IRRIGATION INVESTMENT ANALYSIS
DECISION AID USERS MANUAL

Introduction

Investing in an irrigation system represents a major decision for most producers. All investment decisions should be carefully and accurately evaluated. This decision aid is specifically designed to assist users in evaluating irrigation investment decisions. The decision aid is developed within an Excel spreadsheet. The worksheet includes default values for various parameters needed in the evaluation process. However, it is the user's responsibility to enter appropriate data for individual situations in the cells, as indicated.

This worksheet uses the net present value (NPV) concept in evaluating investment decisions. The flows of income and expense over time are discounted to a present value that is compared to the cost of the investment. If the net present value is positive then the investment is feasible. Since selection of appropriate discount (interest) rates is important, users may want to evaluate sensitivity of results to alternative interest rate assumptions.

USING THE PROGRAM

Selecting a System

The spreadsheet is organized with selected irrigation systems on each sheet. Irrigation systems are identified on the tabs at the bottom of the worksheet. Figure 1 illustrates the system names on tabs at the bottom of the page. For example the highlighted tab in Figure 1 is for the readme file that gives a brief summary of the spreadsheet functionality. The first step is to select the system to be evaluated by clicking on one of the tabs.

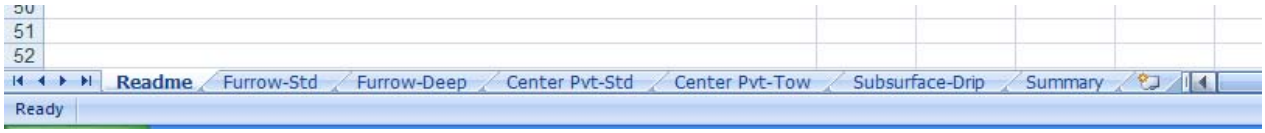
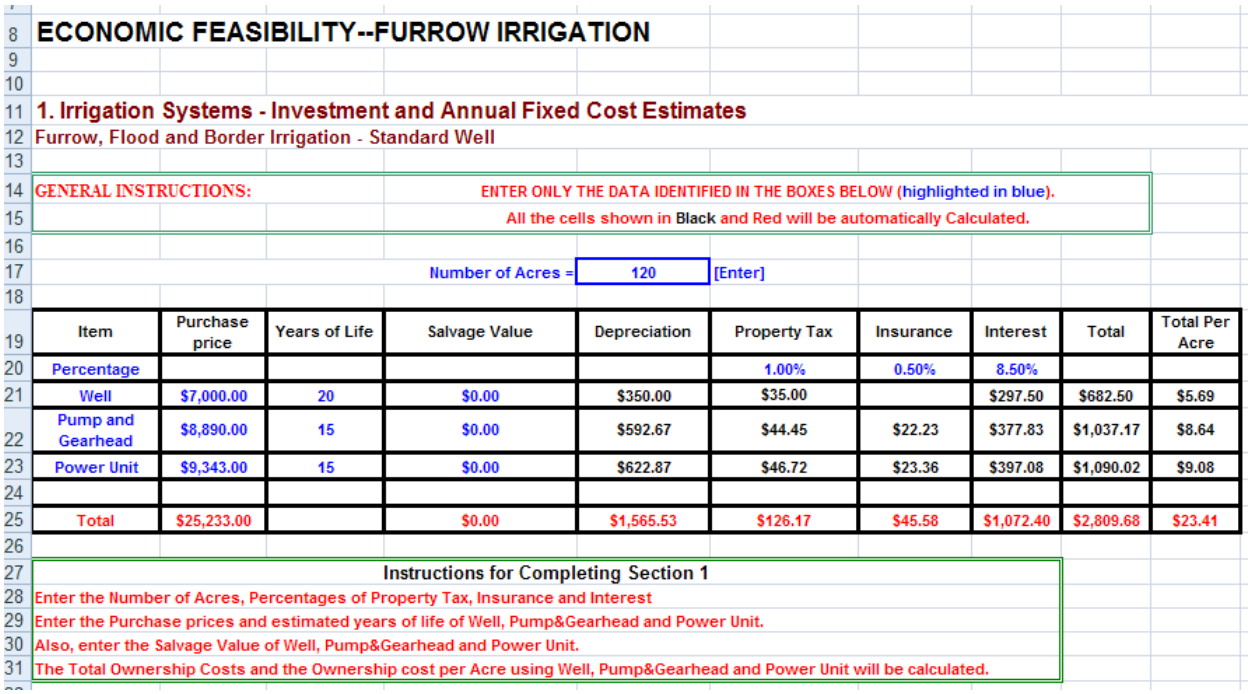


