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Impact of P enriched compost on growth, yield and yield attributes of finger millet (*Eleusine coracana* L. Gaertn.) French bean (*Phaseolus vulgaris* L.) cropping sequence in P rich soils

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Abstract
The excessive use of synthetic fertilizers has led to soil degradation and environmental pollution, highlighting the need for sustainable soil management practices. 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. Results showed that T_{11} recorded higher values in finger millet, including the number of ear heads per hill (4.31 at L_1, 5.10 at L_2), number of fingers per head (6.46 at L_1, 6.66 at L_2), and test weight (3.47 g at L_1, 3.51 g at L_2), followed by T_{14}(ear heads per hill: 4.26 at L_1, 5.09 at L_2; fingers per head: 6.40 at L_1, 6.59 at L_2; test weight: 3.44 g at L_1, 3.51 g at L_2). T_{11} also achieved significantly higher straw yield (60.62 and 61.83 q ha^{-1} at L_1 and L_2, respectively) and grain yield (43.57 and 45.83 q ha^{-1} at L_1 and L_2, respectively), while T_{14} recorded higher straw yield (57.62 and 58.66 q ha^{-1} at L_1 and L_2, respectively) and grain yield (41.90 and 43.02 q ha^{-1} at L_1 and L_2, respectively). Additionally, residual French bean yield attributes in T_{11}, including fresh pod yield (28.25 and 27.10 tons ha^{-1} at L_1 and L_2, respectively), haulm yield (2867.76 and 2868.88 kg ha^{-1} at L_1 and L_2, respectively), and pod dry weight (42.06 q ha^{-1} at L_1, 43.45 q ha^{-1} at L_2). The study highlights that phosphorus-enriched composts, particularly poultry manure, combined with PSB, improve nutrient availability, soil fertility, and crop productivity, offering a sustainable and eco-friendly alternative to synthetic fertilizers. This approach addresses challenges related to phosphorus scarcity and enhances agricultural sustainability in developing countries.

Keywords: Phosphorus solubilizing bacteria (PSB), poultry manure, farm yard manure (FYM), vermicompost, rock phosphate, finger millet, French bean, USWC, vermicompost

Introduction
The excessive use of synthetic fertilizers, without adequate organic inputs, results in soil degradation and environmental pollution, highlighting the importance of proper soil management practices to maintain soil fertility. A balanced approach of incorporating organic matter with synthetic fertilizers is essential for enhancing soil quality, stimulating microbial activity, and promoting nutrient cycling, which ultimately supports high-quality crop yields. Organic amendments not only provide essential nutrients but also improve microbial dynamics, soil structure, and various physical, chemical, and biological aspects of soil health, thereby playing a crucial role in sustainable agricultural practices. Finger millet, a key cereal crop cultivated across tropical regions, is well-adapted to diverse soil types and plays a significant role in food security, particularly in dryland areas of India. The finger millet-French bean cropping system, widely practiced in the Eastern Dry Zone of Karnataka, showcases the importance of integrated cropping practices for maintaining soil fertility while enhancing crop

productivity. French beans, as a leguminous crop, further contribute to soil fertility by fixing nitrogen, thus improving the overall sustainability of the system.

The overuse of chemical fertilizers has raised concerns regarding their environmental impact, energy consumption, and stagnation in crop yields. Integrated Nutrient Management (INM), which combines enriched compost with mineral fertilizers, presents a sustainable alternative, balancing ecological soil health and agricultural productivity. Urban Solid Waste Composting (USWC) has gained recognition as an effective method to recycle organic waste, producing compost that enhances soil quality and reduces the dependency on chemical fertilizers. The application of enriched compost, along with beneficial microorganisms, improves soil fertility, mitigates environmental risks, and can lead to significant cost savings in fertilizer use. Organic manures, such as poultry manure, Farmyard Manure (FYM), and vermicompost, offer a reliable source of nutrients, improving soil structure and fertility. Vermicompost, in particular, is a nutrient-rich amendment that gradually releases nutrients into the soil, making it a viable alternative to conventional fertilizers.

