

Summary

This Special Technical Publication (STP) on the Application of Agricultural Analysis in Environmental Studies serves to present a sampling of the state of the art and the leading edge of research in the field. The topics addressed in this publication are:

1. General Soil Tests
2. Nutrient Status
3. Organic Constituents
4. Heavy Metal Content
5. Liming Requirement

The papers included herein, which have undergone peer review and extensive revision since their original presentation, provide state-of-the-art information on the analyses available in the agricultural community for use in environmental studies. This collection should not be viewed as the sum total of all the analytical methods suitable for use from agriculture, but rather a starting point from which the environmental professional can begin to realize the wealth of knowledge available from intracooperation between diverse disciplines.

General Soil Tests

A wide range of papers on the analysis of chemicals in the soil environment were submitted for this symposium. A number of them, however, did not fit well into a common theme. Their incorporation in the symposium and in this technical publication is indicative of their importance in an environmental evaluation.

Lewis, MacDonell, and Gnanapragasam present a scheme for using existing soil physical, chemical, and bioassay methods to reclaim coal mining spoils. The goal of the scheme is to establish vegetation directly of the waste spoil piles abandoned by "preregulation" mining practices.

Kimble, Knox, and Holzhey outline the analytical methods currently used by the Soil Survey Laboratory of the National Soil Survey Center, National Cooperative Soil Survey. These methods include the physical, chemical, and mineralogical analysis of soil.

Brown and Reinsch present the concepts used in soil survey to develop mapped soil areas, as well as those used to collect and prepare soil samples for the survey laboratory.

While the methods in these papers are not the product of recent research, they form an excellent review of the state of current soil testing. Such a review is invaluable to new investigators which may not know where to start in soil analysis. For more experienced investigators, this review will serve as a checklist of the soil parameters for consideration in any site study.

Nutrient Status

The accurate evaluation of the concentration of nutrient elements and compounds is essential to some types of environmental site assessment and remediation activities. An

adequate concentration and balance of nutrient elements and compounds in a soil matrix is essential to maintain microbial populations for successful bioremediation of contaminated soil media. However, the nutrient status of a soil matrix can become problematic if concentrations of nutrient elements and compounds exist in significant excess. Additionally, accurate evaluation of these elements and compounds can provide an indication of the migration of contaminants from the source area.

Sharpley and Smith present a procedure to allow routine measurement of potential bioavailable phosphorus in runoff waters. The method uses a correlation between phosphorus extracted from the runoff with 0.11 *M* sodium hydroxide (NaOH) and phosphorus uptake by the algae, "*Selenastrum capricornutum*."

Menon describes a method for measuring insoluble phosphorus in soils for evaluating its bioavailability. The test makes use of paper strips impregnated with iron oxides as a sink for the phosphorus mobilized in a soil solution.

Organic Constituents

The importance of accurate and consistent measurement of organic constituents in soil is obvious. A major portion of both the natural soil and the chemicals which contaminate them is organic in nature.

Wolt presents a method which uses soil solution displacement to measure xenobiotics. The displacement and analysis of soil solution provides three benefits: refined measurement of the bioavailability of soil active xenobiotics; static measurements of phase partitioning of xenobiotics under conditions comparable to the field; and dynamic measurements of xenobiotics availability as a function of residence time in the soil.

Schwab, Splichal, and Sonon discuss the factors affecting the extraction of Alachlor, Atrazine, and their degradation products from soil samples. They also present an alternative extraction method using methanol which is less tedious, less expensive, and less subject to contamination than the conventionally used methods.

Chirnside and Ritter describe a solid-phase extraction technique to monitor pesticide movement in soil. The solid-phase extraction technique concentrations and extracts contaminants from the soil efficiently and economically. This method provides an alternative to the liquid-liquid extraction methods commonly employed.

Heavy Metal Content

Heavy metal ions, as environmental contaminants, are one of the oldest environmental problems existing today. These metals were first thrust into the limelight of environmental concern in the late 1960s. At that time, the concern stemmed from the metal ion content of municipal sewage sludge being spread on farmland. While this problem has taken a back seat to other sources and contaminants, the accurate determination of metal content in soil remains as a primary concern of the environmental community.

Baker, Lotse, and Amistadi describe a test based on the concept that the availability of an ion to plants is related to its activity or relative partial molar free energy within the substrate. Therefore, for soil systems, the availability of an ion to a plant root is affected by the water properties, mineral solubilities, ionic adsorption, and other entropy changes.

Heinzig, DeYong, Bowden, Brayton, and Anglin outline a method which couples anion exchange separation and a spectrophotometric analysis to determine lead and cadmium content in sulfuric acid digested soil and sludges. The method is advantageous since the selectivity of the anion exchange separation allows the use of a spectrophotomatic indicator

with a high extinction coefficient. Use of this technique results in detection limits which are in the range of the low parts per millions.

Sawhney, Bugbee, and Stillwell describe experiments on the composted sewage sludge columns to model the leachability of heavy metals from the compost.

Peterson, Luce, and Jenkins present the results of pilot-scale leachability tests to model and predict the migration potential of arsenic from spent gold ore. The experiments consisted of graded serial batch extractions designed to mimic the leachate movement through time and space conditions not available by column tests.

Liming Requirement

It has long been known that lime additions rapidly improve the mechanical characteristics of the soil. The addition of calcium or magnesium carbonates displaces and neutralizes soil acidity. This in turn changes the chemical solubility of elements in the soil solution and influences the ability of chemicals to migrate.

Senft, Baker, and Amestadi describe the use of a dual buffer lime requirement test to reclaim two coal mine refuse sites. Their success demonstrates the ability to create "synthetic" soils from previously unvegetated waste piles.

Grube, Ammons, and Freeman modified a method designed to determine the neutralizing equivalence of agricultural limestone. Their modification results in the quantification of bases present in a broad diversity of solid reagents and products involved in environmental processes. Their discussion covers the method of application of the technique to monitor amounts of reagents added to neutralize acid waste materials.