Science Societies

More consistent sampling and analysis of farm soil organic carbon needed for accurate test results

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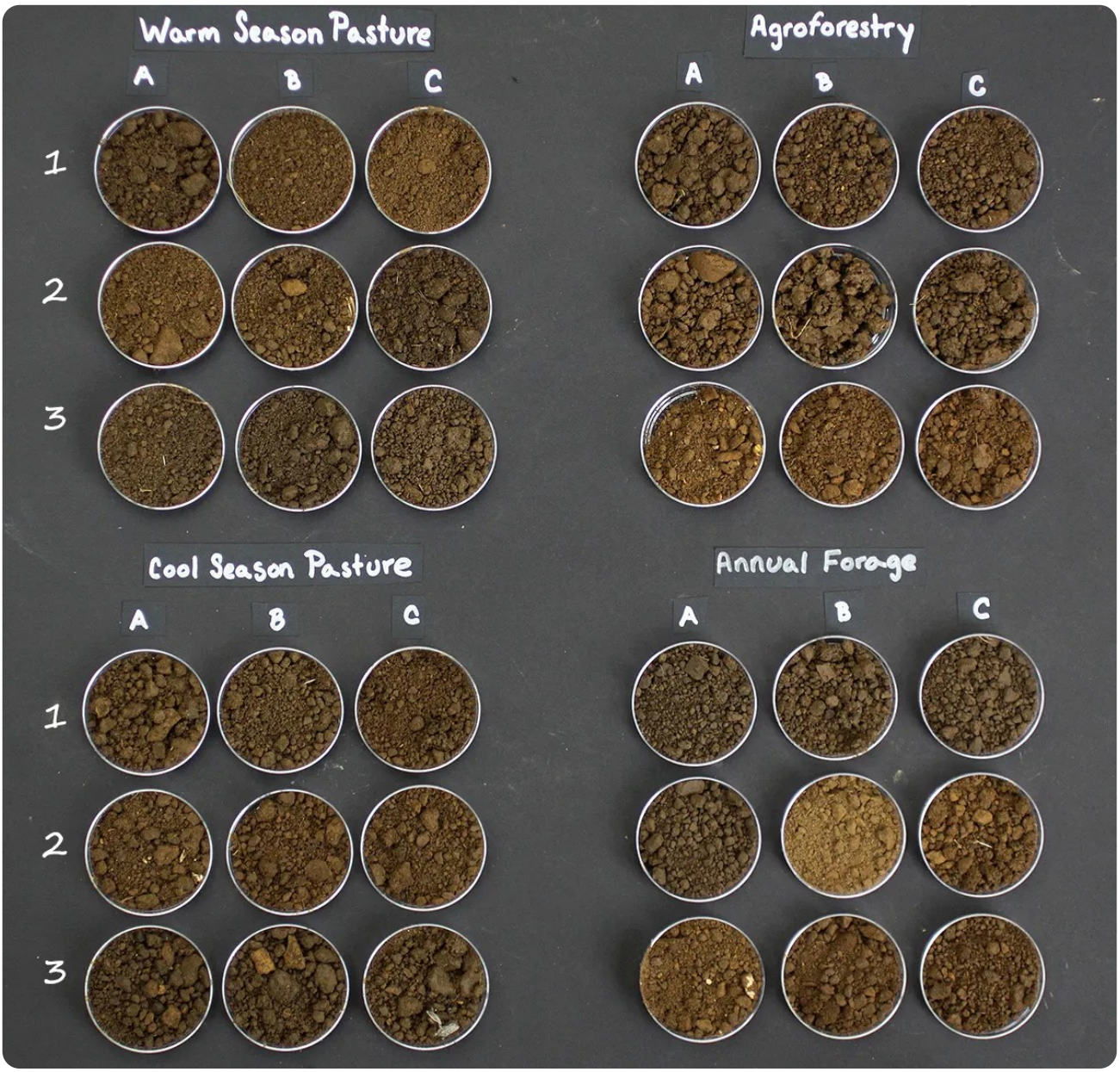

Freshly sampled soils from across the farm. There was significant variability in soil texture and composition across the four management ecosystems, and even within each management system's 3 spatial zones. Photo courtesy of Woods End Laboratories, LLC.

Farmers and agronomists are challenged with collecting accurate and representative soil samples from their fields. As interest grows in monitoring soil health—especially year-to-year changes in organic carbon—more attention is turning to how landscape variability and lab methods influence soil organic carbon test results.

A recently converted regenerative farm in Tennessee, with four different management systems put in place to restore and improve soil health, served as a testing ground for evaluating sources of variability in soil carbon data. Sample numbers (sampling intensity), sample location across different field features (stratification), and lab testing procedures were all compared. For consistency, four different labs used the same methodology for analyzing soil organic carbon—total carbon combustion—on identical sets of samples.

On the farm, 60% of the soils were Armour series (soil order Alfisols) bordering a floodplain where Arrington soil series (Mollisols) predominated. The soils exhibited deep profiles. The project sampled the top 30 cm (12 inches) of soil over the 130 ha (320 acre) farm. Photo courtesy of Zach Wolf.

Significant variation was observed at every level. Surprisingly, differences between laboratories were about the same as differences between distinct spatial zones on the farm. One overlooked factor—the amount of soil combusted in each lab run—appeared

to be a major contributor to inconsistent results.

The findings point to two needed steps to improve accuracy and save costs: (i) increase sample numbers with smart distribution across the landscape while minimizing compositing and (ii) ensure labs use an amount of soil optimized to the combustion test equipment. Without these steps, soil carbon data may misrepresent real differences or even lead to wasted time and money—especially when farms rely on this data to guide long-term decisions.

Dig deeper

Brinton, W., Basso, B., Millar, N., Covey, K., Bettigole, C., Jagadamma, S., Loeffler, F., & Kolodney, S. (2025). An inter-laboratory comparison of soil organic carbon analysis on a farm with four agricultural management systems. *Agronomy Journal*, *117*, e270018. https://doi.org/10.1002/agj2.70018