As the cost of industrial fertilizers, particularly phosphorus-based ones, rises globally, there is increasing interest in alternative phosphorus sources, such as rock phosphate, which is more affordable but less soluble in neutral or alkaline soils. Incorporating organic materials like poultry manure, vermicompost, and FYM with rock phosphate has been shown to improve phosphorus availability and enhance crop performance. In regions like India, where low-grade rock phosphate is abundant, the use of rock phosphate-enriched compost offers a cost-effective, sustainable, and eco-friendly solution for boosting phosphorus supply in agriculture. This method, combined with Phosphate-Solubilizing Microorganisms (PSMs) like *Aspergillus awamori*, can enhance the effectiveness of rock phosphate and improve crop yields, addressing the challenges of phosphorus scarcity and soil fertility degradation in developing countries

Materials and Methods

The present study aimed to examine 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 different locations with phosphorus-rich soils. The first location was in Arasana Halli, Chikkaballapur taluk, Karnataka, during the kharif and summer of 2018-19, and the second was at the Integrated Farming System (IFS) GKVK, Bengaluru, during the kharif and summer of 2023-24. The investigation involved the use of four different compost types urban solid waste compost (USWC), poultry manure, vermicompost, and farmyard manure (FYM) which were enriched with rock phosphate to assess their impact on soil fertility and crop productivity. USWC was sourced from Karnataka Compost Development Corporation Ltd. (KCDC), Bengaluru, poultry manure from Doddabalapur, and vermicompost and FYM from ZARS, UAS, GKVK, Bengaluru. The phosphorus-enriched compost was prepared by thoroughly mixing 5percent rock phosphate and 1percent phosphate-solubilizing bacteria (PSB) such as *Aspergillus awamori* into 100 kg of each type of compost. The compost mixture was incubated for 15 days with periodic mixing to ensure proper curing. After the incubation, the PSB was added, and the compost was applied at 25 percent, 50 percent, and 75 percent of the recommended phosphorus levels, following the package of practices.

The experimental site's soil properties were assessed before initiating the experiment. At the first location (Chikkaballapur), the soil was classified as sandy clay loam, consisting of 65.26 percent sand, 8.1 percent silt, and 25.33 percent clay. The bulk density was 1.37 Mg m^{-3}, and the maximum water holding capacity (MWHC) was 28.6percent. The soil had a neutral pH of 7.41 and an electrical conductivity (EC) of 0.24 dS m^{-1}, with organic carbon content of 0.41percent. The available nutrients in the soil included 128.73 kg ha^{-1} of nitrogen, 76.4 kg ha^{-1} of phosphorus (P_2O_5), and 115.8 kg ha^{-1} of potassium (K_2O). Micronutrients such as copper, zinc, iron, and manganese were also present in the soil, along with trace elements like chromium, cadmium, lead, nickel, and cobalt. The soil had a dehydrogenase activity of 17.81 µg TPF g^{-1} soil $24hr^{-1}$, indicating microbial activity. The experiment was designed as a randomized complete block design (RCBD) with 14 treatments and three replications, and each plot measured 4 m x 3 m. Finger millet variety GPU-48 and French bean variety Arka Sharat were used in the study, with cultural practices followed according to the recommended package of practices (POP).

Treatments details

The treatments for Kharif (for finger millet) were as follows: 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 VC+ PSB, T_7: 100% NK + 50% P through enriched VC+ PSB, T_8: 100% NK + 75% P through enriched VC+ PSB, T_9: 100% NK + 25% P through enriched PM+ PSB, T_{10}: 100% NK + 50% P through enriched PM+ PSB, T_{11}: 100% NK + 75% P through enriched PM+ PSB, T_{12}: 100% NK + 25% P through enriched USWC+ PSB, T_{13}: 100% NK + 50% P through enriched USWC+ PSB, T_{14}: 100% NK + 75% P through enriched USWC+ PSB. For the summer crop (French bean), all treatments involved the application of 100% NK with FYM (without phosphorus). The treatments are as follows: T_1: Absolute Control (Without P), T_2: POP 100% (NPK+FYM), T_3 to T_{14}: 100% NK + FYM (Without P).

Result and Discussion

Main crop (finger millet)

The highest plant height at 30 DAT was recorded in T_{11} (100% NK + 75% P-enriched poultry manure + PSB), with values of 38.15 cm at L_1 and 40.95 cm at L_2. At 60 DAT, T_{11} also showed the highest plant height (93.52 cm at L_1 and 95.23 cm at L_2). At harvest, T_{11} recorded the highest plant height (109.68 cm at L_1 and 113.78 cm at L_2), followed by $T_{14}$and T8. A report of Reddy *et al.* (2004) [7] confirms that the application of P enriched urban compost, poultry manure and NPK fertilizers resulted in longer internodes in maize. Increased plant height at T_{11} might be due to the improved physical soil conditions and the production of phytohormones, which stimulate growth and contribute to the increase in plant height. These findings align with the results reported by Meena *et al.* (2021) [4].

