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Influence of organic manure on nutrient content and yield performance

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Abstract

A field experiment was conducted to evaluate the influence of different organic manures and integrated nutrient management (INM) practices on nutrient concentration, nutrient uptake, and yield performance of finger millet (*Eleusine coracana*). The study compared enriched farmyard manure (EFYM), enriched poultry manure (EPM), enriched vermicompost (EVC), their integration with 75% recommended nitrogen dose (RDN), the recommended dose of fertilizers (RDF), and an untreated control under a randomized complete block design. Results revealed significant variation among treatments for grain yield, straw yield, nutrient concentration, and nutrient uptake. The treatment comprising 75% RDN + 25% nitrogen through enriched poultry manure (T₅) recorded the highest grain yield (2389.69 kg ha⁻¹), straw yield (6305.19 kg ha⁻¹), grain nitrogen concentration, and nitrogen and potassium uptake, demonstrating the superiority of integrated nutrient management. Treatments integrating enriched vermicompost (T₆) and the recommended fertilizer dose (T₇) also produced comparable yields and nutrient uptake. Enriched farmyard manure combined with chemical fertilizers (T₄) enhanced grain phosphorus and potassium concentrations, while enriched vermicompost improved phosphorus concentration in straw. The combined application of organic manures and inorganic fertilizers improved nutrient availability, enhanced microbial activity, promoted efficient nutrient partitioning, and sustained soil fertility compared with sole organic or chemical nutrient sources. The findings indicate that integrating enriched poultry manure with reduced chemical fertilizer is an effective strategy for improving finger millet productivity, nutrient use efficiency, and soil health. Adoption of integrated nutrient management practices can contribute to sustainable millet production, enhanced nutritional security, and resilient farming systems under rainfed conditions.

Keywords: Finger millet, integrated nutrient management, organic manure

Introduction

Finger millet (*Eleusine coracana*), commonly known as ragi, is one of the most important millet crops cultivated in India for both grain and fodder purposes under varied agro-climatic conditions. Its resilience and nutritional richness make it a key crop under India's Millet Mission, particularly for addressing malnutrition and strengthening food security in marginal lands. The crop possesses a high rejuvenation capacity after stress conditions, which makes it suitable for dryland farming. Finger millet grain contains about 65–75 percent carbohydrates, 8 percent protein, 15–20 percent dietary fiber, and 2.5–3.5 percent minerals. It is especially valued for its exceptionally high calcium content of 344 mg per 100 g grain, which is nearly ten times higher than rice or wheat, along with significant amounts of iron, zinc, dietary fiber, and essential amino acids. Millets, including finger millet, have long played an important role in the farming and food culture of semi-arid regions across Africa and Asia, sustaining millions of people due to their ability to withstand heat, drought, humidity, and tropical weather conditions.

In India, finger millet is predominantly grown and consumed in Karnataka, with smaller extents in Andhra Pradesh, Tamil Nadu, Odisha, Maharashtra, Goa, and Uttarakhand. Alfisols form the major soil order in Karnataka, where finger millet serves as a staple food. During 2016–17, Karnataka recorded 5.98 lakh hectares under finger millet cultivation with a production of 8.59 lakh tonnes and productivity of 1436 kg per hectare. At the national level, finger millet covered 1.19 million hectares with an annual production of 1.98 million tonnes and productivity of 1662 kg per hectare. In Tamil Nadu, finger millet was a prominent crop among small millets, with 0.86

lakh hectares under cultivation, 3.21 lakh tonnes of production, and productivity of 3714 kg per hectare in 2018. Finger millet is ranked as the third most important millet in India after sorghum and pearl millet, and it continues to serve as a staple food for many, especially in underprivileged regions, due to its high nutritional value and versatility.

Organic manures are increasingly recognized as vital inputs for sustainable agriculture, as they enrich soils with essential nutrients and improve long-term fertility. Studies have highlighted that organic amendments such as farmyard manure, poultry manure, and vermicompost increase soil organic carbon, improve nutrient retention, and stimulate microbial activity. Integrated use of organic inputs has been shown to enhance the availability of nitrogen, phosphorus, and potassium, resulting in higher crop yields compared to sole reliance on chemical fertilizers. Therefore, integrating organic nutrient management with finger millet cultivation not only improves soil nutrient content and yield performance but also contributes significantly to food security, soil health, and the sustainability of farming systems.