Figure 1. Tabs at bottom of worksheet identify irrigation systems.

Estimating Ownership Costs

Once a system has been selected by clicking on the appropriate tab, the user will be shown a worksheet that contains several sections. For illustration purposes, the furrow irrigation system with a standard depth well (Furrow-Std) will be used to explain functions of the decision aid. Generally, six sections are presented on each page. The first section includes the purchase cost and annual fixed costs for components of the irrigation system selected (Figure 2). As shown, the purchase price of the system and its expected life are entered here. All required user input data is highlighted in blue. Default data is loaded in the spreadsheet and will be used in the calculations if the user does not enter different data. The first section also specifies the number of acres covered by the specified system. Depreciation is calculated using the straight line method, assuming a zero salvage value. Interest on investment represents an opportunity cost of capital invested in the asset. The other coefficients are widely used in budgeting agricultural enterprises.

The property tax coefficient specifies the annual personal property tax rate, based on the average asset value. Some states may not have personal property taxes and in those cases users need to ensure that the coefficient is set to zero. Care should be taken to ensure that adjustments are made to reflect the appropriate tax rate.



ECONOMIC FEASIBILITY--FURROW IRRIGATION

1. Irrigation Systems - Investment and Annual Fixed Cost Estimates

Furrow, Flood and Border Irrigation - Standard Well

GENERAL INSTRUCTIONS: ENTER ONLY THE DATA IDENTIFIED IN THE BOXES BELOW (highlighted in blue).
All the cells shown in Black and Red will be automatically Calculated.

Number of Acres = 120 [Enter]

