

# IRRIG-AID

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## Irrigation Strategy Worksheet For Producers Texas Winter Garden Region



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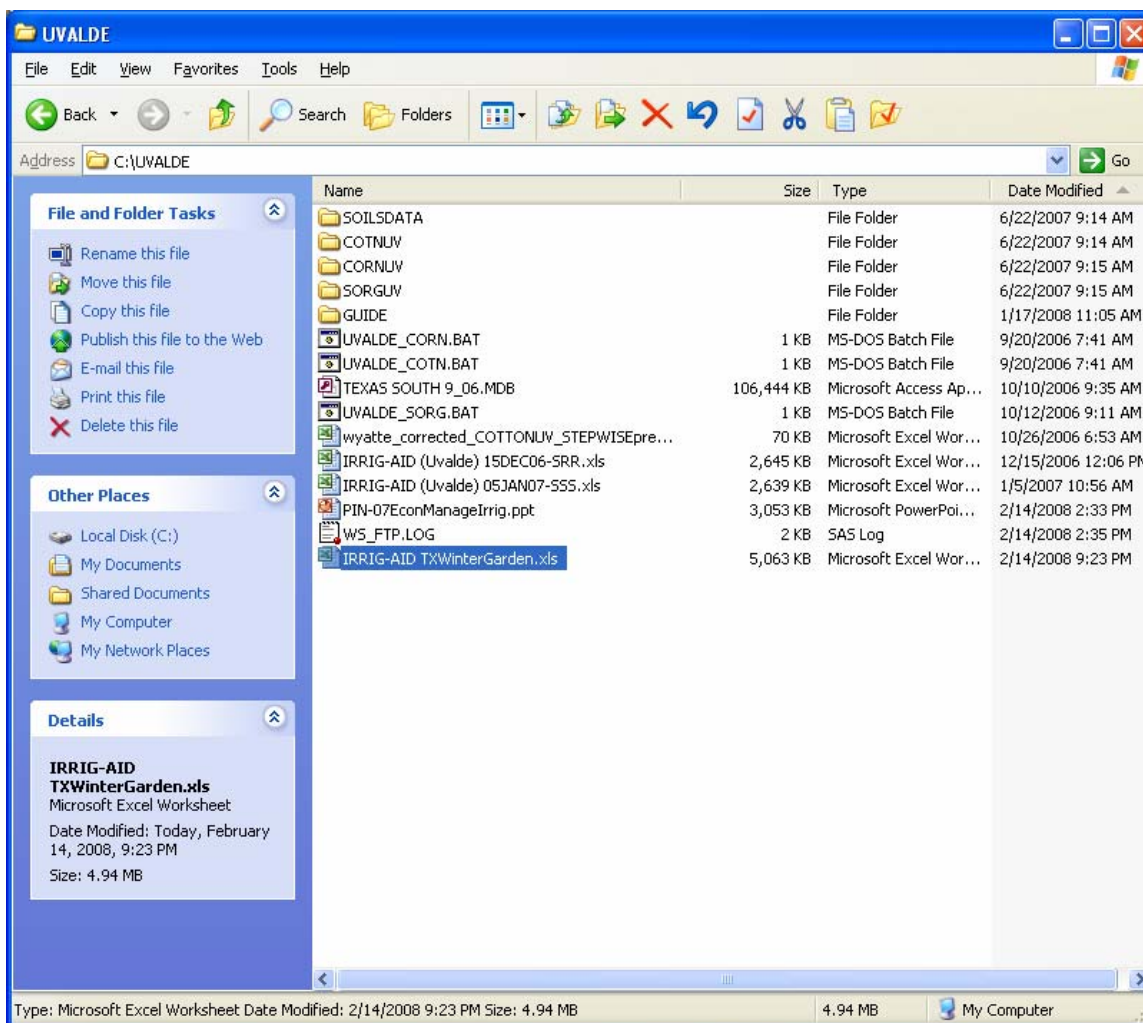
## INTRODUCTION AND OVERVIEW

As part of the Texas Agricultural Experiment Station Cropping System internal grant program, a hands-on spreadsheet decision tool was developed to assess the risk of various crop, soil, and irrigation practices, as well as quantify economic trade-offs in allocating soil and water resources to various cropping alternatives. This instrument will assist producers in achieving efficient water allocations thereby maximizing profitability. Step-by-step instructions for using this tool are presented here.

The producer or user may obtain a copy of this tool from the Decision Aid's web page on the CropMan web site at <http://cropman.brc.tamus.edu/>.

## DOWNLOADING THE WORKSHEET

After the file is downloaded or copied onto the hard drive and the security clearance is granted, simply double click the file from the Windows Explorer File Manager (Figure 1).



**Figure 1: Open File from Windows Explorer**

The file will look like the sample in Figure 2 below:

**Irrigation Strategy Worksheet for Winter Garden Irrigators**

**DIRECTIONS:**  
 1) Fill in **ONLY** the blue boxes to create your irrigation strategy outcomes.  
 2) Choose 'Print' or 'Print Preview' from the File Menu to print and/or view your Worksheet Summary Report.