Materials and Methods

A field experiment was conducted to evaluate the comparative effects of enriched farmyard manure (EFYM), enriched poultry manure (EPM), and enriched vermicompost (EVC), along with NPK fertilizers, on the nutrient content and yield of finger millet (*Eleusine coracana*). The study was carried out at the Crop Field of the Department of Soil Science, Research Farm, Dr. Kalam Agricultural College, Kishanganj. The experimental design consisted of twenty plots, each measuring 4 m × 3 m, separated by 0.5 m margins to avoid nutrient overlap. The plots were arranged in three adjacent blocks, with each block containing eight plots to accommodate the treatment combinations.

Treatments detail

- T₁ Enriched FYM at recommended N equivalent basis
- T₂ Enriched Poultry manure at recommended N equivalent basis
- T₃ Enriched Vermi-compost at recommended N equivalent basis
- T₄ 75% RDN + 25% N equivalent through Enriched FYM
- T₅ 75% RDN + 25% N equivalent through Enriched Poultry manure
- T₆ 75% RDN + 25 N equivalent through Enriched Vermi-compost
- T₇ Recommended dose of fertilizers 50:40:25
- T₈ Absolute control

The treatments were arranged according to a randomized complete block design. Nitrogen in the form of urea was applied as a basal dose, with urea supplying 50 kg N ha⁻¹, DAP supplying 40 kg P₂O₅ ha⁻¹, and MOP supplying 25 kg K₂O ha⁻¹, which together provided the crop with a strong foundation during its early growth stages. In the research plots, finger millet was harvested and the total dried biomass yield from each plot was recorded. After threshing, the grains were separated, cleaned, and weighed to determine the grain yield per plot. The straw yield, expressed in kilograms per hectare, was calculated by subtracting the respective total grain weight from the total biomass yield of each plot. The harvest index was computed as the ratio of economic yield to biological yield per plot, as described by Salisbury and Ross (1986) [13]. Grain yield and straw yield response percentage was calculated as the relative increase or decrease in yield of a treatment compared to the control or reference plot. Plant samples collected for recording dry matter production at harvest were subsequently used for nutrient analysis. After recording the dry weight from each treatment, the

samples were powdered using a grinder, and the powdered material was analyzed for concentrations of macro and micro nutrient present in finger millet.

Results and Discussion

Grain and Straw yield

The grain yield of finger millet varied significantly across treatments, ranging from 733.43 to 2389.69 kg ha⁻¹. The highest grain yield (2389.69 kg ha⁻¹) was recorded under T₅ (75% RDN + 25% N through enriched poultry manure), which was statistically on par with T₆ (2185.44 kg ha⁻¹) and T₇ (2248.08 kg ha⁻¹). Moderate yields were observed under T₂ (1930.52 kg ha⁻¹), T₃ (1892.99 kg ha⁻¹), and T₄ (1715.67 kg ha⁻¹), while T₁ (1429.73 kg ha⁻¹) and the control (T₈: 733.43 kg ha⁻¹) recorded the lowest yields. Statistical grouping revealed that T₅, T₆, and T₇ (group 'a') consistently achieved the highest grain yields, T₂, T₃, and T₄ (group 'b') produced moderate yields, while T₁ (group 'c') and T₈ (group 'd') were distinctly lower.

Straw yield also showed significant variation, ranging between 1778.41 and 6305.19 kg ha⁻¹. The maximum straw yield (6305.19 kg ha⁻¹) was obtained under T₅, followed by T₇ (6009.72 kg ha⁻¹), T₆ (5902.73 kg ha⁻¹), T₂ (5719.63 kg ha⁻¹), and T₃ (5569.86 kg ha⁻¹). Moderate straw yield was recorded under T₄ (4677.25 kg ha⁻¹), while T₁ (2690.04 kg ha⁻¹) and the control (T₈: 1778.41 kg ha⁻¹) produced the lowest values. Grouping analysis indicated that T₂, T₃, T₅, T₆, and T₇ (group 'a') achieved the highest straw yields, T₄ (group 'b') had moderate yield, and T₁ and T₈ (group 'c') were significantly lower.

