APPENDIX D-2
Analytical Procedure for Total Organic Carbon (TOC): Method ASA 29.3.5.2

Total Organic Carbon - Rapid Dichromate Oxidation Technique
ASA Method 29-3.5.2

Summary of Method

Organic carbon in soil is oxidized by reacting with potassium dichromate. The heat of dilution of sulfuric acid in water provides heat for the reaction. Excess dichromate is titrated with ferrous ion using *o*-phenanthroline as the indicator. The oxidation reaction is as follows:

$$2\ Cr_2O_7^{2-} + 3\ C + 16\ H^+ = 4\ Cr^{3+} + 3\ CO_2 + 8\ H_2O$$

Reagents

1. 1 *N* Potassium Dichromate Solution. Dissolve 49.04 g of reagent-grade $K_2Cr_2O_7$ (dried at 105°C) in water, and dilute the solution to 1 liter in a volumetric flask.

2. Sulfuric Acid, concentrated (not less than 96%). If chloride is present in soil, add silver sulfate at 15g/l.

3. *o*-Phenanthroline-ferrous complex, 0.025M. Dissolve 14.85 g of *o*-phenanthroline monohydrate and 6.95 g of ferrous sulfate heptahydrate in water. Dilute the solution to a volume of 1,000ml. (This complex is also available under the trade name of Ferroin.)

4. 0.5 *N* Ferrous Sulfate solution. Dissolve 140 g of reagent-grade $FeSO_4$•7H2O in water. Add 15 ml concentrated sulfuric acid. Cool the solution and dilute it to a volume of 1,000ml. Standardize this reagent daily by titrating against 10.0 ml of 1N potassium dichromate.

Or

0.5 *N* Ferrous Ammonium Sulfate Solution. Dissolve 196 g of reagent-grade $(NH_4)_2SO_4$•FeSO4•6H2O in water. and dilute it to a volume of 1,000ml. Standardize this reagent daily by titrating against 10.0 ml of 1N potassium dichromate.

Procedure

1. Grind the soil to pass through a 0.5-mm sieve, avoiding iron or steel mortars.

2. Transfer a weighed sample, containing 10 to 25 mg of organic C, but not in excess of 10g of soil, into a 500-ml wide-mouth flask.

References

"Walkley-Black Procedure" Section 29-3.5.2 in *Methods of Soil Analysis, Part 2, Chemical and Microbiological Properties*, Second Edition, A. L. Page Editor, American Society of Agronomy, Inc. 1982