**Producer Name:** XYZ FARMS (Optional)  
**DATE:** 2/14/2008

**Counties (for Selection of Soil):**  
 SELECT County: Uvalde  
 Kinney  
 Medina  
 Uvalde

**Soil Type (%sand):**  
 SELECT Soil Type:  
 Percent Sand in topsoil (%): 27 % sand \*  
 \* See "VIEW SOILS" SHEET to view %sand soil values

**Weather Stations (Rainfall):**  
 SELECT Weather Station: Uvalde  
 Bracketville  
 Hondo  
 Uvalde

**Irrigation Strategies:**  
 Enter Total Crop Acreage for each Crop

Irrigated Crop Alternatives	Irrigation Applications During the Growing Season					Enter Total Crop Acreage (acres)	Total Irrigations Applied* (ac/in)
	April (inches/ac)	May (inches/ac)	June (inches/ac)	July (inches/ac)	August (inches/ac)		
Minimum Pumping Capacity (gpm @ 90% operating time)	270	978	978	978	140		
Cotton Irrigations	3.0	5.0	5.0	5.0	2.0	100	1500
Corn Irrigations	3.0	8.0	9.0	1.0		100	2100
Grain Sorghum Irrigations	3.0	8.0	8.0	8.0		100	1100

**Fertilizer Application:**  
 Enter the Amount of Nitrogen you wish to use to Estimate Yield and Fertilizer Cost  
 Amount of N applied as sole-source fertilizer (ex. urea or anhydrous ammonia)  
 Amount of Fertilizer Mix Applied  
 Percent N (%) of Fertilizer Mix, ex. 20-10-10=20%, 10-20-10=10%, etc.  
 Total Amount of Nitrogen Applied

	Cotton-lbs/ac	Corn-lbs/ac	Sorghum-lbs/ac
Amount of N applied as sole-source fertilizer	100.0	200.0	150.00
Amount of Fertilizer Mix Applied	50.0	25.0	0.00
Percent N (%) of Fertilizer Mix	70.0	70.0	0.00
Total Amount of Nitrogen Applied	105.0	202.5	150.00

**Expected Product Price and LDP:**  
 Loan Defcy. Pmt. Selling Price Total

Navigation: YIELD CALC / VIEW SOILS / PROFIT / IRRG COST CALC / REPORT

**Figure 2: Yield Calculation**

The **YIELD CALC** sheet is the yield calculation sheet where the user provides the necessary basic input for potential crop acreage and the specific irrigation, soil, and other information which is used to estimate production yields and returns. The **VIEW SOILS** sheet contains the various soils for all counties in the region. The user may filter the soils for each specific county to view the sand content of these particular soils necessary to estimate the yields. The **PROFIT** sheet utilizes the information from the estimated yields to calculate the user's profit analysis. Part of this includes the *Irrigation Cost Calculator*, included on the **IRRG COST CALC** sheet, whose costs may be adjusted independently. Finally, the **REPORT** sheet provides the user with an irrigation strategy summary based on the inputs provided by the user.

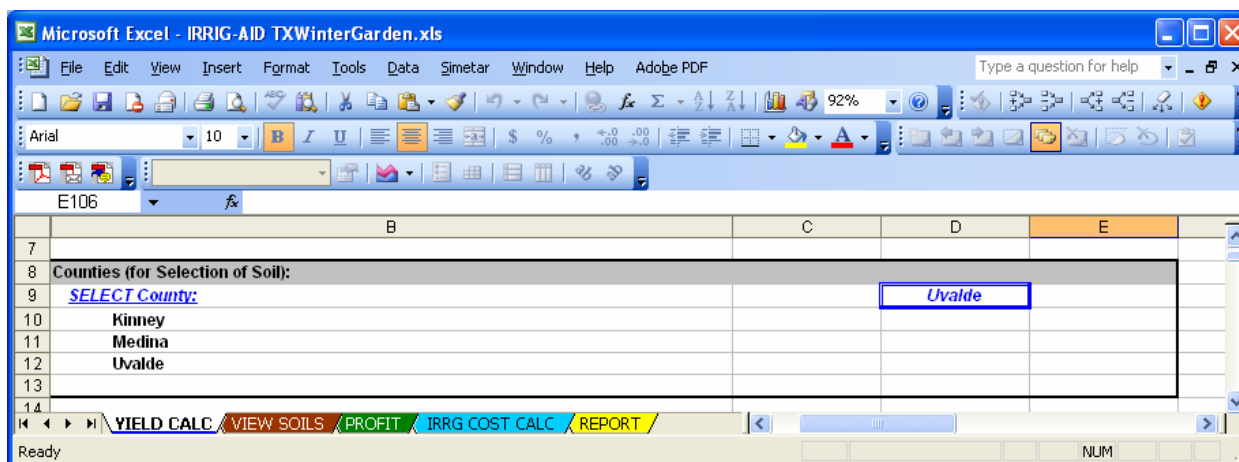
## YIELD CALCULATIONS

Most of the necessary information is entered into the **YIELD CALC** sheet by the user. To aid the user in entering this input, the fields which require user information are designated with blue borders or boxes and/or drop down menus from which to make selections; directions in text are

also found on the left in the same blue color. There are optional fields that simply customize the output for printing; for example, the name of the producer and date may be entered or left as a generic label.

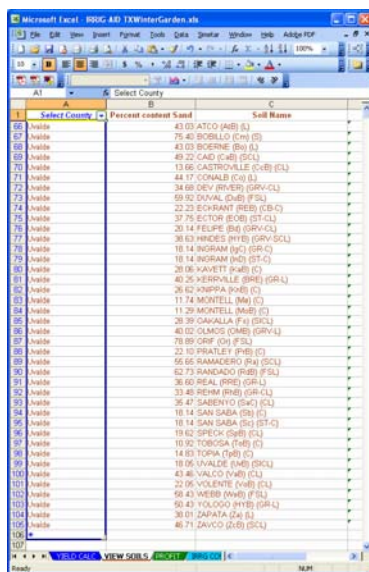
### 1. Select County

The user must select the county in which the appropriate soil information will be taken from the county drop down menu as illustrated in Figure 3.