The superior performance of T₅, T₆, and T₇ highlights the importance of integrated nutrient management (INM), particularly the partial substitution of chemical fertilizers with enriched organic manures. The combination of enriched poultry manure with recommended nitrogen dose (T₅) proved most effective, likely due to improved nutrient availability, enhanced microbial activity, and better soil organic matter status. These findings are consistent with earlier reports by Singh *et al.* (2023) [9], who demonstrated that integrated use of organic inputs with chemical fertilizers enhances nitrogen, phosphorus, and potassium availability, resulting in higher crop yields. Similarly, Verma *et al.* (2024) [11] emphasized that organic amendments such as farmyard manure, poultry manure, and vermicompost improve soil properties by increasing organic carbon and nutrient retention, thereby supporting sustainable yield gains.

Nutrient grain and straw Concentration

Nitrogen

Grain nitrogen concentration in finger millet varied from 0.22 to 2.57% across treatments. The highest grain nitrogen concentration (2.57%) was recorded under T₅ (75% RDN + 25% N through enriched poultry manure), followed by T₆ (1.86%) and T₄ (1.57%). The lowest concentration (0.22%) was observed under the control treatment (T₈). Nitrogen concentration in straw ranged between 0.60 and 1.10%. The maximum straw nitrogen concentration (1.10%) was obtained under T₇ (Recommended Dose of Fertilizers), followed by T₅ (1.05%) and T₈ (1.01%), while the lowest value (0.60%) was recorded under T₁ (Enriched FYM). The results clearly indicate that integrated nutrient management treatments (T₅ and T₆) enhanced grain nitrogen concentration, while chemical fertilizer application (T₇) contributed more to straw nitrogen concentration. The superior performance of enriched poultry manure (T₅) in grain nitrogen concentration can be attributed to its high content of readily available nitrogen forms (uric acid, ammonium), which are quickly mineralized and absorbed by the crop. The role of poultry

manure in boosting grain nitrogen concentration has also been emphasized by Michaelraj and Shanmugam (2013) ^[7], who noted its superiority over FYM and vermicompost due to faster nutrient release.

Phosphorus

Grain phosphorus concentration in finger millet ranged from 0.18 to 0.27% across treatments. The maximum grain phosphorus concentration (0.27%) was recorded under T₄ (75% RDN + 25% N through enriched farmyard manure), followed by T₂ (0.25%) and T₇ (0.24%). The lowest concentration (0.18%) was observed under the control treatment (T₈).

Phosphorus concentration in straw varied between 0.11 and 0.18%. The highest straw phosphorus concentration (0.18%) was obtained under T₆ (75% RDN + 25% N through enriched vermicompost), followed by T₄, T₅, and T₇ (0.16%), while the lowest value (0.11%) was recorded under T₁ (Enriched FYM).

The results indicate that integrated nutrient management treatments (T₄ and T₆) were most effective in enhancing phosphorus concentration in grain and straw, respectively. The higher grain phosphorus concentration under T₄ suggests that enriched farmyard manure improved phosphorus mineralization and uptake efficiency, while the superior straw phosphorus concentration under T₆ reflects the balanced nutrient release from vermicompost, which supports sustained phosphorus availability in vegetative tissues. The moderate performance of T₂ and T₇ highlights the role of poultry manure and chemical fertilizers in supplying readily available phosphorus, though their effect was less pronounced compared to integrated treatments.

These findings are consistent with earlier reports by, Verma *et al.* (2024) ^[11] emphasized that organic amendments improve soil organic carbon and microbial activity, which in turn facilitate phosphorus solubilization and mobility. The role of vermicompost in enhancing phosphorus concentration has also been highlighted by Thilakarathna & Raizada (2015) ^[14], who noted that vermicompost improves nutrient cycling and bioavailability in semi-arid cropping systems.

Potassium

Grain potassium concentration in finger millet ranged from 0.49 to 0.63%. The highest concentration (0.63%) was recorded under T₄ (75% RDN + 25% N through enriched farmyard manure), followed by T₆ (0.62%), while T₂ and T₅ (0.59%) also showed relatively higher values. The lowest concentration (0.49%) was observed under the control treatment (T₈). Statistical grouping revealed that T₄ and T₆ (group 'a') achieved the highest grain potassium concentration, T₂, T₃, T₅, and T₇ (group 'b') recorded moderate concentrations, while T₁ (group 'c') and T₈ (group 'd') were distinctly lower.

