Site Specific Management of Row and Vegetable Crops with Center Pivot Irrigation Under Traditional and Conservation Tillage

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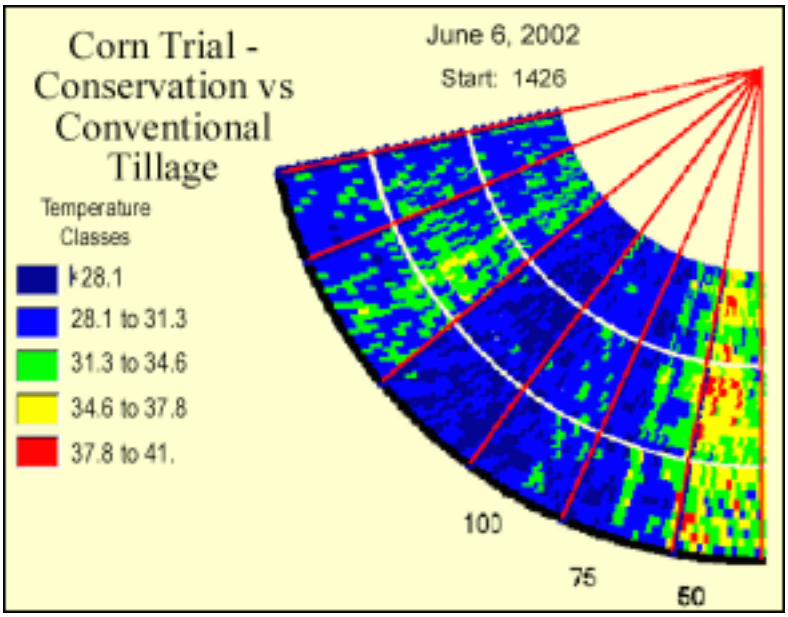
Justification:
Depletion of the Edwards aquifer and competition for water with urban areas limit water available for irrigation. Limited water is even more pressing with the introduction of new limits on irrigation water imposed by the Edwards Aquifer Authority in the Winter Garden area. These limits are based on historical uses, and restrict farmers in the Edwards region to pumping 1 to 2-acre feet of water. However, winter and spring rainfall permit profitable yields if farmers follow best management practices (BMP) in combination with minimum or no tillage.

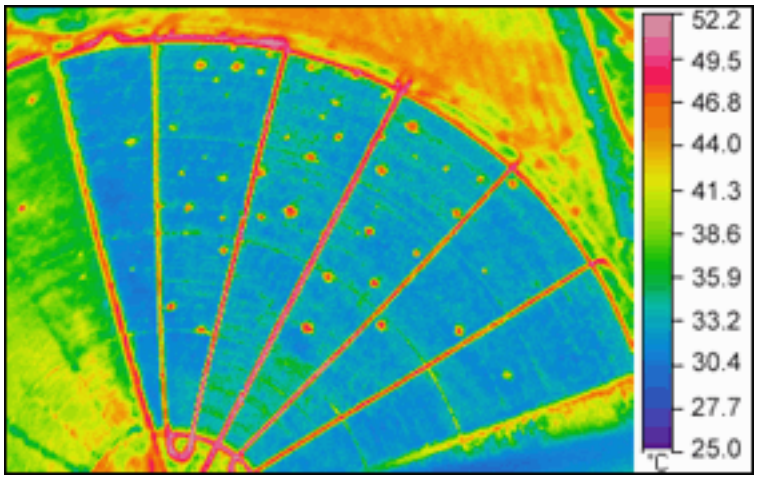
Research and experience repeatedly show that tillage causes soil dryness and compaction. Reducing or eliminating tillage while maintaining soil mulch, water penetration and infiltration from rainfall and overhead irrigation increases irrigation efficiency, and reduces soil evaporation losses. Additionally, rainfall captured during the winter months reduces early season irrigation expenses.

