure which releases organic and inorganic ions or salts into the soil. The increase in soluble salt content of the soil was attributed to the residual effects of the organic manures, which elevated the soluble salt levels. These observations are in consistent with the findings reported by Basavaraj (2001) and Yogananda *et al.* (2010)

Soil pH showed non-significant. However, higher pH values were recorded in T_{11}, with pH levels of 7.52 and 6.57 at L_1 and L_2, respectively and followed by T_{14} (7.50 and 6.56 at L_1 and L_2, respectively) and T_8 (7.48 and 6.56 at L_1 and L_2, respectively). These values were higher than the initial soil pH of 7.41 at L_1 and 6.38 at L_2. An increase in soil pH when applying phosphorus-enriched organic manure, especially in initially acidic soils, might be attributed to several factors *viz*, organic manures might have acted as buffering agents, neutralizing soil acidity by providing basic cations like calcium (Ca^{2+}) and magnesium (Mg^{2+}) which help to counteract soil acidity.

The bulk density of the soil after the harvest of finger millet showed non significant influence among different treatments. However, T_{14} (100% NK + 75% P Enriched USWC+ PSB) showed the lowest bulk density with values of 1.33 and 1.36 Mg m^{-3} at L_1 and L_2, respectively and on par with the T_{13} (100% NK + 75% P Enriched Urban Solid Waste Compost + PSB) (1.33 and 1.40 Mg m^{-3} at L_1 and L_2, respectively) and T_{11} (100% NK + 75% P Enriched Poultry Manure + PSB) (1.34 and 1.35 Mg m^{-3} at L_1 and L_2, respectively. at L_1 and L_2, respectively). decrease in soil bulk density which might be attributed to the addition of a substantial amount of organic matter which promotes soil aggregation and increases pore space compared to the control. These findings align with the results reported by Nandapure *et al*. (2011). Similar outcomes of decreased soil bulk density with the application of organic manures have been documented by Kharche *et al*. (2013) and Sharma *et al*. (2014).

Significantly higher MWHC values were recorded in T_{11} (100% NK + 75% P Enriched Poultry Manure + PSB) (35.19% at L_1 and 36.81% at L_2). The increase in water holding capacity with 100 per cent NK combined with 75 per cent P enriched poultry manure and USWC might be attributed to the increased organic carbon content, which positively influenced the water holding capacity of soils by improving soil structure and porosity (Sathish *et al*., 2011 and Nandapure *et al*., 2011).

Soil Nutrient Status After the Harvest of Finger Millet

Significantly higher available nitrogen (N) in the soil after harvest was recorded in T_{11} (100% NK + 75% P enriched poultry manure + PSB) with the values of 153.87 and 281.01 kg ha^{-1} at L_1 and L_2, respectively and followed by T_{14} (100% NK + 75% P enriched urban solid waste compost + PSB) (145.16 and 275.76 kg ha^{-1} at L_1 and L_2, respectively). The significant increase in soil available nitrogen (N) might be attributed to the addition of RP enriched urban compost, poultry manure and vermicompost which releases nitrogen through mineralization and further enhanced by microbial inoculation including nitrogen-fixing organisms that facilitate the fixation of atmospheric nitrogen and conversion of organically bound nitrogen to inorganic forms. These findings are in consistent with those reported by Punitha and Prakasha., 2016.

A significantly higher available phosphorus (P_2O_5) in the soil after the harvest of finger millet was observed in T_{11} (100% NK + 75% P enriched poultry manure + PSB) which recorded 84.46 and 76.04 kg ha^{-1} at L_1 and L_2, respectively and followed by T_{14} (100% NK + 75% P enriched urban solid waste compost + PSB) (81.98 and 75.73 kg ha^{-1} at L_1 and L_2, respectively). The increase in available phosphorus might be attributed to the formation of metallo-organic complexes with organic ligands, which reduced their susceptibility to absorption, fixation or precipitation reactions in the soil. As a result, these complexes formed soluble compounds with both native and applied phosphorus.

A significantly higher available potassium (K_2O) in the soil after the harvest of finger millet was recorded in T_{11} (100% NK + 75% P enriched poultry manure + PSB) with the values of 132.34 and 252.43 kg ha m^{-1} at L_1 and L_2, respectively. A significant increase in potassium content was observed, likely due to the release of K from composts and the solubilization of mineral-bound or native K. The enhanced potassium status in the soil due to P rich organic material application might be attributed to the greater capacity of organic colloids to hold nutrients at exchange sites, reduce potassium fixation and release potassium into the soil available pool. Similar observation was consistent with the findings of Sailaja and Ushakumari (2002).

