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Soil carbon dynamics in conventional and Organic Mango orchards of Kolar district of Karnataka

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Abstract
This study investigates the interrelationship between nutrient cycling and soil carbon dynamics in organic and conventional mango (*Mangifera indica* L.) Comparative soil analyses were conducted to assess differences in soil organic carbon (SOC), available macronutrients (N, P, K), microbial biomass carbon (MBC), and key soil enzyme activities. Results indicate that Organic management significantly increased SOC content, MBC, and enzymatic activities associated with nutrient mineralization, indicating enhanced microbial activity and improved nutrient turnover. Conversely, conventional systems often show greater short-term nutrient availability but reduced microbial diversity and potential SOC depletion. The results highlight the potential of organic practices to promote long-term soil fertility and carbon sequestration. At the same time, conventional systems may prioritize short-term productivity at the expense of soil health.

Keywords: Soil organic carbon, nutrient cycling, microbial biomass, Mango orchard, organic farming, conventional farming, soil health

Introduction
Soil organic carbon (SOC) and nutrient cycling are central to maintaining productivity, resilience, and ecological function in perennial fruit systems such as mango (*Mangifera indica* L.). Mango undergoes carbon sequestration or uptake mechanism as it grows. Carbon dioxide is absorbed by the tree and used to build the trunk, branches, leaves, and fruit. They are not only carbon-neutral but also have a negative carbon footprint. Mangoes absorb more CO_2 than they release. Mango trees are excellent CO_2 absorbers. Mexican mango trees absorb far more greenhouse gases than they emit during the production and shipping process, making them a climate-friendly crop. According to reports, India's mango orchards sequestered 285 Mt of carbon dioxide (CO_2) over their lifetime (35-40 years), which is equivalent to greenhouse gas emissions from sixty million (60,509,554) passenger vehicles driven in a year or CO_2 emissions from 73 coal-fired power plants annually.

Long-term orchard management practices—particularly organic versus conventional nutrient inputs—can significantly influence SOC dynamics, microbial activity, and nutrient availability. Organic management practices, which emphasize the use of composts, farmyard manure (FYM), green manures, and biofertilizers, are known to enhance microbial biomass, enzymatic activity, and long-term carbon sequestration (Leifeld and Fuhrer, 2010) [11]. In contrast, conventional practices, reliant on synthetic fertilizers and agrochemicals, often lead to short-term increases in nutrient availability but may reduce microbial diversity and carbon stabilization (Talang *et al.*, 2017) [18]. Mango orchards managed under organic systems have shown higher SOC content, microbial biomass carbon (MBC), and enzyme activities such as dehydrogenase and phosphatase (Talang *et al*., 2017) [18].

While there is growing interest in understanding the soil health benefits of organic management in tropical fruit systems, studies specific to mango orchards remain limited. Existing work often lacks comprehensive comparisons of SOC fractions, nutrient availability, and soil biological indicators under long-term organic and conventional regimes. Additionally, interactions among SOC, nutrient pools, and microbial processes are poorly quantified in mango-growing regions of the tropics. The research was carried out to estimate interrelation among the SOC, nutrients and enzyme activities.

Materials and Methods

Study Area: The study was conducted in established mango (*Mangifera indica* L., cv. Alphonso) orchards located in five talukas of Kolar district of Karnataka, a major mango-producing region in the Eastern Dry Zone. The soils are classified as Alfisols [USDA classification], characterized by low inherent fertility and moderate organic matter content.

Soil Sampling and Processing

Soil samples were collected during the flowering stage (November 2020) at a depth of 0-15 and 15-30 cm using a soil auger. From each plot, five subsamples were collected randomly and composited to form a representative sample. Samples were air-dried and sieved (2 mm).

Soil chemical properties analysis

Soil Organic Carbon (SOC): Soil organic carbon content was estimated using the Walkley and Black wet oxidation method (Walkley & Black, 1934) [19]. Briefly, 1 g of air-dried soil was digested with potassium dichromate ($K_2Cr_2O_7$) and concentrated sulfuric acid (H_2SO_4). The unreacted dichromate was titrated against ferrous ammonium sulfate (FAS), and SOC was calculated based on the amount of dichromate consumed during oxidation.