**Figure 3: Select County**

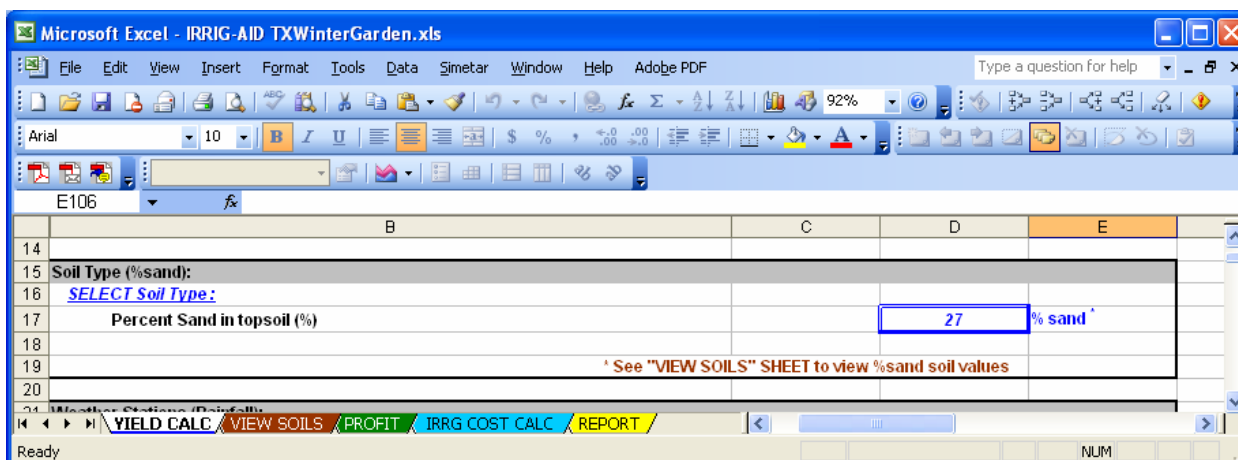
The soil table for each county can be filtered on the **VIEW SOILS** sheet; the user may select the county from the drop down menu and the soils and associated sand contents will be displayed for the selected county (Figure 4).



**Figure 4: View County Soils**

## 2. Select Soil Type

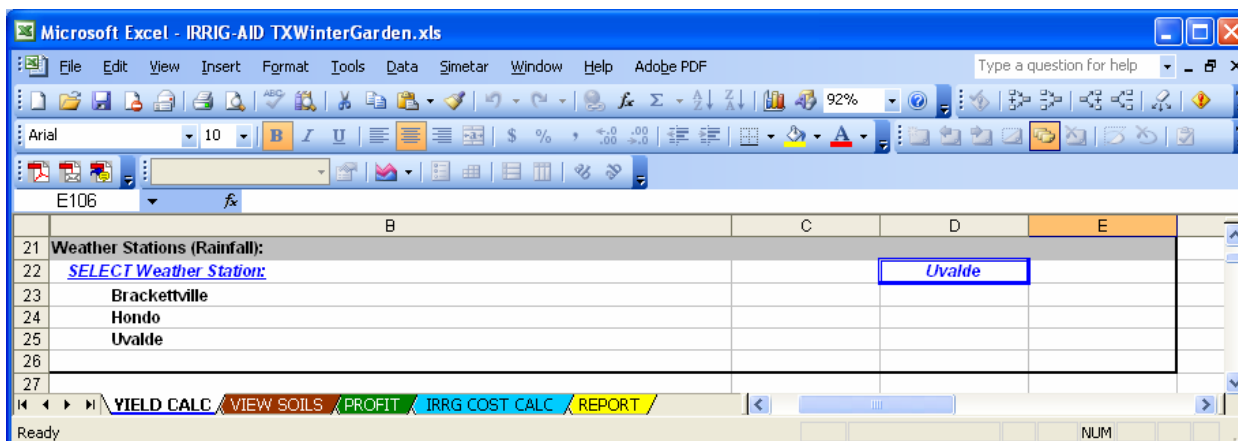
Next, the user will need to enter the amount of sand in the topsoil found in the soil table (% sand value). Enter the sand content in the soil as listed in the soil table. Some fields may have different soil types and in this case, the user may want to assess yields and profits for each soil (Figure 5).



**Figure 5: Select Soil Type**

## 3. Select Weather Station

Next, the user will enter the location of the weather station which the production area is nearest, i.e. enter the station from which the user prefers to use historical weather for precipitation and temperatures (Figure 6).



**Figure 6: Select Weather Station**

## 4. Enter Irrigation and Crop Acreage Data

In the next step, the user must enter the crop acreage for each of the three competing crops: cotton, corn, and sorghum (column H)(Figure 7).

Irrigation Applications During the Growing Season		Irrigation Applications					Enter	
		April (Inches/ac)	May (Inches/ac)	June (Inches/ac)	July (Inches/ac)	August (Inches/ac)	Total Crop Acreage (acres)	Total Irrigations Applied* (acin)
Minimum Pumping Capacity (gpm @ 90% operating time)		270	978	978	978	140		
Cotton Irrigations			3.0	5.0	5.0	2.0	700	1500
Corn Irrigations		3.0	8.0	9.0	7.0		700	2700
Grain Sorghum Irrigations			3.0	0.0	8.0		700	1700

**Figure 7: Enter Irrigation and Crop Acreage Data**

Each crop has a cell for the irrigation amount to be applied during each of the first three months of the growing season (columns C-G, for each of the respective crops). Based on these inputs, the total irrigation applied will be calculated in column I. In addition, the minimum pumping capacity is calculated based on the irrigation amounts applied during each month for all crops at 90% operating time.