The highest exchangeable calcium in the soil after the harvest of finger millet was recorded in treatment T_8 (100% NK + 75% P through enriched vermicompost + PSB) (6.02 and 6.29 c mol (P+) kg^{-1} L_1 and L_2, respectively) and significantly highest exchangeable magnesium (Mg) levels in the soil after

Table 2

Effect of phosphorus enriched composts on Organic carbon, EC (dS m^{-1}), pH, Bulk density (mg m^{-3}) and MWHC (%) in soil after harvest of finger millet at two locations

Treatment	OC (%)		EC (1:2.5 soil water extract) (dS m^{-1})		pH (1:2.5 soil water extract)		Bulk density (Mg m^{-3})		MWHC (%)	
	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2
T_1	0.41	0.44	0.19	0.15	7.41	6.36	1.41	1.51	26.19	27.72
T_2	0.46	0.45	0.22	0.22	7.44	6.52	1.37	1.50	29.87	34.28
T_3	0.44	0.46	0.19	0.19	7.32	6.37	1.42	1.52	26.70	28.11
T_4	0.45	0.47	0.22	0.20	7.38	6.48	1.38	1.45	27.95	28.71
T_5	0.46	0.48	0.22	0.23	7.46	6.52	1.35	1.41	28.25	30.25
T_6	0.44	0.46	0.21	0.21	7.33	6.40	1.41	1.51	27.33	28.67
T_7	0.47	0.48	0.22	0.24	7.46	6.54	1.35	1.48	30.25	35.10
T_8	0.49	0.51	0.23	0.37	7.48	6.56	1.35	1.44	31.81	35.14
T_9	0.44	0.46	0.22	0.23	7.41	6.52	1.35	1.48	28.11	29.83
T_{10}	0.47	0.49	0.23	0.32	7.48	6.55	1.34	1.41	35.15	36.30
T_{11}	0.50	0.52	0.25	0.41	7.52	6.57	1.34	1.35	35.19	36.81
T_{12}	0.45	0.47	0.21	0.25	7.33	6.43	1.35	1.48	28.71	33.77
T_{13}	0.49	0.51	0.23	0.37	7.47	6.54	1.33	1.40	33.77	35.15
T_{14}	0.50	0.52	0.24	0.39	7.50	6.56	1.33	1.36	34.28	35.19
S.Em±	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.28	0.16
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	0.84	1.92
Initial	0.41	0.47	0.24	0.37	7.41	6.38	1.37	1.45	28.6	30.05

Legend :

T_1 : Absolute Control (Without P)
T_2 : POP 100% (NPK+FYM)
T_3 : 100 % NK + 25 % P through enriched FYM+ PSB
T_4 : 100 % NK + 50 % P through enriched FYM+ PSB
T_5 : 100 % NK + 75 % P through enriched FYM+ PSB
T_6 : 100 % NK + 25 % P through enriched vermicompost + PSB
T_7 : 100 % NK + 50 % P through enriched vermicompost + PSB
T_8 : 100 % NK + 75 % P through enriched vermicompost + PSB
T_9 : 100 % NK + 25 % P Enriched Poultry manure + PSB
T_{10}: 100 % NK + 50 % P Enriched Poultry manure + PSB
T_{11}: 100 % NK + 75 % P Enriched Poultry manure + PSB
T_{12}: 100 % NK + 25 % P Enriched Urban Solid Waste Compost + PSB
T_{13}: 100 % NK + 50 % P Enriched Urban Solid Waste Compost + PSB
T_{14}: 100 % NK + 75 % P Enriched Urban Solid Waste Compost + PSB
L_1 : Location 1 (Chikkaballapur)
L_2 : Location 2 (IFS GKVK)

TABLE 3

Effect of phosphorus enriched composts on available macro and secondary nutrients in soil after harvest of finger millet

Treatment	Avail. N (kg ha^{-1})		P_2O_5 (kg ha^{-1})		K_2O (kg ha^{-1})		Exch. Ca [C mol (P^+) kg^{-1}]		Exch. Mg [C mol (P^+) kg^{-1}]		Avail. S (mg kg^{-1})	
	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2
T_1	100.89	193.30	65.09	54.47	92.08	210.99	3.46	3.72	1.47	2.11	10.65	15.27
T_2	128.87	253.12	77.99	68.98	117.67	229.23	4.92	4.76	2.84	4.12	12.43	18.32
T_3	105.57	240.57	69.50	58.76	96.54	215.41	4.20	3.91	1.94	2.18	11.01	16.22
T_4	117.06	246.61	74.14	63.53	102.14	218.54	4.48	4.14	2.63	3.70	11.98	16.85
T_5	127.75	259.38	77.40	70.66	116.49	235.88	4.75	5.17	2.84	4.00	12.26	18.06
T_6	108.79	241.91	71.49	59.28	109.70	222.48	4.62	4.35	2.83	3.39	11.09	16.35
T_7	132.63	260.65	78.15	72.73	123.45	245.15	5.68	6.01	2.92	4.26	12.44	19.43
T_8	139.41	271.34	81.73	74.78	130.99	250.55	6.02	6.29	3.06	4.56	13.23	20.36
T_9	121.12	248.59	75.52	61.92	113.34	220.01	4.59	4.33	2.64	2.52	12.03	17.72
T_{10}	139.23	264.35	78.87	73.56	124.84	246.54	5.68	5.73	2.90	4.14	13.20	19.77
T_{11}	153.87	281.01	84.46	76.04	132.34	252.43	5.88	6.22	3.02	4.29	14.22	21.80
T_{12}	112.25	242.98	73.92	61.83	99.03	221.41	4.22	3.94	2.05	2.12	11.63	17.14
T_{13}	137.09	262.96	78.79	72.28	123.15	242.23	5.52	5.66	2.88	4.14	13.09	19.48
T_{14}	145.16	275.76	81.98	75.73	129.87	250.13	5.81	6.19	2.99	4.29	13.42	20.52
S.Em±	1.38	2.47	0.45	0.84	1.16	1.70	0.07	0.11	0.04	0.11	0.09	0.22
CD at 5%	4.19	7.51	1.37	2.54	3.52	5.17	0.21	0.34	0.13	0.32	0.27	0.67
Initial	128.73	238.7	76.4	62.55	115.8	225.4	4.11	4.96	1.86	2.31	11.3	16.82