Available Nitrogen

Available nitrogen was determined by the alkaline potassium permanganate method (Subbiah & Asija, 1956) [15]. Soil samples (5 g) were digested with alkaline $KMnO_4$, and the released ammonia was trapped in boric acid and titrated with standard sulfuric acid. The nitrogen content was calculated and expressed in kg ha^{-1}.

Available Phosphorus

Available phosphorus was extracted using Bray's and Olsen's extraction method. The Bray and Kurtz No. 1 method (Bray & Kurtz, 1945) [3] for phosphorus estimation in acidic soils. In this method, 5 g of air-dried soil was extracted with 50 mL of Bray I solution (0.03 N NH_4F + 0.025 N HCl) by shaking for 5 minutes at 180 rpm. Absorbance was measured at 660 nm using a UV-Vis spectrophotometer. The Olsen's methods (Olsen *et al.*, 1954), suitable for neutral to alkaline soils. Soil was shaken with 0.5 M sodium bicarbonate ($NaHCO_3$) at pH 8.5, and the phosphorus content in the extract was determined colorimetrically at 880 nm.

Available Potassium

Available potassium was extracted using neutral normal ammonium acetate (1N NH_4OAc) and quantified by flame photometry (Jackson, 1973) [7]. The extract was filtered, and potassium content was measured directly and reported in kg ha^{-1}.

Soil Enzyme Activities

Soil enzyme activities were estimated using standardized colorimetric procedures to assess biological functioning and nutrient cycling in the soil under different management systems.

Urease Activity

Urease activity was determined following the method of Kandeler and Gerber (1988) [8]. Air-dried soil (5 g) was incubated with 2.5 mL of 10% urea solution and 20 mL of citrate buffer (pH 6.7) at 37 °C for 2 hours. After incubation, the released ammonium (NH_4^+) was extracted with 2 M KCl and quantified colorimetrically using the phenol-hypochlorite method. Absorbance was measured at 578 nm, and results were expressed as µg NH_4^+-N g^{-1} soil h^{-1}.

Dehydrogenase Activity (DHA)

Dehydrogenase activity was estimated using the method described by Casida *et al*. (1964) [5]. Fresh soil (5 g) was mixed with 1 mL of 3% 2,3,5-triphenyltetrazolium chloride (TTC) and 2.5 mL of Tris buffer (pH 7.4), and incubated at 37 °C for 24 hours. The reduced product, triphenyl formazan (TPF), was extracted with methanol and quantified at 485 nm using a spectrophotometer. Results were expressed as µg TPF g^{-1} soil h^{-1}.

Acid Phosphatase Activity (AcP)

Acid phosphatase activity was determined using the method of Tabatabai and Bremner (1969) [16]. One gram of soil was incubated with 0.2 mL of toluene, 4 mL of modified universal buffer (pH 6.5), and 1 mL of 0.05 M p-nitrophenyl phosphate (PNPP) solution at 37 °C for 1 hour. The reaction was terminated with 1 mL of 0.5 M $CaCl_2$ and 4 mL of 0.5 M NaOH. The released p-nitrophenol (PNP) was measured at 400 nm. Results were expressed as µg PNP g^{-1} soil h^{-1}.

Aryl Sulphatase Activity (ARS)

Aryl sulphatase activity was measured according to Tabatabai and Bremner (1970) [17]. Soil (1 g) was incubated with 0.25 mL of toluene, 4 mL of acetate buffer (pH 5.8), and 1 mL of 0.05 M potassium p-nitrophenyl sulfate at 37 °C for 1 hour. After incubation, 1 mL of 0.5 M $CaCl_2$ and 4 mL of 0.5 M NaOH were added. The liberated p-nitrophenol (PNP) was determined spectrophotometrically at 400 nm. Results were expressed as µg PNP g^{-1} soil h^{-1}

