Soil Carbon Changes after 10 Years of Corn Stover Removal in an Irrigated System.

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Background

Corn stover is viewed by the renewable energy industry as a large source of inexpensive and "underutilized" feedstock for biomass ethanol production. Stated potential benefits of removing stover for ethanol production are: 1. Increased income for the grower, 2. An expanded industrial base for farming communities from ethanol plants and their associated support activities (residue collection and hauling), 3. Reduced consumption of fossil fuels because tillage is reduced, and 4. Increased C sequestration because residue removal will result in less tillage to incorporate residues in high production systems.

Objective

Determine the influence of residue removal in an irrigated continuous corn high production system on soil carbon levels.

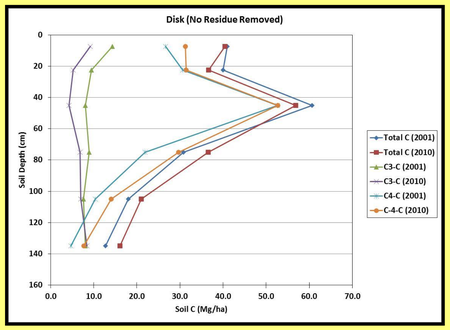
Methods & Materials

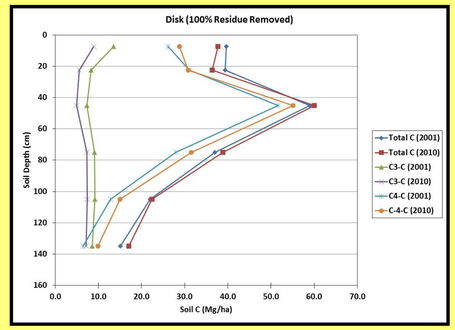
The experiment is a randomized complete block design with the factorial treatments arranged in split-plots. Whole plot factor is tillage: no tillage or disk. Sub-plot factor is residue removal: 0, ~50%, and ~100%. One hybrid and N-level (200 kg N/ha) is used throughout the study. The study is irrigated.

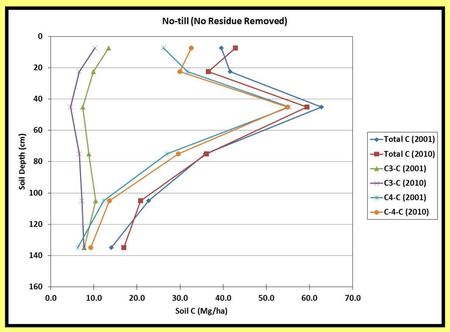
Soil samples were collected in 2001 from all plots to a depth of 150-cm at the beginning of the study and again in the fall of 2010 after harvest to the same depth. All samples were analyzed for total C and $^{13}C/^{12}C$ isotope ratio by combustion. Total C, C3, and C4 levels were calculated using bulk density values for each sampling depth.

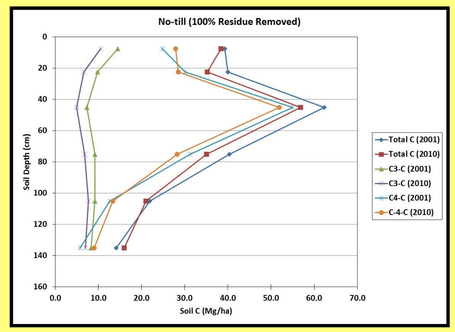
Results

- Initial soil C levels from 2001 were relatively uniform across the site.
- Soil C levels in the top 30 cm were significantly reduced in both tillage systems with residue removal.
- Soil C levels were significantly reduced in the top 30 cm from 2001 to 2010 in both tillage systems, except with no residue removal under notill.
- Soil C levels at depths below 30 cm have not been significantly affected after 10 yr.









Conclusions

- Residue removal has significantly reduced total soil C levels in the top 30 cm after 10 years, mainly due to greater losses of C3-C than gains in C4-C.
- High production levels at this irrigated site has not resulted in greater soil C levels, with or without residue removal.
- Residue removal would not be recommended at this site based on total soil C levels after 10 years.

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