The Conservation of Soil Moisture and the Theory of Vapor Movement.—W. W. Burr, J. C. Russel, and H. E. Weakly, University of Nebraska.

In the conservation of soil moisture, the control of vaporization is considered to be equally important with the control of weeds. Capillarity deserves little attention. Water evaporates within the soil and escapes as a vapor. An understanding of vaporization phenomena is important.

The magnitude of evaporation can be expressed by the formula
\[
\frac{E}{TA} = \frac{K}{fB_1} \frac{B}{M} \frac{E}{TA} = \left( \frac{K}{fB_1} \right) \frac{B}{M},
\]
where \(\frac{E}{TA}\) is water evaporated expressed in mass units per unit of time, \(T\), and transpirational cross section \(A\), \(fB_1\) is a function of barometric pressure in terms of a standard pressure \(B\), \(K\) is constant of proportionality, and \(\frac{M_w - M_a}{1}\) is an expression of saturation deficit gradient.

The latter is derived from the familiar Dalton expression of vapor pressure deficit \((p_w - p_a)\) by conversion of pressure units \(p\) to mass units \(M\) and taking into consideration the depth \(l\) of the air column through which the vapor pressure deficit operates.

Evaporation of water from soil would seem to be controlled when \(M_v\) in the above expression is low, \(M_a\) is high, and \(l\) is large. \(M_v\) is low when the temperature of the soil is low, \(M_a\) is high when there is a stagnant, highly saturated blanket of air over the soil, and \(l\) is large when this blanket of air is deep. Such conditions naturally obtain in cool, damp, calm weather. Shade and mulches, either of straw or earth, would seem to be the most effective ways under man's control of keeping the soil cool. Wind breaks of any sort, like stubble, stalks, growing crops, or a roughened soil surface, should serve to stagnate and raise the humidity of the air immediately over the soil.

Evaporation within the soil occurs at a very slow rate at depths of several inches below the surface, except when the soil is unreasonably porous, and the main objective in vaporization control is the conservation of the small rains that are largely retained in the top few inches.

Cloddy or roughened surfaces that magnify the depth of rainfall by concentrating it in smaller areas lead to penetration beyond the zone of rapid evaporation.

In light of vaporization phenomena, a consideration of the shading and wind break effects of growing crops, the presence in the surface few inches of roots to compete with vaporization for the small rains, and the difference in the character of soils and summer precipitation explain why summer tillage is not equally effective in all sections and why the conservation of moisture by summer tillage varies so from season to season.