Results and Discussion

Soil pH: Soil pH values across the five locations showed consistent trends, with higher pH observed in organically managed mango orchards compared to conventional systems (Table 1). Organic orchard soils ranged from 6.52 to 7.46, while conventional soils exhibited slightly more acidic values, ranging from 5.85 to 6.91. The mean pH for organic soils was significantly higher at both depths (D1: 6.66; D2: 7.23) than that of conventional soils (D1: 6.12; D2: 6.66), with a critical difference (CD) at 5% of 0.67 and 0.73, respectively. The higher pH under organic management could be attributed to the regular application of farmyard manure and compost, which often have a liming effect (Adak and Pandey, 2020) [2]. Moreover, reduced use of acid-forming synthetic fertilizers in organic systems likely contributed to the maintenance of near-neutral pH values. Similar findings were reported by Ganeshamurthy *et al.* (2015) [6], who observed elevated pH levels in organic mango systems in southern India.

Electrical Conductivity (EC)

EC values did not significantly differ between management systems across any location (NS - Not Significant). EC values remained within a narrow range for both organic (0.011-0.033 dS m^{-1}) and conventional orchards (0.014-0.029 dS m^{-1}). The lack of significant variation suggests minimal salt accumulation, likely due to balanced

fertilization practices and adequate leaching during monsoonal periods. This agrees with findings by Singh *et al*. (2014) [1] who observed stable EC levels in mango orchards under both systems, albeit with marginally lower values in organically managed soils.

Soil Organic Carbon (SOC)

SOC content varied significantly between the systems, with organic orchards consistently showing higher SOC values at both soil depths. Mean SOC in organic orchards was 0.80% (D1) and 0.74% (D2), compared to 0.49% (D1) and 0.46% (D2) in conventional orchards. The differences were statistically significant (CD at 5%: 0.056 and 0.050 for D1 and D2, respectively). This increase in SOC under organic management is directly attributable to the sustained use of organic amendments (FYM, compost, mulch), cover cropping, and reduced soil disturbance. These practices enhance carbon inputs and support microbial biomass, which further stabilizes carbon through the formation of microbial residues and aggregates (Kumar *et al*., 2021) [9].

Kumar *et al*. (2021) [9], using a long-term experimental site in Uttar Pradesh, observed a 45-60% increase in SOC under organic mango orchards compared to conventional plots. Similarly, Singha *et al*. (2014) [1] reported enhanced SOC and microbial respiration under integrated and organic nutrient regimes in mango systems. Moreover, the higher SOC levels in the current study were associated with increased biological activity (reported in the enzyme analysis section), reinforcing the positive feedback loop between carbon input, microbial activity, and soil fertility.

Organic management practices such as the incorporation of farmyard manure, compost, and reduced chemical inputs promote carbon inputs to soil, increase microbial biomass, and improve soil aggregation, all of which contribute to enhanced carbon stabilization and sequestration. The increased SOC levels in organic orchards thus reflect effective long-term carbon storage, consistent with findings by Lal (2004) and Smith *et al*. (2016) [9], who emphasized agroecosystems role in climate change mitigation through soil carbon pools. Conversely, conventional mango orchards, reliant on synthetic fertilizers, showed lower SOC and enzyme activities, suggesting reduced microbial-mediated carbon stabilization. Intensive chemical inputs and frequent soil disturbance can accelerate SOC mineralization, potentially releasing stored carbon as CO_2.

Table 1: Soil reaction, Electrical conductivity and SOC in organic and conventional mango orchards

Sampling locations	Organic mango orchard						Conventional mango orchards					
	Soil pH		EC (dSm^{-1})		SOC		Soil pH		EC (dSm^{-1})		SOC	
	D_1	D_2	D_1	D_2	D_1	D_2	D_1	D_2	D_1	D_2	D_1	D_2
Kolar	6.81	7.46	0.019	0.020	0.74	0.69	5.85	6.36	0.023	0.029	0.43	0.42
Mulabaagilu	6.78	7.16	0.024	0.032	0.83	0.75	5.99	6.55	0.020	0.022	0.52	0.50
Srinivaspura	6.52	7.05	0.031	0.033	0.89	0.88	6.16	6.65	0.016	0.019	0.58	0.54
Bangarpet	6.63	7.23	0.023	0.027	0.71	0.64	6.25	6.87	0.021	0.026	0.48	0.45
Malur	6.57	7.27	0.011	0.013	0.81	0.74	6.35	6.91	0.014	0.018	0.44	0.41
Mean	6.66	7.23	0.021	0.025	0.80	0.74	6.12	6.66	0.018	0.022	0.49	0.46
$SEm_{\pm}$	0.22	0.24	NS	NS	0.032	0.040	0.20	0.22	NS	NS	0.027	0.024
CD at 5%	0.67	0.73	NS	NS	0.065	0.082	0.61	0.67	NS	NS	0.056	0.050