Legend :

T_1 : Absolute Control (Without P)
T_2 : POP 100% (NPK+FYM)
T_3 : 100 % NK + 25 % P through enriched FYM+ PSB
T_4 : 100 % NK + 50 % P through enriched FYM+ PSB
T_5 : 100 % NK + 75 % P through enriched FYM+ PSB
T_6 : 100 % NK + 25 % P through enriched vermicompost + PSB
T_7 : 100 % NK + 50 % P through enriched vermicompost + PSB
T_8 : 100 % NK + 75 % P through enriched vermicompost + PSB
T_9 : 100 % NK + 25 % P Enriched Poultry manure + PSB
T_{10}: 100 % NK + 50 % P Enriched Poultry manure + PSB
T_{11}: 100 % NK + 75 % P Enriched Poultry manure + PSB
T_{12}: 100 % NK + 25 % P Enriched Urban Solid Waste Compost + PSB
T_{13}: 100 % NK + 50 % P Enriched Urban Solid Waste Compost + PSB
T_{14}: 100 % NK + 75 % P Enriched Urban Solid Waste Compost + PSB
L_1 : Location 1 (Chikkaballapur)
L_2 : Location 2 (IFS GKVK)

the harvest of finger millet were observed in T_8 (100% NK + 75% P through enriched vermicompost + PSB) with 3.06 and 4.56 c mol (P+) kg^{-1} at L_1 and L_2, respectively. Higher exchangeable calcium and magnesium content observed in treatment T_8 might be attributed to the direct addition of these nutrients through vermicompost as well as changes in soil pH. Dadhich and Somani (2007) also observed an increase in exchangeable calcium and magnesium in plots treated with poultry manure which enhanced solubility of the poultry manure.

The highest available sulfur (S) in the soil after harvest was observed in T_{11} (100% NK + 75% P enriched poultry manure + PSB) with 14.22 and 21.80 mg kg^{-1} at L_1 and L_2, respectively and it was found on par with T_{14} (100% NK + 75% P enriched urban solid waste compost + PSB) (13.42 mg kg^{-1} at L_1 and 20.52 mg kg^{-1} at L_2). Meena *et al*. (2008) reported similar results, noting higher available sulfur content following the application of P enriched organic manure which might be attributed to the mineralization of sulfur from organic matter and the release of sulfur-containing amino acids during the decomposition of organic manures as well as the addition of sulfur-containing fertilizers. Zhang *et al*. (2006) also observed an increase in soil sulfur concentrations due to the mineralization of P enriched compost.

Soil Micronutrient Status after the Harvest of Finger Millet

Significantly higher DTPA extractable micro nutrients in the soil after the harvest of finger millet were recorded in T_{11} (100% NK + 75% P through Enriched Poultry Manure + PSB) with DTPA extractable zinc (Zn) at 2.16 mg kg^{-1} at L_1 and 3.22 mg kg^{-1} at L_2. Similarly, DTPA extractable Copper (0.28 and 1.41 mg kg^{-1} at L_1 and L_2, respectively) and DTPA extractable Iron (58.74 and 42.53 mg kg^{-1} at L_1 and L_2, respectively) were higher with T_{14}. The increase in zinc (Zn) content could be attributed to the enrichment of phosphorus-enriched compost, which supplied additional Zn to the soil pool. Walter *et al*. (2006) reported an increase in total soil Zn concentrations with the application of composted materials. The increase in copper (Cu) content could be attributed to the dissolution of native Cu present in the soil and the release of Cu resulting from the mineralization of phosphorus-enriched Poultry Manure (PEPM).

Soil Dehydrogenase Activity in Soil after the Harvest of Finger Millet

The dehydrogenase activity (µg TPF g^{-1} soil 24 hr^{-1}) in soil after the harvest of finger millet was significantly higher in T_{11} (100% NK + 75% P enriched poultry manure + PSB), recording 20.83 and 35.91 µg TPF g^{-1} soil 24 hr^{-1} at L_1 and L_2, respectively. This was followed by T_{14} (100% NK + 75% P enriched urban solid waste compost + PSB), with values of 20.71 and 35.70 µg TPF g^{-1} soil 24 hr^{-1} at L_1 and L_2. The control (T1) had lower values of 13.49 and 23.25 µg TPF g^{-1} soil 24 hr^{-1} at L_1 and L_2, respectively. The higher enzyme activity in P-enriched organic manure treatments suggests improved soil dehydrogenase activity, likely stimulated by phosphorus and sulfur from the compost. These results are consistent with findings by Karmakar *et al*. (2005) and Parthasarathi *et al.* (2011), who noted that phosphorus-enriched manure boosts fatty acid synthesis and overall soil health.

