



Influence of Different Composting Treatments on the Quality of Turmeric Leaves Compost

**A. D. Patil ^{a*}, D. S. Potdar ^a, V. N. Nale ^a, S. D. Kale ^b,
R. A. Karande ^c, D. D. Takbhate ^a and H. A. Patare ^a**

^a *Division of Soil Science, RCSM Government College of Agriculture, Kolhapur, Maharashtra, India.*

^b *Agriculture Research Station, Kasbe Digraj, Sangli, Maharashtra, India.*

^c *Division of Plant Pathology, RCSM Government College of Agriculture, Kolhapur, Maharashtra, India.*

Authors' contributions

This work was carried out in collaboration among all authors. Author ADP conducted the experiment, collected and analysed the data, and prepared the manuscript. Author DSP supervised the research work and provided guidance during the experiment and manuscript preparation. Author SDK contributed to the experimental work. Author VNN and RAK provided technical guidance and other did support throughout the research work. All authors read and approved the final manuscript.

Article Information

DOI: <https://doi.org/10.9734/ijpss/2026/v38i106367>

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://pr.sdiarticle5.com/review-history/167600>

Original Research Article

Received: 06/08/2026

Accepted: 03/10/2026

Published: 05/10/2026

Abstract

An experiment was conducted to evaluate the effect of different composting treatments on the quality of compost prepared from turmeric leaves at the Agricultural Research Station, Kasabe Digraj, Sangli, Maharashtra, during 2025. Seven treatments, with three replications, were evaluated in a Completely Randomised Design (CRD). Turmeric leaves were composted with FYM, MPKV decomposing culture, Pusa Decomposer and nutrient amendments (urea and SSP), separately and in combinations. Mature compost was analysed for moisture, pH, electrical conductivity, total organic carbon, C:N ratio, nitrogen, phosphorus, potassium, sulphur, iron, manganese, zinc and copper. Significant differences among treatments were recorded for moisture, EC, TOC, C:N ratio and macro- and micronutrient contents, whereas pH did not differ significantly. The moisture content ranged from 20.11 to 23.57%, EC from 1.28 to 2.14 dS m⁻¹, TOC from 22.74 to 31.17% and C:N ratio from 13.14 to 19.85. Treatment T₇ (turmeric leaves + FYM + Pusa Decomposer + urea + SSP) recorded the highest N (1.73%), P (0.58%), K (2.12%) and S (0.77%) contents, along with Fe

*Corresponding author: E-mail: patilajay1803@gmail.com;

Cite as: Patil, A. D., Potdar, D. S., Nale, V. N., Kale, S. D., Karande, R. A., Takbhate, D. D., & Patare, H. A. (2026). Influence of Different Composting Treatments on the Quality of Turmeric Leaves Compost. *International Journal of Plant & Soil Science*, 38(10), 482–488. <https://doi.org/10.9734/ijpss/2026/v38i106367>

(3513 mg kg⁻¹), Mn (361.30 mg kg⁻¹), Zn (163.98 mg kg⁻¹) and Cu (44.62 mg kg⁻¹). The lowest C:N ratio (13.14) and shortest maturity period (78.77 days) were also recorded in T₇, whereas T₂ required the longest period (119.84 days) to reach maturity. All treatments were within the specified FCO limits for the measured quality parameters. It was concluded that the combined application of FYM, decomposing culture and nutrient amendments improved the nutrient composition and accelerated the stabilisation of turmeric leaf compost.

Keywords: Turmeric leaves; composting; decomposing cultures; nutrient amendments; compost quality; compost maturity; C:N ratio.

1. Introduction

Turmeric (*Curcuma longa* L.) is an important spice crop in India and is widely cultivated in Maharashtra. After harvest, a large quantity of turmeric leaf biomass is generated, which is either allowed to rot in fields, disposed of as agricultural residue or burned. These leaves contain considerable organic matter and plant nutrients and can therefore be effectively recycled through composting to produce a stable organic fertiliser (Albaqami *et al.*, 2022).