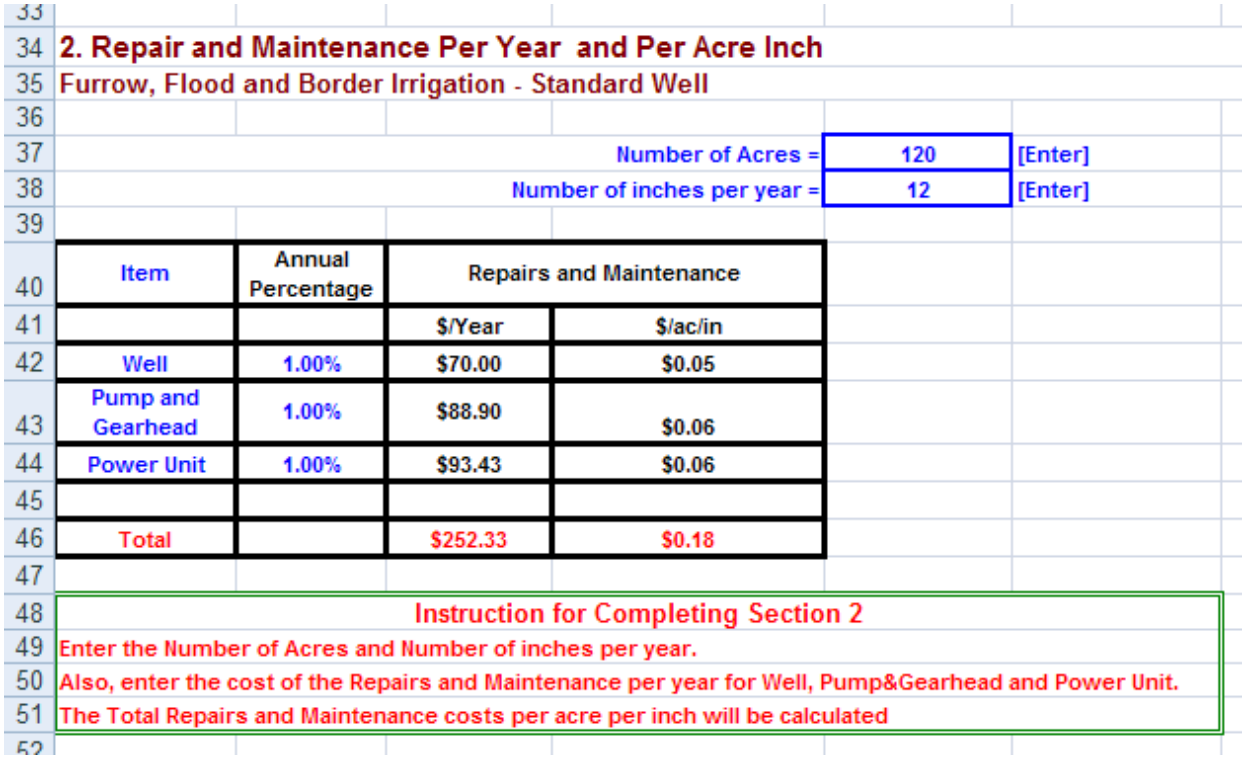
Item	Purchase price	Years of Life	Salvage Value	Depreciation	Property Tax	Insurance	Interest	Total	Total Per Acre
Percentage					1.00%	0.50%	8.50%		
Well	$7,000.00	20	$0.00	$350.00	$35.00		$297.50	$682.50	$5.69
Pump and Gearhead	$8,890.00	15	$0.00	$592.67	$44.45	$22.23	$377.83	$1,037.17	$8.64
Power Unit	$9,343.00	15	$0.00	$622.87	$46.72	$23.36	$397.08	$1,090.02	$9.08
Total	$25,233.00		$0.00	$1,565.53	$126.17	$45.58	$1,072.40	$2,809.68	$23.41

Instructions for Completing Section 1
Enter the Number of Acres, Percentages of Property Tax, Insurance and Interest
Enter the Purchase prices and estimated years of life of Well, Pump&Gearhead and Power Unit.
Also, enter the Salvage Value of Well, Pump&Gearhead and Power Unit.
The Total Ownership Costs and the Ownership cost per Acre using Well, Pump&Gearhead and Power Unit will be calculated.

Figure 2. Illustration of section 1 contents.

Repair and Maintenance Costs

The second section calculates repair and maintenance costs for the selected irrigation system Figure 3). As shown, the annual repair and maintenance charge for the pump and gearhead is 1 percent of the purchase price. In this case the purchase price was $8,890 (shown in cell B22). Therefore, the annual charge for repair and maintenance is .01*$8,890=$88.90. Users should specify their own estimates for each of the components.



2. Repair and Maintenance Per Year and Per Acre Inch

Furrow, Flood and Border Irrigation - Standard Well

Number of Acres = 120 [Enter]

Number of inches per year = 12 [Enter]

Item	Annual Percentage	Repairs and Maintenance	
		$/Year	$/ac/in
Well	1.00%	$70.00	$0.05
Pump and Gearhead	1.00%	$88.90	$0.06
Power Unit	1.00%	$93.43	$0.06
Total		$252.33	$0.18

Instruction for Completing Section 2

Enter the Number of Acres and Number of inches per year.