Residual Crop (French Bean)

Soil Properties after the Harvest of French Bean

The data on organic carbon showed non significant difference among the treatments. The highest Organic Carbon (OC) content was recorded in T_{11} (100% NK + 75% P Enriched Poultry Manure + PSB) with OC values of 0.49% at L_1 and 0.51% at L_2 which was followed by T_{14} (100% NK + 75% P Enriched Urban Solid Waste Compost + PSB) (0.48 and 0.50 % at L_1 and L_2, respectively). Control which had lower OC values with 40% at L_1 and 0.38% at L_2.

The data on electric conductivity showed non significant difference among the treatments. However, higher Electrical Conductivity (EC) was recorded in

TABLE 4

Effect of phosphorus enriched composts on available micro nutrients in soil after harvest of finger millet at two locations

Treatment	Available Cu ($mg\ kg^{-1}$)		Available Zn ($mg\ kg^{-1}$)		Available Zn ($mg\ kg^{-1}$)		Available Mn ($mg\ kg^{-1}$)	
	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2
T_1	0.13	0.43	1.13	1.63	20.83	20.08	19.09	16.51
T_2	0.24	1.13	1.27	2.08	34.74	33.08	21.37	27.20
T_3	0.15	0.58	1.36	1.95	29.21	26.50	22.17	21.78
T_4	0.19	0.75	1.52	2.19	37.70	29.09	22.34	23.92
T_5	0.22	1.05	1.85	2.67	49.27	35.69	28.17	29.34
T_6	0.20	0.82	1.58	2.27	32.74	26.71	22.38	21.95
T_7	0.24	1.20	1.64	2.36	45.74	32.57	26.52	26.77
T_8	0.26	1.32	1.86	2.83	50.46	37.34	28.39	30.70
T_9	0.16	0.76	1.61	2.31	38.25	30.65	23.37	25.20
T_{10}	0.25	1.26	1.97	3.01	53.08	38.43	31.25	31.59
T_{11}	0.26	1.33	2.16	3.22	56.42	38.87	32.51	31.95
T_{12}	0.19	0.94	1.81	2.60	38.69	31.32	27.00	25.74
T_{13}	0.26	1.28	1.94	2.92	53.68	38.69	30.10	31.80
T_{14}	0.28	1.41	2.03	3.03	58.74	42.53	32.19	34.96
S.Em±	0.00	0.04	0.03	0.05	0.98	0.71	0.38	0.58
CD at 5%	NS	0.11	NS	0.16	2.98	2.14	1.16	1.76
Initial	0.19	0.56	1.25	1.92	38.55	27.14	20.25	19.48

Legend :
T_1 : Absolute Control (Without P)
T_2 : POP 100% (NPK+FYM)
T_3 : 100 % NK + 25 % P through enriched FYM+ PSB
T_4 : 100 % NK + 50 % P through enriched FYM+ PSB
T_5 : 100 % NK + 75 % P through enriched FYM+ PSB
T_6 : 100 % NK + 25 % P through enriched vermicompost + PSB
T_7 : 100 % NK + 50 % P through enriched vermicompost + PSB
T_8 : 100 % NK + 75 % P through enriched vermicompost + PSB
T_9 : 100 % NK + 25 % P Enriched Poultry manure + PSB
T_{10}: 100 % NK + 50 % P Enriched Poultry manure + PSB
T_{11}: 100 % NK + 75 % P Enriched Poultry manure + PSB
T_{12}: 100 % NK + 25 % P Enriched Urban Solid Waste Compost + PSB
T_{13}: 100 % NK + 50 % P Enriched Urban Solid Waste Compost + PSB
T_{14}: 100 % NK + 75 % P Enriched Urban Solid Waste Compost + PSB
L_1 : Location 1 (Chikkaballapur)
L_2 : Location 2 (IFS GKVK)

T_{14} (100% NK + 75% P Enriched Urban Solid Waste Compost + PSB) (0.23 and 0.37 dS m^{-1} at L_1 and L_2, respectively) which was followed by T_{11} (100% NK + 75% P Enriched Poultry Manure + PSB) (0.23 and 0.36 dS m^{-1} at L_1 and L_2, respectively). The increase in EC in residual crops and phosphorus-enriched organic manure, such as USWC and poultry manure, might be attributed to several factors. Enriched composts often contain higher concentrations of soluble nutrients and salts, which contribute to elevated EC levels Snehall *et al*. (2010).

The data on pH showed non significant difference among the treatments. The highest pH values were recorded in T_{11}, with pH of 7.56 and 6.78 at L_1 and L_2, respectively, which was followed by T_{14} (7.53 and 6.79 at L_1 and L_2, respectively). The decomposition

TABLE 5

Effect of phosphorus enriched composts on dehydrogenase activity (µg TPF g^{-1} soil 24 hr^{-1}) in soil after harvest of finger millet

