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.

**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 \(0.01 \times 8,890 = 88.90\). Users should specify their own estimates for each of the components.
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.

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.

**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.

**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.

<table>
<thead>
<tr>
<th>6. Investment Feasibility Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected Yield for Irrigated Cotton(Pounds lint/Ac)</td>
</tr>
<tr>
<td>Expected Yield for Dryland Cotton(Pounds lint/Ac)</td>
</tr>
<tr>
<td>Expected Cotton Price per Pound</td>
</tr>
<tr>
<td>Additional Gross Per Acre Annual Revenue from Irrigation</td>
</tr>
<tr>
<td>Added Per Acre Costs Associated with Irrigation</td>
</tr>
<tr>
<td>Additional Per Acre Annual Revenue from Irrigation</td>
</tr>
<tr>
<td>Discount Rate</td>
</tr>
<tr>
<td>NET PRESENT VALUE (without financing)</td>
</tr>
<tr>
<td>NET PRESENT VALUE (including financing)</td>
</tr>
<tr>
<td>Payback Period (Years) [not including financing]</td>
</tr>
<tr>
<td>Payback Period (Years) [including financing]</td>
</tr>
</tbody>
</table>

Instructions for Completing Section 6

Enter the expected yield for irrigated and dryland cotton.
Enter the expected price of cotton per pound of lint.
The expected annual gross revenue will be calculated. Enter any additional costs of production associated with irrigation, such as fertilizer, insecticides, or other costs.
Now, enter the interest rate to be used in making the NPV calculation.
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.
### 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.

<table>
<thead>
<tr>
<th>Irrigation System</th>
<th>NET PRESENT VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FurrowFloodBorder-StdWell</td>
<td>$87,102.62</td>
</tr>
<tr>
<td>FurrowFloodBorder-DeepWell</td>
<td>$62,343.63</td>
</tr>
<tr>
<td>CenterPivot-NonTowable-StdWell</td>
<td>$5,444.88</td>
</tr>
<tr>
<td>CenterPivot-Towable-StdWell</td>
<td>$112,849.91</td>
</tr>
<tr>
<td>Subsurface Drip</td>
<td>$23,091.36</td>
</tr>
</tbody>
</table>