Composting is a biological process in which microorganisms convert agricultural residues into stable organic substances (Mahapatra *et al.*, 2022). During decomposition, easily degradable materials are broken down first, followed by more resistant fractions, resulting in a gradual decrease in organic carbon and C:N ratio and stabilisation of the compost. The quality of mature compost depends on its physicochemical properties and nutrient composition. The levels of major nutrients such as nitrogen, phosphorus, potassium and sulphur may change during decomposition due to mineralisation and loss of organic carbon (Kalamdhad *et al.*, 2009). Recent studies indicate that additive selection, microbial inoculation and feedstock characteristics can influence lignocellulosic degradation, organic-matter transformation and compost maturation (Noor *et al.*, 2024; Wang *et al.*, 2024; El Fels *et al.*, 2024).

The addition of FYM, decomposing cultures and nutrient amendments can influence decomposition and the quality of the final compost. FYM provides organic matter, nutrients and microorganisms (Qureshi *et al.*, 2014). The addition of decomposing cultures helps to break down complex organic materials and may accelerate stabilisation (Game *et al.*, 2016). However, limited information is available on the quality of compost prepared from turmeric leaves. Recycling such agricultural wastes will certainly have great significance for agriculture and soil management in the future. There will also be environmental gains, such as the creation of healthy surroundings and the proper utilisation of all recyclable materials rather than considering them waste materials. Mineral enrichment has also been associated with improved nutrient composition and C:N characteristics of mature compost, while decomposer-assisted composting of lignocellulosic shoot residues has shown enhanced nutrient mineralisation and more rapid decomposition (Shirin *et al.*, 2024; Sumanraj *et al.*, 2026). Although composting approaches for diverse agricultural residues have been investigated, the response of turmeric leaf biomass to combined FYM, decomposer cultures and nutrient amendments, particularly in terms of compost quality and maturity, remains insufficiently documented.

Therefore, the present study was conducted to assess the impact of various formulations involving farmyard manure (FYM), decomposer cultures and nutrients on the quality of compost obtained from turmeric leaves.

2. Material and Methods

2.1 Experimental Site and Design

An experiment was conducted at the Agricultural Research Station, Kasabe Digraj, Sangli, Maharashtra, using a Completely Randomised Design (CRD) with seven treatments and three replications. Composting beds made of HDPE sheets, with a diameter of 1.0 m and a height of 1.0 m, were used.

2.2 Compost Preparation and Treatments

Turmeric leaves were chopped into 5–6 cm pieces and used as the principal raw material. FYM was added in an equal proportion to turmeric leaves wherever applicable. MPKV decomposing culture and Pusa Decomposer were applied at 1 kg t⁻¹ of raw material, while urea and SSP were applied at 8 and 10 kg t⁻¹, respectively. The treatments comprised turmeric leaves with FYM, MPKV decomposing culture or Pusa Decomposer, along with combinations involving FYM and nutrient amendments (urea + SSP) (Table 1).

Table 1. Treatment details

Treatments	Composition
T ₁	Turmeric leaves + FYM
T ₂	Turmeric leaves + MPKV decomposing culture
T ₃	Turmeric leaves + FYM + MPKV decomposing culture
T ₄	Turmeric leaves + FYM + MPKV decomposing culture + Urea + SSP
T ₅	Turmeric leaves + Pusa Decomposer
T ₆	Turmeric leaves + FYM + Pusa Decomposer
T ₇	Turmeric leaves + FYM + Pusa Decomposer + Urea + SSP

2.3 Sampling and Quality Analysis

Representative samples of mature compost were collected from each treatment and replication and examined for moisture content, pH, EC, organic carbon content and C:N ratio using standard analytical techniques. Macronutrients such as N, P, K and S and micronutrients such as Fe, Mn, Zn and Cu were analysed. Nitrogen content was estimated using the Kjeldahl method, whereas phosphorus and potassium were estimated using colorimetry and flame photometry, respectively. Micronutrients were determined by Atomic Absorption Spectroscopy (AAS). Cellulose, hemicellulose and lignin contents of turmeric leaves were estimated using the Van Soest method. The maturity of compost was estimated based on the C:N ratio, which is widely accepted as an indicator of compost stabilisation. Compost was considered mature when the C:N ratio reached 20:1. The linear interpolation method (Chapra & Canale, 2015) was used to estimate the exact maturity time in days.

