



SOIL HEALTH
— INSTITUTE —

WHERE DOES CARINATA FIT WITH SOIL HEALTH

Who is the Soil Health Institute

The Soil Health Institute is a global non-profit with a mission of safeguarding and enhancing the vitality and productivity of soils through scientific research and advancement.

What is Soil Health?

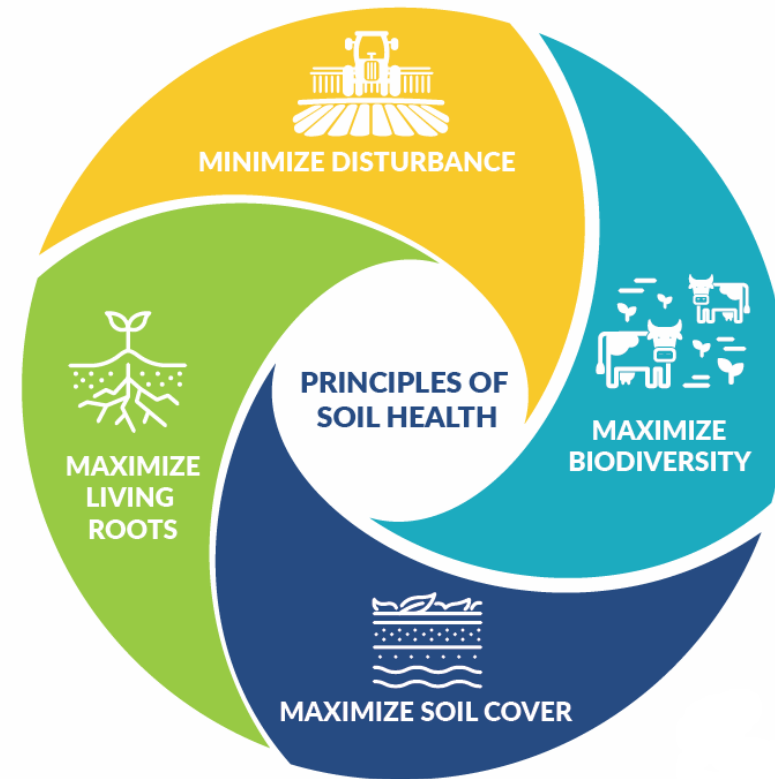


Soil health is defined as the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans.

-NRCS

Principles of Soil Health

- Maintaining soil cover with residue
- Continuous living roots
- Increased biodiversity in the crop rotation
- Minimal soil disturbance



-NRCS

Minimized Disturbance



- Protects habitat and increases diversity in soil organisms
- Maintains soil aggregates
- Prevents weed seed germination or establishment
- Crop residue is converted to soil carbon
- Water is captured and stored
- Reduced erosion by water and/or wind

Maximizing Diversity

- Resilience
- Manages pest
- Balances soil microbial communities



Photo: Dr. Adebukola Dada



Photo: Nawi F.

Continuous Living Roots

- Tap root and fibrous roots contribute to soil structure
- Root biomass
- Increased rhizosphere activity
- Protects and provides food sources for soil microorganisms
- Scavenge nutrients
- provides carbon to build organic matter
- Improves water infiltration



Photo: Nawi F.

Maintaining Soil Cover

- Prevents erosion
- Moderates soil temperatures
- Reduces evaporation
- Reduces compaction from machines and livestock
- Food for microbes
- Fuels the nutrient cycle
- Provides carbon to build organic matter



Tillage Effects on Carinata Yield

TABLE 5 Seed, oil, and erucic acid yield as affected by the effects of tillage and seeding rates, and their interaction in each site-year

