What soil properties regulate respiration rate as an indicator of soil health?

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Objective

To assess the relationship between short-term (a CO₂ evolution (soil respiration) (an indicator of soil health) and other soil properties (e.g., organic carbon (OC), total nitrogen (TN), particulate organic matter (POM), and water-extractable organic carbon and nitrogen (WEOC) under perennial and annual cropping systems.

Materials & Methods

- The experiment was established in 2008 near ISU. All plots are tile drained and receive no tillage.
- The experimental treatments: continuous corn (CC), continuous corn with a rye cover crop (CCW), unfertilized reconstructed multispecies prairie (P), and fertilized reconstructed multispecies prairie (PF).
- Soil sampling: Two composite samples from each plot were collected from the 0-15 cm depth at four times, i.e., in April and November in both 2016 and 2017.
- Soil analyses: Soil properties were determined, e.g., soil CO₂ respiration using the Solvita technique (Fig. 1), OC, TN, POM, WEOC, and WEON.
- Field plot layout

Conclusions

Compared to annual bioenergy crops (CC and CCW treatments), soil under the perennial bioenergy crops (P and PF treatments) had significantly greater concentrations of POM, greater CO₂ respiration rates, and higher soil health indices. POM carbon and water-extractable carbon had statistically significant impacts on CO₂ respiration, but other parameters tested (non-POM organic C, total N, water-extractable N, and clay) did not.

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