Deficit irrigation occurs when amounts of water applied are reduced below levels required for maximum yield of a crop. Deficit irrigation is used in semi-arid regions like the Winter Garden area of Texas where rainfall furnishes part of the crop water requirements, and irrigation is used to provide the remaining water needed. However, under deficit irrigation, crops are often more prone to pest infestations. For example, corn production limited by irrigation develops water stress and sometimes increases diseases such as aflatoxin (a mycotoxin produced by the fungus Aspergillus flavus). This fungus is found in soil, air and decaying plant residues, and because of its extreme toxicity, even very low amounts can pose a risk to human health. Drought is one of several factors that predispose corn to infection by aflatoxin. South Texas corn is prone to aflatoxin contamination because of drought stress often occurs at silking. Efficient irrigation can nearly eliminate the problem, but irrigation must be applied

appropriately. More information is needed on how and when to irrigate corn given the limited water availability as required the Edwards Aquifer Authority. **Thus, research on crop production with limited water availability, and on irrigation management techniques to avoid pest problems, is contributing toward economical viability for the agricultural-based Edwards aquifer dependent communities west of San Antonio.**



Precision Agriculture technology and introduction of new drought tolerant varieties permit crop production using limited water. Good irrigation scheduling is a critical factor for producing high yielding crops. To reduce costs associated with irrigation, we are conducting studies to automate irrigation systems using infrared thermometers (IRT) and other remote sensing devices. The figure on the right is a map created using IRTs mounted on a center pivot. The IRTs measure plant canopy temperature differences among the different irrigation regimes and tillage practices. Early results show the benefits of scheduling irrigation and using variable rate irrigation technology for spot irrigating only the areas under water stress. However, plants infected by some plant diseases exhibit symptoms similar to those of plants under water stress, and thus limit the use of IRT based irrigation scheduling. To verify if IRT or other remote sensing instrumentation can distinguish between disease and water stress, studies are being conducted under a center pivot irrigation system using different type of remote sensing instrumentation. If these instruments hold up, diseased areas can be mapped and less water can be applied is these areas using variable rate water application technology. The picture on the right was taken with an IR camera mounted on a helicopter. The photographed cotton wedge shows high temperature spots (as



red or green spots), and ground work shows these spots to be from damage by ants and cotton root rot. IR technology presents new opportunities when used with variable rate application of chemicals through center pivot-mounted applicators. It also helps save water through conservation tillage practices. Timely and thorough pesticide coverage using appropriate spray volumes is critical to successful row and vegetable crops production in the Winter Garden. The Accu-Pulse system, which is center pivot-mounted and delivering a minimum of 32 gallons/A spray volume, can help with applying correct spray volumes and also will help resolve the issue of timely applications. This system allows chemical cost savings by spraying only targeted areas instead of the entire field, and may help resolve chemigation restrictions. Thoroughness of spray pattern is assessed by placing water-sensitive paper in upper-, mid- and lower-canopy locations in plots with Accu-Pulse system and plots where ground or air application equipment is used. Upper and lower leaf surface spray coverage will be evaluated, and pest populations are monitored periodically during the growing season. When pest populations occur, pre- and post- pesticide application counts are made in both types of plots.

Objectives:

This research seeks to increase the efficiency of typical Winter Garden cropping systems with improved irrigation practices in stress environments, and by identifying agronomic practices with cost savings. To achieve this goal, several vegetable and row crops are being subjected to conventional and no-tillage management, with three varieties used for each crop. Specific objectives are: 1) identify limited irrigation thresholds for each variety grown under conventional and conservation tillage farming practice using PET based irrigation, 2) develop best management practices for reduced tillage systems, 3) investigate the usefulness of remote sensing instrumentation and precision farming technology for optimizing irrigation scheduling and management in biotic and abiotic stress environment, 4) evaluate thoroughness of spray coverage and spray efficacy by comparing spray deposition patterns of the Accu-Pulse system to that of ground

application equipment by using water-sensitive paper and by sampling insect populations.

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