EVALUATING INVESTMENT IN PRECISION FARMING TECHNOLOGY

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ABSTRACT

CYMIDA (Cotton Yield Monitor Investment Decision Aid) is a decision aid designed to help cotton farmers analyze the cotton yield monitor information system investment choice. The decision aid utilizes a combination of partial budgeting, breakeven analysis, and sensitivity analysis techniques to evaluate the input cost savings and yield gains required to pay for a cotton yield monitoring information system. Users can evaluate the breakeven yield gains and input savings needed to cover the cost of a yield monitor for 11 potential crop input decisions that might be made using yield monitor information.

INTRODUCTION

Precision farming has the potential to improve profitability by increasing yields and lowering input costs for farmers. These benefits are potentially very important in input-intensive cotton production. A popular entry point for farmers interested in precision farming is the installation of electronic yield monitors on harvesting equipment. Electronic yield monitors provide farmers a way to collect spatial information about crop yields. Spatial yield data that have been referenced to specific locations in a farm field using a Global Positioning System (GPS) can then be converted from raw data into a yield map using Geographic Information System (GIS)-based computer applications. This database of spatial yield variability can be combined with other field information (e.g., grid soil sampling and remote sensing data) to make field maps for variable rate technology (VRT) input decisions and other crop management decisions such as field drainage, landlord rental negotiations, and documentation of environmental compliance.

One of the impediments to the adoption of precision technology by cotton farmers has been the lack of a reliable yield monitoring system. Cotton yield monitors, first introduced in 1997, had poor accuracy and were not reliable. Subsequent cotton yield monitor technology introduced in 2000 appears to be more reliable and may be more readily adopted by farmers. Because cotton yield monitors are a relatively new technology, information about the yield gains and input savings required to pay for a cotton yield monitoring information system would be useful for farmers considering an investment in the technology. The objective of this analysis is to show how the Cotton Yield Monitor Investment Decision Aid (CYMIDA) can be used by farmers to help them decide whether to purchase cotton yield monitors for their farming operations.

MATERIALS AND METHODS

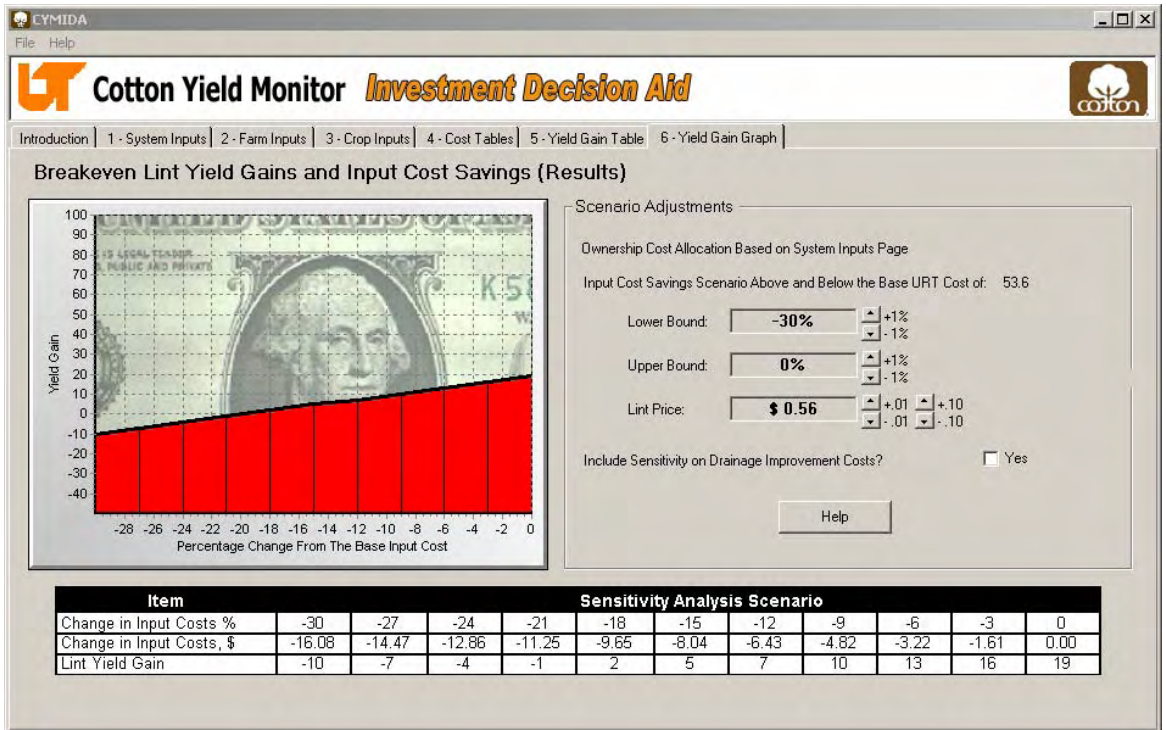
CYMIDA is a computer decision aid designed to guide the user through a systematic analysis of the cotton yield monitor investment decision. CYMIDA is available on-line to be downloaded from the Cotton Incorporated internet site at http://www.cottoninc.com/Agriculture/homepage.cfm?PAGE=3518. The decision aid utilizes a combination of partial budgeting, breakeven analysis, and sensitivity analysis techniques to evaluate the input cost savings and yield gains required to pay for a cotton yield monitoring information system. Users can evaluate the breakeven yield gains and input savings needed to cover the cost of a yield monitor for 11 potential crop input decisions that might be made using yield monitor information. The assumed equipment compliment for a yield monitoring information system includes a general-purpose monitor/controller console, cotton flow sensors on every other chute of a cotton harvester, a digital GPS receiver, a PCMCIA memory card, a desktop computer and color printer, and GIS-based mapping and application recommendation software. These components represent the necessary equipment needed to electronically collect and generate yield maps for management decision-making.

