

Equipment Installation for the Evaluation of Crop Row Direction and Offset Distance from Subsurface Drip Irrigation Laterals

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Background and Objectives

Past research has shown that well designed and managed subsurface drip irrigation (SDI) systems are more water efficient than LEPA and spray irrigation systems, particularly at low irrigation capacities (Bordovsky and Lyle, 1998, Bordovsky and Porter, 2003). However, maintaining crop rows in SDI fields at precisely the same relative location to underground water supply lines, year after year, is very difficult. Crop row position relative to buried drip laterals directly affects seed germination as well as plant development, particularly in areas of limited irrigation capacity. The effects on cotton production of crop row to drip tape location in alternate-furrow SDI installations has not been determined. In addition, planting perpendicular to buried drip tape laterals occurs in some areas of the South Plains, simplifying the use of SDI systems in certain situations. Crop response and the effects of long-term tape deterioration resulting from planting crops perpendicular to drip tape laterals is not known. The overall objectives of this research are to:

- 1) Quantify the effects on cotton germination, yield and WUE of planting row distances (horizontal, not depth) from drip tape laterals at two irrigation levels; and,
- 2) Quantify the effects on soil compaction, cotton germination, yield and water use efficiency of plant row orientation relative to drip lateral direction (perpendicular vs. parallel) at two irrigation levels.

This project assisted in the development and installation of appropriate test equipment for this research.

Description of SDI Installation

This project was conducted at the TAES research facility at Halfway. It involved the installation of 4.4 acres of SDI with sets of drip tape laterals oriented both parallel and perpendicular to the final crop row direction (Figure 1). The SDI field was surveyed (topographic) using mobile GPS survey equipment. From this map, drip tape lateral positions and corresponding GPS tractor guidance files were created using ArcView[®] 9 software. The guidance files were loaded onto a Trimble AgGPS Autopilot[®] aboard a John Deere 7420 4WD tractor. Drip tape was installed with this equipment in a non-listed (flat) field (Figure 2). The drip tape offsets were planned and installed according to the experimental treatments. All drip supply manifolds and flush lines were installed, connected, pressure checked, and flushed (Figures 3 and 4). The concrete base for a control center/filter station has been constructed (Figure 5). An abandoned irrigation well located on the research farm was cleaned and test pumped, and a submersible pump and motor were installed to provide a water source for this field experiment.

The field experiments will be a two factor-split plot design. The main factor will be irrigation capacity with treatments of approximately 2.5 and 4.0 gpm/acre. The sub-factor will be plant row orientation or location relative to drip tape position. The seven sub-factor treatments will be parallel-planted row offsets to SDI tape laterals of zero, 5," 10," and 15" (treatments 1-4) and perpendicular planted rows relative to SDI laterals with lateral spacings of 30," 45," and 60" (treatments 5, 6, and 7). Planted rows will be 30" apart with plot sizes of 8 rows by 90 ft in the parallel lateral treatments and 8 rows wide by 30 ft in perpendicular lateral treatments. The field is divided into four blocks providing four replications. The irrigation system is composed of 8 SDI zones.

The first crop year will be planted in 2006. Plantings will be conducted using a GPS guided tractor to provide planned offset distances from SDI tape laterals. Data collection will include plant population at germination, volumetric soil moisture, soil compaction (across and along drip tape), lint yield, and WUE. Opportunity for root pattern and fertilizer placement studies will exist in the future.

Anticipated Results

Seed germination in dry years and soil compaction around drip tape have caused problems or reduced yields in two of the past three years at the TAES research site at Halfway/Helms (Bordovsky, 2004). In general, documenting crop response relative to drip tape position and orientation will help address management problems and provide information for economic decisions concerning conversion to more efficient drip irrigation systems. This project will also help determine the value of precision-guided tractors in terms of water conservation and production efficiency on the South Plains. Specific benefits of this experiment include improved management by determining the economic loss (or gain) of crop row placement "offset" from optimum position relative to drip tape laterals, and of increasing planting flexibility by planting cotton perpendicular versus parallel to SDI laterals.

