SOIL AND ATMOSPHERIC SCIENCE

Chairman: STEPHEN A. JUSTHAM
Ball State University, Muncie, Indiana 47306

Chairman-Elect: GARY C. STEINHARDT
Purdue University, West Lafayette, Indiana 47907

Abstracts

Chemistry and Mineralogy of Some Shale Derived Soils of Southeastern Indiana. J. R. CRUM and D. P. FRANZMEIER, Agronomy Department, Purdue University, West Lafayette, Indiana 47907.——In Clark County, Indiana, it has been recognized by foresters and soil scientists that the soils developed from the gray-green, New Providence shale are very poor forest producers. In this study, soils ranging from poor forest production to high forest production were sampled and characterized in an attempt to determine those properties, chemical and physical, responsible for differences in forest production.

Three soils were studied. The Rarden, developed on the gray-green New Providence shale, is a member of the fine, mixed, mesic Aquic Hapludults and is considered to have a much lower site index (productivity) than its physical properties would suggest. The Trappist (fine, mixed, mesic Typic Hapludult), developed on the black New Albany shale, is considered to be a moderate forest producer. And the Hickory (fine-loamy, mixed, mesic Typic Hapludalf), developed on calcareous Illinoian glacial till, is considered a high forest producer. Each soil was sampled and then characterized by the Purdue Soil Characterization Laboratory.

To supplement the soils study, leaves from dogwood, sugar maple, and white oak trees were collected at each site and analyzed for twelve nutrient and micronutrient concentrations.

The Rarden and Trappist have very low extractable calcium (<1 meq/100 g) and very high extractable acidity concentrations indicative of highly weathered Ultisols. Of the acidifying cations, hydrogen and aluminum, aluminum is by far the dominant cation with contents as high as 14 meq/100 g in the Rarden soil and 10 meq/100 g in the Trappist soil.

We propose that the Rarden's poor forest production is due to extremely low levels of extractable calcium and very high levels of aluminum. the Trappist has better production due to slightly higher levels of calcium and significantly lower levels of aluminum throughout the profile.

Secondary and Micronutrient Test Data of Purdue's Soil Testing Laboratory. RUSSELL K. STIVERS, Department of Agronomy, Purdue University, West Lafayette, Indiana 47907.——The purpose of this study was to determine (1) the number of soil tests for calcium, magnesium, sulfur, boron, manganese, and zinc made, (2) average values for these tests, and (3) percentages of these tests in the low and very low levels as determined by or for the Purdue Plant and Soil

Analysis Laboratory. Four-year (1974-1975 through 1977-1978) annual average numbers of tests made were 816 for calcium and magnesium, 164 for sulfur, 278 for boron, 403 for manganese, and 414 for zinc. For a fifteen month period in 1977-1978 average test values in parts per two million were 3035 for calcium, 549 for magnesium, 23.0 for sulfur, 1.2 for boron, 40.8 for manganese, and 8.0 for zinc. Both strip-mine and ordinary farm samples were included in these averages, but farm samples were less than half of the total for each element. Out of the farm samples tested, the percentages testing low and very low were 2.1 for calcium, 5.4 for magnesium, 59.1 for sulfur, 82.6 for boron, 68.4 for manganese, and 40.0 for zinc. The implications of this study are that soils that are potentially deficient (testing low and very low) in sulfur, boron, manganese, and zinc may be more widespread in Indiana than previously reported.

Algal Availability of Soluble Phosphorous in Drainage Water of the Black Creek Watershed. R. A. DORICH and D. W. NELSON, Purdue University, West Lafayette, Indiana 47907.——The availability of soluble phosphorous to algae was determined in drainage water of the Black Creek Watershed, Allen County, Indiana. Water samples were collected in sterile glass containers from 7 sites within the Black Creek Watershed immediately following rainfall events on March 28 and June 30, 1977. Algal availability was determined in filtered water samples by the Provisional Algal Assay Procedure Bottle Test (PAAP). The PAAP method involves the generation of a reference curve relating the population of *Selanastrum capricornutum* (a single-celled green alga) and P concentration in PAAP nutrient medium after 4 days of incubation. Four days after inoculation of water samples with *S. capricornutum*, cell numbers in the sample are also determined. The quantity of algal available P in the water sample was determined by comparing the number of cells produced in the water sample to the relationship between algal population and P concentrations in the PAAP nutrient medium.

To determine if a micronutrient deficiency was limiting algal growth, water samples inoculated with *S. capricornutum* were spiked with micronutrients and the growth response compared to that in the unamended sample. The average concentration of soluble inorganic phosphorus (SIP) in March and June samples was 0.149 and 0.069 μg P/ml, respectively. The average algal available SIP in March and June samples was 0.094 and 0.031 μg P/ml, respectively (63 and 45% of SIP). The concentration of algal available P was not equal to or greater than the SIP concentration in any sample. The addition of micronutrients to water samples collected from the Maumee River in both March and June stimulated growth of *S. capricornutum*, suggesting that a micronutrient deficiency was limiting algal growth in the river water.