#### 5. Enter Fertilizer Data

The next section is used to specify fertilizer application (Figure 8). For each crop, enter the amount of nitrogen (N) that is applied as the sole source of fertilizer, some mixture or combination of fertilizers, and the associated portion of N within that mixed fertilizer (Cells C41:E43). The calculated amount used will be listed at the bottom in orange lettering. The user may make adjustments if this total calculated amount of N does not accurately reflect the desired amount of N.

Fertilizer Application:		Cotton-lbs/ac	Corn-lbs/ac	Sorghum-lbs/ac
Enter the Amount of Nitrogen you wish to use to Estimate Yield and Fertilizer Cost				
Amount of N applied as sole-source fertilizer (ex. urea or anhydrous ammonia)		100.0	200.0	150.00
Amount of Fertilizer Mix Applied		50.0	25.0	0.00
Percent N (%) of Fertilizer Mix, ex. 20-10-10=20%, 10-20-10=10%, etc.		10.0	10.0	0.00
Total Amount of Nitrogen Applied		105.0	202.5	150.00

**Figure 8: Enter Fertilizer Data**

## 6. Enter Expected Prices/Loan Deficiency Payment

Next, the user will enter the expected prices for each crop along with any expected loan deficiency payment rates using the noted rate/unit (Figure 9).

Expected Product Price and LDP:	Loan Defcy. Pmt.	Selling Price	Total
Cotton lint income, \$/lb	\$ -	\$ 0.70	\$ 0.70 per pound
Corn income, \$/bu	\$ -	\$ 4.25	\$ 4.25 per bushel
Sorghum income, \$/cwt	\$ -	\$ 7.50	\$ 7.50 per 100 lbs

**Figure 9: Enter Expected Prices/Deficiency Payment Rates**

## 7. Enter/Select Baseline Yields

Based on all of the above information, a model estimated with regression analysis is used to produce a yield estimate for each crop for a specific level of irrigation during the growing period (Figure 10). Each model and its parameters can be found in the Appendix at the end of this report.

Yield Estimates:	Cotton (bales/ac)	Corn (bu/ac)	Sorghum (lbs/ac)
<b>Irrigation Strategies:</b>			
<i>No irrigations. (OPTIONAL): ENTER historical dryland yield and proceed to next row</i>	0.5	0	3,000
<i>No irrigations. SELECT the baseline yield (either your yield or the estimated yield)</i>	0.8	0	1,629
Irrigation applied during April only	--na--	0.0	--na--
Irrigation applied during May only	0.0	0.0	0
Irrigation applied during June only	0.0	0.0	0
Irrigation applied during July only	0.0	0.0	0
Irrigation applied during August only	0.0	--na--	0
Irrigation applied during April and May	--na--	0.0	--na--
Irrigation applied during April and June	--na--	0.0	--na--
Irrigation applied during April and July	--na--	0.0	--na--
Irrigation applied during May and June	0.0	0.0	0
Irrigation applied during May and July	0.0	0.0	3,829
Irrigation applied during May and August	0.0	--na--	0
Irrigation applied during June and July	0.0	0.0	0
Irrigation applied during June and August	0.0	--na--	0
Irrigation applied during July and August	0.0	--na--	0
Irrigation applied during April, May and June	--na--	0.0	--na--
Irrigation applied during April, May and July	--na--	0.0	--na--
Irrigation applied during April, June and July	--na--	0.0	--na--
Irrigation applied during May, June, and July	0.0	0.0	0
Irrigation applied during May, June, and August	0.0	--na--	0
Irrigation applied during May, July and August	0.0	--na--	0
Irrigation applied during June, July and August	0.0	--na--	0
Irrigation applied during April, May, June and July	--na--	141.0	--na--
Irrigation applied during May, June, July and August	4.2	--na--	0

**Figure 10: Yield Estimate**

The user has an option to enter a dryland yield in row 54 based on historical production. In row 55, the user must select either the model's estimated baseline yield or the user's yield from line 54. Using the irrigation amounts entered in rows 34-36, yields will be calculated and appear in the appropriate row for each crop. For example, as indicated on row 34 (Figure 7), cotton has four irrigations ranging from two-inch to five-inch amounts so only one yield will appear in row 78; 4.2 bales per acre will result from applying four irrigations to the cotton crop produced on the specific soil type and weather station indicated. Only two irrigation applications were allocated to the grain sorghum crop so the result will be one irrigated yield for the respective months in which the applications were made. Each line in rows 56-78 represents the yield resulting from the total number of irrigations (specifically the amount(s) within irrigations) for the associated month of the growing season, i.e. month(s) 1, 2, 3 and/or 4.

8. Percentage yield adjustment for insect, disease, weed, poor stand, or storm damage

The user may need to enter a yield adjustment to account for pests, diseases, damage, etc. Collectively, this adjustment is made by entering a percentage reduction in the yield, for example, five percent for cotton (Figure 11). The resulting adjusted yield estimate will appear in orange beneath it.

	Cotton	Corn	Sorghum
80 Percentage yield adjustment for insect, disease, weed, poor stand, or storm damage:			
81		Percent	
82		Corn	Sorghum
83 Percentage yield adjustment by crop	10	2	10
84			
85 Adjusted Yield Estimates:		Adjusted Yields	
86		Cotton (bales/ac)	Corn (bu/ac)
87 Irrigation Strategies:			Sorghum (lbs/ac)
88 Adjusted Yield Estimates	3.8	138.2	3.446
89			

**Figure 11: Percentage Yield Adjustment and Adjusted Yield Estimate**

The associated unit value of the last irrigation(s) is/are calculated below in (\$/inch) for each crop-irrigation scenario.

