Hydrologic Impacts of Strip Tillage for a Coastal Plain Soil

David D. Bosch, Thomas L. Potter, Clint C. Truman, and Timothy C. Strickland
USDA-ARS, Southeast Watershed Research Lab, Tifton, GA
Contact email: david.bosch@ars.usda.gov

ABSTRACT

Strip till, planting into a narrowly tilled strip, is a growing practice among many Coastal Plain farmers. Strip tillage increases crop residue at the surface, leading to reduced evaporation and reduced raindrop impact. This research examines nine years of rainfall-runoff data from a paired conventional till / strip till research site. The study site is a 1.9 ha parcel on the University of Georgia Gibbs Farm located in Tift County, GA, U.S.A. The study began in late 1998. The site was divided into six 0.2 ha plots. Three plots were placed in conventional tillage while three were strip tilled. Cotton was planted in 1999, 2000, 2001, 2003, 2005, and 2007. Peanuts were planted in 2002, 2004, and 2006. Precipitation, surface runoff, and subsurface flow data were collected and summarized for the nine year period.

The total water loss, the sum of the surface and lateral subsurface flow runoff, as a fraction of rainfall received was calculated for both tillage treatments. On an annual basis, the total water lost as a % of rainfall from the conventional till system averaged 34% while it averaged 33% for the strip till systems. Total water loss varied from 12% (2007) to 51% (2003) for the conventional tillage treatment and from 9% (2007) to 53% (2005) for the strip tillage treatment. On the average, the conventional till system lost 23% through surface runoff and 11% through the subsurface. For the strip till system the annual losses were 14% through surface runoff and 19% through subsurface losses.

An 84% increase in lateral subsurface flow was observed from the strip till plots. The greatest increase in lateral subsurface flow occurred primarily during the month of March when antecedent moisture conditions are typically the greatest and evapotranspiration the least. Lateral subsurface flow losses during the summer growing season were typically small, although larger losses were observed during periods when summer tropical depressions produced larger rainfall totals. During the months from June through August a net average gain of 30 mm of infiltrated water was observed for the strip till plots (Fig. 1). During dryer years, when no subsurface losses were observed during the summer months the gains were larger.

The results indicate strip till systems experience enhanced infiltration. This increase is most prevalent during the crop growing season from June through August (Fig. 1). During the growing season, June, July, and August, evapotranspiration reduces soil water leading to less subsurface losses in the strip till system. Aside from the periods of very high summer rainfall caused by tropical storms, there is a net gain in soil water in the profile for the strip till system during the growing season, presumably benefiting crop growth.

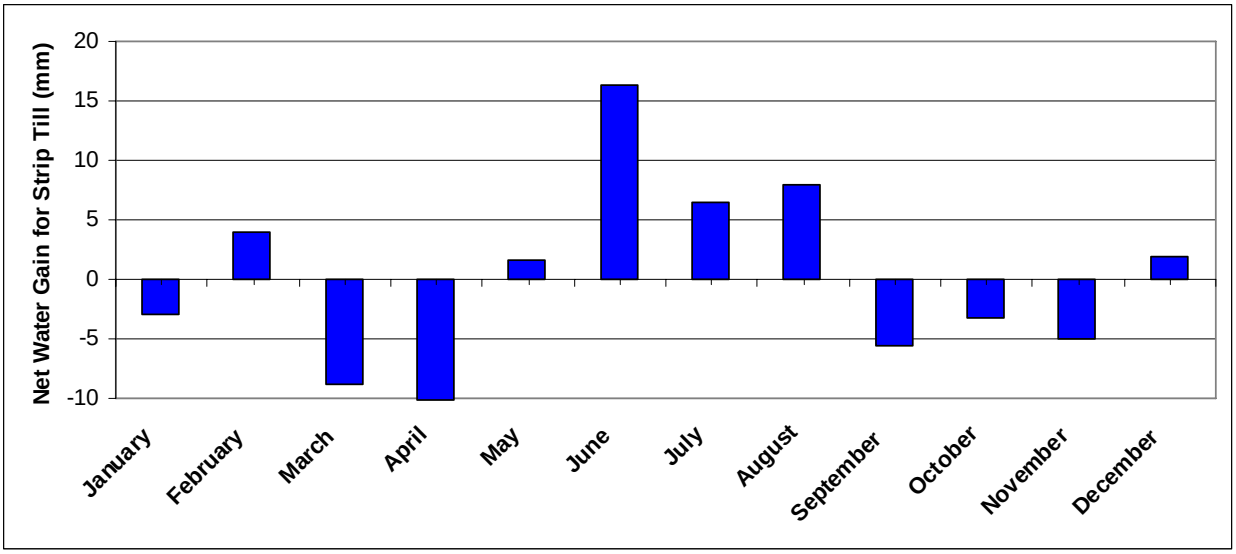

Figure 1. Average monthly net water gain for the strip till system.

Annual water gains in the strip till system obtained through enhanced infiltration and reduced surface runoff were offset by increased subsurface losses. Strip till had the greatest benefit in terms of increased water gains during years with the least annual precipitation. These results indicate that strip till systems can potentially increase plant available water through enhanced infiltration. This increase is most prevalent during the crop growing season from June through August. Water losses through subsurface flow tend to cancel out any gains obtained through increased infiltration occurring throughout the remainder of the year.