PROJECT REPORT

TITLE:

Irrigation and Rainfall Water Management and Conservation

PROJECT LEADER:

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PROJECT GOAL:

Improvement of water use efficiency in the Texas Wintergarden Region through the introduction of high efficiency irrigation systems, water conserving cultural practices and improved water management tools.

PROJECT LOCATION:

Tiro Tres Farms
LaPryor, Texas
COOPERATOR -Ed Ritchie III, Owner/Manager

INTRODUCTION

In the spring of 2000, Tiro Tres Farms provided Texas Cooperative Extension personnel with the use of two corners of a field adjourning a center pivot irrigation system for use in research and demonstration projects in support of the Wintergarden vegetable industry. As a result, this location was selected as the site of the work funded by the grant reported in this report. In addition, Tiro Tres Farms owner/manager, Ed Ritchie indicated his willing to provide TCE access to both a pivot and a furrow system located in adjourning field on this farm. Therefore, with the installation of a drip system to irrigate the pivot corners, all three major irrigation techniques were available to make commercial setting evaluation of application system water use efficiency.

In addition to system efficiency comparison, the site also provided an opportunity to demonstrate the merits of drip systems as a means of effectively and economically irrigating the problem corners left out of production by installation of center pivot systems.

STUDY OBJECTIVES:

To demonstrate the merits of using drip systems to irrigate problem center pivot corners.

To compare water use efficiency of center pivot, furrow and drip irrigation systems.

CONDITIONS OF THE STUDY:

Observational design
Single block / treatment
One variety across treatment blocks
Two phase study
- Phase 1, irrigating pivot corners
- Phase 2, irrigation systems water application use efficiency

PHASE I (drip systems for pivot corners):

A drip irrigation system was installed that had the capability to supply sufficient water to accommodate 6.5 A (total area of two corners). Successive crops of spinach, grain sorghum and onion were planted. A watermelon variety trial was also grown in a portion of the area planted to grain sorghum. Yield was obtained for all crops except spinach.

A) grain sorghum = 6,240 lbs/A
B) watermelon = ranged from approx 25,000 - 120,000 lbs/A (35 varieties planted).
C) onion = 643 cwt/A

PHASE II (application systems water use efficiency):

Although this project was a vegetable crops water use study, grain sorghum was used as the indicator crop due to the rotation cycle requirement for the farm. As a result, grain sorghum of the variety Pioneer 8313 was sown in each of the irrigation treatment. Seeds where sown 28, March 2001 and the crop harvested 25 July, 2001. Similar plant seeding rates were used in all treatments. In the drip block, 80 “ wide raised beds having 60 “ flat tops were used. Two drip lines having a deliver rate of 0.45 gal/hour/100' of tape were buried / bed approx 6 “ deep. Two seed lines per bed were sown in order to maintain similar plant population in all irrigation treatments. All cultural practices, including irrigation scheduling was at the discretion of the cooperator. Water applied to each block (system) was recorded.

RESULTS AND DISCUSSION:

The exceptional yield obtained from the crops grown under drip irrigation in the pivot corners suggest that these systems are well adapted to these situtations. Although expensive to establish, they can prove to be economical in the long run due to yield potential, water savings, and, labor reduction feasible with these systems as compared to furrow irrigating the corner areas as the normal practice in the Wintergarden. In addition, they have the potential to bring into production problem corners normally left fallow or left to grow over with weeds and or brush.

As anticipated, the largest volume of water applied in the Phase II test was in the furrow irrigated block (8.4"), Table 1. Unexpectedly, a larger volume of water was applied in the drip block than in the center pivot block(7.1 “ and 6.0", respectively). However, yield data taken from these blocks indicated that the highest yield was obtained under drip irrigation, 6,240 lbs/A) whereas, only 4,590 lbs/A was harvest from the pivot and, 5680 lbs/A with the furrow system. As shown in Table 1, 878.9 lbs of grain was produced from each inch of pumped water through the drip system as compared to 765 lbs per inch through the center pivot and 676.2 lbs through the furrow system. Based on this data, projections indicate that it would require 14 and 30 % additional water to be pumped through the center pivot and furrow systems respectively to obtain the same rate of grain return from water as achieved by the drip system under the conditions of this study. Therefore, the overall systems water use efficiency ratio ranged from 30:1(gallons water/lb of grain produced) with the drip system to 40:1 with the furrow system, Table 2.

Table 1. Influence of method of irrigation on grain sorghum yield; LaPryor, TX.

Irrigation method	Grain yield (lbs/A)	Water pumped (inches)
Drip	6240	7.1
Furrow	5680	8.4
Center Pivot	4590	6.0

Table 2. Water use efficiency as influenced by irrigation method; LaPryor, TX.

Irrigation method	Grain yield (lbs/A)	Applied water/A		Grain (lbs/in water)	Efficiency ratio gals water/lb grain
		inches	gallons		
Drip	6240	7.1	192793	878.9	31:1
Furrow	5680	8.4	228094	676.2	40:1
Center Pivot	4590	6.0	162924	765.0	36:1

System water application efficiency alone does not explain the yield differences or the volume of water applied. Application scheduling and system run times also impact these differences. As indicated above, scheduling was left to the discretion of the cooperator. Less than 1.5 inches of applied water separated the highest volume applied from the lowest volume applied. It is speculated that a more exacting means of determining water needs and system run time would improve the overall efficiency ratios of all systems. Therefore, demonstration of more effective methods to schedule irrigation is suggested for future projects.

CONCLUSIONS

The results of this demonstration suggest that drip irrigation systems offer an effective and efficient means of irrigating problem field corners created by the installation of center pivot systems. Although drip systems are expensive to install on corners as compared to entire fields, in the long run they can be an economical solution to irrigating or maintaining problem corners. Such systems reduce the labor requirements of furrow systems often used to irrigate these areas and / or reduce weed or brush control in these areas if left out of production. Drip systems are also ideally suite for small acreage of high value speciality crops than can be produced in the corner areas.

Comparisons of the three major forms of supplying supplemental water, center pivot, furrow and drip, indicated that the highest grain yield was obtained with drip irrigation. The least amount of water used in the test was with the center pivot system. However, this technique also produced the lowest grain yield. Based on efficiency ratios (gallons water/lb of grain produced) drip irrigation also resulted in the lowest water to grain ratio. The investigators recognize the fact that drip irrigation cost are prohibitive with agronomic crops such as sorghum. It was selected as the indicator crop based on the normal rotation of the Trio Tres Farms. However, much of the cost to drip establishment is in the filtering system. Once the system is in place agronomic crops can be economically rotated through these areas. No precise technique was use to schedule irrigations. Therefore, differences in yield may have been attributed to differences in timing supplemental water application and/or system run times. Future work is suggested in demonstrating techniques to aid decisions as to when to irrigate.