Predictability of Change in Soil Reflectance on Wetting. J. B. PETERSON, R. H. BECK, and B. F. ROBINSON, Laboratory for Applications of Remote Sensing, Purdue University, West Lafayette, Indiana 47907.——An array of ratios of the reflectances for oven-dry over those for 1/3-bar water levels at .708 μm of surface samples of 15 Indiana soils, 11 mollisols and 4 alfisols of which the mollisols (prairie soils) are darker colored by Munsell color standards and significantly higher in organic carbons than the alfisols (hard-wood forest soils),

shows two significantly different populations for the two groups by the T test. The mean ratio for the mollisols is 2.89 and for the alfisols 2.2.

However, when the decrease in reflectance at .708 μm resulting from wetness (oven-dry reflectance—1/3 bar reflectance) is evaluated over the entire 15 samples the regression shows an R^2 of .9350. The R^2 test for the loss in reflectance for the 11 mollisols, only, on wetting to 1/3 bar versus the reflectances when oven-dry increases to .97441.

When another reflectance band is used, the 1.94-2.06 μm which is not greatly affected by atmospheric moisture when used with the Exotech-30, a similarly orderly relationship is apparent in the reduction in reflectance on increasing the moisture levels from oven-dry to 1/3 bar, in this case an R^2 of .9521.

These preliminary studies emphasize the very good possibility that a careful analysis over a larger sample of soils will show an orderly relationship in change of reflectance among different levels of wetness.

Effects of the Freeze-Thaw Cycles on Compacted Soils. GARY C. STEINHARDT, Agronomy Department, Purdue University, West Lafayette, Indiana 47907.——Soil compaction is a problem observed in many fields in Indiana. It is generally thought that the winter freezing and thawing has reduced soil compaction in the past. One inch deep cores of silt loam soil compacted by a hydraulic press were prepared. These cores were saturated then brought to a moisture content of 40 cm tension on a tension table. Strength of compaction was measured using a needle penetrometer. The cores were frozen in a -23° C freezer and thawed. Some of the cores had weights on top of the core to stimulate overlying soil material. The lowest strength was measured after the saturated core was brought to 40 cm tension not after freezing and thawing. The cores with weights on during the freezing and thawing had greater soil strength than those without weights.

A Determination of Amount of Suspended Solids Carried into Prairie Creek Reservoir. C. E. SPAID and H. F. SIEWERT, Department of Natural Resources, Ball State University, Muncie, Indiana 47306.——The amount of suspended matter carried by four major tributaries of Prairie Creek Reservoir were monitored from March to May, 1978. Positive correlations between discharge, suspended solids, and turbidity were observed. The average amount of suspended solids washed into the reservoir by the four tributaries was 1,379 kg/day during the spring. The life span of the reservoir was estimated.

Air Temperature Fluctuation Aboard the *Fairsea* During the Eclipse of 12 October 1977. WILLIAM R. GOMMEL and VIVIAN P. GOMMEL, Department of Earth Sciences, Indiana Central University, Indianapolis, Indiana 46227.——Using a Science Associates sling psychrometer in tropical waters 1375 nautical miles south of Los Angeles, California, a reduction in air temperature of approximately 4F was observed from 7 minutes after first contact (85.4F at 19:15 GMT) to the end of totality at third contact (81.4F at 20:46 GMT). Wet-bulb temperature fell 1.5F from 78.4F to 76.9F during the same period, and relative humidity increased from 73% to 81%. By 21:45 GMT, the temperature had increased to 84.8F.

At totality onset (12:08 PDT or 19:08 GMT) the ship was located at 11° 6.5′N, 118° 7′W and dead in the water. Clouds were 0.3 to 0.4 cumulus and 0.3 cirrus throughout the eclipse, and horizontal visibilities were more than 10 miles. Surface wind was SE 10-12 knots and did not seem to increase perceptibly as observed by the authors during the Norwegian and African eclipses of 30 June 1954 and 1973, respectively. Shadow bands (apparently an interference of light phenomenon) also were not as distinct as during the African eclipse of 30 June 1973.

The increased velocity of air flow at the observers' location in front of the ship's main air-intake screen resulted in an apparent adiabatic reduction in air temperature of approximately 0.5F (associated with the slight reduction in static pressure there). Otherwise, actual changes in the free air temperature over the ocean should be close to those observed by the authors. Under similar eclipse conditions over inland areas such as Indiana, air temperature fluctuations should be several times larger than observed over oceans.