At 30 DAT, the highest number of tillers per hill was recorded in T_{11} (100% NK + 75% P-enriched poultry manure + PSB), with 1.74 at L_1 and 2.85 at L_2. At 60 DAT, T_{11} also showed the highest tiller number, with 3.70 at L_1 and 4.31 at L_2. At harvest, T_{11} recorded the highest tiller number of 3.73 at L_1 and 4.87 at L_2. Phosphorus plays a crucial role in tiller development and overall plant growth. Previous studies have demonstrated that higher phosphorus availability might significantly increase tiller production and improve crop yields. The results align with findings on the positive impact of phosphorus on tiller number and crop productivity (Reddy *et al*., 2004) [7]. Availability of required quantity of N for long period was probably responsible for producing more tillers as in the case of T_{11} (Wijebandara, 2007) [11].

At 30 DAT, the highest chlorophyll content was recorded in T_{11} (100% NK + 75% P-enriched poultry manure + PSB), with values of 39.00 at L_1 and 42.67 at L_2. At 60 DAT, T_{11} again showed the highest chlorophyll content, with 47.28 at L_1 and 51.72 at L_2. At harvest, Phosphorus is essential for the synthesis of nucleic acids and ATP, which are crucial for chlorophyll formation. The lowest total chlorophyll content was observed under the control, likely due to the enhanced activity of the enzyme chlorophyllase, leading to the destruction of chloroplast structure and the instability of the pigment-protein complex. Chaudhary *et al.* (2014) [12] reported that phosphorus enhances chlorophyll content and photosynthetic efficiency, leading to better crop yields. Singh *et al*. (2023) [9] demonstrated that phosphorus-enriched composts significantly improve chlorophyll content and overall plant health. Similarly, Kumar and Sharma (2022) [3] reported that phosphorus applications increase nutrient uptake and photosynthetic activity.

The highest number of ear heads per hill was recorded in T_{11} (100% NK + 75% P-enriched poultry manure + PSB), with 4.31 at L_1 and 5.10 at L_2. This was followed by T_{14} (100% NK + 75% P-enriched urban solid waste compost + PSB) with 4.26 at L_1 and 5.09 at L_2, A significantly higher number of fingers per head was recorded in T_{11} (100% NK + 75% P enriched poultry manure + PSB) with values of 6.46 and 6.66 at L_1 and L_2, The test weight among the treatment was non-significant. However, higher test weight value was recorded in T_{11} (100% NK + 75% P enriched poultry manure + PSB), with values of 3.47 and 3.51 g at L_1 and L_2, respectively and followed by T_{14} (100% NK + 75% P enriched urban solid waste compost + PSB) (3.44 g at L_1 and 3.51 g at L_2).

A significantly higher grain yield was recorded in T_{11} (100% NK + 75% P enriched poultry manure + PSB) with yields of 43.57 and 45.83 q ha^{-1} at L_1 and L_2, respectively and followed by T_{14}(100% NK + 75% P enriched urban solid waste compost + PSB) (41.90 q ha^{-1} at L_1 and 43.02 q ha^{-1} at L_2), A significant increase in grain yield observed with T_{11} followed by T_{14}might be attributed to the high nutrient content and rapid availability of NPK from P rich poultry manure and PSB might have enhanced phosphorus solubilization and uptake. Poultry manure also improves soil organic matter, enhancing microbial activity and overall soil fertility. The benefits of organic amendments like poultry manure in improving crop yields by enhancing nutrient availability and soil health (Prakash *et al*., 2007) [5].

The higher straw yield was recorded in T_{11} (100% NK + 75% P enriched poultry manure + PSB) with yields of 60.62 and 61.83 q ha^{-1} at L_1 and L_2, respectively and followed by T_{14} (100% NK + 75% P enriched urban solid waste compost + PSB) (57.62 q ha^{-1} at L_1 and 58.66 q ha^{-1} at L_2). The application of 75 percent phosphorus through enriched poultry manure provides both major and micronutrients along with growth promoters and beneficial microflora. The effectiveness likely stems from the manure's capacity to release nutrients adequately to meet the crop's needs at various growth stages, as supported by Jayaprakash *et al.* (2004) [2].