2.4 Statistical Analysis

The data were analysed using a CRD with three replications. Treatment means were compared using the critical difference (CD) at the 5 per cent level of significance.

3. Results and Discussion

3.1 Initial Characteristics of Raw Materials (Table 2)

Physicochemical and nutritional attributes were recorded for the raw materials used for composting, which included turmeric leaves and FYM. Turmeric leaves exhibited higher TOC (47.16%), moisture (44.73%) and C:N ratio (35.75), while FYM had a lower C:N ratio (27.44) and higher concentrations of iron, zinc, copper and manganese, suggesting its suitability as a nitrogen and nutrient source during the composting process. The concentrations of nitrogen, phosphorus, potassium and sulphur in turmeric leaves were 1.32%, 0.32%, 1.49% and 0.48%, respectively, whereas those in FYM were 0.93%, 0.39%, 0.71% and 0.35%, respectively. Furthermore, the cellulose, hemicellulose and lignin contents of turmeric leaves were 26%, 34% and 14%, respectively.

3.2 Physico-Chemical Characteristics of Mature Compost

3.2.1 Moisture Content

The moisture content of mature turmeric leaf compost varied from 20.11% to 23.57%. Treatment T7 exhibited the minimum moisture content (20.11%), similar to T6 (20.66%) and T4 (21.18%). However, the maximum moisture content was observed in treatment T2 (23.57%). The minimum moisture contents in treatments T7, T6 and T4 might be attributed to a rapid decomposition rate, microbial heat production and subsequent moisture loss through evaporation. A reduction in moisture content during composting was also reported by Anand *et al.* (2023), who observed that moisture content declined progressively during composting, mainly due to heat generation from microbial activity and increased evaporation during the thermophilic phase.

3.2.2 pH

The pH of mature turmeric leaf compost ranged from 7.32 to 7.46. The maximum pH was recorded for treatment T2 (7.46), followed by treatment T5 (7.44) and T1 (7.38), whereas the minimum pH was recorded for treatment T7 (7.32). There were no significant differences among the treatments in pH. The slightly alkaline pH values in mature compost might have occurred due to ammonia production during decomposition, followed by ammonia volatilisation, nitrification and humification during composting. All treatments fell within the FCO standard pH range of 6.5–7.5. The present results are inconsistent with those reported by Yang *et al.* (2023), who noted that microbial inoculation promoted an initial rise in pH during active decomposition, followed by stabilisation in the later stages of composting.

3.2.3 Electrical Conductivity

The electrical conductivity (EC) values of mature compost ranged from 1.28 to 2.14 dS m⁻¹. Treatment T2 showed the minimum EC of 1.28 dS m⁻¹, followed by T5 at 1.30 dS m⁻¹, while treatments T7 (2.14 dS m⁻¹) and T4 (2.13 dS m⁻¹) exhibited the highest EC values. The high EC values might have resulted from the application of FYM, decomposer culture, urea and SSP in treatments T4 and T7. This might have facilitated greater dissolution of nutrients released during decomposition. Treatments T2 and T5 showed low EC because they were provided only with decomposer culture and turmeric leaves. All treatments met the FCO permissible limit of less than 4.0 dS m⁻¹. Similar findings were reported by Jothimani *et al.* (2025), who observed a gradual increase in EC throughout composting, with biomineraliser-treated compost recording higher EC than the control due to accelerated organic matter degradation and greater availability of soluble nutrients.

3.2.4 Total Organic Carbon

The organic carbon content of mature turmeric leaf compost ranged from 22.74 to 31.17 per cent. T2 recorded the maximum organic carbon content (31.17%), followed by T5 (30.67%), whereas the minimum was recorded in T7 (22.74%), followed by T4 (23.37%). The comparatively higher carbon content in T2 and T5 may be related to the slower breakdown of organic material. The lower values in T4, T6 and T7 suggest greater utilisation and conversion of carbon during composting, particularly through microbial utilisation of carbon for energy production where FYM and decomposing cultures were combined with nutrient amendments. This observation aligns with Varma *et al.* (2015), who reported that inoculation with *Phanerochaete chrysosporium* improved organic matter decomposition, leading to a greater reduction in TOC content, especially due to greater breakdown of lignocellulosic substrates. The organic carbon content in all treatments remained above the FCO minimum requirement of 14 per cent.