Treatment	Dehydrogenase activity (µg TPF g^{-1} soil 24 hr^{-1})	
	L_1	L_2
T_1 : Absolute Control (Without P)	13.49	23.25
T_2 : POP 100% (NPK+FYM)	17.60	30.34
T_3 : 100 % NK + 25 % P through enriched FYM+ PSB	14.00	24.14
T_4 : 100 % NK + 50 % P through enriched FYM+ PSB	16.65	28.70
T_5 : 100 % NK + 75 % P through enriched FYM+ PSB	17.60	30.34
T_6 : 100 % NK + 25 % P through enriched Vermicompost + PSB	14.77	25.46
T_7 : 100 % NK + 50 % P through enriched Vermicompost + PSB	18.01	31.05
T_8 : 100 % NK + 75 % P through enriched Vermicompost + PSB	19.17	33.04
T_9 : 100 % NK + 25 % P enriched Poultry Manure + PSB	16.84	29.02
T_{10} : 100 % NK + 50 % P enriched Poultry Manure + PSB + PSB	18.43	31.77
T_{11} : 100 % NK + 75 % P enriched Poultry Manure + PSB + PSB	20.83	35.91
T_{12} : 100 % NK + 25 % P enriched Urban Solid Waste Compost + PSB	16.45	28.36
T_{13} : 100 % NK + 50 % P enriched Urban Solid Waste Compost + PSB	18.24	31.44
T_{14} : 100 % NK + 75 % P enriched Urban Solid Waste Compost + PSB	20.71	35.70
S.Em±	0.19	0.44
CD at 5%	0.58	1.34
Initial	17.81	26.3

of these manures releases basic cations like calcium, magnesium and potassium, further increasing pH.

The data on bulk density showed non significant difference among the treatments. However, T_{11} (100% NK + 75% P Enriched Poultry Manure + PSB) recorded the lowest bulk density with values of 1.31 and 1.32 Mg m^{-1} at L_1 and L_2, respectively followed by T_{14} (100% NK + 75% P Enriched Urban Solid Waste Compost + PSB) (1.31 and 1.34 Mg m^{-1} at L_1 and L_2, respectively). The reduced organic matter from decomposed crops might lead to a denser soil matrix, which impairs soil aeration and water infiltration (Shulan *et al.* 2012).

A significantly higher Maximum Water Holding Capacity (MWHC) was observed in T_{11} (100% NK + 75% P Enriched Poultry Manure + PSB) recorded values of 38.01 and 39.6% at L_1 and L_2, respectively and T_{10} (100% NK + 50% P Enriched Poultry Manure + PSB) (37.37% at L_1 and 38.5% at L_1 and L_2, respectively). Phosphorus-enriched organic manure might be attributed to the improved soil structure and increased organic matter content. The addition of organic matter enhances soil aggregation and porosity, allowing for better water retention. Organic matter also boosts microbial activity, which aids in decomposition and further improves soil structure (Mylavarapu and Zinati, 2009 and Iovieno *et al.*, 2009).

Soil Nutrient Status after the Harvest of French Bean

The available nitrogen (N) in the soil after the harvest of French bean varied significantly across treatments at both locations, L_1 (Chikkaballapur) and L_2 (IFS GKVK). The significantly higher available nitrogen

TABLE 6

Effect of phosphorus enriched composts on Organic Carbon (%), EC (1:2.5) (dS m^{-1}), pH, bulk density (Mg m^{-3}) and MWHC (%) in soil after harvest of French bean

Treatment	OC (%)		EC (1:2.5 soil water extract) (dS m^{-1})		pH (1:2.5 soil water extract)		Bulk density (Mg m^{-3})		MWHC (%)	
	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2
T_1	0.40	0.38	0.17	0.13	7.22	6.55	1.40	1.51	26.10	27.6
T_2	0.45	0.41	0.19	0.32	7.45	6.50	1.37	1.49	28.25	34.3
T_3	0.44	0.44	0.18	0.29	7.25	6.61	1.41	1.51	28.11	29.5
T_4	0.42	0.46	0.19	0.18	7.37	6.75	1.39	1.34	28.90	29.7
T_5	0.44	0.46	0.19	0.19	7.50	6.78	1.35	1.39	31.77	32.7
T_6	0.43	0.44	0.19	0.18	7.29	6.71	1.41	1.50	28.12	29.5
T_7	0.40	0.46	0.20	0.34	7.46	6.76	1.36	1.47	32.19	37.0
T_8	0.44	0.50	0.22	0.36	7.49	6.80	1.33	1.42	33.67	37.0
T_9	0.37	0.43	0.20	0.20	7.43	6.60	1.35	1.47	29.41	31.1
T_{10}	0.47	0.46	0.21	0.21	7.49	6.72	1.33	1.41	37.37	38.5
T_{11}	0.49	0.51	0.23	0.36	7.56	6.78	1.31	1.32	38.01	39.6
T_{12}	0.44	0.46	0.20	0.21	7.32	6.60	1.35	1.47	29.19	33.8
T_{13}	0.46	0.49	0.22	0.22	7.48	6.71	1.32	1.39	36.92	38.1
T_{14}	0.48	0.50	0.23	0.37	7.53	6.79	1.31	1.34	37.20	38.3
S.Em±	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.48	0.47
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	1.45	1.43

