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Tillage Effects On Soil Water Redistribution and Bare Soil Evaporation throughout a Season.

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Convention Center, Exhibit Hall BC, Second Floor

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Tillage induced changes in soil properties are difficult to predict, yet can influence how water is redistributed within the profile after precipitation and subsequent evaporation rates. We evaluated the effects of sweep tillage (ST) on near surface soil water dynamics as compared with an untilled (UT) soil during an eight month period. Plots were established in a fallow field under stubble-mulch tillage management 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. All plots were devoid of residue. Soil water contents were monitored using time-domain reflectometry at 0.05, 0.1, 0.15, 0.2, and 0.3 m and using a neutron moisture gage to a depth of 2.3 m. Soil temperature was also monitored at depths to 1 m. Net and global radiation of both UT and ST surfaces were measured after the final tillage operation. Soil bulk density was determined for extracted cores throughout the monitoring period. During a 114 day period from April through July, tillage significantly decreased net water storage above 0.3 m soil depth by an average of 13.6 mm (P = 0.0016) as compared with no-tillage. After tillage, soil water contents at 0.05 and 0.1 m were significantly lower in ST plots, even with repeated precipitation events. Water contents at soil depths below 0.2 m were not influenced by tillage. After extended dry periods (> 30 days), evaporation rates were similar among both treatments (0.25 mm day^{-1}) despite the greater near-surface water contents of UT plots. Compared with UT plots, ST plots exhibited greater infiltration depths during precipitation events but also greater cumulative evaporation. Immediately after tillage, maximum daily net radiation was 19% greater for ST compared with UT surfaces and these differences diminished with time. Increased evaporation under tillage was likely a result of enhanced vapor flow near the surface and greater absorption of radiation by a tilled surface with reduced albedo. A more advanced surface seal development, greater bulk densities, and greater initial water contents were likely responsible for lower cumulative infiltration of UT compared with ST plots. Tillage induced changes in the hydraulic properties influenced the temporal patterns of soil water availability over the season.

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