Coupling Automated Overhead, Low-Pressure Irrigation Systems with Conservation Tillage: A New Irrigation, Crop and Drainage Management Paradigm for the Central San Joaquin Valley?

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The ability to precisely apply small amounts of water at any time during the crop season is thus a distinct advantage of the overhead system.

In this Water Resources Center project, we compared an overhead, low-pressure irrigation system with surface furrow irrigation under both no-tillage and conventional tillage for two cycles of a wheat silage / grain corn rotation at the University of California's West Side Research and Extension Center (WSREC) in Five Points, CA. We also characterized the performance of overhead center pivot irrigation systems for tomatoes, corn and cotton in neighboring farm fields at Red Rock Ranch and at Farming 'D'. Overhead irrigation, though currently not common in this region of California, has become the dominant type of irrigation used in many other areas of the world during the past several decades. Christiansen Uniformity (CU) Coefficients, which are commonly used to measure the overall uniformity of water application in overhead systems, for the linear move system in the WSREC study site (Figure 1) ranged from 85 – 93% depending on the nozzle package used and the height at which the nozzles were set above the ground (Figure 2). Similar, though slightly lower CU's were determined in a variety of farm field determinations at Red Rock Ranch.

Smaller amounts of water were applied more frequently using the overhead system than the furrow system in the wheat /corn rotation study. These applications closely matched cumulative ETc and resulted in about 30% less water applied in the overhead system compared to the furrow system for both wheat and corn. The bulk of water savings of the overhead system relative to the furrow system occurred during the early season crop establishment irrigations. The ability to precisely apply small amounts of water at any time during the crop season is thus a distinct advantage of the overhead system. Crop growth, as measured by almost daily destructive biomass harvests and periodic leaf area index and canopy cover determinations, was similar in all irrigation and tillage system combinations.

We determined the relative amounts of soil evaporation following wetting to field

Figure 1: Catch-can uniformity determinations under overhead linear move irrigation system at UC WSREC, Five Points, CA

capacity under bare soil and a wheat residue mulch. After a two-week drying period, twice as much water remained in the surface 20 cm of soil under the wheat residue than in the top 20 cm of the bare soil as measured by D and gravimetric water content determinations. Finally, we determined changes in soil water storage during intercrop tillage events between wheat and corn in standard tillage and in no-till systems and found significantly more water in the surface 20 cm under no-till than in the standard tillage systems.

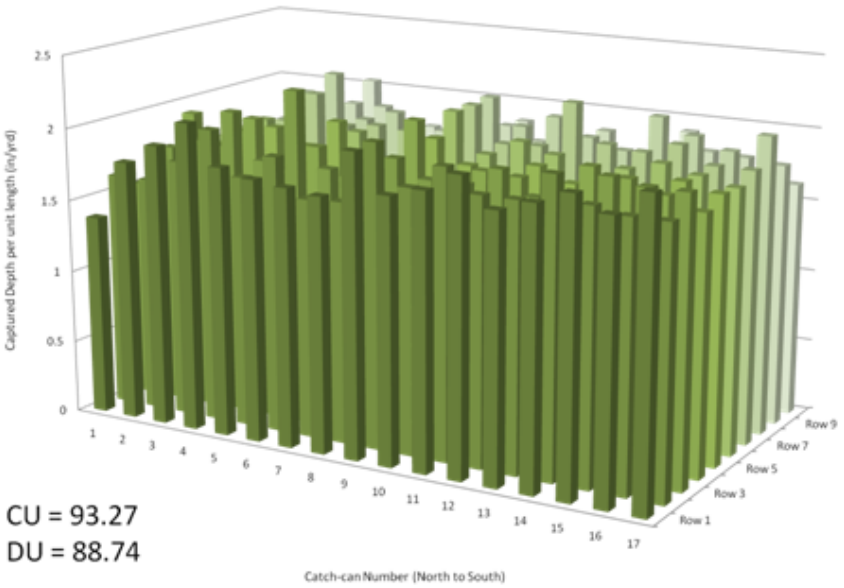

Figure 2. Christiansen Uniformity Coefficient (CU) determinations for overhead irrigation system at UC WSREC, Five Points, CA.

Professional Presentations

Jeff Mitchell. 2009. Soil management and carbon sequestration. California Ag Climate Symposium. California Climate Symposium. Californai Climate Network. October 1, 2009. Davis, CA.

Jeff Mitchell. 2009. Perspectivas en el desarrollo de la labranza de conservacion. 1er Simposium internacional de agricultura ecologica. September 29, 2009. Ciudad de Obregon, Sonora, Mexico.

Brooks Landers, 2009. Overhead Irrigation. 2009 Agronomic Crops Field Day. University of California West Side Research and Extension Center. Five Points.

Jeff Mitchell. 2009. Coupling overhead irrigation with no-tillage production systems. Water, Money, and Energy Conference. August 12, 2009. Modesto, CA.

Jeff Mitchell. 2009. Overhead irrigation of small grains. Agronomy Field Day. University of California West Side Research and Extension Center, Five Points, CA. May 7, 2009.

Collaborative Efforts

The core work of this project has been conducted by a quite diverse group of collaborators including Randy Southard, Karen Klonsky, Wes Wallender, Will Horwath and Jeff Mitchell of UC Davis, Dan Munk, Tom Turini and Kurt Hembree of UCCE Fresno, Five Points, CA farmers, John Diener and Scott Schmidt, and private sector partners, Monte Bottens of CalAgSolutions and Ray Batten, Pat Murray and John Bliss of Valley Irrigation.

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