ICAR conducts study to assess various factors impacting Soil Organic Carbon (SOC)

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Scientists at the Indian Council of Agricultural Research (ICAR) have developed an agro-ecological base map to assess how fertiliser use, cropping systems, elevation, and climate factors influence Soil Organic Carbon (SOC) across India. This marks a crucial step toward evidence-based soil management and climate-resilient agriculture.

Aspect	Details
Definition of SOC	SOC represents the **carbon component of soil organic matter** (~60%) and includes carbon from decomposed plants, animals, and soil organisms — excluding fresh, undecomposed surface material.
Thermal Relationship	**SOC is inversely related to temperature** — higher temperatures accelerate decomposition, leading to a decline in SOC content.
Impact of Fertiliser Use	**Imbalanced fertiliser application**, particularly excessive use of **urea and phosphorus**, has depleted SOC levels in **Haryana, Punjab, and Western Uttar Pradesh**. Over-reliance on chemical fertilisers without organic inputs reduces microbial activity and soil carbon storage.
Cropping System Influence	**Rice-based and pulse-based systems** maintain higher SOC compared to **wheat and coarse-grain-based** systems. Pulses contribute organic residues and biological nitrogen fixation, improving carbon retention.
Micronutrient Correlation	Soils **deficient in SOC** tend to exhibit **higher micronutrient deficiencies** (like zinc, iron, manganese), indicating the strong linkage between soil health and nutrient cycling.
Elevation Impact	Higher land elevations tend to have **greater SOC levels**, likely due to lower decomposition rates and greater biomass cover.
Heat Absorption	Soils richer in carbon absorb **more heat**, influencing local microclimates and evapotranspiration patterns.

Recommendations & Policy Implications

Recommendation	Explanation
Promote Continuous Vegetation Cover	Encourage **cover cropping and agroforestry** to maintain soil cover and enhance organic inputs.
Facilitate Carbon Credit Systems	Reward farmers who adopt **carbon-sequestering practices** such as residue retention, organic amendments, and reduced tillage under **carbon credit frameworks**.
Encourage Carbon Sequestration Strategies	In **low-SOC regions**, promote **crop diversification, organic farming, and conservation agriculture** to rebuild soil carbon stocks.
Integrated Nutrient Management (INM)	Combine **organic manures, compost, green manure, and biofertilisers** with chemical fertilisers to restore soil organic matter.
Strengthen Soil Monitoring	Use the new **agro-ecological base map** for targeted soil health interventions and regional policy planning.

Significance

Provides a scientific basis for region-specific soil management.

Aids in achieving the goals of National Mission for Sustainable Agriculture (NMSA) and Soil Health Card Scheme.

Supports India’s climate commitments under the Paris Agreement by promoting carbon sequestration in agricultural soils.