Value of Irrigation Water per Unit Applied:			
Irrigation Strategies:	Unit Value of Water		
	Cotton (\$/in)*	Corn (\$/in)	Sorghum (\$/in)
Unit value of single April application	--na--	\$0.00	--na--
Unit value of single May application	\$0.00	\$0.00	\$0.00
Unit value of single June application	\$0.00	\$0.00	\$0.00
Unit value of single July application	\$0.00	\$0.00	\$0.00
Unit value of single August application	\$0.00	--na--	\$0.00
Unit value of May after April application	--na--	\$0.00	--na--
Unit value of June after April application	--na--	\$0.00	--na--
Unit value of July after April application	--na--	\$0.00	--na--
Unit value of June after May application	\$0.00	\$0.00	\$0.00
Unit value of July after May application	\$0.00	\$0.00	\$10.91
Unit value of August after May application	\$0.00	--na--	\$0.00
Unit value of July after June application	\$0.00	\$0.00	\$0.00
Unit value of August after June application	\$0.00	--na--	\$0.00
Unit value of August after July application	\$0.00	--na--	\$0.00
Unit value of June after April & May application	--na--	\$0.00	--na--
Unit value of July after April & May application	--na--	\$0.00	--na--
Unit value of July after April & June application	--na--	\$0.00	--na--
Unit value of July after May & June application	\$0.00	\$0.00	\$0.00
Unit value of August after May & June application	\$0.00	--na--	\$0.00
Unit value of August after May & July application	\$0.00	--na--	\$0.00
Unit value of August after June & July application	\$0.00	--na--	\$0.00
Unit value of July after April, May & June application	--na--	(\$15.44)	--na--
Unit value of August after May, June, & July application	\$179.69	--na--	\$0.00

**Figure 12: Value of Irrigation Water per Unit Applied**

These values are used to allocate water among competing crops to achieve the highest value per unit applied of the last irrigation (Figure 12). The unit value of water is calculated using the following formula:

$$VW = (Y_i - Y_{i-1}) \times P \div IRG$$

where,

$VW$  = unit value of water (\$/inch)

$Y_i$  = Estimated yield resulting from current irrigation strategy (unit / acre)

$Y_{i-1}$  = Yield resulting from previous irrigation strategy or dryland yield (unit / acre)

$P$  = Expected price(\$/unit)

$IRG$  = Irrigation amount from current irrigation strategy (inches)

Note: These values reflect the unit value of water based on the actual yields before any yield adjustments due to pests, weather, etc., are made; however, the yield adjustments are reflected on the **PROFIT** sheet when determining income from yield. The user can review the **PROFIT** analysis and make adjustments to input prices. Click the **PROFIT** tab (Figure 13).

PROFIT ANALYSIS OF IRRIGATED CROPS					
Fill in ONLY the blue boxes to calculate your Profit Analysis					
Income:		Cotton	Corn	Sorghum	
Per Acre		(\$/ac)	(\$/ac)	(\$/ac)	
Dryland		-	-	-	-
Irrigation applied during April only		--na--	-	--na--	-
Irrigation applied during May only		-	-	-	-
Irrigation applied during June only		-	-	-	-
Irrigation applied during July only		-	-	-	-
Irrigation applied during August only		-	--na--	-	-
Irrigation applied during April and May		--na--	-	--na--	-
Irrigation applied during April and June		--na--	-	--na--	-
Irrigation applied during April and July		--na--	-	--na--	-
Irrigation applied during May and June		-	-	-	-
Irrigation applied during May and July		-	-	258.45	-
Irrigation applied during May and August		-	--na--	-	-
Irrigation applied during June and July		-	-	-	-
Irrigation applied during June and August		-	--na--	-	-
Irrigation applied during July and August		-	--na--	-	-
Irrigation applied during April, May and June		--na--	-	--na--	-
Irrigation applied during April, May and July		--na--	-	--na--	-
Irrigation applied during April, June and July		--na--	-	--na--	-
Irrigation applied during May, June, and July		-	-	-	-
Irrigation applied during May, July and August		-	--na--	-	-
Irrigation applied during June, July and August		-	--na--	-	-
Irrigation applied during April, May, June and July		--na--	587.14	--na--	-
Irrigation applied during May, June, July and August		-	1,283.00	--na--	-
<b>Expenses:</b>					
Per Acre		\$Unit	Irrigation cost	Irrigation cost	
Select Fuel Type (Option: To customize go to "IRRIG COST CALC" SHEET)		Electric	Based on Fuel Type \$ 5.00	OR	ENTER Your estimate
cost per acre/inch			Cotton	Corn	Sorghum
			(\$/ac)	(\$/ac)	(\$/ac)
Select Irrigation Cost/inch		\$ 5.00	\$ 75.05	\$ 105.07	\$ 55.04
Fertilizer (N costs only) Unit Cost/lb		\$ 0.33	\$ 34.13	\$ 65.81	\$ 48.75
Mixed Fertilizer (Other excluding N) Total Cost/ac			\$ 10.00	\$ 5.00	\$ -
Additional or Other Costs/ac (see note below)			\$ 643.24	\$ 199.77	\$ 151.84
Annual Interest Rate (6 months interest expense)		7.00%	\$ 26.68	\$ 13.15	\$ 8.95
Total		-	\$ 789.10	\$ 388.74	\$ 264.57
<b>Net Income:</b>					
Per Acre			Cotton	Corn	Sorghum
Net Income (\$/ac)			\$ 493.90	\$ 198.40	\$ (6.12)
Total Crop Acreage (acres)			100	100	100
TOTAL Net Income (\$)			\$ 49,390.29	\$ 19,840.16	\$ (612.15)
			Additional Costs for Irrigated Crops:	199.77	151.84
			Additional Costs for Dryland Crops:	129.94	114.25
<a href="http://aqecoxext.tamu.edu/resources/crop-livestock-budgets/by-district/district-10/2008.html">http://aqecoxext.tamu.edu/resources/crop-livestock-budgets/by-district/district-10/2008.html</a> Visit this site to review/update cost estimates for additional costs					

