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Natural Resources Research Update

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Title: Use of the Solvita[®] gel system to measure soil carbon dioxide respiration as a measure of soil fertility.

The measurement of soil carbon dioxide respiration is a means to gauge biological soil fertility. Test methods for respiration employed in the laboratory vary somewhat, and to date the equipment and labor required have somewhat limited more widespread adoption of such methodologies. A new method to measure soil respiration was tested along with the traditional alkali trap and titration method (1). The new method involves the Solvita[®] gel system which was originally designed for CO₂ respiration from compost, but has been applied in this research to soils with treatments of increasing dairy manure compost. The objective of this research was to: (1) examine the relationship between the CO₂ release after one day of incubation from soils amended with dairy manure compost that have been dried and rewetted as determined using the titration method and the Solvita[®] gel system; and (2) compare water-soluble organic N, as well as C, N, and P mineralization after 28 days of incubation with 1-d CO₂ release from the titration method and Solvita[®] gel system. Both 1-day CO₂ from titration and the Solvita[®] gel system were highly correlated with cumulative 28 day CO₂ as well as the basal rate from 7-28 days of incubation. Both methods were also highly correlated with 28 day N and P mineralization as well as the initial water extractable organic N and C concentration. The data suggest that the Solvita[®] gel system for soil CO₂ analysis could be a simple and easily used method to quantify soil microbial activity and possibly provide an estimate of potential mineralizable N and P.

In another study (2) soil CO₂ respiration was measured using three methods: (1) titration method; (2) Infrared gas analysis (IRGA); and (3) the Solvita[®] gel system for soil CO₂ analysis. We acquired 36 soil samples from across the USA for comparison which ranged in pH from 4.5-8.5, organic C from 0.8-4.6% and the clay content from 6-62%. All three methods were highly correlated with each other after 24 hr. of incubation (titration and Solvita[®] $r^2=0.82$, respirometer and Solvita[®] $r^2=0.79$ and titration vs. respirometer $r^2=0.95$).

The 24 hr. (1-day) CO₂ release from all three methods was also highly correlated to both basal soil respiration (7-28 d) and cumulative 28 d CO₂ respiration. An additional 24 soil samples were acquired and added to the original 36, for a total of 60 soil samples. These samples were used for calibration of the Solvita[®] gel digital reader results using CO₂-titration results and regression analysis. Regression analysis resulted in the equation $y=20.6*(\text{Solvita}^{\text{®}} \text{ number})-16.5$ with an r^2 of 0.83. The data suggest that the Solvita[®] gel system for soil CO₂ analysis could be a simple and easily used method to quantify soil microbial activity. Once standardized soil sampling and laboratory analysis protocols are established, the Solvita[®] method could be easily adapted to commercial soil testing labs as an index of soil microbial activity.

1. Haney, R.L., Brinton, W.H., Evans, E. 2008. Estimating soil carbon, nitrogen, and phosphorus mineralization from short-term CO₂ respiration. *Communications in Soil Science and Plant Analysis*. 39(17&18):2706-2720.
2. Haney, R.L., Brinton, W.F., Evans, E. 2008. Soil CO₂ respiration: Comparison of chemical titration, CO₂ IRGA analysis and the Solvita[®] gel system. *Renewable Agriculture and Food Systems*. 23: 171-176.

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