Comparison of Neutron Moisture Meter and Watermark Sensor Readings in a Field Experiment of Full and Limited Irrigation of Corn

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Abstract. Population growth along the Front Range of Colorado has led to increased competition for water resources. Recent field research has evaluated "limited irrigation," a management strategy that maintains substantial yields while limiting most irrigation applications to physiological growth stages that are sensitive to water stress. Accurate field measurements of soil water content are necessary to quantify water savings from limited irrigation strategies. Since 2006, limited and full irrigation treatments of corn have been evaluated at the Colorado State University Agricultural Research, Development, and Education Center, five miles north of Fort Collins, CO. An on-site weather station measures and records all meteorological data, and during the growing season soil moisture content readings are taken weekly using a neutron moisture meter (NMM). In 2009, Watermark brand soil water tension sensors were installed in six plots at depths of 15 and 75 cm, logging hourly. The objective of this study was to compare soil water content readings from the NMM and Watermark sensors in full and limited irrigation treatments. Eighty-two gravimetric samples were obtained to calibrate the Watermark sensors to observed soil water content; calibration curves had an R^2 of 0.667 for the shallow sensors and 0.656 for the deep sensors. Total water over the top 100 cm of soil was calculated based on these calibrations, and compared to weekly NMM measurements. Evapotranspiration was calculated based on a water balance, for both the neutron probe and Watermark measurements. Statistical analysis was performed, evaluating both soil water content and evapotranspiration. Final results were compared with a CERES-Maize cropping systems model that was calibrated and validated based on prior growing seasons.