Figure 13: Profit Analysis of Irrigated Crops

### PROFIT ANALYSES

The **PROFIT** analysis sheet is used to calculate the user’s profits for each of the competing crops. In the first section of the profit sheet, net income/acre is calculated based on the applied amounts of irrigation and yields calculated from the associated irrigation amounts on the **YIELD CALC** sheet. If no irrigations were applied then the income from the dryland yield will appear. In the second section of the profit sheet, the user may enter the expenses

(per acre) and finally, the last section calculates the total net income by crop. The second section, *Expenses*, requires input from the user as indicated in blue lettering and/or blue bordered cells or boxes:

1. Enter Irrigation Cost or Calculate Pumping Cost

The user enters a flat rate for irrigation cost (cost per acre/inch) in cell E32 if there is no energy requirement for pumping as in cases of multiple irrigation district flat rate charges (Figure 13). Alternately, for a pumping cost of irrigation, the user must enter the fuel type from the drop down menu in cell B32 and a default irrigation cost using the specified fuel type will appear in cell C32. However, with energy prices being volatile, the user should always check the fuel price in the *Irrigation Cost Calculator*. Click **IRRG COST CALC** to customize fuel prices and other pumping plant specifications (Figure 14).

In addition to checking the specific fuel price, the user should make appropriate pumping plant adjustments including pumping lift, discharge pressure, engine or electric motor horsepower, design specifications on gear heads (turbine pumps) and engines, and fuel price. Thus, the **IRRG COST CALC** tab/sheet allows the user to customize pumping plant information and recalculate irrigation costs using specific fuels including electricity, gas, L.P. or natural gas.

	A	B	C	D	E	F	G	H	
1	<b>Electricity Irrigation Costs</b>		Default	<b>Natural Gas Irrigation Costs</b>		Default			
2	Gallons per Minute:	450.0	450.0	Gallons per Minute:	890.0	890.0			
3									
4	Pumping Lift (in Feet):	150.0	150.0	Pumping Lift (in Feet):	365.0	365.0			
5									
6	Discharge Pressure (PSI):	25.0	25.0	Discharge Pressure (PSI):	8.0	8.0			
7									
8	Pump Efficiency (Percent):	60.0	60.0	Pump Efficiency (Percent):	60.0	60.0			
9									
10	Motor Efficiency (Percent):	88.0	88.0	Gear Head Efficiency (Percent):	95.0	95.0			
11	Vertical Hollow Shaft Motor (88%)			Engine Efficiency (Percent):	22.0	22.0			
12	Submersible Motor (80%)								
13									
14	Electricity Cost per Kilowatt Hour:	\$0.15	\$0.15	Natural Gas Costs per MCF:	\$10.00	\$10.00			
15									
16									
17	Pump Horsepower Requirement:	39.3466	39.3466	Pump Horsepower Requirement:	151.2038	151.2038			
18									
19	Kilowatt Load:	33.3552	33.3552	Hourly Fuel Use (Million Cubic Feet)	1.7492	1.7492			
20									
21	Hourly Power Use	5.0033	5.0033	Hourly Fuel Cost (\$/MCF):	17.4915	17.4915			
22									
23	<b>Cost per Acre Inch of Water:</b>	<b>\$5.00</b>		<b>Cost per Acre Inch of Water:</b>	<b>\$8.84</b>				
24									
25	<b>L.P. Irrigation Costs</b>		Default	<b>Diesel Irrigation Costs</b>		Default			
26	Gallons per Minute:	550.0	550.0	Gallons per Minute:	190.0	190.0			
27									
28	Pumping Lift (in Feet):	150.0	150.0	Pumping Lift (in Feet):	315.0	315.0			
29									
30	Discharge Pressure (PSI):	4.0	4.0	Discharge Pressure (PSI):	20.0	20.0			
31									
32	Pump Efficiency (Percent):	60.0	60.0	Pump Efficiency (Percent):	60.0	60.0			
33									
34	Gear Head Efficiency (Percent):	95.0	95.0	Gear Head Efficiency (Percent):	95.0	95.0			
35									
36	Engine Efficiency (Percent):	22.0	22.0	Engine Efficiency (Percent):	32.0	32.0			
37									
38	L.P. Cost per Gallon:	\$2.00	\$2.00	Diesel Cost per Gallon:	\$2.25	\$2.25			
39									
40									
41	Pump Horsepower Requirement:	36.8611	36.8611	Pump Horsepower Requirement:	28.8838	28.8838			
42									
43	Engine Shaft Horsepower:	38.8012	38.8012	Engine Shaft Horsepower:	30.4040	30.4040			
44									
45	Hourly Fuel Use (Gallons per Hour)	4.9873	4.9873	Hourly Fuel Use (Gallons per Hour)	1.7912	1.7912			
46									
47	Hourly Fuel Cost	\$9.97	\$9.97	Hourly Fuel Cost	\$4.03	\$4.03			
48									
49	<b>Cost per Acre Inch of Water:</b>	<b>\$8.16</b>		<b>Cost per Acre Inch of Water:</b>	<b>\$9.55</b>				
50	Provided by Drs. Stan Bevers, Prof. and Extension Economist, Vernon, Texas, and Leon New, Prof. and Irrigation Engineer, Amarillo, Texas.								

**Figure 14: Irrigation Cost Calculator**

2. Select Irrigation Cost per Inch

The next step is to select the irrigation cost per inch or select between the costs from the *Irrigation Cost Calculator* on the **IRRIG COST CALC** tab/sheet or the flat rate cost entered

by the user. This is done in cell B35 and facilitates the calculation of irrigation cost per inch on a crop-by-crop basis. The irrigation cost by crop is then calculated in cells C35, D35, and E35.