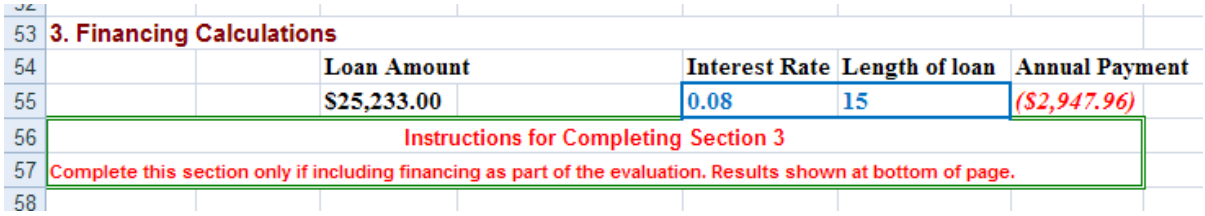
Also, enter the cost of the Repairs and Maintenance per year for Well, Pump&Gearhead and Power Unit.

The Total Repairs and Maintenance costs per acre per inch will be calculated

Figure 3. Section 2, Repair and maintenance costs

Financing the Investment

Section 3 of the worksheet addresses financing charges, if the user wants to include financing as part of the analysis. In this case, 100 percent financing is assumed. Further, it is assumed that this amount is financed for 15 years at 8 percent interest. Again, users should specify terms (interest rate and length of loan) appropriate for their situation. Financing charges are included as part of the net present value (NPV) calculations presented later in the worksheet. As shown here, the annual principal and interest charges would be $2,947.96.



3. Financing Calculations

Loan Amount	Interest Rate	Length of loan	Annual Payment
$25,233.00	0.08	15	*($2,947.96)*

Instructions for Completing Section 3

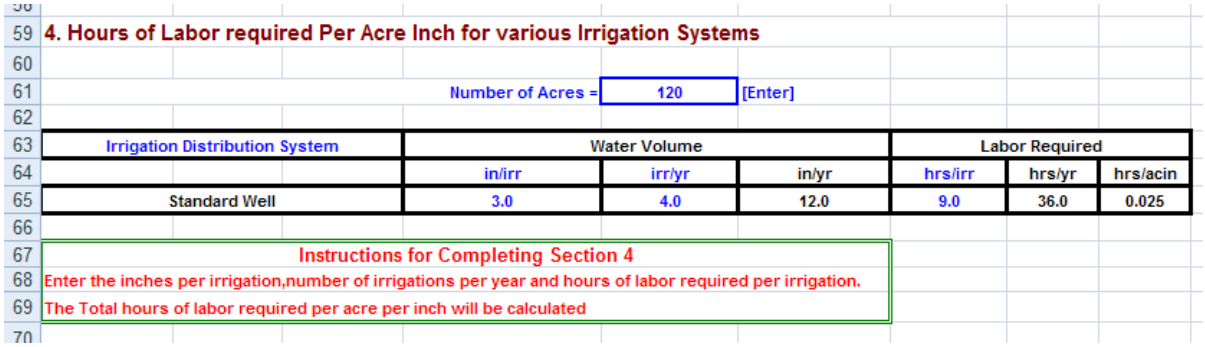
Complete this section only if including financing as part of the evaluation. Results shown at bottom of page.

Figure 4. Section 3, Financing the irrigation investment.

Estimating Labor Requirements

The next section of the worksheet presents the labor requirements for the selected irrigation system. Since labor requirements are dependent on the number of applications, the user specifies

the number of applications and the amount of water applied in each application. Figure 5 shows the screen shot for the labor calculation section.



4. Hours of Labor required Per Acre Inch for various Irrigation Systems

Number of Acres = 120 [Enter]

Irrigation Distribution System	Water Volume			Labor Required		
	in/irr	irr/yr	in/yr	hrs/irr	hrs/yr	hrs/acin
Standard Well	3.0	4.0	12.0	9.0	36.0	0.025