Potassium concentration in straw varied between 1.90 and 2.14%. The maximum concentration (2.14%) was observed under T₄ and T₆, followed by T₅ (2.11%), whereas the lowest values were recorded under treatments with lower organic input contribution. The higher straw potassium concentration under T₄ and T₆ indicates that enriched farmyard manure and enriched vermicompost contributed to sustained potassium release and uptake in vegetative tissues, while integrated treatments ensured balanced nutrient supply to both grain and straw.

The results highlight the importance of integrated nutrient management (INM) in enhancing potassium concentration in finger millet. The superior performance of T₄ and T₆ can be attributed to the role of organic amendments in improving soil cation exchange capacity, reducing leaching losses, and enhancing microbial-mediated nutrient cycling. Vermicompost,

in particular, is known to improve potassium solubilization and availability due to its rich microbial population and humic substances. Farmyard manure contributes to long-term potassium retention in soil, which explains the higher concentrations observed in both grain and straw.

These findings are consistent with earlier reports by, Chaudhary & Bhandari (2001) ^[17] reported that farmyard manure and vermicompost improve potassium dynamics in soils, leading to better nutrient partitioning between grain and straw.

Nutrient uptake

Nitrogen uptake by grain in finger millet ranged from 1.58 to 61.87 kg ha⁻¹. The highest uptake (61.87 kg ha⁻¹) was recorded under T₅ (75% RDN + 25% N through enriched poultry manure), followed by T₆ (40.10 kg ha⁻¹), T₂ (27.27 kg ha⁻¹), and T₄ (26.20 kg ha⁻¹). Statistical grouping revealed that T₅ (group 'a') achieved the highest nitrogen uptake in grain, while T₂, T₄, and T₆ (group 'b') recorded moderate uptake. Treatments T₁, T₃, and T₇ (group 'c') showed lower uptake, and the control (T₈: 1.58 kg ha⁻¹) was distinctly the lowest (group 'd'). Nitrogen uptake by straw varied between 17.96 and 66.44 kg ha⁻¹. The maximum uptake was recorded under T₅ (66.44 kg ha⁻¹), which was statistically comparable to T₇ (66.08 kg ha⁻¹) and T₆ (51.19 kg ha⁻¹). Grouping analysis indicated that T₂, T₃, T₅, T₆, and T₇ (group 'a') achieved the highest straw nitrogen uptake, T₄ (group 'b') showed moderate uptake, while T₁ and T₈ (group 'c') were distinctly lower. The superior performance of T₅ (enriched poultry manure + reduced chemical fertilizer) highlights the effectiveness of integrated nutrient management in enhancing nitrogen uptake. Poultry manure is rich in readily available nitrogen forms, which are quickly mineralized and absorbed by the crop, thereby improving grain nitrogen uptake. The comparable performance of T₆ (enriched vermicompost) and T₇ (recommended fertilizer dose) in straw nitrogen uptake suggests that both organic and inorganic sources contribute to sustained nitrogen availability in vegetative tissues. These findings are consistent with earlier reports by Singh *et al.* (2023) ^[9] and Verma *et al.* (2024) ^[11].