* D_1 = (0-15 cm), D_2 = (15-30 cm)

Table 2: Available macronutrients in organic and conventional mango orchards

Sampling locations	Organic mango orchards						Conventional mango orchards					
	N (kg ha^{-1})		P_2O_5 (kg ha^{-1})		K_2O (kg ha^{-1})		N (kg ha^{-1})		P_2O_5 (kg ha^{-1})		K_2O (kg ha^{-1})	
	D_1	D_2	D_1	D_2	D_1	D_2	D_1	D_2	D_1	D_2	D_1	D_2
Kolar	330.13	289.60	35.26	27.20	262.06	236.65	490.60	393.56	41.27	35.5	303.88	259.68
Mulabaagilu	438.82	363.60	42.66	37.65	326.88	221.93	544.96	481.32	48.56	38.07	369.26	343.07
Srinivaspura	495.83	390.13	45.31	37.71	334.05	365.80	576.60	498.26	54.57	45.63	385.63	385.80
Bangarpet	414.04	335.36	40.29	35.65	309.77	280.03	528.12	427.68	47.00	40.02	356.11	330.45
Malur	384.92	327.20	39.32	31.48	285.22	289.60	512.51	401.43	44.22	37.44	323.16	307.00
Mean	412.74	341.17	40.56	33.93	303.59	278.80	530.55	440.45	47.12	39.33	347.60	325.20
$SEm_{\pm}$	14.14	11.69	1.39	1.16	10.40	9.55	18.18	15.09	1.61	1.35	11.91	11.14
CD at 5%	41.86	34.60	4.11	3.44	30.79	28.28	53.81	44.67	4.78	3.99	35.25	32.98

* D_1 = (0-15 cm), D_2 = (15-30 cm)

Available Nitrogen (N): Across all sampling sites, the available nitrogen (N) content was significantly higher in conventional mango orchards compared to organic ones at both depths (Table 2). The mean available N in organic soils was 412.74 kg ha^{-1} (D1) and 341.17 kg ha^{-1} (D2), while in conventional soils, it was higher at 530.55 kg ha^{-1} (D1) and 440.45 kg ha^{-1} (D2). These differences were statistically significant (CD at 5%: 41.86 and 34.60 kg ha^{-1} for D1 and D2, respectively). The enhancement of available nitrogen in organic systems is primarily attributed to the continuous application of organic manures such as FYM and compost, which release nitrogen slowly and sustainably through microbial mineralization, while higher available N in conventional mango orchards is likely due to the addition of Urea, DAP during the flowering stage. These findings are consistent with those reported by Adak *et al*. (2014) and Ganeshamurthy *et al*. (2015) [1, 6], who noted that organic amendments improve nitrogen availability by enhancing microbial activity and nitrogen mineralization potential.

Available Phosphorus (P_2O_5): Available phosphorus (as P_2O_5) also showed higher values in conventional orchards in compared to organic orchards across all locations. The mean values in organic systems were 40.56 kg ha^{-1} (D1) and 33.93 kg ha^{-1} (D2), compared to 47.12 and 39.33 kg ha^{-1} in conventional orchards. These differences were statistically

significant (CD at 5%: 4.11 and 3.44 kg ha^{-1}). Although the absolute P_2O_5 values were slightly higher in conventional orchards—likely due to direct application of soluble phosphorus fertilizers—the organic systems maintained comparable levels due to the presence of organic acids from compost decomposition, which enhance P solubility and availability. Similar observations were made by Kumar *et al*. (2017) [10], who emphasized the role of phosphatase enzymes and microbial biomass in regulating phosphorus availability in organically managed systems.