Legend :
T_1 : Absolute Control (Without P)
T_2 : POP 100% (NPK+FYM)
T_3 : 100 % NK + 25 % P through enriched FYM+ PSB
T_4 : 100 % NK + 50 % P through enriched FYM+ PSB
T_5 : 100 % NK + 75 % P through enriched FYM+ PSB
T_6 : 100 % NK + 25 % P through enriched vermicompost + PSB
T_7 : 100 % NK + 50 % P through enriched vermicompost + PSB
T_8 : 100 % NK + 75 % P through enriched vermicompost + PSB
T_9 : 100 % NK + 25 % P Enriched Poultry manure + PSB
T_{10}: 100 % NK + 50 % P Enriched Poultry manure + PSB
T_{11}: 100 % NK + 75 % P Enriched Poultry manure + PSB
T_{12}: 100 % NK + 25 % P Enriched Urban Solid Waste Compost + PSB
T_{13}: 100 % NK + 50 % P Enriched Urban Solid Waste Compost + PSB
T_{14}: 100 % NK + 75 % P Enriched Urban Solid Waste Compost + PSB
L_1 : Location 1 (Chikkaballapur)
L_2 : Location 2 (IFS GKVK)

was recorded in T_{11} (100% NK + 75% P Enriched Poultry Manure + PSB) (111.30 and 236.47 kg ha^{-1} at L_1 and L_2, respectively). The incorporation of enriched composts to soil along with inorganic fertilizer enhanced the soil N concentration which might be due to the inherent higher value of N in the enriched compost and build-up of NO_3-N and NH_4-N in the soil due to release of mineralizable N from the constituents in the compost by the nitrification process as reported by Kavitha and Subramanian (2007) and Rathod *et al*. (2012).

The available phosphorus (P_2O_5) in the soil after the harvest of French bean varied significant across treatments at both locations, L_1 (Chikkaballapur) and L_2 (IFS GKVK). The significantly higher available phosphorus was recorded in T_{11} (100% NK + 75% P Enriched Poultry Manure + PSB) with 69.37 and 57.77 kg ha^{-1} at L_1 and L_2, respectively. Higher available P increased after the harvest of French bean with higher levels of RP enriched poultry manure which might be due to the direct addition of P by rock phosphate enriched poultry manure to the soils available pool and improvements in soil physical properties that enhance P availability. Singh *et al*. (2003)

The available potassium (K_2O) in the soil after the harvest of French bean varied significantly across treatments at both locations, L_1 (Chikkaballapur) and L_2 (IFS GKVK). The highest available potassium was recorded in T_{11} (100% NK + 75% P Enriched Poultry Manure + PSB) with 133.21 and 184.65 kg ha^{-1} at L_1 and L_2, respectively. The higher available K_2O content in the soil might be attributed to the application of Phosphorus-enriched Poultry Manure (PEPM). These amendments help minimize the leaching loss of potassium (K) by retaining K ions on the exchange sites of their decomposed products, thereby contributing to a greater accumulation of K in the soil pool (Giusquiani *et al*. 2001 and Sunitha *et al*., 2010).

The exchangeable calcium and magnesium in the soil after the harvest of French bean varied significantly across treatments at both locations, L_1 (Chikkaballapur) and L_2 (IFS GKVK). The highest exchangeable calcium was recorded in T_8 (100% NK + 75% P Enriched Vermicompost + PSB) with 5.98 and 6.25 cmol (P^+) kg^{-1} at L_1 and L_2, respectively. Whereas Significantly higher exchangeable magnesium was recorded in T_8 (100% NK + 75% P Enriched Vermicompost + PSB) with 3.03 and 4.41 cmol (P^+) kg^{-1} at L_1 and L_2, respectively. Exchangeable calcium (Ca) and magnesium (Mg) contents in the soil were higher in plots treated with phosphorus-enriched Poultry Manure (PEPM) at the harvest of residual french beans which might be attributed to RP enriched PM serving as an additional source of Ca and Mg which enhances the dissolution of these nutrients and subsequently increases their concentration in the soil solution upon mineralization of the compost (Manjunatha 2011).

The available Sulfur (S) in the soil after the harvest of French bean varied significantly across treatments at both locations, L_1 (Chikkaballapur) and L_2 (IFS GKVK). The highest available Sulfur was recorded in T_{11}, with 11.40 and 19.29 mg kg^{-1} at L_1 and L_2, respectively followed by T_{14} (11.00 and 18.24 mg kg^{-1} at L_1 and L_2, respectively). The higher Sulfur (S) content might be due to the oxidation of elemental Sulfur and mineralization of Sulfur by microorganisms from the native soil, as noted by Zhang *et al*. (2006).

Soil Micronutrients Status after the Harvest of French Bean

The DTPA extractable micronutrients in the soil after the harvest of French bean varied significantly across treatments at both locations. Significantly higher DTPA extractable micronutrients were recorded in the T_{14}, in which DTPA extractable Cu was 0.23 at L_1 and 1.36 mg kg^{-1} at L_2 and DTPA extractable Fe was 48.03 at L_1 and 35.52 mg kg^{-1} at L_2. Whereas T_{11} recorded significantly higher DTPA extractable Zn of 2.02 at L_1 and 3.07 mg kg^{-1} at L_2 and available Mn was 25.06 and 26.69 mg kg^{-1} at L_1 and L_2, respectively. The higher iron (Fe) content in the soil might be attributed to the release of Fe from the native soil, facilitated by chelating agents

TABLE 7

Residual effect of phosphorus enriched composts on available macro and secondary nutrients in soil after harvest of French bean