Residual crop (French bean)

T_{11} (100% NK + 75% P Enriched Poultry Manure + PSB) recorded the highest plant heights at all stages of growth. At 25 DAS, it achieved 32.03 cm at L_1 and 31.16 cm at L_2. At 45 DAS, T_{11} recorded 51.51 cm at L_1 and 51.06 cm at L_2. At harvest, it reached the tallest height of 56.28 cm at L_1 and 54.18 cm at L_2. Higher plant height was recorded in T_{11} (100% NK + 75% P Enriched Poultry Manure + PSB) which might be attributed to the fact that P enriched poultry manure not only provides nitrogen but also phosphorus and other essential nutrients for plant growth. The nitrogen from the organic residues in T_{11} might have supported the vegetative growth and root development of French bean crop. Similar finding aligns with the results of Rooge (1995) [8] and Sukumari (1997) [10].

T_{11} (100% NK + 75% P Enriched Poultry Manure + PSB) recorded significantly higher fresh pod yield with 28.25 and 27.1 tons ha^{-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) (27.17 and 26.0 tons ha^{-1} at L_1 and L_2, respectively)

Significantly higher haulm yield was recorded in T_{11} (100% NK + 75% P Enriched Poultry Manure + PSB) with the values of 2867.76 and 2868.88 kg ha^{-1} at L_1 and L_2, respectively and it was found on par with T_{14} (100% NK + 75% P Enriched USWC + PSB) (2842.39 and 2742.92 kg ha^{-1} at L_1 and L_2, respectively.

Significantly higher pod dry weight was recorded in T_{11} (100% NK + 75% P Enriched Poultry Manure + PSB) (42.06 and 43.45 q ha^{-1} at L_1 and L_2, respectively) and it was found statistically on par with T_{14} (100% NK + 75% P Enriched Urban Solid Waste Compost + PSB) (40.98 and 39.55 q ha^{-1} at L_1 and L_2, respectively).

The Harvest Index (%) data for the French bean across two locations (L_1 and L_2) was significantly recorded among the treatments. At Location 1 (L_1), higher harvest index was observed in T_{11} (59.46%) followed by T_{14} (59.05%) and T_8 (58.93%). At Location-2 (L_2) T_{10} recorded the highest harvest index of 60.66 percent followed by T_{11} (60.23%) and T_{13} (60.35%). However, T_7 (60.24%) and T_{14} (59.05%). The lowest Harvest Index at both locations was observed in T_1 with values of 47.98% at L_1 and 50.64% at L_2.

The yield attributes of residual French bean, including the number of pods per plant, pod dry weight (q ha^{-1}), total number of green pods per plant, pod length (cm) and number of branches $plant^{-1}$ and fresh pod yield (tons ha^{-1}), were notably higher with the application of recommended NK along with 75% phosphorus from enriched poultry manure followed by Urban Solid Waste Compost (USWC) and vermicompost. The enhancement was due to improved phosphate solubilization and nitrogen fixation which in turn contributed to increased pod and haulm yield. The nitrogen from organic residues irrespective of its initial content, was utilized by the French bean for vegetative growth and root development. According to Reddy and Reddy (2002) [6] one ton of organic manure typically supplies about 5 to 8 kg of N and K and 2 kg of P. They also reported that approximately one-third of the total N and half of the total P were available to the first crop, with the remaining N and P benefiting subsequent crops as residual effects.

Table 1: Effect of phosphorus enriched composts on yield attributes of finger millet in P rich soils at two locations

Treatment	Fingers head^{-1}		Test weight (1000) (g)	
	L_1	L_1	L_1	L_2
T_1: Absolute control (Without P)	4.39	4.47	2.99	2.98
T_2: POP 100% (NPK+FYM)	6.00	6.19	3.34	3.37
T_3: 100% NK + 25% P through enriched FYM+ PSB	4.98	4.95	3.04	2.96
T_4: 100% NK + 50% P through enriched FYM+ PSB	5.64	5.67	3.21	3.16
T_5: 100% NK + 75% P through enriched FYM+ PSB	5.86	6.06	3.28	3.32
T_6: 100% NK + 25% P through enriched vermicompost + PSB	5.42	5.40	3.11	3.03
T_7: 100% NK + 50% P through enriched vermicompost + PSB	6.08	6.24	3.36	3.39
T_8: 100% NK + 75% P through enriched vermicompost + PSB	6.28	6.49	3.44	3.48
T_9: 100% NK + 25% P enriched poultry manure + PSB	5.69	5.75	3.27	3.24
T_{10}: 100% NK + 50% P enriched poultry manure + PSB + PSB	6.27	6.43	3.38	3.41
T_{11}: 100% NK + 75% P enriched poultry manure + PSB + PSB	6.46	6.66	3.47	3.51
T_{12}: 100% NK + 25% P enriched urban solid waste compost + PSB	5.60	5.68	3.16	3.14
T_{13}: 100% NK + 50% P enriched urban solid waste compost + PSB	6.25	6.39	3.36	3.44
T_{14}: 100% NK + 75% P enriched urban solid waste compost + PSB	6.40	6.59	3.44	3.51
S.Em±	0.03	0.07	0.00	0.02
CD at 5%	0.10	0.23	NS	NS

