

Estimating financial costs and benefits of supplemental irrigation

JULIE SHORTRIDGE AND MITCHELL PAOLETTI

DEPARTMENT OF BIOLOGICAL SYSTEMS ENGINEERING



United States
Department of
Agriculture

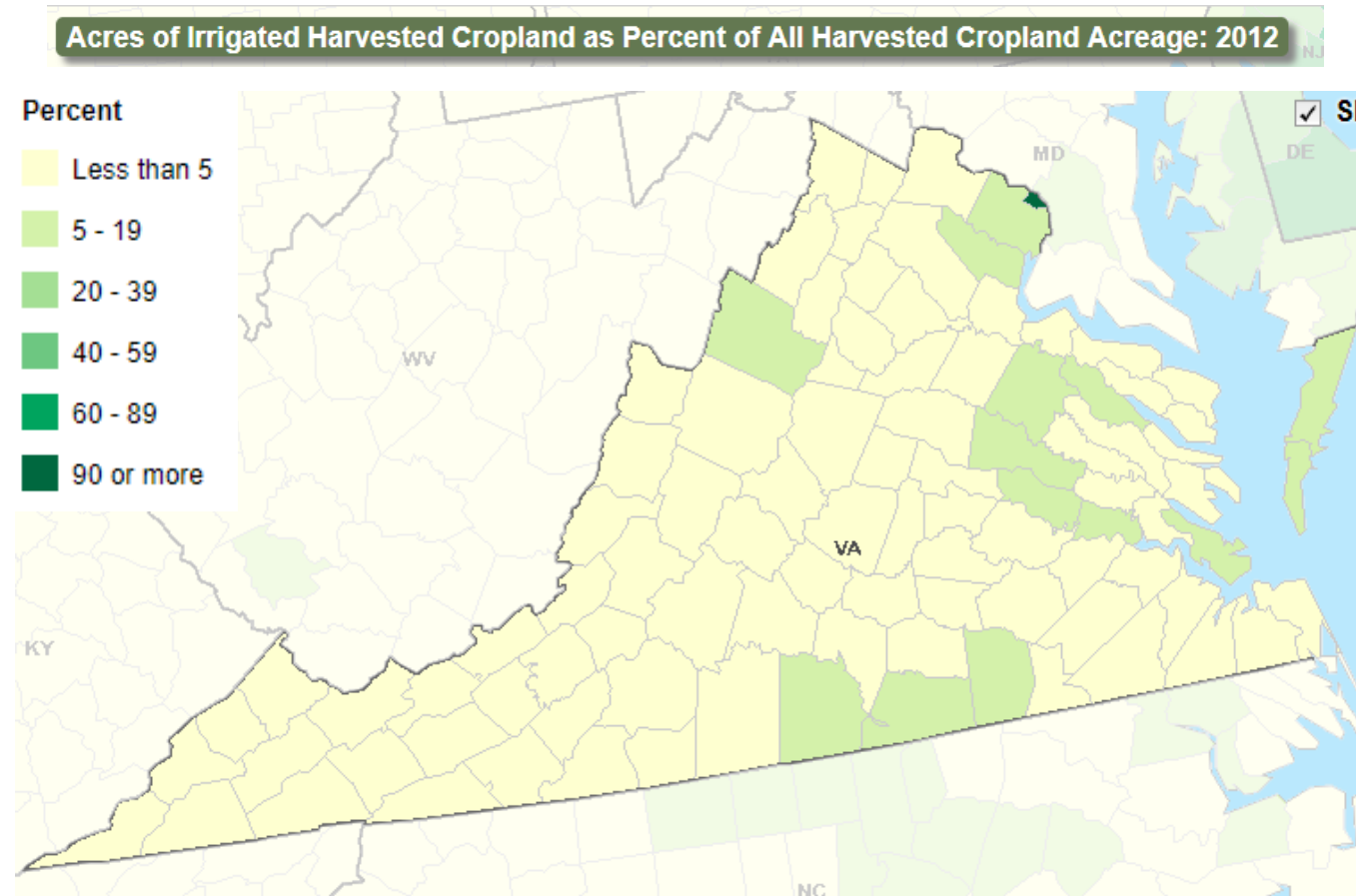
National Institute
of Food and
Agriculture

