**Land use change from cotton to perennial bioenergy grasses in the Texas High Plains: Implications on Water and Nitrogen Balances**

Cotton is one of the major crops grown in the Texas High Plains (THP) region, where about 25% of the U.S. cotton was produced in 2013. The USDA estimated that 11.4% of existing croplands and pastures in the Southeastern U.S., including the THP will be required for fuel use to meet the 2022 national cellulosic biofuel target. About 97% of water withdrawn from the Ogallala Aquifer in the THP is used for irrigating row crops such as cotton. However, groundwater levels in this region have been declining very rapidly. In addition, this semi-arid region has been experiencing recurring droughts recently. Rapid decline in groundwater levels, frequent occurrence of droughts and land requirement to meet biofuel production goals may induce land use change from high-water-demanding crops such as cotton to perennial bioenergy crops in the THP. Potential land use change from cotton to perennial crops may play a key role in addressing the challenges being faced by the THP. The APEX and SWAT models were integrated in this study to assess the impacts of replacing cotton with switchgrass and *Miscanthus* on water and nitrogen balances in the Double Mountain Fork Brazos watershed in the THP region. Results revealed a significant ($p$<0.05) decrease in the average (1994-2009) annual surface runoff (88%), nitrogen load in surface runoff (92%) and nitrate leaching (99%) under the perennial grasses scenarios when compared to the baseline cotton scenario. When compared to the baseline irrigated/rainfed cotton scenarios, the simulated soil water content enhanced significantly under the irrigated switchgrass scenario, and decreased significantly from April to July under the dryland *Miscanthus* scenario. The nitrogen loading to surface water and nitrate leaching to groundwater, a major concern in the THP, were negligible under the perennial grasses scenarios relative to the baseline cotton scenario.

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