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# NO-TILL PRACTICES PROVE TO CONSERVE WATER

by Shelby Axtell

Irrigated farming is a way of life for most in western Kansas. With the depleting Ogallala Aquifer being the main water source, irrigation wells are increasingly unable to pump at former capacities. As a result, producers have to find alternative farming practices that will result in profit while using less water.

Researchers at the Kansas State University Southwest Research-Extension Center (SWREC) in Garden City, Kan., are currently working on water conserving techniques for no-till farming. No-till farming practices have continued to increase in the past few years. According to the Kansas No-till Handbook, no-till acreage in 1990 was around 3 percent and by 1998 no-till planting acreage had increased to 13 percent.

No-till is planting a new crop in the residue of the previously harvested crop. No-till reduces soil erosion, which in turn reduces run off of agrochemicals and nutrients. It improves the physical properties of the soil.

Dr. Norman Klocke, professional engineer and professor of water resources engineering at K-State's SWREC, said no-till also captures more blowing snow than bare ground, utilizing more of nature's free moisture.

Not only does no-till save water, but there is also less farm equipment required. Klocke said only three pieces of equipment are needed for a no-till operation: sprayer, planter and combine. Since the ground is not tilled between crops, producers spray to reduce weeds and control insects.



Wheat is beginning to sprout through the corn stalk residue at the no-till experiment field at the SWREC, Garden City, Kan. When using no-till, crop rotations have been the most successful. Photo by Shelby Axtell.

## Measuring Evaporation and Transpiration

When using an irrigation sprinkler system, water can be lost to evaporation. With no-till practices, the residue left on the ground reduces evaporation. Klocke, Rob Aiken, research crop scientist, and

Lloyd Stone, soil physicist, all with Kansas State Research and Extension, are working together to evaluate soil water evaporation and plant transpiration of water for no-till crops.

Klocke said when using a sprinkler system on no-till soil, producers are able to save about half the water that is lost when irrigating on bare soil. This is because the residue on the ground reduces evaporation and water runoff.

Researchers measure evaporation through mini-lysimeters. These mini-lysimeters are cylinders,



Above: These mini-lysimeters are used to measure water evaporation from the soil at the SWREC, Garden City, Kan. From left includes corn stalk no-till, bare soil, and wheat stalk no-till. By comparing the no-till stalks to the bare soil, researchers can determine which type of ground cover loses the least water through evaporation. Right: A bare soil mini-lysimeter in the crop field at the SWREC.



305 mm (approximately 1 foot) across and 140 mm (approximately 1/2 foot) deep, of natural soil taken from the crop field to represent each

experimental unit. Three types of tillage systems are being evaluated: no-till corn stubble, no-till wheat stubble, and bare soil. The stover and stubble when compared with the bare soil will show how much water is saved with no-till.

“Farmers can incorporate our research information based on the mini-lysimeters to determine if it is worth it to add residue management practices to their crop production plans,” Klocke said.



This is the linear sprinkler system being used on the no-till experiment field at the SWREC, Garden City, Kan. The sprinkler system can apply six different water amounts, ranging from nearly dryland, which is only three inches, to fully irrigated.

*Photo by Shelby Axtell.*

Plant transpiration is measured by sap flow heat gauge techniques. Sap flow is measured by applying a constant heat to the crop stem and measuring the radial and vertical heat movement. Water conducts heat better than the plant stem, and the vertical movement of the heated water is easily detected as the plant transpires. Klocke said the sap flow gauge provides a check for the mini-lysimeters measurements. The mini-lysimeters are weighed everyday to determine water loss and irrigated either once or twice a week. Results thus far are very encouraging, he said. No-till practices can save two to three inches of water over a corn season when the corn is fully irrigated, and similar amounts of water can be saved with other crops.

Klocke said the three inches of water being conserved can result in \$22.3 million savings in pumping costs on an 880,000 acres of corn and 182,000 acres of soybeans. Three inches of extra water could also result in 1,500 bushels of soybeans, and 5,000 bushels of corn for each sprinkler system. This could mean a \$56.5 million economic impact for western Kansas.

### **No-till results in higher yields**

No-till has its advantages, because it decreases the required farm equipment investment and conserves water resulting in a greater crop yield. Klocke, along with Randall Currie, weed scientist, and Mike Brouk, animal scientist, all with K-State Research and Extension, are working on a project that combines the best irrigation and crop residue management techniques into one management system to test final crop yields.

Researchers grew corn, soybean, winter wheat, grain

sorghum, and sunflower on an experimental field at the SWREC with a linear sprinkler system to test the harvested grain yield. Six water applications were applied to the crops, ranging from nearly dryland with only three inches of total water, to fully irrigated treatments.

Klocke said from the first year's (2005) crops, sunflowers with only three inches of rain had the highest yields. The first year's results are promising, Klocke said. Researchers predict these higher yields are due to the crop residue. However, more years of data are needed before results can be confirmed.

### **Technology is benefiting producers**

Producers can also use a computer program to tell them what crops would be the most profitable from the amount of water available to them. The Crop Water Allocator (CWA) is able to plan cropping patterns, and give producers an idea of what would be the most profitable return when using limited irrigation water.

This program can determine if it is more efficient to spread irrigation water over the whole field or if it is better to concentrate it in a smaller area. All results are ranked in order from the highest economic return to the least.



Dr. Klocke views the Crop Water Allocator computer program in his office at the SWREC in Garden City, Kan. Klocke is just one of the many researchers working on Ogallala Initiative projects to preserve the Ogallala Aquifer.

*Photo by Shelby Axtell.*

Over an 11 month period, Klocke said CWA had about 700 hits and 230 downloads of the computer program on the World Wide Web. In the near future, Klocke said they hope to also incorporate the no-till results that are being discovered in the two projects mentioned above.

This “computerized decision tool for irrigators,” can be downloaded at no cost from [www.oznet.ksu.edu/mil](http://www.oznet.ksu.edu/mil).

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