Table 2. Initial characteristics of substrate used

Raw Material	TOC (%)	Moisture (%)	C:N ratio	pH (1:10)	EC (dS m ⁻¹)	N	P	K	S	Fe	Zn	Cu	Mn	Cellulose	Hemicellulose	Lignin
								(%)			(mg kg ⁻¹)				(%)	
Turmeric Leaves	47.16	44.73	35.75	–	–	1.32	0.32	1.49	0.48	405.60	54.40	19.00	39.04	26.00	34.00	14.00
FYM	25.52	24.13	27.44	6.70	1.89	0.93	0.39	0.71	0.35	2565.00	168.25	37.50	406.75	–	–	–

Table 3. Physico-chemical properties, nutrient composition and maturity period of turmeric leaves compost

Treatment	Moisture (%)	pH (1:10)	EC (dSm ⁻¹)	TOC (%)	C:N ratio	TN (%)	TP (%)	TK (%)	TS (%)	Fe (mg kg ⁻¹)	Mn (mg kg ⁻¹)	Zn (mg kg ⁻¹)	Cu (mg kg ⁻¹)	Days for maturity
T ₁	22.49	7.38	1.97	26.83	16.17	1.66	0.51	1.89	0.67	2889	312.20	146.10	37.74	107.23
T ₂	23.57	7.46	1.28	31.17	19.85	1.57	0.46	1.63	0.57	2253	226.97	121.82	23.91	119.84
T ₃	22.48	7.36	2.02	25.22	15.03	1.68	0.52	1.95	0.70	3169	323.60	152.80	40.77	95.13
T ₄	21.18	7.35	2.13	23.37	13.68	1.71	0.56	2.07	0.73	3374	349.40	160.37	43.91	83.02
T ₅	23.45	7.44	1.30	30.67	19.17	1.60	0.47	1.75	0.60	2384	238.40	129.20	25.80	115.74
T ₆	20.66	7.36	2.03	24.24	14.36	1.69	0.54	1.97	0.71	3324	340.70	157.02	42.87	88.84
T ₇	20.11	7.32	2.14	22.74	13.14	1.73	0.58	2.12	0.77	3513	361.30	163.98	44.62	78.77
SE ±	0.76	0.05	0.03	0.55	0.85	0.02	0.02	0.03	0.01	61.35	6.31	2.91	0.65	0.77
CD @ 5%	2.33	NS	0.09	1.66	3.06	0.06	0.06	0.08	0.04	186.09	19.14	8.83	1.97	2.34
FCO std.	< 25.0	6.5–7.5	< 4.0	≥ 14.0	< 20	≥ 0.5	≥ 0.5	≥ 0.5	-	-	-	≤ 1000	≤ 300	-

Note: TOC = Total Organic Carbon; C:N = Carbon to Nitrogen ratio; TN = Total Nitrogen; TP = Total Phosphorus; TK = Total Potassium; TS = Total Sulphur; Fe = Iron; Mn = Manganese; Zn = Zinc; Cu = Copper

3.2.5 C:N Ratio

The C:N ratio is considered an important indicator for assessing compost maturity. The C:N ratio varied from 13.14 to 19.85. Treatment T2 recorded the highest C:N ratio at 120 days of composting (19.85), followed by T5 (19.17). In contrast, the lowest C:N ratio was observed in T7 (13.14), followed by T4 (13.68) and T6 (14.36). The low C:N ratios obtained in treatments T4 and T7 could be due to the presence of nitrogen and phosphorus derived from FYM, urea and SSP, thereby favouring microbial utilisation of carbon-containing substrates. Similar trends were reported by Dhapate *et al.* (2018), who observed a reduction in the C:N ratio during sugarcane trash composting due to enhanced decomposition by cellulolytic fungal cultures. According to Game *et al.* (2016), the C:N ratio continuously decreased with increasing composting time. The inoculated composts exhibited a greater reduction in the C:N ratio compared with the uninoculated compost. This implies improved compost maturity. A reduction in the C:N ratio to less than 20 in all treatments shows that the compost attained maturity, as recommended by the FCO standard.

