EFFICIENT USE OF IRRIGATION RESOURCES

Water use has become a hot issue in the Delta region of the Mississippi River basin. The total annual rainfall in the Mississippi Delta region is typically more than required for optimum plant growth; however, water distribution in the summer months can be scarce. Periodic summer droughts make irrigation necessary to avoid crop failure. Two approaches to help increase the supply of water for crop use are: 1) increase the intake and storage of moisture in the soil; 2) increase supplemental irrigation. Irrigation application is costly and time consuming, making efficient use of irrigation a main objective for crop production in the region.

Materials and Methods

In 2013, the Monsanto Learning Center at Scott, MS began investigating ways to utilize irrigation more efficiently. Conversation with local university and agricultural engineers, pointed to the fact that silt loam soils commonly found throughout the region, are known to compact and seal over (Figure 1). When sealing occurs, the soils do not allow irrigation water to penetrate to the crop root zone. In some fields, much of the rainfall and supplemental irrigation being applied may merely run over the ground flowing directly into the ditches. Fall deep tillage has proven to help store rainfall for the following season.

Knowing that fall deep tillage can help soils store rainfall, the question becomes, are there benefits to in-season deep tillage? Discussions with a local agricultural engineer revealed an in-season tillage system he utilized in the early 1990's, which provided effective water utilization, and helped reduce the number of pivot irrigation applications needed. This engineer designed and constructed a deep-tillage parabolic subsoiler for use in-crop. The subsoiler was used to break the compaction layer of the silt loam soil to allow the irrigation water to penetrate the root zone and eliminate irrigation frequencies.

For the initial study, many possible tillage systems were explored. The following selection criteria were used. The tillage must:

- Run 10 to 12 inches deep
- Provide minimal soil movement
- Be adaptable to commonly used implements
- Be used in conjunction with other operations

For this trial, a subsoiler was constructed with M1 Winged Anhydrous Knives manufactured by Nichols Tillage Tools® and mounted on an Orthman® toolbar directly behind the buster. The subsoiler was adjusted to run 10 inches deep and could be used in conjunction with the buster to allow for furrow irrigation (Figure 2). An on-farm trial was initiated in 2013 in a field planted to soybeans, with a portion of the pivot irrigated field left untreated as a check. In-season deep tillage was run with the constructed subsoiler at crop layby.

The Monsanto Learning Center at Scott, MS was assisted by Jason Krutz, Associate Research/Extension Professor specializing in irrigation at the Mississippi State Delta Research and Extension Center. Moisture sensors were installed to measure infiltration rates in the treated and untreated areas of the field. Each sensor is approximately 4 inches in length and sensors were installed at depths of 6 and 12 inches (Figure 3). A sensor placed at 6 inches measured water movement from 4 to 8 inches and a sensor placed at 12 inches measured water movement from 10 to 14 inches.

Figure 1. Soil compaction that can cause the silt loam soil to seal and reduce water penetration. Photo source: Jason Krutz, Associate Research/Extension Professor Mississippi State University.

Figure 4 provides results from the 2013 sensor data. Plots that received in-season tillage from the constructed subsoiler are signified by the symbol ▲ and plots that did not receive in-season tillage are signified by the symbol ●. The Y-axis provides the level of soil saturation or water potential, with 0 water potential representing the point of soil saturation. Decreasing numbers indicate soil drying, with -250 water potential representing a very dry soil. The -100 water potential level triggered irrigation initiation. When irrigation was applied, treated areas were recharged to soil saturation at the 6- and12-inch levels. When irrigation was initiated in the plots that did not receive in-season tillage, the recharge never reached the sensor. This means that irrigation water never recharged moisture to the 4-inch level.

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Results from the demonstration indicated that the in-season subsoiler tillage treatments disrupted the shallow 8- to 10-inch compaction layer and allowed irrigation water to infiltrate the soil to the 6- and 12-inch levels. The sensor data from the study demonstrates that when the plots did not receive the in-season subsoiler tillage treatment that irrigation water never infiltrated the soil more than 4 inches, with the balance most likely becoming runoff water.

Figure 2. Row without in-season tillage (left) vs. row with in-season tillage (right). Photo source: Jason Krutz, Associate Research/Extension Professor Mississippi State University.

Summary Comments

From the 2013 sensor data collected from the in-season subsoiler treatments, the following observations and evaluations were made.

- The infiltration rate was much higher in the plots that received in-season subsoiler treatments.
- Infiltration rates for plots that did not receive in-season tillage were reduced.

The information discussed in this report is from a single site, non-replicated, one-year demonstration. This informational piece is designed to report the results of this demonstration and is not intended to infer any confirmed trends. Please use this information accordingly.

Legals

Individual results may vary, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible.

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Figure 3. Sensor used to measure infiltration rates.

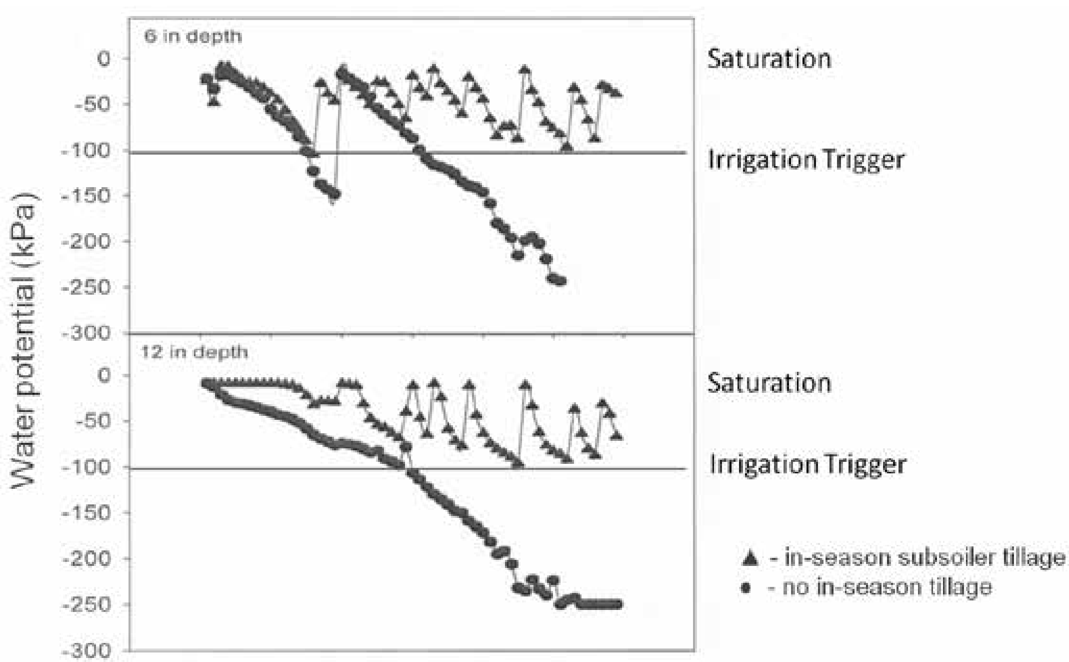

Figure 4. Effect of in-season subsoiler tillage on soil water potential at 6- and 12-inch depths.