Talk Overview

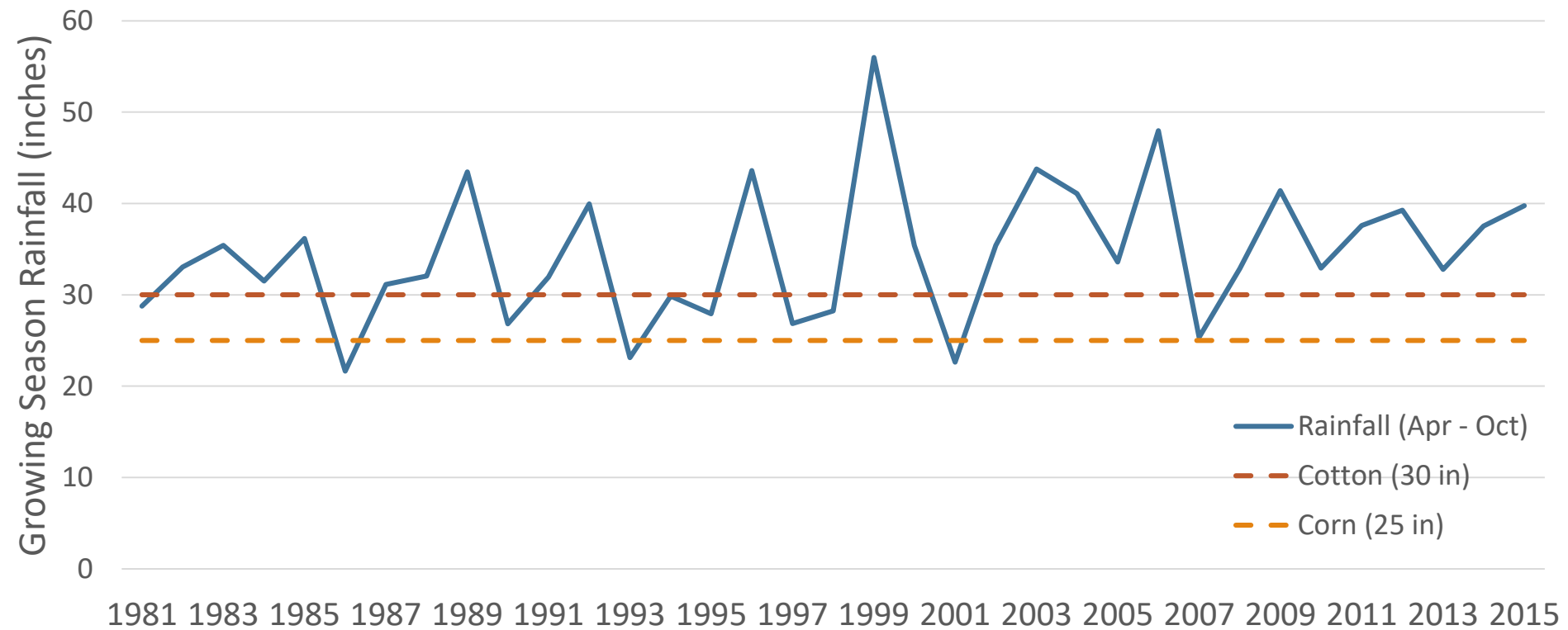
- Irrigation in Humid Climates
- The Irrigation Financial Estimator Tool (IFET)
- How IFET works
- Example scenarios and results
- Plans for future development

