



Soil Organic Carbon Sequestration: A Key to Climate-Smart Agriculture

Dr. Maria Santos *

Department of Climate & Soil Studies, Federal University of Terra, Brazil

*Corresponding author: Dr. Maria Santos, Department of Climate & Soil Studies, Federal University of Terra, Brazil, Email: m.santos@uff.br

Citation: Maria S (2025) Soil Organic Carbon Sequestration: A Key to Climate-Smart Agriculture. J Soil Sci Plant Health 7: 231

Received: 01-Jun-2025, Manuscript No. JSPH-26-183593; Editor assigned: 4-Jun-2025, Pre-QC No. JSPH-26-183593 (PQ); Reviewed: 18-Jun-2025, QC No. JSPH-26-183593; Revised: 25-Jun-2025, Manuscript No. JSPH-26-183593 (R); Published: 30-Jun-2025, DOI: 10.4172/jsp.1000231

Introduction

Soil organic carbon (SOC) is a fundamental component of healthy soils, influencing fertility, structure, water retention, and microbial activity. Beyond its agricultural significance, SOC plays a critical role in mitigating climate change by acting as a natural carbon sink. Soil organic carbon sequestration refers to the process of capturing atmospheric carbon dioxide (CO₂) and storing it in soils through organic matter inputs and stable carbon compounds. Enhancing SOC not only improves soil productivity but also contributes to long-term environmental sustainability.

Discussion

SOC sequestration occurs when plant residues, root biomass, and organic amendments are incorporated into the soil and transformed into stable organic compounds through microbial activity. Practices that increase biomass input, such as cover cropping, crop rotation, agroforestry, and the application of compost or manure, provide the raw material for SOC formation. The stability of sequestered carbon is further enhanced when it becomes associated with soil minerals or forms aggregates, protecting it from rapid decomposition.

Conservation tillage and reduced soil disturbance are important strategies for maintaining SOC levels. Conventional plowing accelerates the breakdown of organic matter, releasing CO₂ back into the atmosphere. In contrast, minimal tillage preserves soil structure,

reduces erosion, and allows organic matter to accumulate over time. Combining reduced tillage with residue retention amplifies carbon storage while improving soil fertility and moisture retention.

Agroecological practices, such as integrating perennial crops or trees, contribute to SOC sequestration by continuously supplying organic inputs and enhancing belowground carbon allocation. Additionally, biochar application has been recognized as an effective method for long-term carbon stabilization, as it is highly resistant to microbial decomposition. These practices collectively support soil resilience, nutrient cycling, and water management, creating a climate-smart agricultural system.

Soil organic carbon sequestration also provides environmental co-benefits. By capturing atmospheric CO₂, soils act as a carbon sink, helping to mitigate climate change. Enhanced SOC improves soil structure, reduces erosion, and promotes biodiversity, both above and belowground. Economically, increasing SOC can improve crop yields, reduce dependency on chemical fertilizers, and enhance the sustainability of farming systems.

Conclusion

Soil organic carbon sequestration is a critical strategy for achieving sustainable agriculture and climate mitigation. By adopting practices that increase organic inputs, reduce soil disturbance, and enhance carbon stability, farmers can improve soil health, boost productivity, and contribute to environmental protection. Scaling up SOC sequestration requires a combination of sound land management, policy support, and farmer awareness. Protecting and building soil carbon is not only essential for food security but also for addressing the pressing global challenge of climate change.

References

- Brown MB, Jones SA (2005) Hyaluronic acid: a unique topical vehicle for the localized delivery of drugs to the skin. J Eur Acad Dermatol Venereol 19: 308-318
- Zhu J, Tang X, Jia Y, HO CT, Huang Q, et al. (2020) Development, Characterization and Use of Liposomes as Amphipathic Transporters of Bioactive Compounds for Melanoma Treatment and Reduction of Skin Inflammation: A Review. Int J Pharm 578: 119127-2020.
- Bavo B, Correia P, Gonçalves Junior JE (2022) Benefits of topical hyaluronic acid for skin quality and signs of skin aging: From literature review to clinical evidence. Dermatologic therapy 35: e15903.
- Galvez-Martin P, Soto-Fernandez C, Romero-Rueda J, Cabañas J, Torrent A, et al. (2023) A Novel Hyaluronic Acid Matrix Ingredient with Regenerative, Anti-Aging and Antioxidant Capacity. Int J Molec Sci 24: 4774.
- Farage MA, Miller KW, Elsner P, Maibach HI (2008) Intrinsic and extrinsic factors in skin ageing: a review. Int J Cosmt Sci 30: 87-95.