THE EFFECT OF SURFACE COVER ON SOIL MOISTURE LOSSES BY EVAPORATION

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RECENTLY, Duley and Russel proposed for experimental consideration a new method of farming that they call “sub-surface tillage” \(^3\). By this method soil would rarely if ever be turned upside down, but would be handled as regards all operations of seedbed preparation, planting, and tillage, in such manner as to leave all residues so far as possible on the surface of the ground. This method has four objectives: namely, facilitated infiltration, reduced evaporation, decreased erosion by water, and improved control of the hazards of blowing. In another paper Duley \(^1\) has dealt with experimental work being conducted by the Soil Conservation Service and the Nebraska Experiment Station on factors affecting infiltration. This paper will deal with the question of surface evaporation.

METHODS OF STUDY

In the study of evaporation losses in the field, the investigator has the choice of two methods. Either he may rely on soil moisture samples which he interprets as percentages or converts to surface inches, or he may isolate columns of soil where he can compute evaporation losses by periodic weighings. In the work discussed herein both methods have been used, the first to obtain practical field culture magnitudes and the second to develop fundamental principles.

For the study of evaporation in isolated columns a new method has been developed. Its essential equipment is a steel sampler (Fig. 1) within which a core of soil may be taken surrounded by, and later enclosed within, a waterproof cylinder of cardboard without disturbing the field structure. The dimensions of the sampler are made to correspond to commercial cardboard boxes having a 1/16 inch thickness of wall. The one shown has a cutting diameter of 4.95 inches, exactly the same as so-called 5-inch custom stock and takes cylinders of 6 or 7.5 inch lengths depending on the collar that is used. The sampler has a 1/16 inch shoulder on which the lower end of the cylinder rests and the collar a corresponding shoulder that holds the upper end.\(^4\)

The sampler with cardboard tube enclosed is forced into the ground with an anchored jack \(^5\) and is removed by twisting and lifting simultaneously. It is then plugged at the top with a towel, and laid on the side, and the tight soil at the cutting end is carved away until the cylinder is free so that it can be pushed out. The lower end of the tube is then capped with a special metal bottom of spun aluminum, a bail of paraffined cord is attached, and the column is ready for weighing and exposure.

Cylinders are exposed ordinarily under ground, at ground level in a hole lined with another cardboard container of slightly larger diameter. Water-proof cardboard is used in preference to metal for the reason that its conductivity is practically that of soil and thereby abnormal transfer downward is avoided. The tubes are made proof by dipping in a hot bath of about 3 to 5 parts paraffin and 1 part duPont’s synthetic opal wax. This mixture softens but very little under outdoor temperatures and is an adequate waterproofing for several months of continuous exposure.

The method described has several advantages. It permits a wide collection of soil since these small containers can be transported readily to central points for exposure. It facilitates handling and weighing, therefore studies can be repeatedly replicated. Also it lends itself to various modifications.

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\(^3\) Reference by number is to “Literature Cited”, p. 70.

\(^4\) The sampler was constructed for this work by a Lincoln scientific apparatus concern. It was made from a 16-inch length of Shelby cold drawn seamless steel tubing of \(\frac{1}{4}\) inch wall thickness and \(\frac{5}{8}\) inch outside diameter. The inside dimensions of the main sleeve are 9.25X5.10 inches plus 0.75X4.95 inches for a cutting end.

\(^5\) The sampler with cardboard tube enclosed is forced into the ground with an anchored jack.