Background – Irrigation in Humid Climates

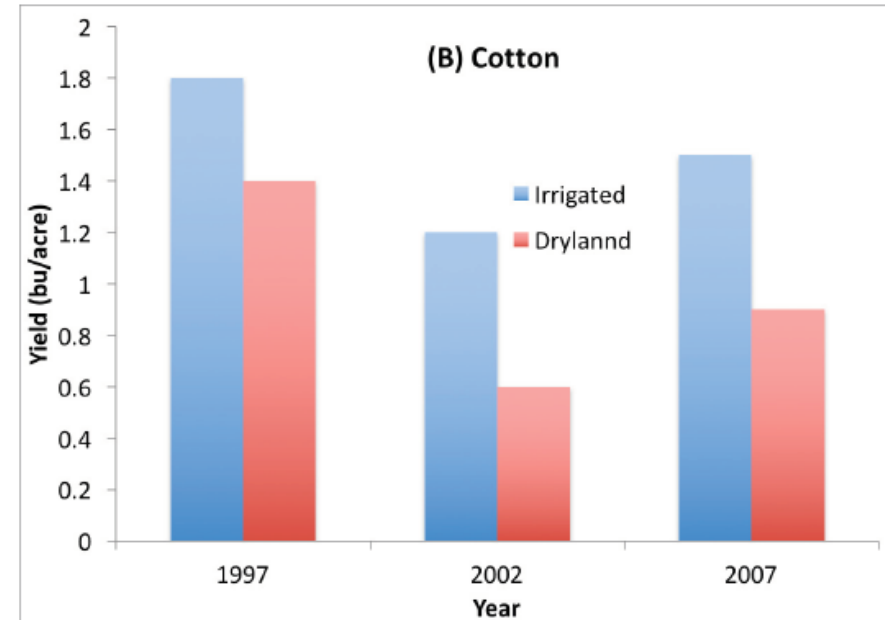
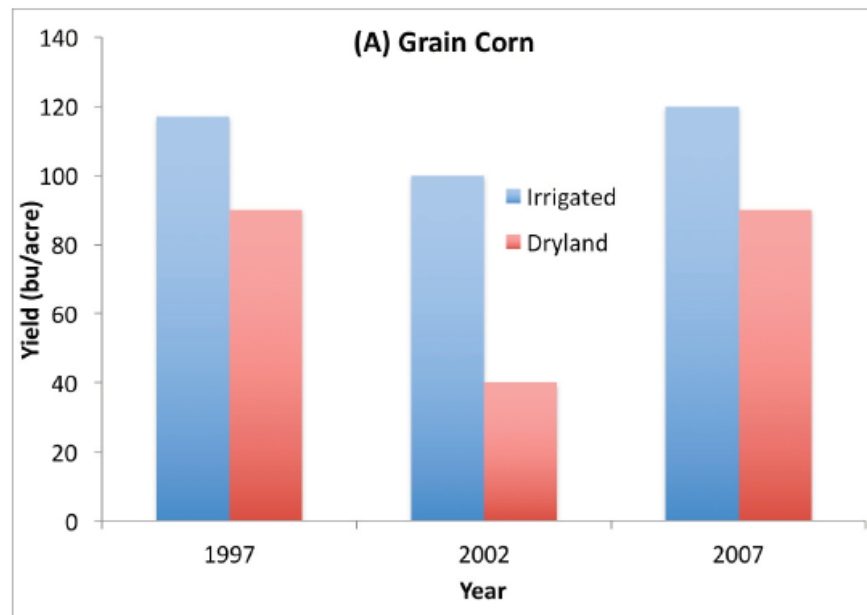
- Irrigated cropland:
< 5% to 20% of total,
depending on county
- Supplemental irrigation:
operated during dry periods
and droughts, rather than
all season
- Almost every Eastern state
has seen an increase in
irrigation in past decade



Background – Irrigation in Humid Climates



Background – Irrigation in Humid Climates



“Crop farms with access to sufficient irrigation water were able to take advantage of excellent prices along with excellent yields... leading to record breaking net income... However, dryland farms didn't fare as well.” (Nebraska IANR News, 2012)

Background – Irrigation in Humid Climates

“The cost of power is usually the biggest shock to a new irrigator. The grower will get his first electric/fuel bill once he has started irrigating and will probably have sticker shock.” (2)

“Irrigation costs you if you have it or if you don't. If you don't have it during a drought, you can incur significant loss. And in other years, farmers use their irrigation less often than normal because of above-average rainfall.” (3)

“Investment decisions should in many cases account for total costs and the returns the investments generate not just in terms of years, but decades.” (3)

Background – Irrigation in Humid Climates

What factors influence financial costs and returns from irrigation?