3.3 Nutrient Characteristics of Mature Compost

3.3.1 Macronutrient Content

The major nutrients, viz., nitrogen, phosphorus, potassium and sulphur, in mature compost differed significantly among treatments. The combined application of FYM, decomposer cultures and nutrient amendments (urea + SSP) resulted in higher nutrient concentrations compared with treatments receiving individual inputs.

At the end of 120 days of composting, total N, P, K and S varied within ranges of 1.57–1.73%, 0.46–0.58%, 1.63–2.12% and 0.49–0.77%, respectively. The maximum amounts of total N, P, K and S were observed in treatment T7, which had 1.73%, 0.58%, 2.12% and 0.77%, respectively. Total N in treatment T7 was followed by T4 (1.71%), T6 (1.69%) and T3 (1.68%). Total P in treatment T7 was comparable with T4 (0.56%), T6 (0.54%) and T3 (0.52%). Likewise, total K (2.12%) and S (0.77%) in T7 were comparable with T4 (2.07%) and T4 (0.73%), respectively. The lowest amounts of total N, P, K and S were found in T2. The greater nutrient contents observed in treatments T7 and T4 might be attributed to increased mineralisation and better nutrient availability. FYM provided additional nutrients, whereas decomposers aided the breakdown of complex organic compounds, and urea and SSP provided additional amounts of N and P, respectively. Loss of carbon as CO₂ results in a decrease in the weight of organic matter, thereby increasing the relative concentration of nutrients. The results are consistent with the findings of Verma *et al.* (2024), who observed variations in nutrient contents during the composting of banana plant waste using various microbial inocula. This variation may be attributed to microbial degradation of organic matter, thereby improving nutrient transformation. Hulage *et al.* (2025) also observed an increasing trend in nutrient contents at the maturity stage after composting the biomass of various weeds, which could be attributed to the mineralisation of organic nutrients.

3.3.2 Micronutrient Content

After 120 days of composting, the micronutrient contents of mature turmeric leaf compost varied significantly among the treatments. T₇ (Turmeric leaves + FYM + Pusa decomposer + urea + SSP) recorded the highest Fe, Mn, Zn and Cu contents, with values of 3513, 361.30, 163.98 and 44.62 mg kg⁻¹, respectively. The Fe (3374 mg kg⁻¹), Mn (349.40 mg kg⁻¹) and Cu (43.91 mg kg⁻¹) contents in T₇ were at par with T₄, while the Zn content was at par with T₄ (160.37 mg kg⁻¹) and T₆ (157.02 mg kg⁻¹). In contrast, T₂ recorded the lowest concentrations of Fe (2253 mg kg⁻¹), Mn (226.97 mg kg⁻¹), Zn (121.82 mg kg⁻¹) and Cu (23.91 mg kg⁻¹). The greater micronutrient concentration in T₇ may be attributed to the contribution of FYM and improved mineralisation during decomposition. Progressive degradation of organic matter and loss of carbon through microbial respiration reduce the compost mass, thereby increasing the relative concentration of mineral elements. Conversion of organically bound micronutrients into more available forms and their association with stable organic complexes may further contribute to their accumulation in mature compost. Similar findings were reported by Kopeć *et al.* (2018), who observed increased Fe, Zn, Cu and Mn contents during the composting of poultry waste mixed with maize and different additives, which was associated with nutrient concentration and organometallic interactions during decomposition.

3.4 Maturity Period of Compost

The time required to reach maturity among the various treatments ranged from 78.77 to 119.84 days. Maturity was considered to have been reached when the C:N ratio reached 20:1. The shortest maturity period was observed in treatment T7 (78.77 days), followed by treatment T4 (83.02 days). In contrast, the longest duration required to achieve maturity was recorded in treatment T2 (119.84 days). The shorter maturity periods can be explained by better nutrient availability and higher microbial activity in treatments T7 and T4.