Instructions for Completing Section 4

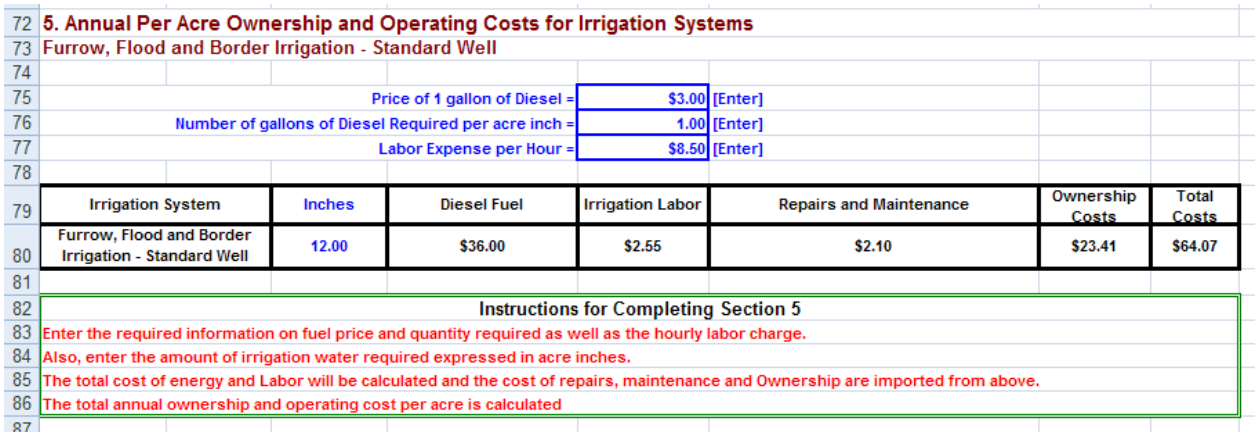
Enter the inches per irrigation,number of irrigations per year and hours of labor required per irrigation.

The Total hours of labor required per acre per inch will be calculated

Figure 5. Section 4, Labor requirements for irrigation.

Fuel Costs

Section 5 of the worksheet summarizes the per acre operating and ownership costs for the irrigation system. Fuel costs are calculated and added here. The user specifies a price for diesel fuel and the amount of fuel required to pump one acre inch of water. Based on these parameters, the spreadsheet calculates fuel costs and adds other costs previously calculated. Figure 6 illustrates information contained in section 5.



5. Annual Per Acre Ownership and Operating Costs for Irrigation Systems

Furrow, Flood and Border Irrigation - Standard Well

Price of 1 gallon of Diesel = $3.00 [Enter]

Number of gallons of Diesel Required per acre inch = 1.00 [Enter]

Labor Expense per Hour = $8.50 [Enter]

Irrigation System	Inches	Diesel Fuel	Irrigation Labor	Repairs and Maintenance	Ownership Costs	Total Costs
Furrow, Flood and Border Irrigation - Standard Well	12.00	$36.00	$2.55	$2.10	$23.41	$64.07

Instructions for Completing Section 5

Enter the required information on fuel price and quantity required as well as the hourly labor charge.

Also, enter the amount of irrigation water required expressed in acre inches.

The total cost of energy and Labor will be calculated and the cost of repairs, maintenance and Ownership are imported from above.

