Name of Solution:

Enriching soil OC using biochar, composting and Conservation Agriculture practices

Submitter: (ICRISAT)

Solution Overview

What is it, and what problem does it solve? Brief 2–3 sentence description.

Declining Soil Organic Carbon (SOC) is a critical issue affecting soil fertility, water retention, and climate resilience especially in smallholder farming systems. This solution focuses on enriching SOC through biochar application, composting of organic residues, and conservation agriculture (CA) practices, offering an integrated approach that transforms agricultural waste into a valuable resource. It represents a practical "waste-to-wealth" initiative, where crop residues, animal waste, and on-farm biomass are recycled into long-lasting carbon sources to regenerate soil health.

In India, the availability of surplus crop residues is estimated at 84–141 million tonnes per year, while broader assessments by the National Policy for Management of Crop Residues (MNRE) estimate over 500 million tonnes annually, of which 92 million tonnes are burned in fields. Conservation Agriculture enables in-situ recycling of these residues, while unused portions can be diverted to biochar and compost production, offering a circular, carbon-positive solution that addresses both environmental degradation and climate goals.

Key Features & Benefits

Main components and why it is useful? Bullet points summarizing methods, tools, and value added.

- Biochar Use: Biochar produced from crop residues (e.g., paddy straw, maize stalks, horticultural prunings) stabilizes carbon in the soil, improves cation exchange capacity, and enhances water holding—especially in degraded soils.
- Composting of Organic Waste: Utilizes on-farm inputs like animal dung, vegetable market waste, leaf litter, and kitchen scraps to produce nutrient-rich compost, boosting microbial activity and restoring soil life.
- Conservation Agriculture Practices: Combines reduced tillage, residue retention, and diverse crop rotations to protect soil structure, reduce erosion, and build SOC over time.
- Multi-functional Benefits: Improves root zone health, moderates soil temperature, enhances water infiltration, and supports soil biodiversity, making farms more resilient to drought and input shocks.
- Climate-smart and Circular: Reduces emissions from residue burning, recycles biomass into carbon-rich amendments, and contributes to long-term carbon sequestration—aligning with global climate and circular economy goals.

Where It Works and Where It Can Work

Existing and potential target regions, agroecologies, or farming systems. Include examples if available.

This approach is well-suited to diverse farming systems, where chemical inputs are limited and soil degradation is advanced. It has already been tested in multi-location trials in Uttar Pradesh, Maharashtra, and eastern India, and shows potential for large-scale uptake through landscape restoration.

Evidence & Impact What results has it shown? Stats, pilot outcomes, or testimonials.

Field trials across multiple sites have shown that the biochar and compost can increase SOC by 15–40%, depending on soil type and management. Conservation agriculture practices have reduced erosion losses by up to 60%, enhanced moisture availability during dry spells, and improved crop yields by 10–25%. Enhanced microbial biomass and enzyme activity have been observed, confirming a biological recovery of the soil system. Farmer feedback also indicates reduced input needs and more stable yields under these practices.

Scalability & Adoption Support Why it can be scaled and what's needed to adopt it? Low-cost, adaptable, partner-ready, etc.

- Cost-effective and resource-efficient: Relies on locally available biomass, reducing dependency on external inputs.
- Fits into existing programs: Can be scaled through PMKSY-WDC, tribal development schemes, and FPO-led initiatives.
- Training and demonstration: Required for biochar production (e.g., low-cost kilns), composting techniques, and CA implementation.
- Policy support: Needed for incentivizing carbon-rich amendments, banning residue burning, and linking carbon credits or payment-for-ecosystem-services (PES) to SOC gains.
- Monitoring-ready: Changes in SOC can be tracked over time using hyperspectral and multispectral remote-sensed data, supporting long-term sustainability monitoring.

Partners & Contact Info

Who's involved and how to connect? List of key contact and partners + email / phone.

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