Phosphorus uptake by grain in finger millet ranged from 1.37 to 5.53 kg ha⁻¹. The highest uptake (5.53 kg ha⁻¹) was recorded under T₇ (Recommended Dose of Fertilizers), followed by T₅ (5.43 kg ha⁻¹), T₆ (4.86 kg ha⁻¹), T₄ (4.68 kg ha⁻¹), and T₂ (4.67 kg ha⁻¹). Statistical grouping revealed that T₂, T₃, T₅, T₆, and T₇ (group 'a') achieved the highest grain phosphorus uptake, while T₁ (group 'b') showed moderate uptake, and the control (T₈: 1.37 kg ha⁻¹) was distinctly lower (group 'c'). Phosphorus uptake by straw varied between 2.59 and 10.57 kg ha⁻¹. The maximum uptake (10.57 kg ha⁻¹) was observed under T₆ (75% RDN + 25% N through enriched vermicompost), followed by T₅ (10.07 kg ha⁻¹) and T₇ (9.77 kg ha⁻¹). The lowest value (2.59 kg ha⁻¹) was recorded under the control (T₈). Grouping analysis indicated that T₅, T₆, and T₇ (group 'a') achieved the highest straw phosphorus uptake, T₂, T₃, T₄, and T₈ (group 'b') showed moderate uptake, while T₁ (group 'c') was distinctly lower. The superior performance of T₅, T₆, and T₇ highlights the importance of integrated nutrient management (INM) in enhancing phosphorus uptake. The higher grain phosphorus uptake under T₇ reflects the immediate availability of phosphorus from chemical fertilizers, while the higher straw phosphorus uptake under T₆ indicates the sustained release and solubilization effect of vermicompost. Poultry manure (T₅) also contributed significantly, owing to its balanced nutrient composition and faster mineralization compared to farmyard manure. These findings are consistent with recent studies. Kodigal *et al.* (2023) reported that substituting part of chemical fertilizers with farmyard manure improved soil

organic carbon and enhanced phosphorus uptake in finger millet under Alfisols of Karnataka. Alam *et al.* (2023) ^[16] found that vermicompost application significantly increased phosphorus uptake and protein content in finger millet, while integrated FYM + vermicompost improved soil fertility and crop quality. Singh *et al.* (2023) ^[9] emphasized that INM practices combining organic manures with fertilizers enhance nutrient uptake efficiency. Potassium uptake by grain in finger millet ranged from 3.59 to 14.07 kg ha⁻¹. The highest uptake (14.07 kg ha⁻¹) was recorded under T₅ (75% RDN + 25% N through enriched poultry manure), followed by T₆ (13.57 kg ha⁻¹) and T₇ (13.01 kg ha⁻¹). The lowest uptake (3.59 kg ha⁻¹) was observed under the control (T₈). Statistical grouping revealed that T₅, T₆, and T₇ (group 'a') achieved the highest grain potassium uptake, T₂, T₃, and T₄ (group 'b') showed moderate uptake, while T₁ (group 'c') and T₈ (group 'd') were distinctly lower. Potassium uptake by straw varied between 33.97 and 133.67 kg ha⁻¹. The maximum uptake (133.67 kg ha⁻¹) was recorded under T₅, followed by T₆ (126.29 kg ha⁻¹), T₇ (122.52 kg ha⁻¹), T₂ (116.08 kg ha⁻¹), and T₃ (114.22 kg ha⁻¹). Grouping analysis indicated that T₅, T₆, and T₇ (group 'a') achieved the highest straw potassium uptake, T₂, T₃, and T₄ (group 'b') showed moderate uptake, while T₁ (group 'c') and T₈ (group 'd') were distinctly lower. The superior performance of T₅, T₆, and T₇ highlights the importance of integrated nutrient management (INM) in enhancing potassium uptake. Poultry manure (T₅) provided readily available potassium and improved nutrient mineralization, while vermicompost (T₆) contributed to sustained nutrient release and enhanced microbial activity. The recommended fertilizer dose (T₇) ensured immediate nutrient availability, which explains its strong performance in both grain and straw uptake. The moderate uptake under T₂, T₃, and T₄ suggests that partial substitution with organic inputs improves nutrient efficiency but is less effective than poultry manure or vermicompost integration. These findings are consistent with recent studies Alam *et al.* (2023) ^[16].

Table 1: Effect of organic inputs on finger millets grain and straw yield

Treatments	Grain Yield (kg ha ⁻¹)	Straw (kg ha ⁻¹)	Harvest index %	Grain yield response %	Straw yield response %
T ₁	1429.73 ^c	2690.04 ^c	34.70	94.94	51.26
T ₂	1930.52 ^b	5719.63 ^a	25.24	163.22	321.61
T ₃	1892.99 ^b	5569.86 ^a	25.37	158.10	213.19
T ₄	1715.67 ^b	4677.25 ^b	26.84	133.92	163.00
T ₅	2389.69 ^a	6305.19 ^a	27.48	225.82	254.54
T ₆	2185.44 ^a	5902.73 ^a	27.02	197.98	231.91
T ₇	2248.08 ^a	6009.72 ^a	27.22	206.52	237.93
T ₈	733.43 ^d	1778.41 ^c	29.20		
S.Em(+)	119.93	478.63	0.418		
CD(P=0.05)	364.8	1455.91	1.279		

