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Soil Carbon Sequestration in Fighting Climate Change

M. Jagadesh
Tamil Nadu Agricultural University, Coimbatore

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Introduction

Soils have shown to be a powerful ally in the battle against climate change. Beneath the surface, soil carbon sequestration is a powerful weapon against rising carbon dioxide (CO_2) levels (Honegger et al., 2021). This can lessen the consequences of climate change and make a major contribution to healthier soil and more environmentally friendly farming methods.

The Carbon Dilemma

Because of human activities like burning fossil fuels and deforestation, the amount of CO_2 in the atmosphere has been steadily rising. This excess CO_2 is one of the primary causes of climate change and global warming. In these conditions, soil's long-lasting ability to store carbon has provided us with a silent solution that has been in place for thousands of years. Research indicates that soils store more carbon than the atmosphere and all terrestrial plants combined (Lal, 2004). It is estimated that 2,500 billion tons of organic carbon are stored in soils worldwide (Jobbágy et al., 2000). Soil carbon sequestration involves collecting and storing carbon from the atmosphere in soil organic matter in order to reduce carbon emissions that contribute to climate change (Smith et al., 2010).

Revealing the Secret of Soil

Soil is more than just dirt; it is a thriving ecosystem full of microorganisms and organic stuff. As part of their photosynthetic respiration process, plants absorb CO_2 from the atmosphere and convert it to sugars. These sugars are subsequently absorbed by plant roots into the soil. Microbes in the soil break down these sugars, releasing some CO_2 back into the atmosphere. However, some of this carbon sinks and remains in the soil for a very long time (Shukla et al., 2019).

The Power of Soil Carbon Sequestration

The benefits of soil carbon sequestration go far beyond lowering global warming. It improves soil fertility, water retention, and resistance to floods and droughts (Lal, 2004; Jagadesh et al., 2024). Studies have shown that enhanced soil structure and nutrient availability

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can lead to higher agricultural yields (Powlson, et al. 2014). According to studies, using less tillage and cover crops are two sustainable soil management strategies that can increase soil carbon stocks by up to 8% (Powlson et al. 2014). This not only mitigates the consequences of climate change but also makes agricultural systems more resilient to extreme weather.

A Win-Win for Climate and Soil

Comparing increasing soil carbon to reducing climate change has significant drawbacks. It improves the soil's tolerance to drought and flooding as well as its fertility. Farmers that use soil carbon sequestration often report increased crop yields and decreased need for synthetic fertilizers. In addition to preventing climate change, healthy soils support more productive agriculture (Jagadesh et al., 2024).

Soil Management

Many soil management strategies are available to enhance soil carbon sequestration.

- Soil covering is increased and organic matter is built up for the soil's microorganisms by planting cover crops during the off-season.
- Tilling the soil causes the atmosphere to absorb stored carbon. No-till farming can be used to get around this issue by leaving crop residues on the soil's surface to decompose and absorb carbon.
- In addition to the biomass of the trees themselves, planting trees in agricultural settings aids in the storage of carbon in the soil through their root systems and leaf litter.
- Adding compost and other organic matter to soils promotes microbial activity, which in turn improves carbon storage.
- Grazing fields can promote the increase of plant and soil carbon by relocating animals between pastures (Ogle et al., 2005).

The Path Ahead

There are challenges even with the enormous potential for soil carbon sequestration. It calls for changes to farming practices, farmer education, and laws that incentivize environmentally responsible behaviour. The best methods for different soil types and climates are constantly being investigated. Increased farm productivity and resilience, as well as advantages to the environment, are the results of agricultural practices that include soil carbon sequestration.

Conclusion

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Soil carbon sequestration is a crucial element in the fight against climate change. In our efforts to reduce emissions and transition to renewable energy sources, we must turn to nature for inspiration. Therefore, now is the moment to use soil carbon sequestration to build a better and more sustainable future for the earth.

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