Project Narrative

Name of Project: Utilizing Subsurface Drip Irrigation and Conservation Tillage in Crop Production Systems in the Texas Rolling Plains.

Is This a New Project or Request for Continuation: New Project

Geographic Area of the Project: Texas Rolling Plains

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Amount of funding request: $14,808

Project Need, Description and Expected Outcomes

A long-term management plan for water conservation and utilization is essential if irrigated production agriculture is to survive in the Texas Rolling Plains. Subsurface drip irrigation (SDI) is the most efficient (nearly 100%) water delivery system to roots of plants and can be considered one component of precision agriculture. The technology and equipment life expectancy have increased in the last 15 years to the point that SDI may now be competitive with traditional center pivots on smaller acreages. Frequently, crop yields equal or exceed those of some traditional irrigation methods while requiring less water, thus saving valuable water resources. There are many aspects of SDI on crop production that are unknown and have not been researched. This is particularly true for the Texas Rolling Plains environment where underground water resources are fragmented and limited in acreage, capacity, and water quality. During dry seasons, excessive pumping can deplete underground water resources to the point that wells are no longer functional. Also, during these dry periods, a lowering of the water table often results in reduced water quality; i.e. increased salinity.

We believe that SDI will play an increasing role in Rolling Plain's agriculture in the near future. The Texas Agricultural Experiment Station must be proactive in this important water management area and must seize the opportunity to advance our knowledge of SDI as growers will surely contemplate adopting this new technology. Our initial research will focus on cotton production, the primary summer crop in the Rolling Plains. There are regional challenges that need to be met to maximize the impact of SDI on water conservation and cotton production. The proposed research is the initial effort to advance our knowledge about numerous production aspects concerning SDI in the Rolling Plains. Growers need answers to make intelligent management decisions concerning the merits of SDI on whether to embrace this new technology.

The expected outcomes from the proposed research include (1) new knowledge on water-use and water-use efficiency in SDI compared with furrow irrigation in the Rolling Plains region, (2) insect and weed populations and their dynamics under SDI with and without a cover crop, (3)

crop growth and reproductive development response to SDI and within-row yield response, (4) observations on cotton root rot severity in SDI and furrow-irrigated cotton, and (5) observations on rainfall capture and seedling protection from wind due to a terminated small grain cover crop.

In early 2002, a 30-acre SDI system was installed at the Munday, TX station and is currently operational. The $60,000 system is more complex than commercial systems, but it lends itself to a wide variety of research projects. The system has 66 individually-controlled stations of about 0.4 acres each. Also, each station is capable of being irrigated on 40-inch or 80-inch drip line centers. Stations are fitted with injection ports for chemicals, if desired, and separate water meters.

Specific Issues Addressed

Decreasing supplies of surface and underground water used for irrigation must be countered with more innovative and efficient water management systems and tillage practices that capture and conserve limited rainfall. Most SDI systems utilize conventional tillage on field crops or conventional tillage plus plastic mulch on high-value horticultural or ornamental crops. Information to combine SDI with conservation tillage involving cover crops is lacking. Cover crops are, perhaps, the most economical method of providing mulch on large, field-scale operations. Even SDI systems using conventional tillage are still subject to soil erosion by wind and water, blowing-sand damage to seedlings, and loss of nutrients through runoff. A terminated cover crop greatly reduces or eliminates these problems. Captured rainfall should result in lower costs associated with SDI through less pumping and maintenance of the system. Conservation tillage coupled with SDI should allow producers to raise more cotton under irrigation with the same well capacity and/or reduce drawn-down of the aquifer to permit more efficient irrigations during the season with marginal-capacity wells. The result would increase revenue to the producer, the cotton industry, and accelerate paying for the cost of SDI installation. We believe the inclusion of a cover crop in a SDI system is a novel approach to further enhance SDI's efficiency and effectiveness.

The proposed research addresses many high-priority conservation concerns: (1) water resources–quantity and/or quality, (2) irrigation efficiency–agriculture, (3) wind erosion control, (4) water management and conservation, (5) soil management, (6) cropping systems and rotations, (7) mulching, and (8) the economics of conservation practices. Of course, not all concerns can be fully addressed in one year, but early study results will provide enough information to allow a more focused research effort and opportunities for additional funding in the future in areas that benefit producers the most when they adopt SDI technology.

The objective of this research is to initiate studies to characterize plant development, insect activity, weed management, lint quality, disease development, and yield under SDI and compare results with those from conventional, furrow-irrigated tillage systems. In addition, we propose to include a terminated cover crop (rye or wheat) and general conservation tillage practices. Subsurface drip irrigation with and without conservation tillage brings into question concerns about insect, disease, and weed control, pest population dynamics, and even shifts in species. To our knowledge, these questions have not been addressed, but answers are needed as more producers consider SDI as a means to enhance returns with limited water resources.

Collaboration

Mr. Stan Bevers, Extension Economist, will cooperate by providing an economic analysis of SDI as it relates to yield enhancement, water savings, fiber-quality issues, pest control, etc. Todd Baughman, Extension Agronomist and Weed Specialist, will provide counsel on weed

management issues. The Cotton Foundation provided partial support for SDI installation (33%) and currently provides $15,500 in financial support for ongoing SDI cotton research. Eco-Drip, Inc. will collaborate on operational management and programming of the SDI system to accomplish the goals of this research effort.

Submitted by:

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