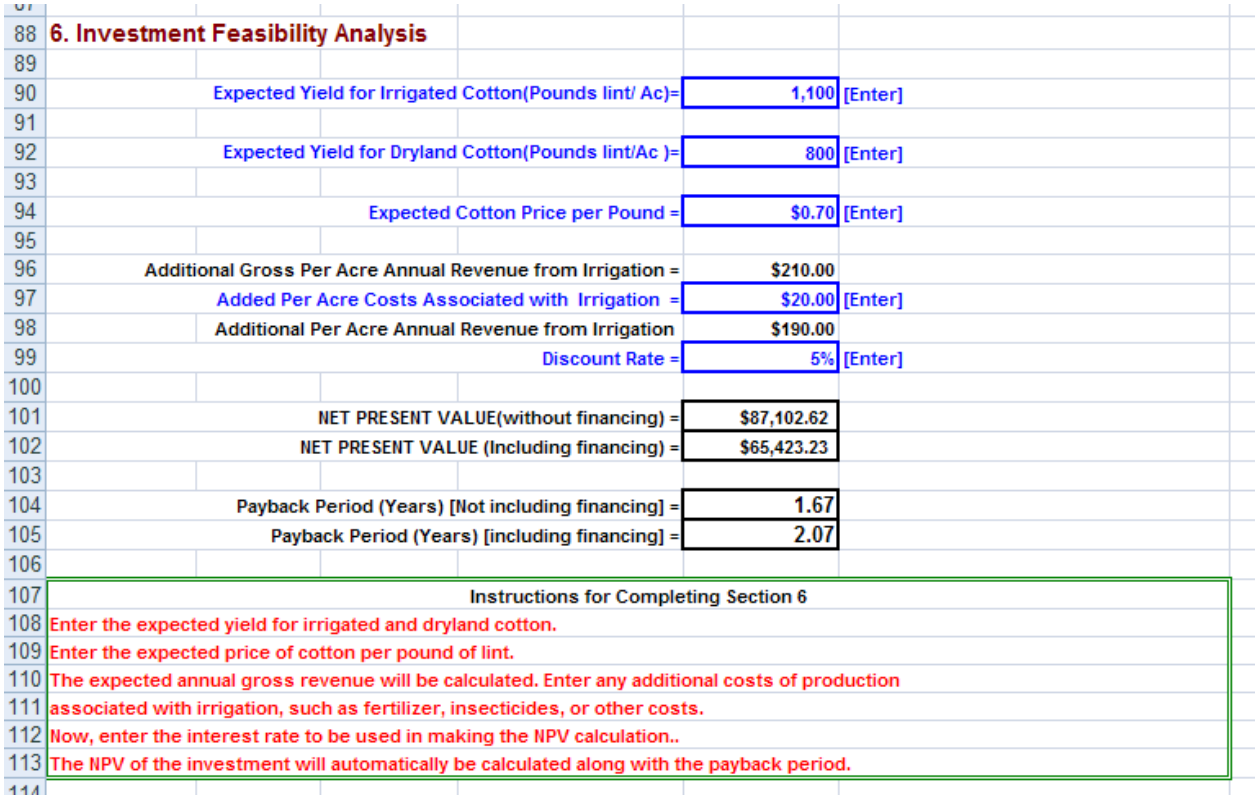
The total annual ownership and operating cost per acre is calculated

Figure 6. Summary of ownership and operating costs for selected irrigation system.

Calculating the Net Present Value

The final section of the worksheet calculates the net present value (NPV) of the selected irrigation system investment. This investment analysis tool compares the present value of the estimated income stream from the investment with the present cost of the investment. If the value is positive, the investment is feasible. The pay back measure of feasibility is also included. This is a commonly used measure of investment feasibility, but it does not consider the time value of money. Figure 6 illustrates the data required to make the NPV calculation. The user is required to enter the expected dryland cotton yield and the irrigated yield. The difference in lint yield is

multiplied times the expected lint price to generate the gross income from the irrigation investment. This income is assumed to occur each year. The ownership and operating costs previously calculated are deducted from the gross income to generate the net income from the irrigation system. Users may include additional costs (beyond the irrigation system itself) for irrigated cotton. Typically these costs may include additional insecticide applications, additional harvest costs, or other items. This net income flow is discounted, based on a user-specified discount rate to arrive at the net present value. The actual annual cash flows are shown in a section below section 6 in the worksheet. The NPV results shown in section 6 are positive indicating that the investment is feasible.

