The book as a whole, however, I found to be valuable in bringing together in one volume a tremendous amount of information on Canadian tills, scattered at present in many diverse journals and publications. The book should be of value not only to Canadian pedologists, geomorphologists, and geologists but also to all workers involved in studies on glacial till. Even though I suspect that not a large majority of readers will be interested only in a few selected papers covering their own particular discipline or interests.—L. J. EVANS, Assistant Professor, Department of Land Resource Science University of Guelph, Ontario, Canada

Soil Porosity Characterization by Means of Electro-Optical Image Analysis (Quantimet 720)


In this paperback publication, S. N. A. Ismail describes improvement in existing methods for preparing thin sections of soils and for describing soil porosity. He shows that freeze-drying of samples and special care in preparation of thin sections is needed to obtain the 15 μm thickness needed to examine pores down to 30 μm in diameter. Even so, the size distributions determined with a physical method (Pf) are mostly totally different from micromorphometric soil-porosity measurements, especially in sandy soils. The lack of agreement, he believes, results from difficulties with the physical measurements and not with the micromorphometric measurements.

Two samples (8 by 15 cm) with different freezing rates were achieved through freeze-drying samples (8 by 15 cm) within a very short time interval in Freon 12 (CCLF2) at −15°C. Thin sections were made from the outer 4 mm of the blocks. The fabric of this portion is unchanged by freeze-drying although there may be many cracks in the center of the blocks. Subsequent drying takes place at a constant vacuum of 200 mtorr and is complete within 48 hours. The impregnation is accomplished in two steps. The first freeze-dried sample is soaked in 50 min Hg vacuum with Synolite 544 diluted with monostyrene or acetone. This procedure is completed in about 1 hour. Next a pressure of 40 atm N is applied. Finally, the 2 samples are degassed to remove dissolved N and left standing until the plastic has set (about 5 weeks).

The author used special procedures to obtain a suitable picture for measuring the pore-size distribution of thin sections of soils with the Quantimet 720. In soils which do not contain transparent grains, the picture is taken in normal light; the soils have transparent grains but few negatives are obtained. The first is taken under crossed polarizers which are turned during exposure in locked position in steps of 10 degrees over 50 degrees in total. A second negative is obtained in plane polarized light. A positive transparency is made from the second negative. The transparency and the negative taken under crossed polarizers are then combined to give a final picture (photogram) on which the pores are black.

The Quantimet 720 is then used to analyze the photograms. In doing so the electro-optical image analysis equipment transforms the photogram into a grid of 600,000 electrical pulses. The height (intensity) of a pulse depends on the gray-value of the corresponding point in the image. Next, by means of a computer-module, three parameters of the detected domains can be determined, i.e., area, number of intersections between horizontal scan-lines and the right side boundary of the domains, and the number of domains.

Fifteen soil profiles were analyzed. In comparing freeze-drying and air drying to prepare samples for making thin sections, he found that in general the percentage of larger pores diminishes when samples are air-dried, however, there is an increase in the percentage of cracks. Only samples which had been freeze dried prior to thin sectioning could be compared with physically determined pore-size distributions. The pores larger than 30 μm were also measured indirectly from the moisture release curve for Copeck rings. Micromorphometrically and physically determined pore-size distributions do not agree at all well. For example, the correlation for the 100 to 300 μm, vertically-oriented pores measured by the two methods is 0.518 and the slope of the regression line is 0.750. The author states that the differences in the measurements result from distortions of the cores during sampling, and from slaking, swelling and the neffect in the soil cores. It should also be kept in mind that the inherent variability in soil porosity and water movement may require more than three cores and large (8 by 15 cm) thin sections to obtain reliable mean values (Mason, D. D., J. F. Lutz, and R. G. Petersen. Hydraulic conductivity as related to certain soil properties in a number of great soil groups—sampling errors involved. 1957. Soil Sci. Soc. Am. Proc. 21:554-560).

Although the micromorphometric method may measure the pore-size distribution in soils directly and accurately there are several other points to consider before obtaining the data, and others to make the measurements. First the method measures only those pores > 30 μm. These pores are drained by a suction of 1 atm, they are a small part of the total porosity, and they are not the part important to plants and water movement in the soil. Even if one could measure the pore-size distribution, it has considerably less applicability to soils problems than have the more easily measured characteristics such as total porosity, field capacity, wilting point, and hydraulic conductivity.

The book should be of interest to soil physicists and especially to soil micromorphologists. Few of us will be able to afford the few hundred thousand dollars needed to purchase the Quantimet 720 Image Analysis System. Consequently we should appreciate Ismail's study of micromorphometric soil-porosity characterization.—WILFRED D. NETTLETON, National Soil Survey Laboratory, MTSC, SCS, Federal Bldg.-U.S. Courthouse, Room 345, Lincoln, Nebraska.

Endomycorrhizas


This timely text contains 41 papers on endomycorrhizas of plants. Subjects covered are evolution, classification and culture of endophytes; physiology and biochemistry; mycorrhizal physiology; plant pathology and mycorrhizas; mycorrhizal symbiosis; and mycorrhizal development, spread and function. The author used special procedures to obtain a suitable picture for measuring the pore-size distribution of thin sections of soils with the Quantimet 720. In soils which do not contain transparent grains, the picture is taken in normal light; the soils have transparent grains but few negatives are obtained. The first is taken under crossed polarizers which are turned during exposure in locked position in steps of 10 degrees over 50 degrees in total. A second negative is obtained in plane polarized light. A positive transparency is made from the second negative. The transparency and the negative taken under crossed polarizers are then combined to give a final picture (photogram) on which the pores are black.

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The most striking aspect of papers presented in the text is the tremendous increases in plant growth induced by endomycorrhizae. Ten-fold increases in dry weight biomass of various agronomic plants and forest trees were reported in several papers. Another impressive aspect is the reports on distribution of endomycorrhizae in crop plants and how the density of inoculum is influenced by plant species, soil fertility, soil type, and tillage practices.

This text provides a great deal of valuable information for plant scientists. After reading it, perhaps a few more enlightened scientists will see the biological implications of endomycorrhizae to the growth of plants in the world. Hopefully, next will come more research aimed at either introduction or manipulation of these beneficial and often times essential fungi to improve plant production to meet the world’s needs for food, fuel, and fiber. This text is a beginning in that direction of enlightenment. I strongly recommend it for all plant scientists and students with interest in “normal” growth, development and production of plants.—DONALD H. MARX, USDA Forest Service, Southeastern For. Exp. Stn. Instit. for Mycorrhizal Research and Development, Forestry Sciences Lab., Athens, Ga. 30602.