LEPA Irrigation Project Report

Submitted to: Southwest Kansas Groundwater Management District #3

By: Dr. William E. Spurgeon Assistant Professor, Kansas StateUniversity, SWREC, Garden City, KS

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A LEPA system was installed on a center pivot system owned by the KSU Southwest Research-Extension Center. Our purpose in this project was to evaluate the performance of a LEPA system for the conditions encountered in southwest Kansas and determine the crop water use for corn using LEPA. We conducted a pilot runoff study to help design a more comprehensive tillage and nozzle pattern study.

Procedures:

We fertilized the field with 240 lb of Nitrogen for corn and planted on May 11 in a circle. We ran the system around once to establish the tower tracks. Our operator used the tower tracks as a mark and planted from the even towers (ie towers 2, 4 and 6) out to the odd towers.

We installed the LEPA nozzles between June 15 -20. Lindsay Manufacturing provided the rental equipment to drill holes and press fit couplers into the span pipe. We chose this procedure rather than welding couplers to help reduce corrosion. It also eliminated the need to paint the couplers. Special swedge couplers were inserted into holes in the span pipe and the stem was compressed to form a tight fit against the inside surface of the pipe.

Aluminum access tubes were installed for use with a neutron probe to determine the soil moisture status which was monitored weekly. The soil moisture data has not been completely analyzed. Preliminary analysis show that soil moisture increased over the season in the high water treatments and decreased for the low water treatments as expected.

June was very wet (6.7 inches) and the corn grew so fast that it was impossible to use a dammer-diker to install dikes in the furrows. Dikes or deep ripping are usually used to store water for infiltration over a longer period which prevents excessive runoff.

Irrigation treatments consisted of 0.4, 0.7, 1.0 and 1.3 times ET (evapotranspiration - estimated crop water use). We changed the rated flow for the nozzles by the respective percentage. Irrigation frequencies of 3, 6 and 9 days were also used. Each treatment was replicated four times. A typical replication is shown in Figure 1.

Our first irrigation occurred on July 7 with a 1.5 inch application to all the plots. Plots were then irrigated every Monday or Friday depending on the irrigation frequency. We replenished the amount of water used during each time interval at the end of that interval.

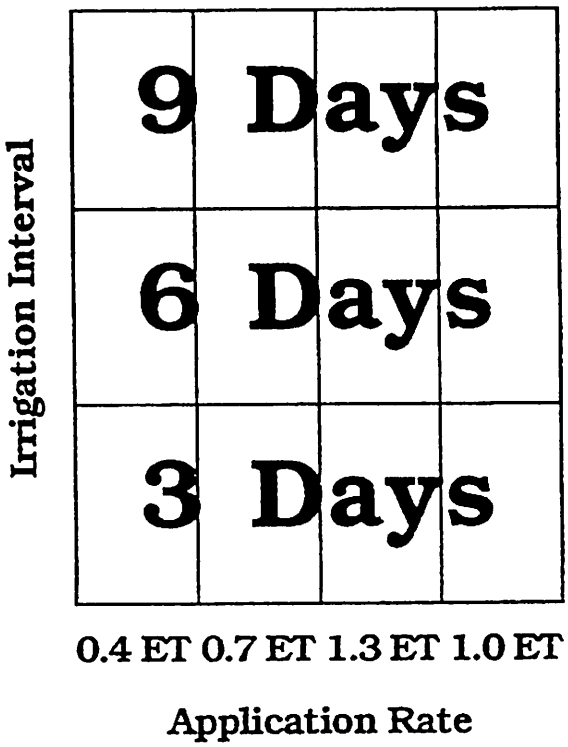

Figure 1. Amount and Frequency plot layout for a typical replication.

Irrigation amounts for each plot varied by treatment and frequency. Application amounts ranged from 0.4 to 3 inches. The three day frequency was used to study the effects of high frequency applications. LEPA systems will probably require amounts less than one inch because of high runoff potential. We applied 1.5 inches per irrigation on the bulk field and had considerable runoff (there was no deep ripping or dikes in the field). The system could be set in the flat spray mode to reduce runoff. The 6 day frequency was used because this is a typical interval for sprinkler irrigation. The 9 day frequency results in very high water applications for LEPA but the plots were bordered to contain the water. That treatment simulates the effect of low frequency irrigation like furrow irrigation.

We hand harvested forty feet of row from each plot on October 11. Yields were adjusted to 15.5 percent moisture and reported in bushels per acre.

