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Cover Crop Effect on Soil Carbon Fractions Under Conservation Tillage Cotton

Why Does it matter?

Soil organic C (SOC) is critical to maintaining soil productivity because it influences important soil physical, chemical and biological properties. Soils in the humid region of the Southeastern USA have lost SOC due to a history of intensive cultivation and warm humid climate that promotes microbial degradation of crop residues. Conservation tillage with cover crops can help restore SOC by providing residue C and decreasing rates of SOC loss. Cover crop mixtures can enhance SOC by contributing to active organic matter pools and altering C cycling dynamics due to improved biomass production and diversity of chemical constituents compared with planting a single species. Optimizing mixtures of cover crops for restoring SOC can provide beneficial information for producers seeking to restore soil productivity and improve crop production.

What was done?

Agricultural Research Service scientists from Watkinsville and Tifton, GA, along with scientists from the University of Georgia and Fort Valley State University evaluated alternative combinations of cover crops for conservation cotton production at Tifton and Bartow, GA over three years.

Cover combinations included:

(1) Crimson clover (*Trifolium incarnatum* L.),

(2) Rye (*Secale cereale* L.),

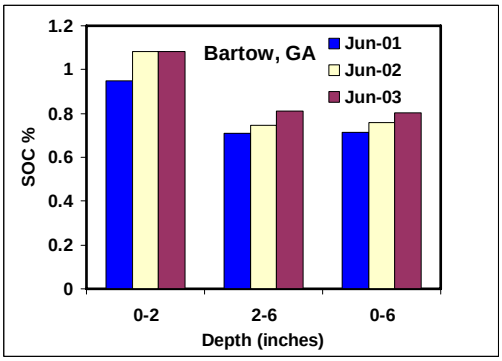
(3) Blend of legumes containing balansa clover (*Trifolium michelianum* Savi), hairy vetch (*Vicia villosa* Roth), and crimson clover,

(4) Rye + Combination 3

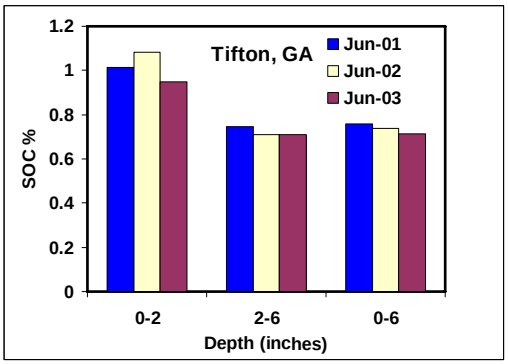
Dryland (Bartow) and irrigated (Tifton) cotton was grown in strip tillage systems where legume cover crops were killed in strips for cotton planting and rye was totally killed. Between-row legume cover crops continued to grow three to four weeks. SOC and the more active fractions of soil C, potentially mineralizable C (PCM) and microbial biomass C (MBC) were measured three times. The active fractions are more dynamic and are considered to be indicators of long term change in SOC.

What was found?

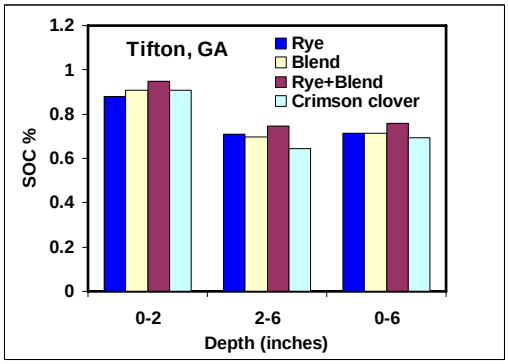
Changes in SOC, were small while soil active and slow C fractions were influenced by rainfall, temperature, C inputs from cover crops and cotton biomass, residue C/N ratio, and soil water conditions at both locations. In Bartow's dryland cotton, only seasonal variations in PCM and MBC occurred in response to changes in temperature, rainfall, and substrate availability.



In contrast, in Tifton's irrigated cotton, differences in C inputs and residue C/N ratio between cover crop treatments and seasonal variations in temperature and rainfall influenced SOC, PCM, and MBC levels. Greater C inputs with rye and rye + blend than with blend and crimson clover increased SOC and MBC but PCM remained the same or decreased slightly.



Although not directly comparable, results from the two locations indicate that differences in soil water availability (irrigated versus non-irrigated) not only produced different crop biomass yields and C inputs but also influenced C mineralization, microbial dynamics, and organic matter in comparable soils under conservation tillage cotton. Benefits of cover crops in increasing C sequestration and improving soil quality can be achieved more readily in irrigated than in dryland cotton.



What is the impact?

A majority of the 2.9 million acres of cotton produced in the Southeast is located on the Costal Plain where adoption of conservation systems in cotton is 50%. Addition of cover crops is critical for maximizing benefits of conservation systems. Although the changes detected in SOC and active C fractions were small they indicate that cotton producers in the region would benefit from adopting more intensive cover crop practices to increase SOC and cotton production. This information is also important for NRCS personnel and agricultural consultants seeking to increased water use efficiency, boost cotton yields, and protect agricultural soils.

Research Team and Contact information

Cooperating Scientists:

Agricultural Research Service: Harry Schomberg & Glynn Tillman (Georgia), Upendra M. Sainju (Montana), Sharon L. Lachnicht-Weyers (Minnesota)

University of Georgia: Sharad C. Phatak (Tifton)

Fort Valley State University: Bharat P. Singh & Wayne F. Whitehead

Contact: *Dr.* Harry Schomberg, 706-769-5631 x 222

Email: harry.schomberg@ars.usda.gov

Publication:

Sainju, U.M., H.H. Schomberg, B.P. Singh, W.F. Whitehead, P.G. Tillman, S.L. Lachnicht-Weyers, U.M. 2007. *Cover crop effect on soil carbon fractions under conservation tillage cotton.* Soil & Tillage Research 96:205-218.