

# *Carbon Sequestration through Organic Farming Practices*

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## **ABSTRACT**

The continuous rise in atmospheric carbon dioxide (CO<sub>2</sub>) has emerged as one of the most critical global environmental challenges, highlighting the urgent need for sustainable climate mitigation strategies. In this context, agriculture holds significant potential as a natural carbon sink through the process of carbon sequestration, particularly when managed under organic farming systems that emphasize soil health and ecological sustainability. Organic farming enhances carbon storage by increasing soil organic matter, stimulating beneficial microbial activity, and avoiding the excessive use of synthetic fertilizers and pesticides that contribute to greenhouse gas emissions. Several organic management practices—including diversified crop rotations, green manuring, application of compost and farmyard manure, reduced soil disturbance, and integration of livestock—facilitate the capture, accumulation, and long-term stabilization of atmospheric carbon in the soil. Empirical evidence suggests that well-managed organic and biodynamic farming systems can significantly enhance soil carbon stocks while simultaneously improving soil fertility, biological diversity, and overall farm productivity. Although the large-scale adoption of organic farming may face challenges such as the need for greater technical knowledge, higher labor requirements, and potential short-term yield variability, these limitations can be effectively overcome through capacity-building initiatives, supportive government policies, and appropriate economic incentives.

Consequently, organic farming represents a promising and sustainable pathway for climate change mitigation while simultaneously strengthening agricultural resilience and rural livelihoods.

## INTRODUCTION

Organic farming is a holistic agricultural production system that excludes the use of synthetic fertilizers, chemical pesticides, and genetically modified organisms, while emphasizing the maintenance of soil fertility, ecological balance, and environmental sustainability. It is based on natural and biological processes such as crop rotation, green manuring, biological pest management, and diversified cropping systems to maintain soil productivity and crop health. The continuous addition of organic inputs including compost, farmyard manure, and crop residues enhances soil structure, improves nutrient cycling, and stimulates beneficial microbial activity. These processes increase the soil's capacity to capture and store atmospheric carbon dioxide, thereby contributing to carbon sequestration and climate change mitigation. Moreover, organic farming systems are environmentally friendly, require relatively low external inputs, and support food safety and long-term agricultural sustainability. In India, the rapidly expanding demand for organic products in both domestic and international markets offers farmers opportunities to earn higher incomes through premium prices. This economic incentive, combined with the environmental benefits, is encouraging greater adoption of organic farming practices and strengthening its role in promoting sustainable agriculture and enhanced carbon sequestration.

### Carbon Sequestration

Carbon sequestration refers to the process by which carbon dioxide is removed from the atmosphere and stored in long-term reservoirs such as soils, forests, and oceans. Among these

reservoirs, agricultural soils have considerable potential to function as effective carbon sinks when managed sustainably. Organic farming represents an environmentally sound agricultural system that contributes to carbon sequestration by increasing soil organic carbon, reducing greenhouse gas emissions, and encouraging biological diversity. The capacity of soils to store carbon is strongly influenced by farm management practices, particularly the use of organic amendments and reduced soil disturbance. When organic inputs are applied using appropriate agronomic methods, soils can retain greater amounts of carbon and contribute positively to the global carbon cycle.

### Carbon sequestration potential of organic agriculture

Organic agricultural practices such as cover cropping, compost application and reduced tillage play a significant role in increasing soil organic matter and enhancing carbon storage. Diversified crop rotations improve biomass production and return a wide range of plant residues to the soil, which contributes to organic matter formation and microbial activity. In addition, organic farming promotes biodiversity, creating resilient ecosystems that rely on biological processes rather than chemical inputs. Nitrogen-fixing microorganisms and increased plant biomass contribute to stable soil organic carbon pools. Certain soil microbes transform plant residues into microbial necromass, which is recognized as a highly stable form of carbon storage. Improved soil structure and natural pest regulation further reduce carbon losses caused

by erosion and environmental stress. Organic systems also reduce greenhouse gas emissions by minimizing the use of energy-intensive synthetic fertilizers and pesticides. Long-term experiments, such as the DOK trial, revealed that biodynamic systems with higher livestock integration were more effective in maintaining or increasing soil organic carbon than both conventional and standard organic systems. The continuous application of high-quality compost and manure in these systems compensated for carbon losses through decomposition (Fliessbach *et al.*, 2007).

### **Challenges in carbon sequestration through organic farming**

- Organic farming requires specialized knowledge related to crop planning, soil health assessment, compost preparation, and biological pest management, which may not be easily accessible to all farmers.
- During the transition period, crop yields may temporarily decline as soils adjust to organic management practices, potentially affecting farmer income.
- Higher labor requirements and input costs associated with organic farming can pose economic challenges, particularly for small and marginal farmers.

### **CONCLUSION**

Organic farming offers a promising pathway for enhancing carbon sequestration by improving soil organic matter, increasing biodiversity, and lowering greenhouse gas emissions. Management practices such as crop diversification, organic nutrient application, reduced tillage, and livestock integration enable agricultural soils to store atmospheric carbon while improving long-term soil health and productivity. Research evidence suggests that well-managed organic and biodynamic systems can significantly strengthen soil carbon reserves. Although challenges related to technical expertise, transitional yield reductions, and initial investment costs exist, these limitations can be addressed through farmer education, policy interventions, and financial incentives. With adequate institutional support, organic farming can play a vital role in climate change mitigation and the development of sustainable agricultural systems.

### **REFERENCE**

Fliessbach, A., Oberholzer, H.-R., Gunst, L., & Mäder, P. (2007). Soil organic matter and biological soil quality indicators after 21 years of organic and conventional farming. *Agriculture, Ecosystems & Environment* 118(1-4), 273–2.