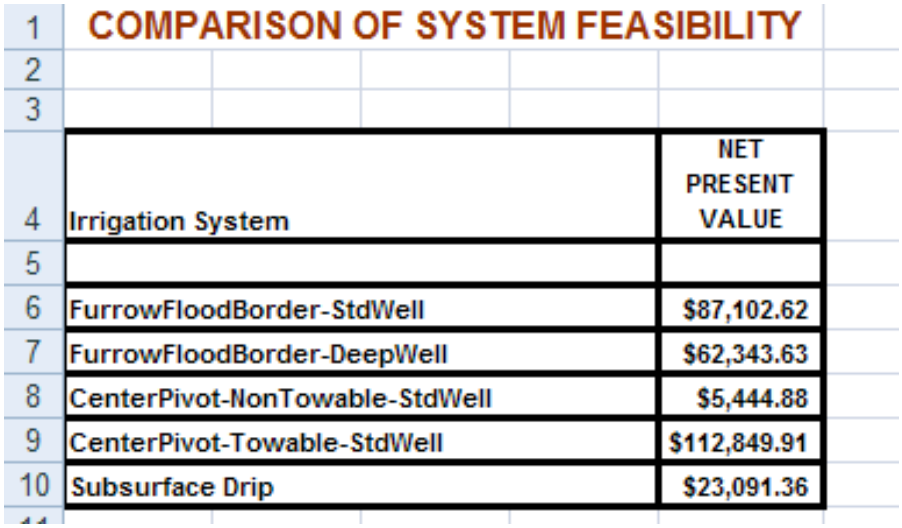


88	**6. Investment Feasibility Analysis**		
89			
90	Expected Yield for Irrigated Cotton(Pounds lint/ Ac)=	1,100	[Enter]
91			
92	Expected Yield for Dryland Cotton(Pounds lint/Ac)=	800	[Enter]
93			
94	Expected Cotton Price per Pound =	$0.70	[Enter]
95			
96	Additional Gross Per Acre Annual Revenue from Irrigation =	$210.00	
97	Added Per Acre Costs Associated with Irrigation =	$20.00	[Enter]
98	Additional Per Acre Annual Revenue from Irrigation	$190.00	
99	Discount Rate =	5%	[Enter]
100			
101	NET PRESENT VALUE(without financing) =	$87,102.62	
102	NET PRESENT VALUE (Including financing) =	$65,423.23	
103			
104	Payback Period (Years) [Not including financing] =	1.67	
105	Payback Period (Years) [including financing] =	2.07	
106			
107	Instructions for Completing Section 6		
108	Enter the expected yield for irrigated and dryland cotton.		
109	Enter the expected price of cotton per pound of lint.		
110	The expected annual gross revenue will be calculated. Enter any additional costs of production		
111	associated with irrigation, such as fertilizer, insecticides, or other costs.		
112	Now, enter the interest rate to be used in making the NPV calculation..		
113	The NPV of the investment will automatically be calculated along with the payback period.		

Figure 7. Section 6, calculating the net present value of the irrigation investment.

Comparing Irrigation Systems

One of the tabs on the spreadsheet identifies a summary sheet that automatically summarizes and compares all the irrigation systems. Please note that the user must enter information for all systems to obtain the comparison. If user data are not entered, the comparison will be based on default parameters. The comparison is made based on the NPV of each system.



COMPARISON OF SYSTEM FEASIBILITY

Irrigation System	NET PRESENT VALUE
FurrowFloodBorder-StdWell	$87,102.62
FurrowFloodBorder-DeepWell	$62,343.63
CenterPivot-NonTowable-StdWell	$5,444.88
CenterPivot-Towable-StdWell	$112,849.91
Subsurface Drip	$23,091.36

Figure 8. Comparison of irrigation systems feasibility

Summary

This worksheet is designed as a decision aid. It is not intended to replace a careful evaluation of alternative investments, but simply to make that job easier. It is the responsibility of the user to supply the correct information appropriate for a specific situation and not rely solely on the default information included here.

Results obtained are very sensitive to the revenue estimates. The user should carefully evaluate expected yield response to irrigation and cotton price. This aid was developed using a 300 pounds of lint per acre yield response to irrigation and a cotton price of $0.70 per pound of lint. If the expected yield response is less, then revenue will be reduced and the feasibility of irrigation will be affected. This aid only evaluates the explicit costs and expected returns for each irrigation system. The decision aid does not explicitly include considerations for timeliness of operation or risk. Users, however, may include these considerations by making appropriate adjustments in yields and or prices. Some irrigation systems may require a longer time to irrigate a given acreage and if the additional time requirement limits yield response, then this should be reflected in the data entered by the user.

The development of this decision aid was made possible through the support of Cotton Incorporated.