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WHY SUBSURFACE DRIP IRRIGATION (SDI)? AN ECONOMIC ANALYSIS

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Abstract

Economic budgeting is used to compare the levels of returns to operator labor, management, risk and profit for Subsurface Drip Irrigation (SDI) and open furrow irrigation systems. The Water Use Efficiency (WUE) and the associated increase in cotton lint yields of SDI technology makes the adoption of this method of irrigation an economically sound decision.

Introduction

Cotton is the predominate agronomic crop produced in west Texas. The limited growing-season rainfall of far west Texas has made groundwater irrigation necessary to sustain economically viable production levels. Limited groundwater resources and increasing energy costs have encouraged producers to adopt subsurface drip irrigation (SDI) technology.

This paper compares the water use efficiency and profitability of SDI and open furrow irrigation in the St. Lawrence area of far west Texas. Average annual rainfall in this three county area has averaged 16 inches per year. However, only 6 to 12 inches of this occurs during the growing season (NOAA 1980-1999). Water well yields have declined to 20 to 35 g.p.m., and producers typically tie as many as 6 wells together to assemble adequate irrigation volume. To the extent that adequate volume is available, other research has suggested that Low Energy Precision Application (LEPA) irrigation technology with a much lower initial cost may offer a more profitable alternative to SDI (Segarra).

Objectives

Water use efficiency (WUE) is simply defined as the pounds of cotton harvested for each acre inch of water applied. With a constant quantity of water the WUE gained under SDI production practices allows for either greater yield per irrigated acre or more acres being irrigated. The fixed costs per acre associated with the installation a drip system often limits the number of acres converted to drip irrigation.

Profitability of the two irrigation/production systems will be assessed by comparing production budgets generated through numerous sessions with commercial producers in the St. Lawrence area. Water input was held constant between both irrigation systems to illustrate water use efficiency, but other variable costs were allowed to vary based on perceived best management practices. Fiber quality, and the associated pricing differentials produced by the two irrigation systems was not taken into consideration for this paper. However, other researchers have reported higher fiber quality under SDI systems than furrow irrigation systems (Hanson et. al, 2000, Camp et. al, 2000).

Methods and Procedures

Production budgets for cotton production in the St. Lawrence area were generated with the input of several commercial producers. Many of these producers farm more land than they have water resources. Therefore numerous producers may actually have cotton being produced under dryland conditions, furrow irrigation and SDI.

Table 1 summarizes the economic comparison of drip and furrow irrigation systems in the St. Lawrence area of Texas. A detailed analysis of the variable costs is presented. Only selected fixed cost items were highlighted to make clear some of the differences inherent to a particular method of irrigation. These estimated budgets are representative of the entire St. Lawrence area. Individual producers may have circumstances that will create markedly different cost structures.

Water use efficiency for furrow irrigation has been estimated at 34 pounds of lint per acre inch of water, while the WUE of SDI has been estimated at 55 pounds of lint per acre inch of water. With the greater potential for yield producers are more apt to use a transgenic seed variety. This is reflected in per acre seed and chemical costs. Similarly, this substituting of chemical weed control for mechanical weed control and the reduced maintenance of irrigation ditches and furrows lowers pre-harvest fuel, lube and machinery repair costs. Labor costs are also considerably lower under a SDI system.

Depreciation of the irrigation equipment has been separated from the other farming machinery and equipment on Table 1. Total investment in SDI equipment, including irrigation wells, pumps, motors and other accessories was assumed to be $625 per irrigated acre and that this equipment would have an average useful economic life of 8 years. The total investment in furrow irrigation was assumed to be $134 per irrigated acre, and also have a useful life of 8 years.

An opportunity cost was assessed to each budget on the value of all machinery and equipment. The opportunity cost of using a resource in a production process is the income which could be received from the best alternative use of that resource (Bevers et. al). This opportunity cost is essentially the time value of the respective investment. A land charge is also assessed to each irrigation system. The land charge is an imputed charge, and will either cover principle and interest payments on the real estate, cash rent, landlord's share of production under a crop share lease arrangement or simply a return to land usage charge.

Summary and Conclusions

The adoption of SDI technology is not without risk. Investment per acre for the drip tape and piping and manifold systems can exceed $500 per acre (Frerich). Producers converting from a furrow irrigation system may already have the investment in irrigation wells, pumps, motors and other accessories. These costs are estimated to total $125 per irrigated acre. Add to these costs the $423.95 per acre in total variable costs, and a significant level of financial risk is being assumed. However, SDI should increase average yields while at the same time reducing the volatility of yields experienced by dryland farmers.

Utilizing loan rate commodity prices, the returns over variable costs for furrow irrigation and SDI technology are expected to be $9.28 per acre and $128.50 per acre respectively. At these price levels neither irrigation system can show an economic profit. Both systems are expected to a negative return to operator labor, management, risk and profit. The furrow irrigation system has a return of $-87.90 while the SDI system has a return over total costs of $-42.47. Unfortunately, at these commodity price levels capital asset replacement, term debt payments and operator labor (family living) obligations will need to be met with direct government payments.

As producers continue to struggle with limited water and shrinking margins, additional gains in water use efficiency are being sought. Enciso and Unruh have shown that narrower row spacing can further increase the water use efficiency of SDI. Additional analysis will be necessary to determine if those gains will offset costs of appropriate harvesting equipment.

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Table 1. Economic Comparison of West Texas Furrow and Drip Irrigation Systems.

	Furrow	**SDI**
WUE	34	55
Water Applied (In./Ac)	17	17
Yield (pounds cotton lint/Ac.)	629	935
Price per unit ($/lb.)	$0.52	$0.52
Gross Income per ac.	**$366.38**	**$551.85**
Variable Cost Analysis: $/Acre		
Seed	15.19	35.25
Fertilizer	14.80	25.65
Chemical	11.81	32.80
Irrigation costs	152.90	152.90
Crop Insurance	15.50	18.00
Labor costs	37.05	19.13
Custom Application	3.50	3.50
Interest on Line of Credit	9.27	9.89
Gin, Bag, Tie, Haul Modules	54.90	89.76
Harvest - fuel, lube, repair, chemicals	23.37	24.25
Total Variable Cost	**$356.79**	**$423.35**
Return Above Variable	**9.58**	**128.50**
Fixed cost Analysis: $/Ac.		
Depr.: Irrigation System	15.14	76.04
Depr. : Other Machinery & Equipment	15.06	13.70
Land Charge	50.00	50.00
Opportunity	15.29	33.70
Total Fixed Costs	**$97.48**	**$170.97**
Planned Returns To Operator Labor, Management, Risk and Profit	**$-87.90**	**$-42.27**
Breakeven Price Per Pound to Cover Total Costs	**$0.66**	**$0.56**