Discussion:

We patterned this study after a study in Texas conducted by Dr. Bill Lyle. He used the same amount and frequency treatments and added a 12 day frequency treatment. Our data and his show that irrigation frequencies of 3, 6 and 9 days are not significantly different. His 12 day frequency yields were significantly lower than the 3, 6, and 9 day treatments. His data showed a trend when water was limited (ie the 0.4 treatment) yields could be increased by irrigating more frequently. They had a much drier season than we experienced at Garden City in 1989. Our data did not reveal that trend.

Average yields for irrigation frequency treatments were nearly 170 bushels per acre (Figure 2). There are no significant differences among treatments. We might expect a greater response in a dry year.

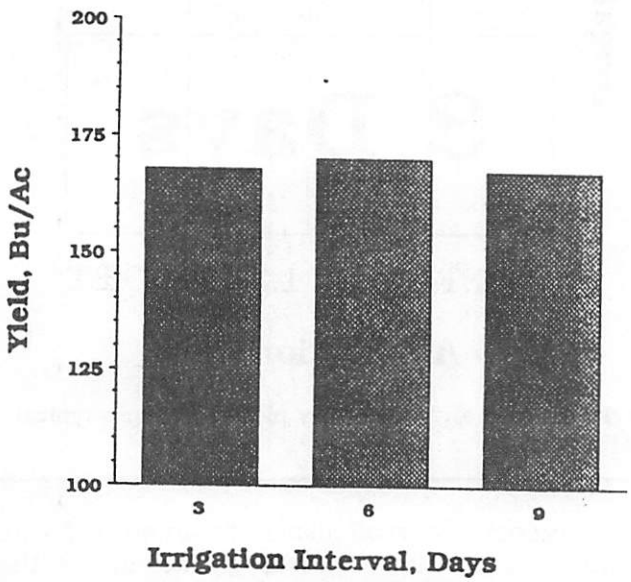

Figure 2. Average yield for frequency treatments.

We received 15.4 inches of rainfall during the growing season. The irrigation amounts applied were 4.78, 8.36, 11.94 and 15.52 inches for the ET treatments 0.4, 0.7, 1.0 and 1.3 respectively. This results in total water use of 20.28, 23.76, 27.34 and 30.92 for the respective treatments. These results show that yields do level off for amounts greater than 1.0 ET (Figure 3). This presents a strong case for using irrigation scheduling and monitoring soil moisture to help the producer obtain optimum yield.

We did not include results of the pilot runoff study due to large experimental errors caused by water transfer between treatments. It appeared that ripping and

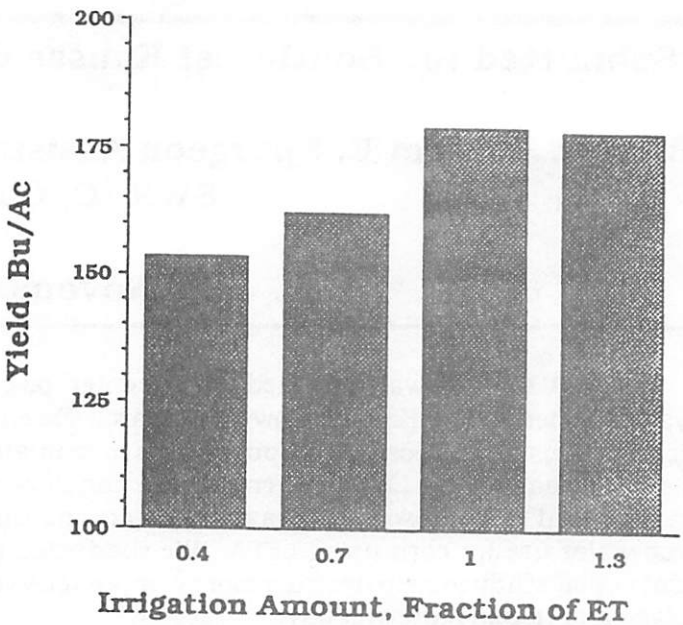

Figure 3. Average yield for amount treatments.

diking plus ripping increased yields by allowing additional water to infiltrate on slopes between 1 and 3 percent. We propose to conduct a more through study of tillage and spray modes next year and have approached the Kansas Corn Commission for funding support.

Conclusions:

LEPA systems will probably require smaller amounts of water per irrigation due to the higher application rate in the small wetted diameters of the nozzles. Amounts from 0.75 to 1 inch may be needed to minimize runoff which forces the farmer into a 2 to 3 day frequency. Reservoir tillage equipment (furrow dikers and/or deep rippers) may be needed to store water from higher application rates to allow infiltration over longer time periods.

Yield results indicate that there is no significant difference between irrigation frequencies of 3, 6 and 9 days. As expected, yields increase with increasing irrigation amounts up to 1.0 ET. There was a significant difference between the yields for the two low ET treatments and the two high ET treatments.