### 3. Fertilizer Unit Cost (\$/lb)

Fertilizer cost per pound must be entered and the associated costs by crop will be calculated based upon this entry. This cost is for nitrogen fertilizer **ONLY**. The cost of any other fertilizer applied may be entered in the next step.

### 4. Mixed Fertilizer Cost (\$/ac)

If any other fertilizers including a mixed fertilizer were used, the user would enter the cost of those additional fertilizers, **EXCLUDING Nitrogen**, here.

### 5. Additional Other Costs

The additional other costs include seed, labor, pesticides, fuel, and repairs. Do not include interest on operating capital. Examples of default costs have already been entered based on County extension information but the user may change them as necessary (<http://agecoext.tamu.edu/resources/crop-livestock-budgets/by-district/district-10/2008.html>). These costs are found in the footnote at the end of the **PROFIT** sheet:

1/ Additional Costs for Irrigated Crops:	643.24	199.71	151.84
Additional Costs for Dryland Crops:	263.33	129.94	114.25

### 6. Interest Rate

An interest rate on operating costs is used to calculate the interest charges. This rate can represent the rate of borrowed capital or the “opportunity cost” of savings if owned capital is used for operating in lieu of being in a savings account or other type short-term investment. Since the loan period is typically less than or equal to 6 months, only that portion of the cost should be included. This calculates the interest on operating costs. After all of the expenses have been entered, the user will see the calculated net income based on the entries from both the **YIELD CALC** sheet and **PROFIT** sheet.

## SUMMARY REPORT

Click the **REPORT** tab/sheet to preview the summary report (Figure 15). The user may print the report using the standard Windows printing procedure by selecting “Print” from the File Menu.