Effect	Seed yield			Oil yield			Erucic acid yield		
	kg ha ⁻¹			L ha ⁻¹					
	Shorter-2018 [†]	Jay-2019	Quincy-2019	Shorter-2018	Jay-2019	Quincy-2019	Shorter-2018	Jay-2019	Quincy-2019
<i>Tillage regime (T)</i>									
Broadcast-disc	*	948 ^a	514 ^b	*	453 ^a	284 ^b	*	203 ^a	127 ^b
Conventional	1868 ^{a‡}	1009 ^a	800 ^{ab}	1029 ^a	483 ^a	432 ^{ab}	428 ^a	220 ^a	196 ^{ab}
No-till	1421 ^b	1032 ^a	931 ^a	772 ^b	507 ^a	513 ^a	321 ^b	230 ^a	232 ^a
Ripper-roller	1476 ^b	1012 ^a	875 ^a	816 ^b	507 ^a	487 ^a	346 ^b	226 ^a	222 ^a
<i>Seeding rates (S)</i>									
1 kg ha ⁻¹	1260 ^b	819 ^b	505 ^b	685 ^b	399 ^b	277 ^b	289 ^b	179 ^b	125 ^b
6 kg ha ⁻¹	1665 ^a	1135 ^a	818 ^a	923 ^a	553 ^a	451 ^a	391 ^a	248 ^a	204 ^a
10 kg ha ⁻¹	1727 ^a	1014 ^a	828 ^a	952 ^a	493 ^a	453 ^a	399 ^a	223 ^a	206 ^a
15 kg ha ⁻¹	1701 ^a	1033 ^a	969 ^a	929 ^a	505 ^a	535 ^a	382 ^a	230 ^a	243 ^a
T × S	ns	ns	ns	ns	ns	ns	ns	ns	ns

Abbreviation: ns, not significant.

[†]Site-2018 and site-2019 refer to site-harvest years.

*No data available for broadcast-disc because it was not part of the tillage treatment during 2017/2018 season.

[‡]Means followed by the same superscript letter within a column and effect were not significantly different at $p < 0.05$ (LSD).

Increased Crop Diversity with Carinata

- **Increased cotton lint yield following carinata vs. fallow and winter wheat**
Billman and Campbell, 2023. Crop Sci
- **Carinata can successfully be produced after cotton or peanut**
Iboyi et al., 2023. Industrial Crops and Products

Soil Organic Carbon in Carinata Systems

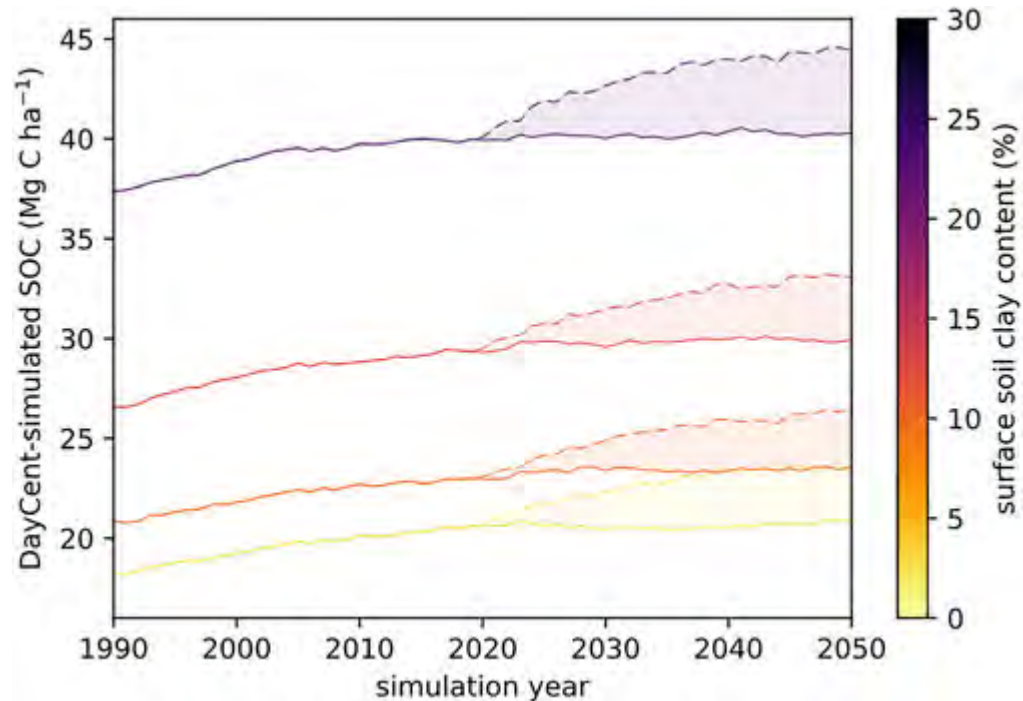


FIGURE 4. Representative soil carbon modeling results for the climate-smart no-till establishment scenario, showing four randomly selected simulation strata. The solid lines show SOC trends under the business-as-usual cotton–cotton–peanut reference rotation for each stratum, with the underlying soil texture indicated by color. Carinata integration starts in 2020 and results in an increasing SOC trend (dashed lines).

