Significance of Moisture Translocation From Soil Zones of Low Moisture Tension to Zones of High Moisture Tension by Plant Roots

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Plants absorb water from the soil by means of tension or suction force developed within the plant roots. Opposing tension is built up in the soil as the available moisture approaches depletion, and absorption ceases when these forces become equal. A plant growing under normal conditions draws moisture from both the surface and the subsoil, but the surface soil is usually depleted of available moisture first, mainly because of root concentration and surface evaporation. It is conceivable that evaporation from the surface soil could develop a soil moisture tension higher than that in the roots located in it if the plant had roots also in moist subsoil of low moisture tension to supply the needed water. The tendency then would be toward withdrawal of moisture from the roots lying in the surface soil and intake of moisture from the subsoil.

Breazeale (1) and Breazeale and Crider (2) presented data which indicated that this phenomenon did take place, and that it permitted plants to maintain or develop roots in soil so dry as to be otherwise unfavorable for root growth. Breazeale implied that, given the proper conditions, a plant would actually build up the soil moisture to the wilting range. However, Davis (3) presented data to show that corn plants depleted soil moisture to below the permanent wilting point in the vicinity of the crown even though adequate moisture was supplied to roots at a distance of 4 feet from the crown of the plant. Hendrickson and Veihmeyer (5) stated that their results indicate that roots will not grow into soil which contains less moisture than the permanent wilting percentage. Breazeale also presented data to show that potassium could be absorbed by plants from soil at the wilting point.

It was the purpose of this investigation to obtain further information on the significance of soil moisture translocation through plant roots with respect to the maintenance or build-up of soil moisture, the absorption of mineral nutrients from soil at and below the permanent wilting point, and the development of roots into dry soil areas.

Relation of the Permanent Wilting Point to the Critical Soil Moisture

The term critical soil moisture is used in this report to indicate the apparent level to which a turgid plant will reduce the soil mois-