4. Conclusion

The present study revealed that quality compost can be produced from turmeric leaf biomass in combination with FYM, decomposer inoculants and nutrients. In the current investigation, treatment T₇ (turmeric leaves + FYM + Pusa decomposer + urea + SSP) produced optimum-quality compost compared with the other treatments, based on its high contents of N, P, K, S and micronutrients, along with suitable pH, EC, moisture and organic carbon and a lower C:N ratio. All treatments met the standards specified by FCO for the selected quality attributes. Compost maturity was achieved most rapidly in treatment T₇, within 78.77 days of composting, indicating better decomposition and stability. Therefore, the combined application of FYM, Pusa decomposer and

nutrients in treatment T₇ produced a stable compost enriched with nutrients, indicating the efficient reutilisation of turmeric leaf waste biomass as compost.

5. Limitation

This study evaluated compost quality under one experimental setting using seven treatment combinations and selected physicochemical, macro- and micronutrient indicators. The findings therefore describe the tested composting conditions and should be interpreted within that experimental scope. Assessment across additional composting cycles, locations, and use conditions would help establish the consistency of the observed treatment responses.

Acknowledgements

The authors sincerely acknowledge the support and facilities provided by the Agricultural Research Station, Kasbe Digraj, Sangli, and RCSM Government College of Agriculture, Kolhapur, for conducting the present study. The authors are grateful to the technical and field staff for their valuable assistance during the preparation, maintenance and sampling of the composting experiment. The authors also acknowledge the support and cooperation received during the laboratory analysis and completion of the research work.

Declaration of AI Use

This manuscript was prepared through the intellectual contributions of the author(s) to the study design, data analysis, interpretation of results, and scholarly content. Grammarly and ChatGPT were used solely to assist with grammatical refinement and reference formatting during manuscript revision. The author(s) accept full responsibility for the accuracy, integrity, and final content of the manuscript.

Competing Interests

The authors declare that they have no competing interests.

