Soil moisture dynamics and plant transpiration under contrasting annual perennial cover types

Abstract: Soil moisture dynamics are influenced by land cover, thus different land covers would be expected to have different soil moisture behavior. This project tested various land covers and crops to see whether and how moisture was retained or depleted.

What was done and why?

The introduction of annual crops such as corn and soybeans in place of perennial plant communities in much of the Midwestern landscape has altered the natural hydrology of the region’s ecosystem. In much of the upper Midwest, annual crops are planted in the spring and there is little plant growth until late spring or early summer. Spring also features periods of higher rainfall. It is expected that annual field crops will have different water use characteristics than perennial plants, and thus soil water conditions under each vegetation type also will differ.

Despite these expectations, there is little information about the soil moisture dynamics of contrasting vegetative types or land uses in the Midwest. Yet interest is growing in the use of perennial plants as a feedstock for ligno-cellulosic biofuel production, and in restoration of native prairie areas. Correspondingly, there is a need to understand how water use functions in these systems to better estimate the positive or negative effect these introductions might have on water quality and water resources.

The objective of this project was to quantify 1) soil moisture dynamics within the root zone and 2) plant transpiration under contrasting annual perennial plant communities.

What did we learn?

The study results suggest that perennial cover crops could be used to reduce soil water storage content or soil water storage during the growing season, thereby increasing the soil water storage capacity for subsequent rainfall events. This is important in reducing surface/subsurface flow and nutrient loss from the agricultural fields, particularly in the spring to early summer periods when perennial plants use more water. Some mixed prairie systems likely have higher water use than a single plant cover system and, therefore, have less soil water storage within the root zone.

The project results have increased knowledge of soil moisture dynamics under varying land covers.