References

- Bordovsky, J.P. and W.M. Lyle. 1998. Cotton irrigation with LEPA and subsurface drip systems on the Southern High Plains. Proceedings of the 1998 Beltwide Cotton Conference, San Diego, CA, 409-412.
- Bordovsky, J.P. and D.O. Porter. 2003. Comparison of spray, LEPA, and subsurface drip irrigated cotton. Paper No. 032008. American Society of Agricultural Engineers International Meeting, Las Vegas, Nevada. Pp. 1-11.
- Bordovsky, J. P. 2004. Subsurface drip irrigation design and management for cotton production. Project 02-210 TX. 2003 Annual Report to Cotton Incorporated. 13 pp.

Subsurface Drip Lateral Offset and Orientation Study
 Texas Agricultural Experiment Station, Halfway, TX
 All crops will be planted in rows in the east-west direction.

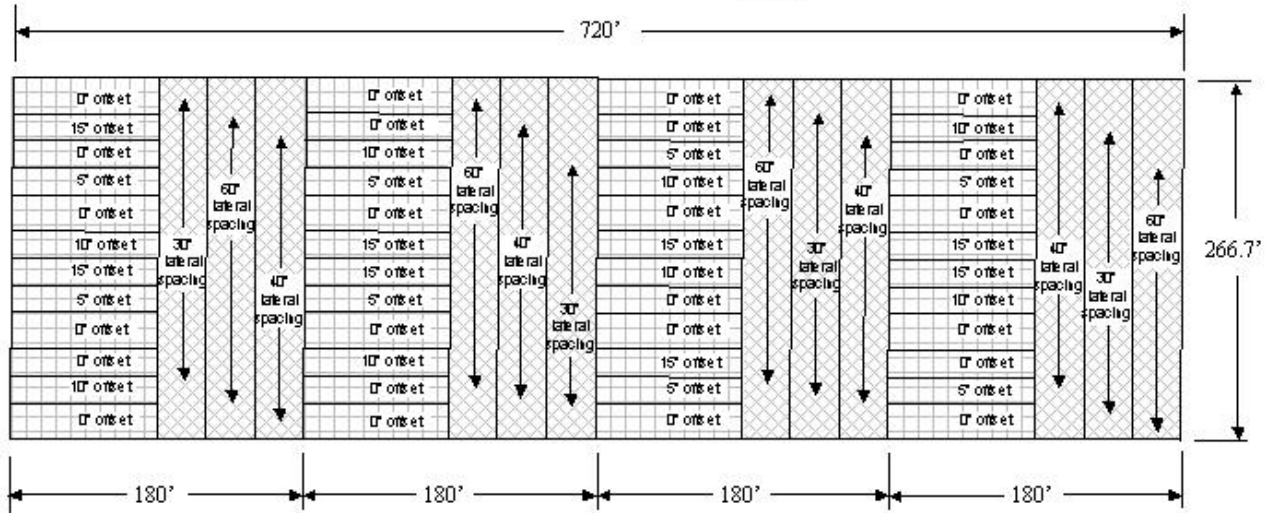
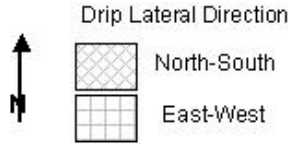


Figure 1. Plot map for drip lateral offset and orientation study, TAES, Halfway. Installation was conducted in 2005. The first crop experiments will be in 2006.



Figure 2. Installation of SDI laterals with GPS guided tractor, Joe Mustian, Doug Nesmith, and Cody Mull, TAES, 2005.



Figure 3. Opening ditches with a Cleveland trencher for water supply and flush manifold connections to SDI laterals.



Figure 4. SDI drip lateral connection to water supply manifolds, TAES, 2005.



Figure 5. Concrete base for SDI water filter and zone valve control station, TAES, 2005.