Treatment	Avail. N (kg ha^{-1})		P_2O_5 (kg ha^{-1})		K_2O (kg ha^{-1})		Exch. Ca [c mol (P$^+$) kg^{-1}]		Exch. Mg [c mol (P$^+$) kg^{-1}]		Available S (mg kg^{-1})	
	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2
T_1	94.52	183.93	50.75	38.13	83.78	155.14	3.35	3.60	1.42	2.04	8.50	12.97
T_2	98.45	226.04	62.89	52.95	112.58	172.04	4.72	5.12	2.72	4.07	9.98	16.01
T_3	96.89	219.71	56.60	42.98	92.48	161.71	4.02	3.73	1.82	2.09	8.83	13.57
T_4	97.49	222.07	59.87	45.03	105.02	166.27	4.41	4.08	2.48	2.48	9.64	14.73
T_5	98.27	225.84	61.86	51.88	111.67	169.85	4.70	4.56	2.69	3.97	9.97	15.75
T_6	97.19	220.03	57.19	44.18	105.06	166.82	4.54	4.27	2.67	3.67	8.88	14.05
T_7	98.82	227.90	63.99	53.12	120.77	179.64	5.42	5.76	2.83	4.14	10.58	16.85
T_8	107.53	230.44	67.72	54.98	126.66	183.53	5.98	6.25	3.03	4.41	10.85	17.89
T_9	97.60	225.20	61.64	46.26	108.16	167.34	4.44	4.17	2.66	3.36	9.84	15.47
T_{10}	100.90	228.89	66.03	54.73	124.18	180.60	5.42	5.47	2.75	4.09	10.62	17.13
T_{11}	111.30	236.47	69.37	57.77	133.21	184.65	5.76	6.10	2.94	4.18	11.40	19.29
T_{12}	97.47	220.69	59.26	44.86	98.06	163.55	4.28	3.99	2.47	2.16	9.61	14.35
T_{13}	98.84	228.31	66.02	54.51	117.50	176.09	5.00	5.40	2.73	4.07	10.60	16.86
T_{14}	108.40	232.00	68.23	57.57	126.61	183.10	5.61	5.99	2.84	4.14	11.00	18.24
S.Em±	0.58	1.42	0.60	0.71	1.64	1.07	0.09	0.11	0.05	0.10	0.10	0.22
CD at 5%	1.76	4.32	1.83	2.16	4.97	3.24	0.26	0.33	0.15	0.31	0.31	0.66

Legend :

T_1 : Absolute Control (Without P)
T_2 : POP 100% (NPK+FYM)
T_3 : 100 % NK + 25 % P through enriched FYM+ PSB
T_4 : 100 % NK + 50 % P through enriched FYM+ PSB
T_5 : 100 % NK + 75 % P through enriched FYM+ PSB
T_6 : 100 % NK + 25 % P through enriched vermicompost + PSB
T_7 : 100 % NK + 50 % P through enriched vermicompost + PSB
T_8 : 100 % NK + 75 % P through enriched vermicompost + PSB
T_9 : 100 % NK + 25 % P Enriched Poultry manure + PSB
T_{10}: 100 % NK + 50 % P Enriched Poultry manure + PSB
T_{11}: 100 % NK + 75 % P Enriched Poultry manure + PSB
T_{12}: 100 % NK + 25 % P Enriched Urban Solid Waste Compost + PSB
T_{13}: 100 % NK + 50 % P Enriched Urban Solid Waste Compost + PSB
T_{14}: 100 % NK + 75 % P Enriched Urban Solid Waste Compost + PSB
L_1 : Location 1 (Chikkaballapur)
L_2 : Location 2 (IFS GKVK)

TABLE 8

Residual effect of phosphorus enriched composts on DTPA extractable micro nutrients (mg kg^{-1}) in soil after harvest of French bean

Treatment	Available Cu (mg kg^{-1})		Available Zn (mg kg^{-1})		Available Fe (mg kg^{-1})		Available Mn (mg kg^{-1})	
	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2
T_1	0.11	0.41	0.97	1.45	17.87	16.43	15.13	12.15
T_2	0.20	1.09	1.02	1.81	36.99	25.49	15.54	14.58
T_3	0.12	0.55	1.25	1.83	20.14	16.83	15.67	15.80
T_4	0.13	0.73	1.43	2.09	26.35	17.40	16.23	17.50
T_5	0.18	1.01	1.69	2.49	40.00	26.04	20.71	21.13
T_6	0.18	0.91	1.46	2.15	23.52	17.31	16.36	17.62
T_7	0.21	1.17	1.53	2.24	34.65	22.71	18.09	17.88
T_8	0.22	1.28	1.74	2.70	40.80	26.91	21.49	23.01
T_9	0.13	0.70	1.51	2.21	30.52	20.36	16.40	17.85
T_{10}	0.21	1.22	1.80	2.84	42.71	27.85	22.84	23.24
T_{11}	0.23	1.29	2.02	3.07	44.13	29.51	25.06	26.69
T_{12}	0.16	0.79	1.58	2.36	33.66	22.54	19.48	20.90
T_{13}	0.22	1.24	1.74	2.70	43.64	28.04	21.81	23.02
T_{14}	0.23	1.36	1.91	2.90	48.03	35.52	25.00	23.53
S.Em±	0.00	0.03	0.04	0.05	1.10	0.66	0.41	0.47
CD at 5%	NS	0.11	0.11	0.16	3.35	2.00	1.24	1.43

