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Measuring Soil Profile Carbon Sequestration Rates with a Vis-NIR-EC-Force Probe

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Using soil conservation tillage practices to sequester soil carbon is being considered as an incentivized method for reducing greenhouse gases. There is skepticism, however, that soil carbon can be accurately measured and accounted for in a way that yields credible real additional reductions in greenhouse gases. Also, recently published research has raised doubts that profile carbon (0-60 cm) is sequestered by the adoption of conservation tillage practices that directly affect only the top few centimeters of soil. In order to address these two concerns, a Veris P4000 Vis-NIR-EC-Force hydraulic probe was deployed on long-term, replicated tillage plots at five sites throughout the eastern U.S. The geographic spread provided a wide range of climate, soils, cropping, and tillage practices. Lab-analyzed samples and Veris spectroscopy-based sensors were utilized to measure carbon levels, and to compare the accuracy and cost-effectiveness of lab and sensor measurements. At each site, Veris sensor probes collected data from more than a hundred 0-60 cm insertions, approximately 30 0-60 cm soil cores were collected, providing 100 lab-analyzed calibration/validation samples for each state. Results showed that while carbon can be sequestered in the soil profile by changing cropping practices, the responses vary with regional climate and cropping constraints. Significant carbon sequestration amounts, nearly 50 mg C per hectare, were found in a cropping system that included cover crops and manure. At each site, at least one conservation practice resulted in increased carbon within the soil profile. Lab analyses and field sensors were able to measure soil carbon adequately at all but one site, where C levels were extremely low.