Table 2: Effect of phosphorus enriched composts on yield of finger millet in P rich soils at two locations

Treatment	Straw yield (q ha^{-1})		Grain yield (q ha^{-1})	
	L_1	L_2	L_1	L_2
T_1: Absolute control (Without P)	31.86	36.29	22.49	27.36
T_2: POP 100% (NPK+FYM)	52.40	52.92	35.56	41.01
T_3: 100% NK + 25% P through enriched FYM+ PSB	33.16	40.65	24.14	33.93
T_4: 100% NK + 50% P through enriched FYM+ PSB	47.01	50.53	29.25	39.57
T_5: 100% NK + 75% P through enriched FYM+ PSB	51.67	52.90	33.53	40.75
T_6: 100% NK + 25% P through enriched vermicompost + PSB	37.36	43.12	25.02	38.55
T_7: 100% NK + 50% P through enriched vermicompost + PSB	54.04	53.49	36.70	41.21
T_8: 100% NK + 75% P through enriched vermicompost + PSB	55.36	57.42	40.14	43.43
T_9: 100% NK + 25% P enriched poultry manure + PSB	49.08	50.85	31.78	40.64
T_{10}: 100% NK + 50% P enriched poultry manure + PSB + PSB	55.05	56.70	39.96	42.78
T_{11}: 100% NK + 75% P enriched poultry manure + PSB + PSB	60.62	61.83	43.57	45.83
T_{12}: 100% NK + 25% P enriched urban solid waste compost + PSB	46.71	49.74	27.42	39.33
T_{13}: 100% NK + 50% P enriched urban solid waste compost + PSB	54.18	55.53	38.22	42.69
T_{14}: 100% NK + 75% P enriched urban solid waste compost + PSB	57.62	58.66	41.90	43.02
S.Em±	0.78	0.83	0.40	0.53
CD at 5%	2.36	2.51	1.22	1.60

Table 3. Effect of phosphorus enriched composts on chlorophyll (SPAD METER) content of finger millet at different days after transplanting

Treatment	Chlorophyll (SPAD METER)			
	60 DAT		At harvest	
	Location 1	Location 2	Location 1	Location 2
T_1: Absolute control (Without P)	36.86	40.32	15.26	16.70
T_2: POP 100% (NPK+FYM)	42.80	46.42	18.35	20.08
T_3: 100% NK + 25% P through enriched FYM+ PSB	37.19	40.69	16.20	17.72
T_4: 100% NK + 50% P through enriched FYM+ PSB	42.70	44.73	17.09	18.70
T_5: 100% NK + 75% P through enriched FYM+ PSB	42.80	46.82	17.56	19.21
T_6: 100% NK + 25% P through enriched vermicompost + PSB	40.83	44.63	16.67	18.22
T_7: 100% NK + 50% P through enriched vermicompost + PSB	44.18	48.29	18.35	20.06
T_8: 100% NK + 75% P through enriched vermicompost + PSB	45.75	50.01	19.43	21.24
T_9: 100% NK + 25% P enriched poultry manure + PSB	42.70	46.67	17.18	18.78
T_{10}: 100% NK + 50% P enriched poultry manure + PSB + PSB	44.53	48.72	19.29	21.10
T_{11}: 100% NK + 75% P enriched poultry manure + PSB + PSB	47.28	51.72	20.32	22.23
T_{12}: 100% NK + 25% P enriched urban solid waste compost + PSB	41.42	44.20	16.67	18.44
T_{13}: 100% NK + 50% P enriched urban solid waste compost + PSB	44.28	47.24	18.87	20.87
T_{14}: 100% NK + 75% P enriched urban solid waste compost + PSB	47.23	50.39	19.76	21.86
S.Em±	0.36	0.39	0.36	0.40
CD at 5%	1.10	1.18	1.10	1.22