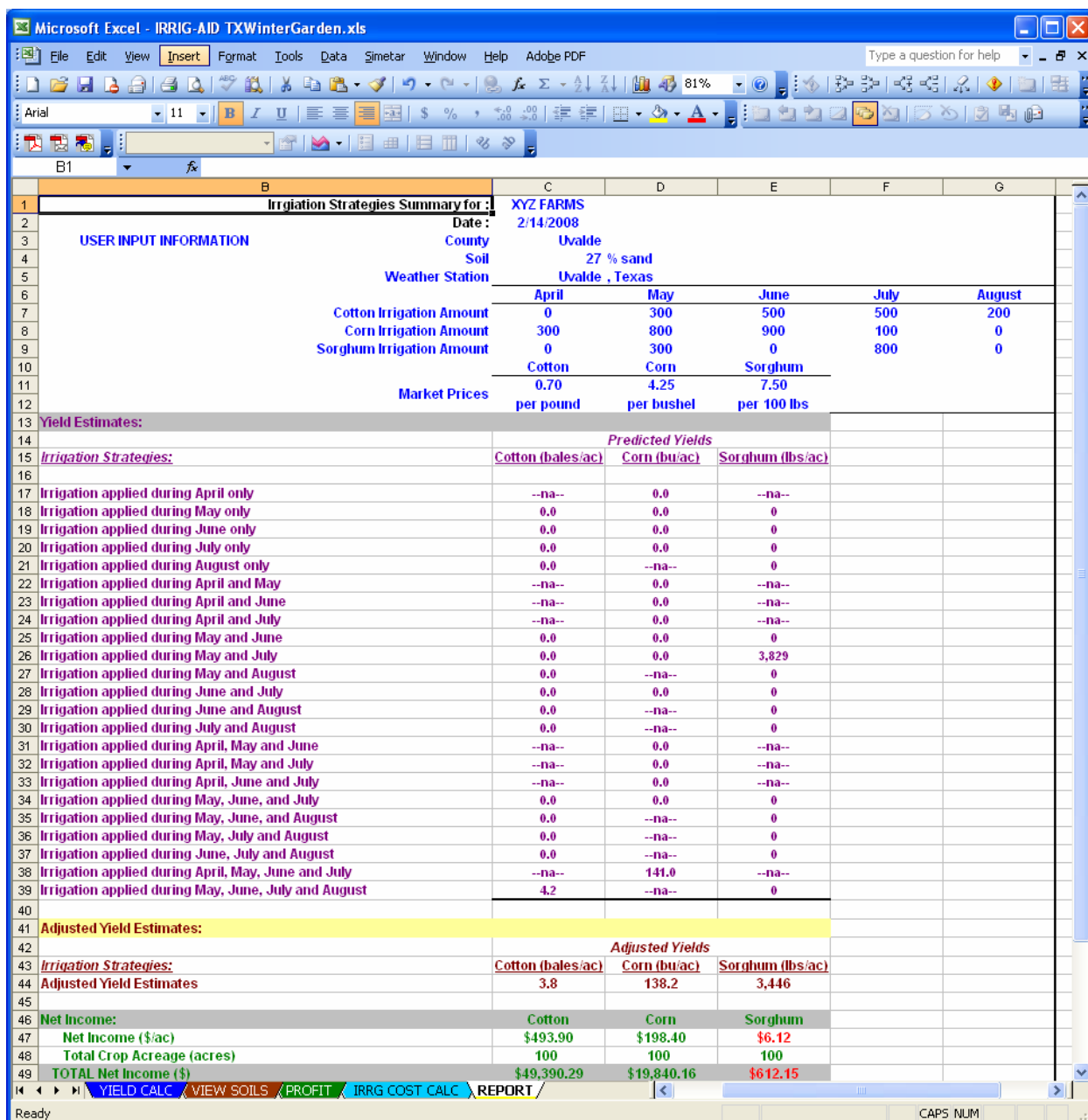


Figure 15: Summary Report

## APPENDIX: ESTIMATED REGRESSION EQUATIONS

### Cotton:

$$\begin{aligned}
 Y_{CT} = & -0.24468 + 0.11231 \text{ SAND} - 8.77 \text{ E} - 04 \text{ SAND}^2 + 0.35476 \text{ IRG}_{\text{MAY}} + 0.46169 \text{ IRG}_{\text{JUN}} \\
 & - 1.08 \text{ IRG}_{\text{AUG}} - 0.00835 \text{ IRG}_{\text{MAY}}^2 - 0.01148 \text{ IRG}_{\text{JUN}}^2 - 0.00642 \text{ IRG}_{\text{JUL}}^2 - 0.00288 (\text{PRCP} * \text{SAND}) \\
 & - 0.03094 (\text{PRCP} * \text{IRG}_{\text{JUL}}) + 6.00 \text{ E} - 07 (\text{PRCP} * \text{SAND})^2 + 4.854 \text{ E} - 05 (\text{PRCP} * \text{IRG}_{\text{JUL}})^2 \\
 & + 2.0552 \text{ E} - 04 (\text{PRCP} * \text{IRG}_{\text{AUG}})^2 - 8.1158 \text{ E} - 04 (\text{SAND} * \text{IRG}_{\text{MAY}}) - 0.00194 (\text{SAND} * \text{IRG}_{\text{JUN}}) \\
 & + 2.18 \text{ E} - 06 (\text{SAND} * \text{IRG}_{\text{JUN}})^2 - 0.01327 (\text{IRG}_{\text{MAY}} * \text{IRG}_{\text{JUN}}) - 0.01534 (\text{IRG}_{\text{MAY}} * \text{IRG}_{\text{JUL}}) \\
 & - 0.01687 (\text{IRG}_{\text{JUN}} * \text{IRG}_{\text{JUL}}) + 0.42853 (\text{IRG}_{\text{JUL}} * \text{IRG}_{\text{AUG}}) - 0.00626 (\text{IRG}_{\text{JUL}} * \text{IRG}_{\text{AUG}})^2 \\
 & + 0.00137 (\text{IRG}_{\text{MAY}} * \text{IRG}_{\text{JUN}} * \text{IRG}_{\text{JUL}})
 \end{aligned}$$

$$R^2 = 0.9524$$

### Corn:

$$\begin{aligned}
 Y_{CN} = & 22.92895 + 1.25209 \text{ SAND} - 0.0222 \text{ SAND}^2 + 0.174980 \text{ IRG}_{\text{MAY}}^2 + 0.21967 (\text{PRCP} * \text{IRG}_{\text{JUN}}) \\
 & - 0.0002075 (\text{PRCP} * \text{IRG}_{\text{JUN}})^2 + 3.00 \text{ E} - 05 (\text{SAND} * \text{IRG}_{\text{JUN}})^2 + 0.14862 (\text{IRG}_{\text{APR}} * \text{IRG}_{\text{MAY}} * \text{IRG}_{\text{JUN}}) \\
 & - 0.00013202 (\text{IRG}_{\text{APR}} * \text{IRG}_{\text{MAY}} * \text{IRG}_{\text{JUN}})^2 - 0.0000358 (\text{IRG}_{\text{MAY}} * \text{IRG}_{\text{JUN}} * \text{IRG}_{\text{JUL}})^2
 \end{aligned}$$

$$R^2 = 0.8958$$

### Grain Sorghum:

$$\begin{aligned}
 Y_{GS} = & -3016.0126 + 186.70854 \text{ SAND} - 1.60016 \text{ SAND}^2 + 548.1533 \text{ IRG}_{\text{MAY}} + 580.03266 \text{ IRG}_{\text{JUN}} \\
 & - 14.51481 \text{ IRG}_{\text{MAY}}^2 - 26.06415 \text{ IRG}_{\text{JUN}}^2 - 5.58674 (\text{PRCP} * \text{SAND}) + 5.53392 (\text{PRCP} * \text{IRG}_{\text{JUN}}) \\
 & + 27.34138 (\text{PRCP} * \text{IRG}_{\text{JUL}}) + 0.00133 (\text{PRCP} * \text{SAND})^2 - 0.0419 (\text{PRCP} * \text{IRG}_{\text{JUL}})^2 \\
 & - 1.46934 (\text{SAND} * \text{IRG}_{\text{MAY}}) + 0.00147 (\text{SAND} * \text{IRG}_{\text{JUN}})^2 + 0.00115 (\text{PRCP} * \text{IRG}_{\text{JUL}})^2 \\
 & - 19.07298 (\text{IRG}_{\text{MAY}} * \text{IRG}_{\text{JUN}}) - 37.35235 (\text{IRG}_{\text{MAY}} * \text{IRG}_{\text{JUL}}) - 22.00455 (\text{IRG}_{\text{JUN}} * \text{IRG}_{\text{JUL}}) \\
 & + 0.16336 (\text{IRG}_{\text{MAY}} * \text{IRG}_{\text{JUL}})^2 + 0.00070265 (\text{IRG}_{\text{MAY}} * \text{IRG}_{\text{JUN}} * \text{IRG}_{\text{JUL}})^2
 \end{aligned}$$

$$R^2 = 0.9050$$

## Model Parameter Description:

<b>Variable Name</b>	<b>Description</b>	<b>Units</b>
PRCP	Precipitation	inches
SAND	Sand Content in Topsoil	percent
IRG <sub>MONTH</sub>	Irrigation Amount in Month = APR, MAY, JUN, JUL, or AUG	inches