Capital Costs

System type
Acreage
Water source
Power/fuel source
Financing options

Operating Costs

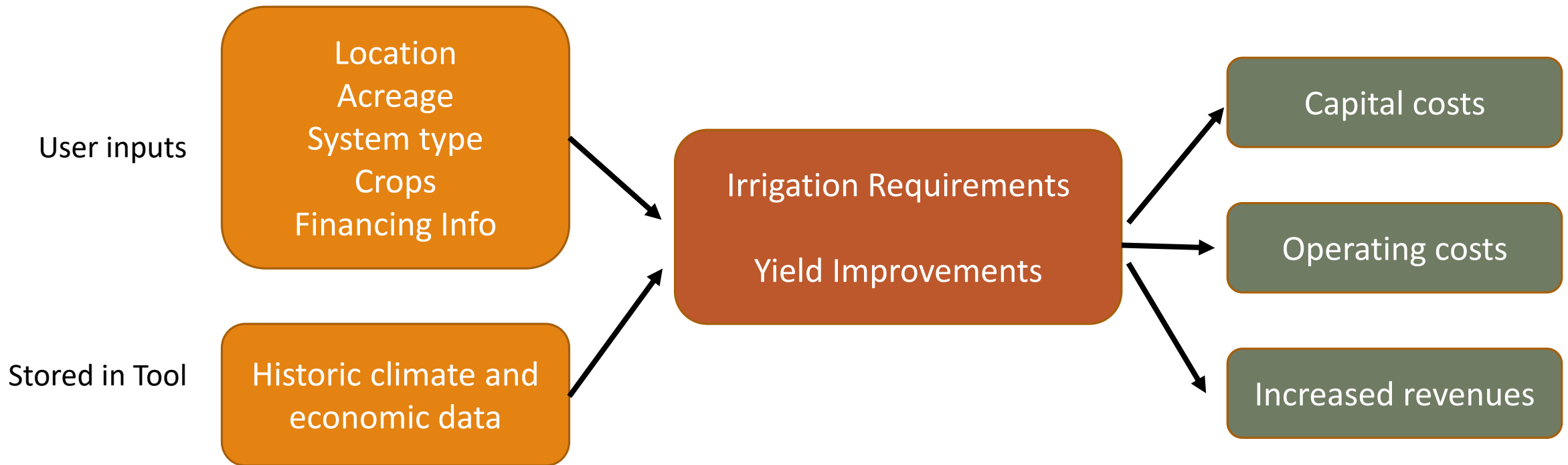
Water needs
Fuel source and prices
Labor requirements and costs
Maintenance requirements

Returns

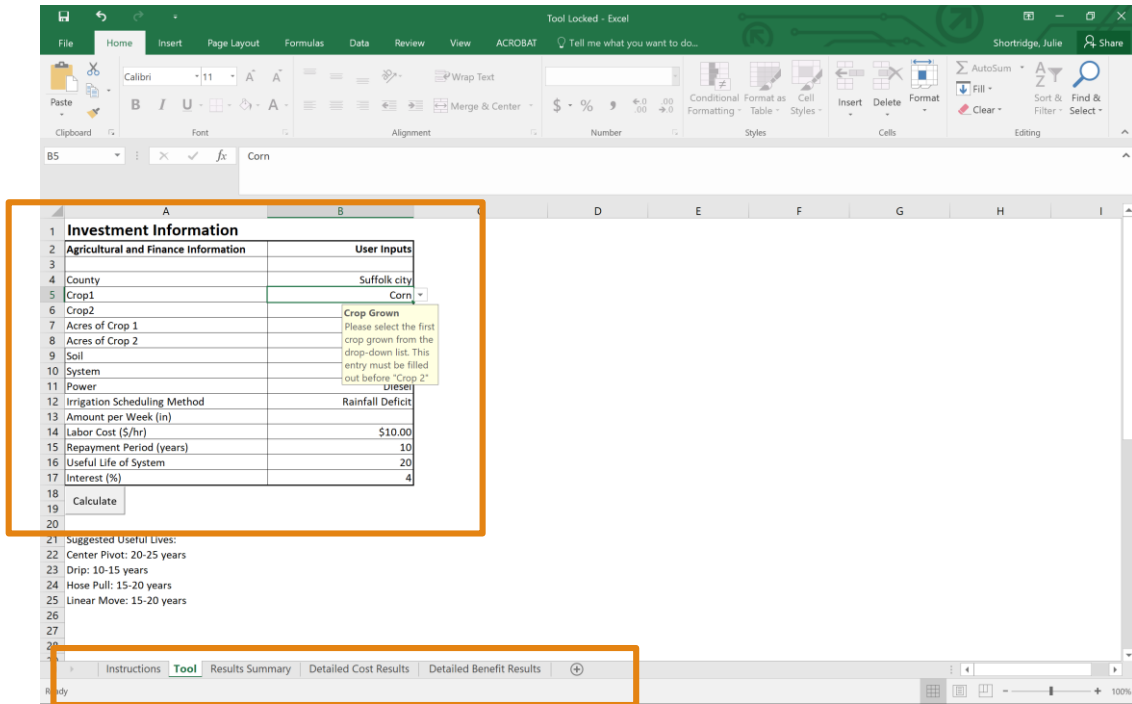
Rainfall
Yield improvements
Crops prices

