Subsurface Drip Irrigation Project

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Introduction

An ambitious subsurface drip irrigation (SDI) project covering eight acres was initiated and installed in 2007. It is a permanent installation with plastic drip lines buried 18 in. deep and spaced 60 in. apart in a field divided into 12 operating zones. The project was undertaken with the following objectives:

1. Demonstrate SDI installation, equipment, and operation.
2. Demonstrate best management practices for growing crops with SDI.
3. Conduct irrigation research in areas of scheduling and fertility.
4. Provide a platform for educational and outreach activities.

Materials and Methods

- A 6 in. diameter well was installed in April 2007. The well is 72 ft deep with 25 ft of screen. A constant pressure submersible 3 HP Flint & Walling CP150 pump was set in the well and produced 10 gpm to 85 gpm output depending on demand (number of zones to be irrigated).
- A 120 mesh disk filter hooked to the well head prevented plugging of components.
- An adjustable pressure-regulating valve provided uniform system pressure and prevented drip line bursting.
- A flowmeter coupled to a controller recorded water flow and irrigation events.
- A PVC manifold with electric valves controls water flow to the 12 irrigation zones.
- Air/vacuum release valves were installed at all high points to prevent fine debris entering the emitters when system shut down.
- A NMC-64 Netafim controller drives the system and was used to schedule irrigations, fertigations, and monitor system operation.
- A Neptune PZD-32 metering pump was used for injecting fertilizer and chemicals into irrigation water.
- Drip tape is Netafim PC 636 015 F, a pressure compensating dripperline with 18 in. emitter spacing and emitter flow rate of 0.16 GPH. Each irrigation zone (0.6 acre) has nine drip lines buried 18 in. deep and spaced 60 in. apart. One hour run time delivered 557 gallons to a zone or .033 acre inch.

Results and Discussion

The system was installed in time to plant corn and soybeans by late May. The crops grew well initially but became visibly drought stressed by early July due to warm temperatures and an extended period of no rainfall. Digging into the coarse, sandy soil revealed crop roots had developed only in the upper portion of the soil profile, which was now dry, and were not reaching moisture around the drip lines. Aggravating this problem was a very hard layer of dry soil between the roots and irrigation lines. Eventually, starting on July 16, heavy rainfall soaked and softened the soil profile allowing roots to penetrate the hardpan. Once roots reached moisture around drip lines, vigorous plant growth resumed. Unfortunately this was too late for the corn crop—moisture stress had already caused poor pollination and harvest was a disappointing 125 bushels/acre. Soybeans, which have a longer reproductive period than corn, fared better with 60 bushels/acre. In the future, we plan to eliminate soil compaction and start fertilizer injection through drip lines earlier

in the season to stimulate deep root growth and prevent this problem from occurring again.

Much was accomplished this year and we are looking forward to using the system in the future. From our initial experience with SDI it is obvious that it will require a different management approach than the overhead irrigation systems. For starters, the upper soil profile is always dry (unless it rains) even when irrigating and it is difficult to tell if too much or too little water is being applied. Accurate irrigation scheduling will be critical if good yields and efficient water management are to be achieved. This is an area we plan to explore in 2008.

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