Table 2: Effect of organic inputs on finger millets nutrient concentration

Treatments	N concentration%		P concentration%		K concentration%	
	Straw	Grain	Straw	Grain	Straw	Grain
T ₁	0.60 ^c	1.01 ^b	0.11 ^c	0.24	1.94 ^c	0.53 ^c
T ₂	0.69 ^b	1.40 ^b	0.13 ^b	0.25	2.03 ^b	0.59 ^b
T ₃	0.72 ^b	1.21 ^b	0.15 ^a	0.23	2.05 ^b	0.57 ^b
T ₄	0.81 ^b	1.57 ^b	0.16 ^a	0.27	2.14 ^a	0.63 ^a
T ₅	1.05 ^a	1.97 ^a	0.16 ^a	0.22	2.11 ^a	0.59 ^b
T ₆	0.86 ^b	1.86 ^a	0.18 ^a	0.22	2.14 ^a	0.62 ^a
T ₇	1.10 ^a	0.58 ^c	0.16 ^a	0.24	2.04 ^b	0.57 ^b
T ₈	1.01 ^a	0.22 ^c	0.14 ^b	0.18	1.90 ^c	0.49 ^d
S.Em(+)	0.07	0.23	0.010	0.018	0.02	0.01
CD(P=0.05)	0.22	0.71	0.033	N/A	0.07	0.03

Table 3: Effect of organic inputs on finger millets nutrient uptake

Treatments	N Uptake (kg ha ⁻¹)		P Uptake (kg ha ⁻¹)		K Uptake (kg ha ⁻¹)	
	Straw	Grain	Straw	Grain	Straw	Grain
T ₁	16.13 ^f	14.44 ^e	4.11 ^c	3.66 ^b	72.88 ^c	7.66 ^c
T ₂	39.46 ^d	27.02 ^c	7.41 ^b	4.67 ^a	116.08 ^b	11.57 ^b
T ₃	40.10 ^d	22.90 ^d	8.31 ^b	4.38 ^a	114.22 ^b	10.81 ^b
T ₄	37.88 ^e	26.93 ^c	7.82 ^b	4.68 ^a	100.07 ^b	10.82 ^b
T ₅	66.20 ^a	47.07 ^a	10.07 ^a	5.43 ^a	133.67 ^a	14.07 ^a
T ₆	50.76 ^c	40.65 ^b	10.57 ^a	4.86 ^a	126.29 ^a	13.57 ^a
T ₇	60.70 ^b	13.03 ^e	9.77 ^a	5.53 ^a	122.52 ^a	13.01 ^a
T ₈	7.11 ^g	1.61 ^f	2.59 ^d	1.37 ^c	33.97 ^d	3.59 ^d
S.Em(+)	1.98	1.04	0.46	0.53	5.46	0.72
CD(P=0.05)	1.57	1.53	1.40	1.61	16.62	2.19

Conclusion

The present field experiment demonstrated that integrated nutrient management (INM) practices significantly enhanced the nutrient concentration, uptake, and yield of finger millet compared to sole organic or chemical inputs. Among the treatments, T₅ (75% RDN + 25% N through enriched poultry manure) consistently recorded the highest grain yield, nitrogen concentration, and nutrient uptake, while T₆ (enriched vermicompost + 75% RDN) and T₇ (recommended fertilizer dose) also performed strongly, particularly in straw nutrient uptake. The results clearly establish that balanced integration of organic manures with chemical fertilizers improves nutrient availability, enhances microbial activity, and sustains soil fertility. Poultry manure contributed to rapid nutrient mineralization and higher grain quality, while vermicompost and farmyard manure improved long-term nutrient retention and soil health. This synergy between organic and inorganic sources ensured higher productivity, better nutrient partitioning between grain and straw, and improved harvest index. These findings are in agreement with recent studies (Singh *et al.*, 2023; Kodigal *et al.*, 2023; Alam *et al.*, 2023; Verma *et al.*, 2024) ^[9, 16, 11], which emphasize that INM practices not only increase yield and nutrient uptake but also contribute to sustainable soil management under rainfed conditions. In conclusion, enriched poultry manure integrated with recommended nitrogen dose (T₅) emerged as the most effective treatment for maximizing yield and nutrient uptake in finger millet. Adoption of such INM strategies can play a vital role in strengthening food security, improving crop quality, and promoting sustainable agriculture in regions like Kishanganj, where finger millet serves as a climate-resilient staple.