Field et al., 2022 Front Energy Res.

Economics of Soil Health

Economic analysis represents partial budgeting analysis- a method for measuring changes in production costs rather than a comparison of overall costs for conventional production compared to soil health management systems.

Expense Category	Cotton	
	Benefits	Costs
	Reduced Expense	Additional Expense
Seed	0.00	23.60
Fertilizer & Amendments	32.33	4.69
Pesticides	21.91	10.14
Round Module Covers	0.00	0.67
Fuel and Electricity	12.52	5.58
Labor and Services	20.28	10.96
Post-harvest Expenses	0.00	0.00
Equipment Ownership	32.15	14.49
Total Expense Change	119.19	72.13
	Additional Revenue	Reduced Revenue
Yield, lb.	80.00	0.00
Price Received, \$, lb	0.67	0.67
Revenue Change	53.60	0.00
	Total Benefits	Total Costs
	172.79	72.13
Change in Net Farm Income	100.66	

Economics of Soil Health

\$47.06

- Savings per acre due to soil health management

1,770 acres

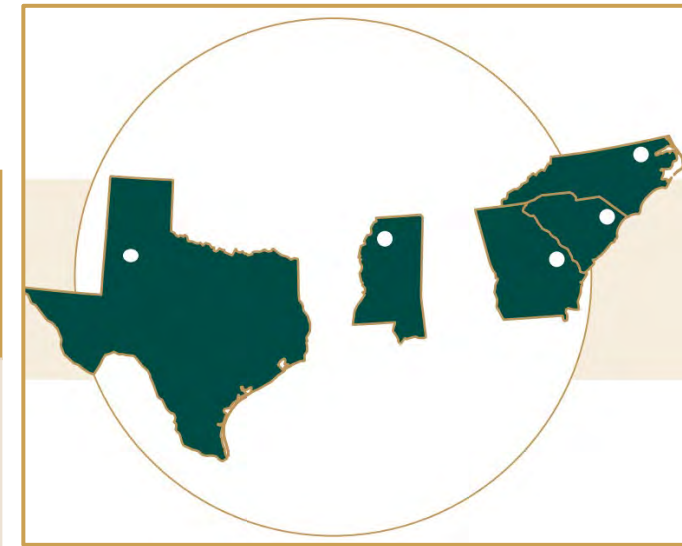
- Average acres of cotton
- 500 is the average for U.S.

\$100.66

- Increased net farm income (savings + income)

100%

- Number of farmers reporting improved crop resilience and water quality



Read the factsheet:



Carinata Economics

- **Carinata in rotation can reduce risk with a fixed contract price**
- **Could increase profitability in SE US**
- **Least risk identified in cotton-cotton-peanut rotation**

Karami et al., 2022. *Frontiers in Energy Research*

Goal

INCREASING ADOPTION OF REGENERATIVE SOIL HEALTH SYSTEMS IN U.S. COTTON THROUGH EMPOWERING FARMERS AND THEIR ADVISORS WITH LOCALLY RELEVANT TECHNICAL KNOWLEDGE, ECONOMIC INFORMATION, AND DECISION SUPPORT TOOLS.



Overview

Geographic Focus

9 States, representing 85% of cotton production - Texas, Georgia, Mississippi, Arkansas, Alabama, North Carolina, Missouri, California, and Oklahoma

Duration

5 years

Key Collaborators

Cotton Incorporated, State Extension Programs, Natural Resources Conservation Service, National Association of Conservation Districts, Field to Market, Prairie View A&M University, University of Arkansas Pine Bluff, Alcorn State University, Fort Valley State University, Minorities in Agriculture and Related Sciences, Rivers Agency

Program Focus Areas

Soil Health Targets, Soil Health Economics, Soil Health Training, Impact Assessment, Diversity & Inclusion

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