CYMIDA was used to evaluate the breakeven yield gains and inputs savings for a farmer wanting to use VRT to manage seed, nitrogen, and growth regulator inputs in the field. It was assumed that information from the yield monitor would be used to divide cotton fields into low, medium, and high productivity zones for the purpose of managing seed, nitrogen, and growth regulator inputs. Under this system, input usage may be reduced in the low and medium productivity zones because yield potential in these zones may be lower. Breakeven yield gains were calculated for input cost savings ranging from 0% to 30%. Annual ownership costs for the yield monitoring information system were calculated for a farm that has 2,000 acres of cotton and 1,500 acres of other crops. An expected lint price of $0.56/lb was used to calculate the breakeven yield gains

RESULTS AND CONCLUSIONS

For a farm with 2,000 acres of cotton and 1,500 acres of other crops, the annual total ownership cost for the yield monitoring information system is $6,044. This annual ownership cost assumes that cotton yield monitors are retrofitted onto each of the three cotton pickers owned by the farm and only one computer system is required for data management. On a cost per unit of cotton area basis the ownership cost is $3.02/acre if all of the information system costs are allocated to cotton area only. If computer, software, and annual workshop costs are spread over areas of all crops, the annual cost would fall to $2.60 acre^{-1} of cotton area.

Breakeven yield gains to pay for the information system for alternative input cost savings scenarios are presented in Figure 1. If no input cost savings are achieved using the information system to manage inputs, then the required yield gain to pay for the information system is 19 lb/ acre. On the other hand, lint yields can decline by 10 lb/acre and still breakeven with ownership costs if input savings of $16.08/acre (30%) are achieved using the information system. Total cotton production costs decline by $13.48/acre under the 30% input savings scenario. With care in specifying values in the model, users of CYMIDA should be able to evaluate a variety of precision farming "what if" scenarios.



Item	Sensitivity Analysis Scenario										
Change in Input Costs %	-30	-27	-24	-21	-18	-15	-12	-9	-6	-3	0
Change in Input Costs, $	-16.08	-14.47	-12.86	-11.25	-9.65	-8.04	-6.43	-4.82	-3.22	-1.61	0.00
Lint Yield Gain	-10	-7	-4	-1	2	5	7	10	13	16	19

Figure 1. Breakeven Lint Yield Gains and Input Costs Savings in CYMIDA