

CONSERVATION TILLAGE AND WATER MANAGEMENT I: QUANTIFYING CROP WATER USE IN CONSERVATION TILLAGE SYSTEMS

D.L. Rowland^{1*}, W.H. Faircloth¹ and Kathy Gray¹

¹USDA-ARS, National Peanut Research Laboratory, 1011 Forrester Dr. SE, Dawson, GA 39842-0509

*Corresponding author's e-mail address: drowland@npnl.usda.gov

ABSTRACT

Conservation tillage systems purportedly have greater plant available water than conventional tillage systems. However, this conclusion is often based on measurements of soil responses instead of direct measurements of crop water use. In order to fully characterize crop response to a conservation tillage system, we monitored detailed physiological response to strip tillage (ST) and compared it to responses in a conventional tillage (CT) system in a peanut-cotton rotation. In 2003, 2004, and 2005, crop water use via stem flow collars, root growth via rhizotrons, and canopy infrared surface temperature were correlated with measurements of soil moisture and temperature in both ST and CT systems. Further, crop phenological development was monitored throughout the season and integrated water-use efficiency was evaluated through the use of carbon isotope discrimination. Yield and crop quality were also evaluated for both peanuts and cotton. Tillage system had a significant effect on almost every crop response parameter measured, except yield. Plant sap flow was significantly altered by tillage and showed a lowered water use for ST plants. Root growth was significantly greater in the ST system and appeared to be influenced by the previous cover crop's rooting pattern. Reproductive phenology was not significantly affected by ST in the peanut crop which was contrary to grower expectation. Soil moisture patterns were similar to previous studies indicating greater availability in the ST system. This study adds important information about plant response to the growing body of information about the benefits and problems in conservation tillage systems.