Table 4: Effect of phosphorus enriched composts on tiller per hill (No's) of finger millet at different days after transplanting at two locations

Treatment	Tillers hill^{-1} (No's)			
	60 DAT		At harvest	
	L_1	L_2	L_1	L_2
T_1: Absolute control (Without P)	1.67	1.78	1.71	2.07
T_2: POP 100% (NPK+FYM)	2.94	3.46	2.86	3.30
T_3: 100% NK + 25% P through enriched FYM+ PSB	2.20	2.34	2.25	2.35
T_4: 100% NK + 50% P through enriched FYM+ PSB	2.87	2.97	2.77	3.01
T_5: 100% NK + 75% P through enriched FYM+ PSB	2.93	3.11	2.84	3.19
T_6: 100% NK + 25% P through enriched vermicompost + PSB	2.53	2.57	2.57	2.64
T_7: 100% NK + 50% P through enriched vermicompost + PSB	3.13	3.42	3.04	3.46
T_8: 100% NK + 75% P through enriched vermicompost + PSB	3.47	3.63	3.44	3.78
T_9: 100% NK + 25% P enriched poultry manure + PSB	2.87	3.10	2.84	3.15
T_{10}: 100% NK + 50% P enriched poultry manure + PSB + PSB	3.47	3.59	3.24	3.64
T_{11}: 100% NK + 75% P enriched poultry manure + PSB + PSB	3.70	4.31	3.73	4.87
T_{12}: 100% NK + 25% P enriched urban solid waste compost + PSB	2.87	2.97	2.57	2.83
T_{13}: 100% NK + 50% P enriched urban solid waste compost + PSB	3.36	3.56	3.14	3.61
T_{14}: 100% NK + 75% P enriched urban solid waste compost + PSB	3.66	3.86	3.69	4.01
S.Em±	0.07	0.08	0.06	0.08
CD at 5%	0.20	0.23	0.19	0.25

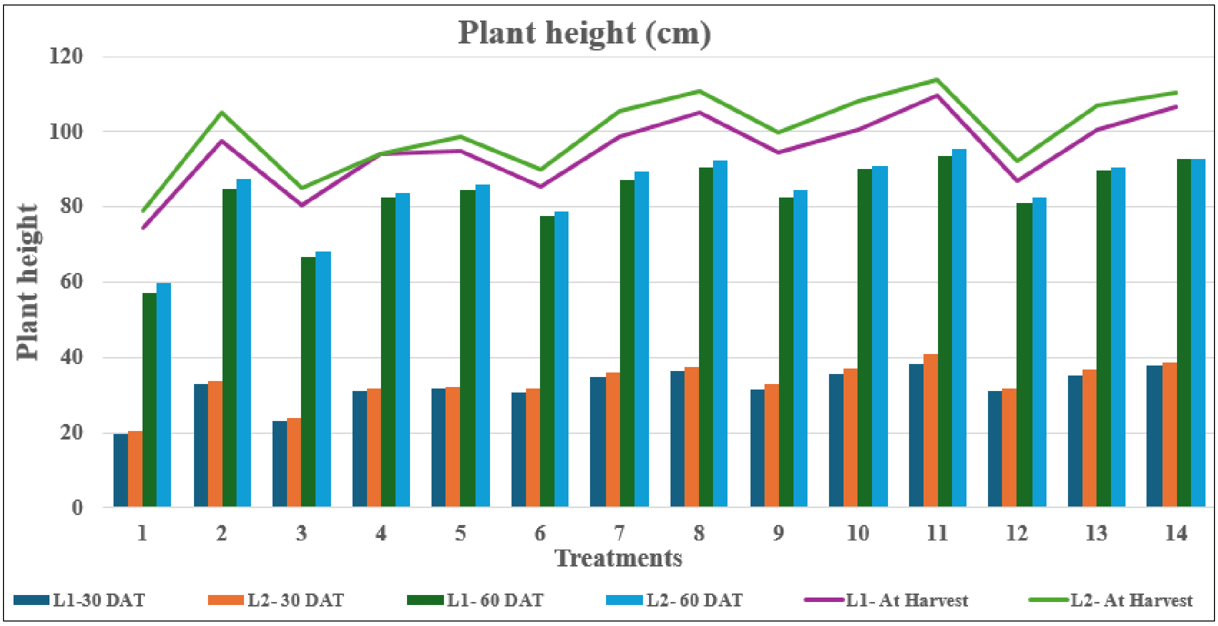

Fig 2: Effect of phosphorus enriched composts on plant height (cm) finger millet at different days after transplanting

