Improvements in the Nylon Method of Measuring Soil Moisture in the Field

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The nylon-moisture-measuring unit was offered in 1948 as a promising method for measuring the moisture content of soils under field conditions (2). Of a very large number of moisture cells made of different materials and in various patterns, the nylon unit proved to be the most satisfactory. It was not only capable of measuring soil moisture content from saturation to almost air dryness, but it was also very sensitive to changes of moisture content, especially at the saturation range where a sensitive moisture measuring method is most needed. In addition, the nylon unit would last a long time in the soil, even under excessively wet conditions. Because of these favorable characteristics, it was decided to conduct further researches on the method, with the main goal to bring the method to as high a state of perfection as possible.

IMPROVEMENTS IN THE NYLON METHOD

As a result of the further researches conducted, at least three important improvements have been made on the method. One deals with the mechanical construction of the nylon unit; the second pertains to the materials that comprise the unit; and the third involves the calibration and installation of the unit in the soil. Admittedly, the construction of the nylon unit has proven to be somewhat difficult and complicated. This is principally due to the fact that the pressure applied to bring the electrodes and the fabric into intimate contact has to be of a controlled magnitude. If too much pressure is applied the nylon fabric is likely to be crushed or cut, and electrical short circuits are thereby encouraged. If the pressure, on the other hand, is of insufficient magnitude, the contact between electrodes and nylon fabric will be poor and the unit will give unstable performance. The earliest nylon units manufactured proved defective in those respects. The technique that has been finally developed and is presently in use has been improved and has eliminated these defects. The units are now pressed under the same high pressure, which is controlled and constant. As a result, they are standardized and uniform, need no individual calibration, and give surprisingly similar readings at similar moisture levels.

Unquestionably, the most important improvement that has taken place in the nylon unit is the change in the electrodes and in the outer metal case. In the original unit, the electrodes consisted of monel screen, and the casing was of pure nickel. It was discovered that in many soils both the monel and the nickel corroded, and this corrosion resulted in the formation of a nickel salt which

The U. S. Bureau of Standards has made a study on the corrosion of metals in soils in the stainless steel of the variety 18–8 to be resistant to corrosion. In fact, stainless steel was free of corrosion, having been buried in corrosive soils for 14 years.

Thus at last, a metal has been found which eliminates the most serious weakness in the original nylon units. This has been shown by the result of a series of experiments in which the durability and stability of stainless steel in the units was tested. After 19 months, a number of soils, the units were entirely free of corrosion. This was true even when an electric current was passed through the nylon unit buried in the soil.

The newest nylon unit as finally perfected is shown in figure 1. It consists of two pieces of fine monel screen acting as electrodes to which are soldered the plastic coating. The electrodes are separated by three single pieces of nylon fabric. The assembly is then placed in a perforated stainless steel case and subjected to a uniform and controlled high pressure. The center of the unit is being held under pressure the edges of the unit are mechanically held the enclosed assemblage permanently and in contact. The enveloping case has 2/10-inch square holes and is 64% open. The holes cover the entire surface of the case, thus giving absorbent extensive exposure to the soil.

The third improvement pertains to the installation of the nylon unit in the soil. The enveloping case has 2/10-inch holes and is 64% open. The thickness of the metal is only 0.0254 inches, and the outer metal case tends to interfere with and perfect contact between soil and unit, which is true of the bottom side of the unit when in the soil. When the unit is placed upon the soil, though it is pressed down, the soil does not enter the holes of the metal case on the bottom of it; it always make a direct and perfect contact with the fabric. On the upper side of the unit, however, the soil does enter the holes and comes into intimate contact with the nylon fabric without difficulty.