References

- Albaqami, J. J., Hamdi, H., Narayanankutty, A., Visakh, N. U., Sasidharan, A., Kuttithodi, A. M., Famurewa, A. C., & Pathrose, B. (2022). Chemical composition and biological activities of the leaf essential oils of *Curcuma longa*, *Curcuma aromatica* and *Curcuma angustifolia*. *Antibiotics*, 11(11), 1547. <https://doi.org/10.3390/antibiotics11111547>
- Anand, Prakasha, H. C., & Subbarayappa, C. T. (2023). Studies on variations in physico-chemical, biochemical and biological characteristics at different maturity stages of segregated and unsegregated urban solid waste of drum compost. *International Journal of Plant & Soil Science*, 35(13), 1–15. <https://doi.org/10.9734/ijpss/2023/v35i132981>
- Chapra, S. C., & Canale, R. P. (2015). *Numerical methods for engineers* (7th ed.). McGraw-Hill Education.
- Dhapate, S. S., Dilpak, S. A., & Pawar, R. K. (2018). Studies on effect of cellulolytic fungi on decomposition of sugarcane trash. *Journal of Pharmacognosy and Phytochemistry*, 7(Special Issue 1), 2975–2977.
- El Fels, L., Naylo, A., Jemo, M., Zrikam, N., Boularbah, A., Ouhdouch, Y., & Hafidi, M. (2024). Microbial enzymatic indices for predicting composting quality of recalcitrant lignocellulosic substrates. *Frontiers in Microbiology*, 15, 1423728. <https://doi.org/10.3389/fmicb.2024.1423728>
- Game, B., Deokar, C., & Navale, A. (2016). Composting of organic wastes using newly developed cellulolytic microbial consortium. *International Journal of Agriculture, Environment and Biotechnology*, 9(4), 525–534. <https://doi.org/10.5958/2230-732X.2016.00069.3>
- Hulage, M. B., Thakare, R. S., Kamble, B. M., & Shelke, S. R. (2025). Evaluation of nutrient potential in compost prepared using various weed species. *Journal of Agriculture Research and Technology*, 50(3), 330–333. <https://doi.org/10.56228/JART.2025.50313>
- Jothimani, P., Sathyan, S., Raja, S., Muthusamy, S., Chidambaram, P., Paraval, N., & Subramaniyan, R. (2025). Bioconversion of banana pseudostem into value added bio manure. *International Journal of Environment and Climate Change*, 15(11), 386–399. <https://doi.org/10.9734/ijecc/2025/v15i115121>
- Kalamdhad, A. S., Singh, Y. K., Ali, M., Khwairakpam, M., & Kazmi, A. A. (2009). Rotary drum composting of vegetable waste and tree leaves. *Bioresource Technology*, 100(24), 6442–6450. <https://doi.org/10.1016/j.biortech.2009.07.030>
- Kopeć, M., Gondek, K., Mierzwa-Hersztek, M., & Antonkiewicz, J. (2018). Factors influencing chemical quality of composted poultry waste. *Saudi Journal of Biological Sciences*, 25(8), 1678–1686. <https://doi.org/10.1016/j.sjbs.2016.09.012>
- Mahapatra, S., Ali, M. H., & Samal, K. (2022). Assessment of compost maturity-stability indices and recent development of composting bin. *Energy Nexus*, 6, 100062. <https://doi.org/10.1016/j.nexus.2022.100062>
- Noor, R. S., Shah, A. N., Tahir, M. B., Umair, M., Nawaz, M., Ali, A., Ercisli, S., Abdelsalam, N. R., Ali, H. M., Yang, S. H., Ullah, S., & Assiri, M. A. (2024). Recent trends and advances in additive-mediated composting technology for agricultural waste resources: A comprehensive review. *ACS Omega*, 9(8), 8632–8653. <https://doi.org/10.1021/acsomega.3c06516>
- Qureshi, S. A., Rajput, A., Memon, M., & Solangi, M. A. (2014). Nutrient composition of rock phosphate enriched compost from various organic wastes. *E3 Journal of Scientific Research*, 2(3), 47–51.
- Shirin, K. S. A., Aparna, B., Rani, B., Mini, V., Bindhu, J. S., & Sreelekshmi, M. (2024). Production and characterization of mineral-enriched NADEP composts for enhanced soil fertility. *International Journal of Environment and Climate Change*, 14(11), 52–59. <https://doi.org/10.9734/ijecc/2024/v14i114527>

- Sumanraj, P. N., Kallimani, C. S., Doreswamy, C., Venkatesha, B. K., & Hadnur, A. (2026). Evaluation of quality of compost produced from shredded mulberry shoots (SMS) using different decomposers. *Uttar Pradesh Journal of Zoology*, 47(4), 1–12. <https://doi.org/10.56557/upjoz/2026/v47i45506>
- Varma, V. S., Ramu, K., & Kalamdhad, A. S. (2015). Carbon decomposition by inoculating *Phanerochaete chrysosporium* during drum composting of agricultural waste. *Environmental Science and Pollution Research*, 22(10), 7851–7858. <https://doi.org/10.1007/s11356-014-3989-y>
- Verma, L. K., Raj, K. K., Dippal, Ismail, S., Chowdhury, T., & Soni, R. (2024). Banana plant waste composting through microbial inoculation and its performance in spinach. *International Journal of Recycling of Organic Waste in Agriculture*, 13(5). <https://doi.org/10.57647/ijrowa-e53s-31d4>
- Wang, Y., Yu, Q., Zheng, C., Wang, Y., Chen, H., Dong, S., & Hu, X. (2024). The impact of microbial inoculants on large-scale composting of straw and manure under natural low-temperature conditions. *Bioresource Technology*, 400, 130696. <https://doi.org/10.1016/j.biortech.2024.130696>
- Yang, Q., Zhang, S., Li, X., Rong, K., Li, J., & Jiang, L. (2023). Effects of microbial inoculant and additives on pile composting of cow manure. *Frontiers in Microbiology*, 13, 1084171. <https://doi.org/10.3389/fmicb.2022.1084171>

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of the publisher and/or the editor(s). This publisher and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

© Copyright (2026): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here: <https://pr.sdiarticle5.com/review-history/167600>