Available Potassium (K_2O): Potassium levels were markedly higher in organic orchards. The mean available K_2O was 303.59 kg ha^{-1} (D1) and 278.80 kg ha^{-1} (D2) in organic plots, while the conventional plots had higher values (347.60 and 325.20 kg ha^{-1} at D1 and D2, respectively). The differences were statistically significant (CD at 5%: 30.79 and 28.28 kg ha^{-1}). This finding aligns with past research by Kumar *et al*. (2021) [9], who observed enhanced potassium retention in conventional orchards due to direct application of muriate of potash and reduced leaching losses. However, in organic systems, potassium availability is often mediated by gradual mineralization of compost and release from crop residues, which supports long-term soil K stability.

Soil Enzyme Activities

In the organic mango orchards, urease, acid phosphatase, dehydrogenase, and arylsulfatase activities were substantially high at the upper soil layer (D1) across all locations. For instance, dehydrogenase activity peaked at 68.56 µg TPF g^{-1} h^{-1}, while arylsulfatase reached 190.86 µg S g^{-1} h^{-1} (Table 3). These elevated enzyme activities mirror enhanced microbial metabolic processes driven by abundant organic inputs. The findings echo observations by Kumar *et al*. (2021) [9] in Dashehari orchards, where long-term organic treatment resulted in dehydrogenase activity of 0.784 µg TPF g^{-1} h^{-1} vastly higher than conventional plots at 0.053 µg TPF g^{-1} h^{-1}. Similarly, acid phosphatase and alkaline phosphatase activities were significantly greater in organic orchards, consistent with our high acid phosphatase values (~71 µg PNP g^{-1} h^{-1} at Srinivaspura). Kumar *et al*. also reported alkaline phosphatase activities of around 139 µg PNP g^{-1} soil h^{-1} under organic systems. These levels are supported by findings from Singha *et al.* (2014) and Ganeshamurthy *et al*. (2015) [1, 6] documented significantly enhanced urease, acid phosphatase, and arylsulfatase activities in conservation-based mango management compared to conventional practices. Their observations align with the data, particularly the elevated urease activity in organically managed soils, reflecting improved nitrogen cycling vitality.

Table 3: Enzyme activities in organic and conventional mango orchards

Sampling locations	Urease activity (mg NH_4 N g^{-1} soil 2 h^{-1})		Acid phosphatase activity (µg PNP g^{-1} h^{-1})		Dehydrogenase activity (µg TPF g^{-1} h^{-1})		Arylsulfatase activity (µg S g^{-1} h^{-1})	
	D_1	D_2	D_1	D_2	D_1	D_2	D_1	D_2
Kolar	23.92	18.29	62.78	58.55	54.36	49.10	150.89	100.65
Mulabaagilu	31.22	23.45	68.93	68.09	60.68	57.32	180.63	130.71
Srinivaspura	34.49	25.38	71.27	70.00	68.56	64.69	190.86	150.58
Bangarpet	28.88	21.96	65.02	63.80	58.96	52.98	170.31	130.57
Malur	25.56	20.97	64.20	63.88	55.04	51.24	170.06	110.13
Mean	28.81	22.01	66.44	64.86	59.52	55.06	172.55	124.52
$SEm_{\pm}$	0.97	0.74	2.25	2.19	2.01	1.86	5.83	4.21
CD at 5%	2.91	2.23	6.72	6.56	6.02	5.57	17.45	12.59

* D_1 = (0-15 cm), D_2 = (15-30 cm)

Conclusion

Increased SOC in organic soils promotes improved nutrient retention and availability, particularly nitrogen and potassium, by enhancing soil structure and cation exchange capacity. While available phosphorus was slightly higher in conventional plots due to synthetic fertilization, organic systems compensated through elevated phosphatase activity that enhances biological P mobilization. Enzymes such as urease, acid phosphatase, dehydrogenase, and arylsulfatase showed a clear positive association with SOC levels. Higher SOC provides a substrate-rich environment that supports diverse and active microbial communities responsible for these enzymatic processes. This biological activity drives nutrient mineralization and sustains soil fertility in organic mango orchards. In summary, organic mango orchard management enhances SOC accumulation and associated microbial functions, directly contributing to improved carbon sequestration. This dual benefit of productivity and climate change mitigation underscores the sustainability value of an organic mango orchard.

