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Saving Smallholder Farmers and Us: The Unexpected Benefits of Very Small-Scale Biochar

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Abstract

Smallholder farmers produce about 30% of the world's food and are central to food security, especially in developing countries. However, agriculture contributes up to 25% of global greenhouse gas emissions, and smallholders also generate significant smoke (PM_{2.5}) from burning crop waste. At the same time, many smallholders face poor soils, limited access to fertilizers, and low incomes. Unfortunately, the non-collectability of smallholders biomass means that it will always contribute to climate change and smoke (PM_{2.5}) emissions.

Very small-scale biochar offers a simple and affordable solution. Made from crop waste through low-oxygen heating (pyrolysis), biochar reduces smoke emissions and stores carbon in the soil. When mixed with manure, it improves soil fertility and water retention, helping farmers increase productivity sustainably.

Despite limited awareness and policy support, small-scale biochar requires no expensive infrastructure and can be produced locally. It presents a practical, low-cost strategy to reduce emissions, improve public health, and strengthen smallholder livelihoods—a clear win-win for people and the environment.