MONITORING TILLAGE EFFECTS ON SOIL WATER DYNAMICS USING AUTOMATED TIME-DOMAIN REFLECTOMETRY

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ABSTRACT

Tillage modifies soil physical properties near the surface, which can influence evaporation and how water is redistributed within the profile. The objective of this study was to evaluate the effects of sweep tillage soil water dynamics at a high temporal resolution. Plots were established in a fallow field under stubble-mulch tillage on a Pullman clay loam (Fine, mixed, superactive, thermic Torrertic Paleustolls). Half of the plots were periodically tilled to a depth of .08 m using a sweep plow. The remaining plots were not tilled throughout the duration of the study. Plots were kept weed free and devoid of residue throughout the study period. Soil water contents were monitored at half-hourly intervals using time-domain reflectometry at 0.05, 0.1, 0.15, 0.2, and 0.3 m. During a 123 day period from April to August, tillage decreased net water storage by 10 mm ($P < 0.05$) at 0 to 0.3 m as compared with no-tillage. Higher water contents at 0.05 and 0.1 m depths under no tillage persisted throughout the summer despite greater rainfall infiltration amounts under sweep tillage (21 mm) and the absence of residues in both treatments. Maximum daily net radiation of the tilled surface after DOY 203 ranged from 4 to 19% greater than that of the no tillage surface and these differences diminished with time after tillage. Increased soil water depletion under tillage was likely due to a change in soil hydraulic properties accompanied by enhanced vapor flow near the surface and greater absorption of radiation by a tilled surface with reduced albedo.