References

1. Adak T, Singha A, Kumar K, Shukla SK, Singh VK. Soil organic carbon, dehydrogenase activity, nutrient availability and leaf nutrient content as affected by organic and inorganic sources of nutrients in mango orchard soil. Bioscan. 2014;9(3):1207-1210.
2. Adak T, Pandey G. Soil enzymatic activity as a soil health indicator for mango orchards under subtropical region. J Appl Nat Sci. 2020;12(1):75-80.
3. Bray RH, Kurtz LT. Determination of total, organic, and available forms of phosphorus in soils. Soil Sci. 1945;59(1):39-46.
4. Bukhari SFH, Farhan M, Kiran R, Hayat R, Bukhari SZH. Impact of soil health on mango cultivation and production under changing climatic scenarios. In: Bukhari SFH, editor. Climate Change and Mango Production. Cham: Springer; 2025. p. 247-267.
5. Casida LE Jr, Klein DA, Santoro T. Soil dehydrogenase activity. Soil Sci. 1964;98(6):371-376.
6. Ganeshamurthy AN, Ravindra V, Panneerselvam P, Sathyarahini K, Bhat RM. Conservation horticulture in mango orchards: Comparative effects of conventional and conservation management practices on soil properties of an Alfisol under seasonally dry tropical savanna climate. J Agric Sci. 2015;7(7):160-170. doi:10.5539/jas.v7n7p160.

7. Jackson ML. Soil Chemical Analysis. New Delhi: Prentice Hall of India Pvt Ltd; 1973.
8. Kandeler E, Gerber H. Short-term assay of soil urease activity using colorimetric determination of ammonium. Biol Fertil Soils. 1988;6:68-72.
9. Kumar G, Suman A, Lal S, Ram RA, Bhatt P, Pandey G, *et al*. Bacterial structure and dynamics in mango (*Mangifera indica*) orchards after long-term organic and conventional treatments under subtropical ecosystem. Environ Res. 2021;200:111327. doi:10.1016/j.envres.2021.111327.
10. Kumar K, Adak T, Singh VK. Green manuring and nutrient management impacting soil properties and sustainability of mango orchard. J Soil Water Conserv. 2017;16(1):72-78.
11. Leifeld J, Fuhrer J. Organic farming and soil carbon sequestration: What do we really know about the benefits? Agric Ecosyst Environ. 2010;139(3-4):207-219. doi:10.1016/j.agee.2010.08.004.
12. Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. USDA Circular No. 939. Washington (DC): U.S. Government Printing Office; 1954.
13. Patel DR, Patil HB, Prashanth JM, Patil SN. Studies on the integrated nutrient management strategies for higher productivity in mango cv. Kesar. Indian J Agric Sci. 2005;75(2):80-83.
14. Singha A, Adak T, Kumar K, Shukla SK, Singh VK. Effect of integrated nutrient management on dehydrogenase activity, soil organic carbon and soil moisture variability in a mango orchard ecosystem. J Anim Plant Sci. 2014;24(3):843-849.
15. Subbiah BV, Asija GL. A rapid procedure for estimation of available nitrogen in soils. Curr Sci. 1956;25:259-260.
16. Tabatabai MA, Bremner JM. Use of *p*-nitrophenyl phosphate for assay of soil phosphatase activity. Soil Biol Biochem. 1969;1(4):301-307.
17. Tabatabai MA, Bremner JM. Arylsulfatase activity of soils. Soil Sci Soc Am J. 1970;34(2):225-229.
18. Talang HD, Hazarika BN, Bhuyan M. Effect of integrated nutrient management on mango cv. Himsagar. J Hortic Sci. 2017;12(1):47-52.
19. Walkley A, Black IA. An examination of the Degtjareff method for determining soil organic matter and a proposed modification of the chromic acid titration method. Soil Sci. 1934;37(1):29-38.