Table 5: Residual effect of phosphorus enriched composts on plant height (cm) of French bean at different days after sowing

Treatment	Plant height (cm)					
	25 DAS		45 DAS		At harvest	
	L_1	L_2	L_1	L_2	L_1	L_2
T_1: Absolute Control (Without P)	18.89	16.99	32.87	29.57	38.59	36.14
T_2: POP 100% (NPK+FYM)	26.13	26.08	43.48	39.85	49.11	48.89
T_3: 100% NK + 25% P through enriched FYM+ PSB	21.16	17.38	37.40	30.71	42.56	40.97
T_4: 100% NK + 50% P through enriched FYM+ PSB	24.24	21.46	42.30	37.45	46.97	46.16
T_5: 100% NK + 75% P through enriched FYM+ PSB	26.09	23.51	43.07	39.31	48.29	47.28
T_6: 100% NK + 25% P through enriched vermicompost + PSB	22.34	18.08	39.84	32.24	44.77	43.10
T_7: 100% NK + 50% P through enriched vermicompost + PSB	28.09	22.08	44.92	41.18	49.80	47.94
T_8: 100% NK + 75% P through enriched vermicompost + PSB	29.55	28.74	47.10	45.81	52.93	51.27
T_9: 100% NK + 25% P enriched poultry manure + PSB	25.70	23.98	42.70	38.81	47.96	46.48
T_{10}: 100% NK + 50% P enriched poultry manure + PSB + PSB	29.36	27.59	45.43	43.40	51.02	50.95
T_{11}: 100% NK + 75% P enriched poultry manure + PSB + PSB	32.03	31.16	51.51	51.06	56.28	54.18
T_{12}: 100% NK + 25% P enriched urban solid waste compost + PSB	23.96	23.18	40.63	35.31	46.33	45.21
T_{13}: 100% NK + 50% P enriched urban solid waste compost + PSB	28.79	26.34	45.02	42.69	50.45	49.11
T_{14}: 100% NK + 75% P enriched urban solid waste compost + PSB	29.88	30.84	49.47	50.12	55.40	53.63
S.Em ±	0.43	0.54	0.55	0.76	0.55	0.56
CD at 5%	1.31	1.63	1.67	2.31	1.67	1.71

Table 6: Residual effect of phosphorus enriched composts on fresh pod yield (tons ha^{-1}) and haulm yield (kg ha^{-1}) of French bean

Treatment	Fresh Pod yield (tons ha^{-1})		Haulm yield (kg ha^{-1})	
	L_1	L_2	L_1	L_2
T_1: Absolute Control (Without P)	15.09	15.6	2416.62	2335.61
T_2: POP 100% (NPK+FYM)	22.73	23.2	2766.37	2490.25
T_3: 100% NK + 25% P through enriched FYM+ PSB	17.14	16.8	2520.19	2358.09
T_4: 100% NK + 50% P through enriched FYM+ PSB	21.34	19.5	2716.78	2398.42
T_5: 100% NK + 75% P through enriched FYM+ PSB	22.28	22.3	2733.42	2462.31
T_6: 100% NK + 25% P through enriched vermicompost + PSB	18.99	17.4	2661.84	2383.81
T_7: 100% NK + 50% P through enriched vermicompost + PSB	23.36	23.5	2796.75	2486.81
T_8: 100% NK + 75% P through enriched vermicompost + PSB	25.31	25.3	2834.16	2761.89
T_9: 100% NK + 25% P enriched poultry manure + PSB	22.22	21.4	2728.71	2453.98
T_{10}: 100% NK + 50% P enriched poultry manure + PSB + PSB	24.19	24.7	2815.29	2516.29
T_{11}: 100% NK + 75% P enriched poultry manure + PSB + PSB	28.25	27.1	2867.76	2868.88
T_{12}: 100% NK + 25% P enriched urban solid waste compost + PSB	20.13	18.3	2687.47	2394.28
T_{13}: 100% NK + 50% P enriched urban solid waste compost + PSB	23.92	24.2	2806.24	2494.03
T_{14}: 100% NK + 75% P enriched urban solid waste compost + PSB	27.17	26.0	2842.39	2742.92
S.Em±	0.42	0.43	14.68	18.90
CD at 5%	1.27	1.29	44.53	57.34