Legend :
T_1 : Absolute Control (Without P)
T_2 : POP 100% (NPK+FYM)
T_3 : 100 % NK + 25 % P through enriched FYM+ PSB
T_4 : 100 % NK + 50 % P through enriched FYM+ PSB
T_5 : 100 % NK + 75 % P through enriched FYM+ PSB
T_6 : 100 % NK + 25 % P through enriched vermicompost + PSB
T_7 : 100 % NK + 50 % P through enriched vermicompost + PSB
T_8 : 100 % NK + 75 % P through enriched vermicompost + PSB
T_9 : 100 % NK + 25 % P Enriched Poultry manure + PSB
T_{10}: 100 % NK + 50 % P Enriched Poultry manure + PSB
T_{11}: 100 % NK + 75 % P Enriched Poultry manure + PSB
T_{12}: 100 % NK + 25 % P Enriched Urban Solid Waste Compost + PSB
T_{13}: 100 % NK + 50 % P Enriched Urban Solid Waste Compost + PSB
T_{14}: 100 % NK + 75 % P Enriched Urban Solid Waste Compost + PSB
L_1 : Location 1 (Chikkaballapur)
L_2 : Location 2 (IFS GKVK)

that form ligands with higher oxides of Fe converting it to soluble forms. Increase in the plots treated with phosphorus-enriched urban solid waste compost (USWC) and Poultry Manure (PEPM). Zhang *et al*. (2001) suggested that the increase in Mn content could be due to the release of Mn from organic amendments during the mineralization process or the dissolution of native Mn from the soil and similar trends were observed by Lavanya and Sathish, 2020

Soil Dehydrogenase Activity in Soil after the Harvest of French Bean

Dehydrogenase activity in soil after the harvest of French bean varied significantly across treatments at both locations, L_1 (Chikkaballapur) and L_2 (IFS GKVK). The highest dehydrogenase activity was recorded in T_{11} (100% NK + 75% P Enriched Poultry Manure + PSB) with values of 18.76 and 33.57µg

TABLE 9

Residual effect of phosphorus enriched composts on dehydrogenase activity (μg TPF g^{-1} soil $24hr^{-1}$) in soil after harvest of French bean

Treatment	Dehydrogenase activity (μg TPF g^{-1} soil $24hr^{-1}$)	
	L_1	L_2
T_1 : Absolute Control (Without P)	11.56	21.13
T_2 : POP 100% (NPK+FYM)	16.22	28.84
T_3 : 100 % NK + 25 % P through enriched FYM+ PSB	13.37	23.43
T_4 : 100 % NK + 50 % P through enriched FYM+ PSB	15.80	27.82
T_5 : 100 % NK + 75 % P through enriched FYM+ PSB	16.22	28.82
T_6 : 100 % NK + 25 % P through enriched Vermicompost + PSB	13.80	24.47
T_7 : 100 % NK + 50 % P through enriched Vermicompost + PSB	16.43	29.31
T_8 : 100 % NK + 75 % P through enriched Vermicompost + PSB	17.85	31.61
T_9 : 100 % NK + 25 % P enriched Poultry Manure + PSB	15.89	28.03
T_{10} : 100 % NK + 50 % P enriched Poultry Manure + PSB + PSB	17.60	30.92
T_{11} : 100 % NK + 75 % P enriched Poultry Manure + PSB + PSB	18.76	33.57
T_{12} : 100 % NK + 25 % P enriched Urban Solid Waste Compost + PSB	15.27	27.12
T_{13} : 100 % NK + 50 % P enriched Urban Solid Waste Compost + PSB	16.54	29.64
T_{14} : 100 % NK + 75 % P enriched Urban Solid Waste Compost + PSB	18.45	33.10
S.Em±	0.23	0.41
CD at 5%	0.70	1.24

TPF g^{-1} soil 24 hr^{-1} at L_1 and L_2, respectively, followed by T_{14} (18.45 and 33.10 μg TPF g^{-1} soil 24 hr^{-1}) and T8 (17.85 and 31.61 μg TPF g^{-1} soil 24 hr^{-1}). The control had lower values (11.56 and 21.13 ìg TPF g^{-1} soil 24 hr^{-1}). Dehydrogenase activity, an indicator of microbial activity, is influenced by agronomic practices and correlates with soil biomass carbon. The increased enzyme activity with 100% NK + 75% P Enriched poultry manure is attributed to higher organic matter, soil biomass carbon and enhanced microbial activity, similar observation reported by Ramesh *et al*. (2007).

The study indicates that rock phosphate-enriched compost, particularly when combined with poultry manure and PSB, significantly improves soil properties, nutrient availability and dehydirgenase activity in the finger millet-French bean cropping system. The application of RP enriched compost provides a sustainable solution to the challenges posed by excessive inorganic fertilizer use, offering improved soil fertility and enhanced crop productivity while reducing environmental impacts. The research shows the potential of integrated nutrient management using RP enriched composts to promote long-term soil health and ensure food security in phosphorus-rich soils of the Eastern Dry Zone of Karnataka.

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