SOIL HEALTH INSTITUTE
Enriching Soil, Enhancing Life

Benchmarking Soil Health

Southern Coastal Plain, South Carolina

Minimizing soil disturbance and maximizing living roots can reduce production costs, build resilience to extreme weather, and increase yield by improving soil health over time. What's been missing is knowing how healthy a region's soils can become through these practices. Our benchmarking approach shows what optimal soil health looks like in a region, reveals what's working to move row crop production toward that standard, and helps growers and advisors set achievable, locally relevant goals.

In South Carolina's Southern Coastal Plain, we found that **using no-till and annual cover cropping is improving soil health and resilience to water stress for cotton and peanut farmers**.

Comparing row crop soils to minimally disturbed sites

In 2024, we sampled 66 fields in Major Land Resource Area 133A, representing 500,000 acres of cropland, with 27% of the region is used for crop production, primarily cotton, peanut, corn, and soy. To find out how healthy the region's soils can become, we looked at minimally disturbed **REFERENCE** sites with optimal soil health. We then evaluated two types of row crop production: typical **BASELINE** management, and fields where growers use additional **SOIL HEALTH PRACTICES** beyond the baseline for the region.

BASELINE

Dryland cotton-peanut and corn-soy rotations with strip-till and deep ripping



25 FIELDS

SOIL HEALTH PRACTICES

Dryland and irrigated cotton-peanut and corn-soy rotations with strip-till or no-till and deep ripping, and annual cover crops for at least 3 years



24 FIELDS

REFERENCE

Grazed pastures, hayfields, pine stands



17 FIELDS

At each location, we measured three essential indicators. As these scores improve, growers may see benefits including increased yield, profitability, drought resilence, and flood management.

- **Soil organic carbon:** Measures organic matter in soil. Management that increases organic carbon content helps make nutrients and water more available to crops, making soil more productive.
- **Aggregate stability:** Small clumps of soil create needed space for water, air, and roots. When these aggregates are strong, they prevent erosion and let the field absorb water.
- **Carbon mineralization potential:** Measures the activity of soil microbes. A healthy microbiome provides nutrients to crops and breaks down crop residue to improve the soil.

We use soil texture and soil organic carbon to predict **available water holding capacity**: the amount of water the soil can store and provide to plants, improving resilience to drought and erosion. To give growers an estimate of their soil's current and potential carbon storage, we calculate **organic carbon stock** — the amount of organic carbon in the top 12 inches of soil — using soil organic carbon and bulk density measurements.

Along with management, soil texture (sand/clay content) also affected the indicators we measured, so we evaluated the results by clay content.

How healthy can Southern Coastal Plain soils become?

Here's what minimally disturbed REFERENCE soils looked like, and how the two types of row crop management compared to reference values across both soil textures.

	LOAMY SAND SOIL (7% CLAY)			SANDY LOAM SOIL (16% CLAY)		
	BASELINE	SOIL HEALTH PRACTICES	REFERENCE	BASELINE	SOIL HEALTH PRACTICES	REFERENCE
Soil organic carbon (%)	0.71	0.77	1.40	0.85	0.93	1.69
Aggregate stability (Index from 0 to 1)	0.75	0.79	0.90	0.66	0.72	0.85
Carbon mineralization potential (mg C/kg soil/day)	9	10	19	12	13	25
Organic carbon stock (metric tons C/acre)	10	10	15	11	12	18
Available water holding capacity (inches)	.68	0.69	0.80	0.73	0.75	0.89

Values were calculated using hierarchical models to adjust for differences in soil texture, pH, mean annual temperature, and mean annual precipitation across sampled locations. Available water holding capacity and organic carbon stock are estimated based on soil organic carbon plus soil texture and bulk density measurements, respectively.

Comparing minimally disturbed **REFERENCE** samples to row crop fields with **BASELINE** practices shows just how much healthier soils in row crop production systems in the region can be.

Compared to BASELINE, samples from REFERENCE fields had on average:

+97% soil organic carbon

+115% carbon mineralization potential

+18% predicted available water holding capacity

+22% aggregate stability

+57% organic carbon stock

How are management changes improving soil health?

Compared to BASELINE, samples from fields with SOIL HEALTH PRACTICES had on average:

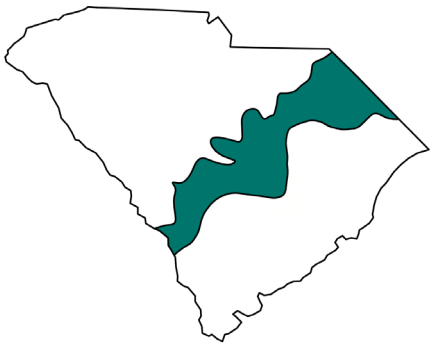
+9% soil organic carbon

+12% carbon mineralization potential

+2% predicted available water holding capacity

+6% aggregate stability

+5% organic carbon stock



Challenges that soil health practices can address in the Southern Coastal Plain include:

- Surface sealing that impacts germination and water infiltration
- Compaction from tillage that restricts root growth
- Erosion from wind and rain
- Inconsistent rainfall throughout the growing season
- Heavy rainfall in hurricane season

With no-till used on 33%, reduced tillage on 41%, and cover crops on just 7% of cropland, many more farmers in the region could benefit from improving the health of their soils.

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