Table 7: Residual effect of phosphorus enriched composts on pod dry weight (q ha^{-1}) and harvest index (%) of French bean

Treatment	Pod dry weight (q ha^{-1})		Harvest index (%)	
	L_1	L_2	L_1	L_2
T_1: Absolute control (Without P)	22.29	23.96	47.98	50.64
T_2: POP 100% (NPK+FYM)	37.06	35.72	57.26	58.92
T_3: 100% NK + 25% P through enriched FYM+ PSB	24.78	24.80	49.58	51.26
T_4: 100% NK + 50% P through enriched FYM+ PSB	27.87	34.06	50.64	58.68
T_5: 100% NK + 75% P through enriched FYM+ PSB	36.76	35.08	57.35	58.76
T_6: 100% NK + 25% P through enriched vermicompost + PSB	25.86	25.82	49.28	52.00
T_7: 100% NK + 50% P through enriched vermicompost + PSB	37.76	37.67	57.45	60.24
T_8: 100% NK + 75% P through enriched vermicompost + PSB	40.66	38.96	58.93	58.52
T_9: 100% NK + 25% P enriched poultry manure + PSB	30.47	34.98	52.76	58.77
T_{10}: 100% NK + 50% P enriched poultry manure + PSB + PSB	38.56	38.80	57.80	60.66
T_{11}: 100% NK + 75% P enriched poultry manure + PSB + PSB	42.06	43.45	59.46	60.23
T_{12}: 100% NK + 25% P enriched urban solid waste compost + PSB	26.77	28.23	49.90	54.11
T_{13}: 100% NK + 50% P enriched urban solid waste compost + PSB	37.86	37.96	57.43	60.35
T_{14}: 100% NK + 75% P enriched urban solid waste compost + PSB	40.98	39.55	59.05	59.05
S.Em±	0.79	0.71	0.50	0.42
CD at 5%	2.40	2.14	1.51	1.27

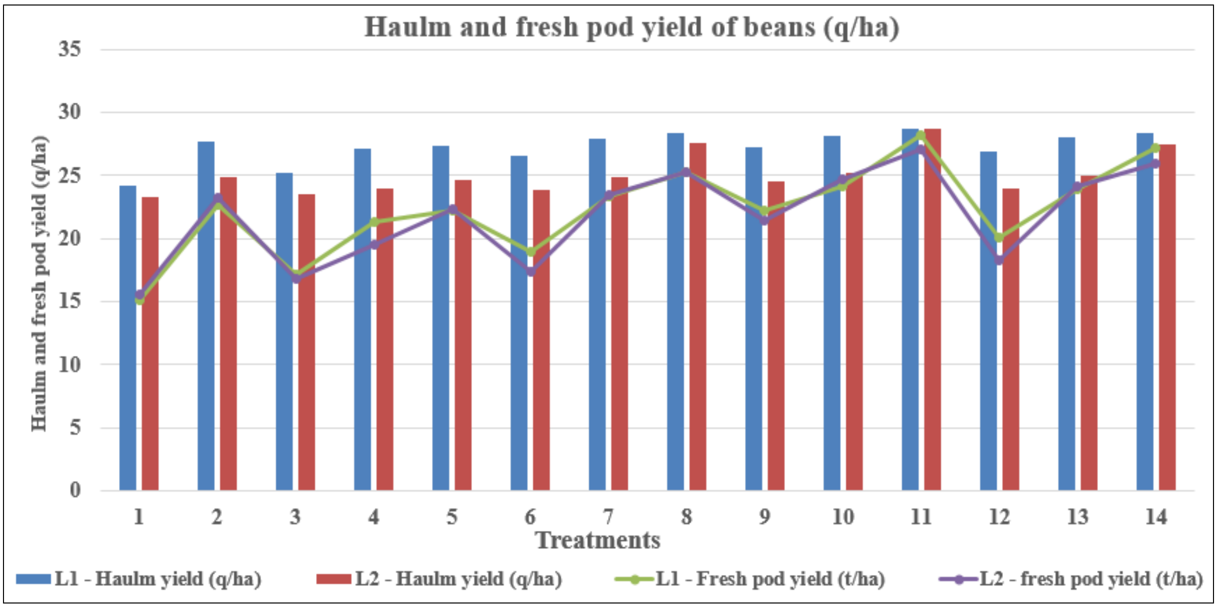

Fig 3: Residual effect of phosphorus enriched composts on fresh pod yield (tons ha^{-1}) and haulm yield (kg ha^{-1}) of French bean

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