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References

1. Azarmi R, Giglou MT, Taleshmikil RD. Influence of vermicompost on soil chemical and physical properties in tomato field. *Afr J Biotechnol.* 2008;7(14):2397-2401.
2. Food and Agriculture Organization of the United Nations. *Millets: Future smart food for nutrition and climate resilience.* Rome: Food and Agriculture Organization of the United Nations; 2021.
3. Gopalan C, Rama Sastri BV, Balasubramanian SC. *Nutritive value of Indian foods.* Hyderabad: Indian Council of Medical Research; 1989. Reprinted 2011.
4. Indiatat. *Indiatat.* 2018.
5. Kumar A, Dwivedi GK, Tewari S, Jaipaul, Sah VK, Singh H,

- et al.* Soil organic carbon pools under *Terminalia chebula* Retz. based agroforestry system in Himalayan foothills, India. *Curr Sci.* 2020;118(7):1093-1098.
6. Maharajan T, Antony Ceasar S, Ajeesh Krishna TP, Ignacimuthu S. Finger millet [*Eleusine coracana* (L.) Gaertn]: an orphan crop with a potential to alleviate the calcium deficiency in the semi-arid tropics of Asia and Africa. *Front Sustain Food Syst.* 2021;5:684447.
 7. Michaelraj PSJ, Shanmugam A. A study on millets based cultivation and consumption in India. *Int J Mark Technol.* 2013;3(12):1-11.
 8. Prasad JVS, Srinivasa Rao C, Srinivasa K, Naga Jyothi C, Venkateswarlu B, Ramachandrappa BK, *et al.* Effect of ten years of reduced tillage and recycling of organic matter on crop yields, soil organic carbon and its fractions in Alfisols of semi-arid tropics of southern India. *Soil Tillage Res.* 2016;156:131-139.
 9. Singh R, Amipara RP, Makwana BD. Impact of organic amendments on soil fertility and crop yield. *J Soil Sci.* 2023;16(Special Issue):1-11.
 10. Singh S, Devi NB, Divya D, Kumar A, Singh S, Tyagi G, *et al.* Soil fertility management: Role of organic amendments and bio-fertilizers: A review. *Int J Res Agron.* 2024;7(12):766-772.
 11. Verma S, Sharma R, Gupta A. Effect of organic manure on different soil properties: A review. *Int J Res Agron.* 2024;7(11):701-709.
 12. Wambi W, Otiunno G, Tumwesigye W, Mulumba J. Genetic and genomic resources for finger millet improvement: Opportunities for advancing climate-smart agriculture. *J Crop Improv.* 2021;35(2):204-233.
 13. Salisbury FB, Ross CW. *Plant physiology.* 4th ed. Belmont (CA): Wadsworth Publishing Company; 1986.
 14. Thilakarathna MS, Raizada MN. A review of nutrient management studies involving finger millet in the semi-arid tropics of Asia and Africa. *Agronomy.* 2015;5(3):262-290.
 15. Prabhakar M, Gopinath KA, Sai Sravan U, Srasvan Kumar G, Thirupathi M, Samba Siva G, *et al.* Potential for yield and soil fertility improvement with integration of organics in nutrient management for finger millet under rainfed Alfisols of Southern India. *Front Nutr.* 2023;10:1095449.
 16. Alam M, Kumar A, Singh R, Yadav P. Impact of vermicompost and farmyard manure on nutrient uptake and quality of finger millet (*Eleusine coracana* L.). *Int J Plant Soil Sci.* 2023;35(24):120-131.
 17. Chaudhary DR, Bhandari AL. Organic manures and crop productivity: A review. *Indian J Agron.* 2001;46(2):201-206.