Irrigation Financial Estimator Tool (IFET)

Goal: Create a user-friendly, customizable tool to estimate financial costs and benefits of irrigation for row crop production in Virginia

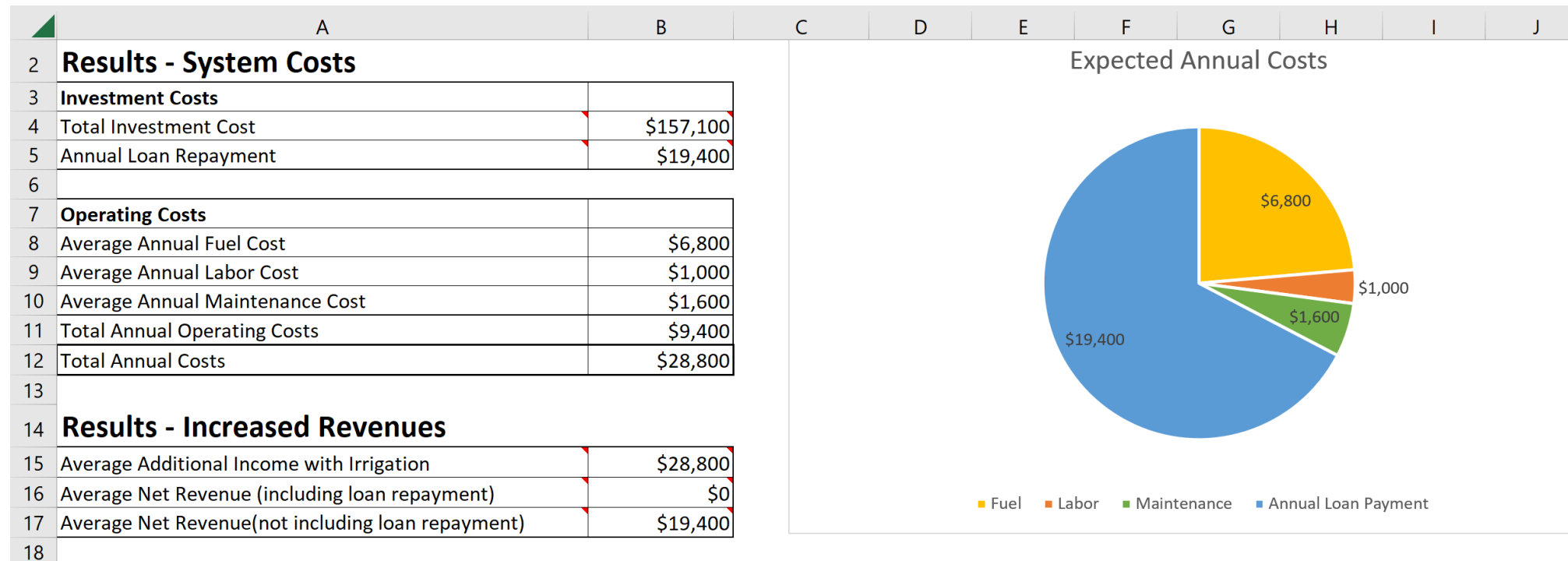


How IFET works – user inputs



	A	B
1	Investment Information	
2	Agricultural and Finance Information	User Inputs
3		
4	County	Suffolk city
5	Crop1	Corn
6	Crop2	Corn
7	Acres of Crop 1	Cotton
8	Acres of Crop 2	Soybeans
9	Soil	Wheat
10	System	None
11	Power	out before "Crop 2"
12	Irrigation Scheduling Method	Diesel
13	Amount per Week (in)	Rainfall Deficit
14	Labor Cost (\$/hr)	\$10.00
15	Repayment Period (years)	10
16	Useful Life of System	20
17	Interest (%)	4
18	Calculate	
19		
20		

How IFET works - results

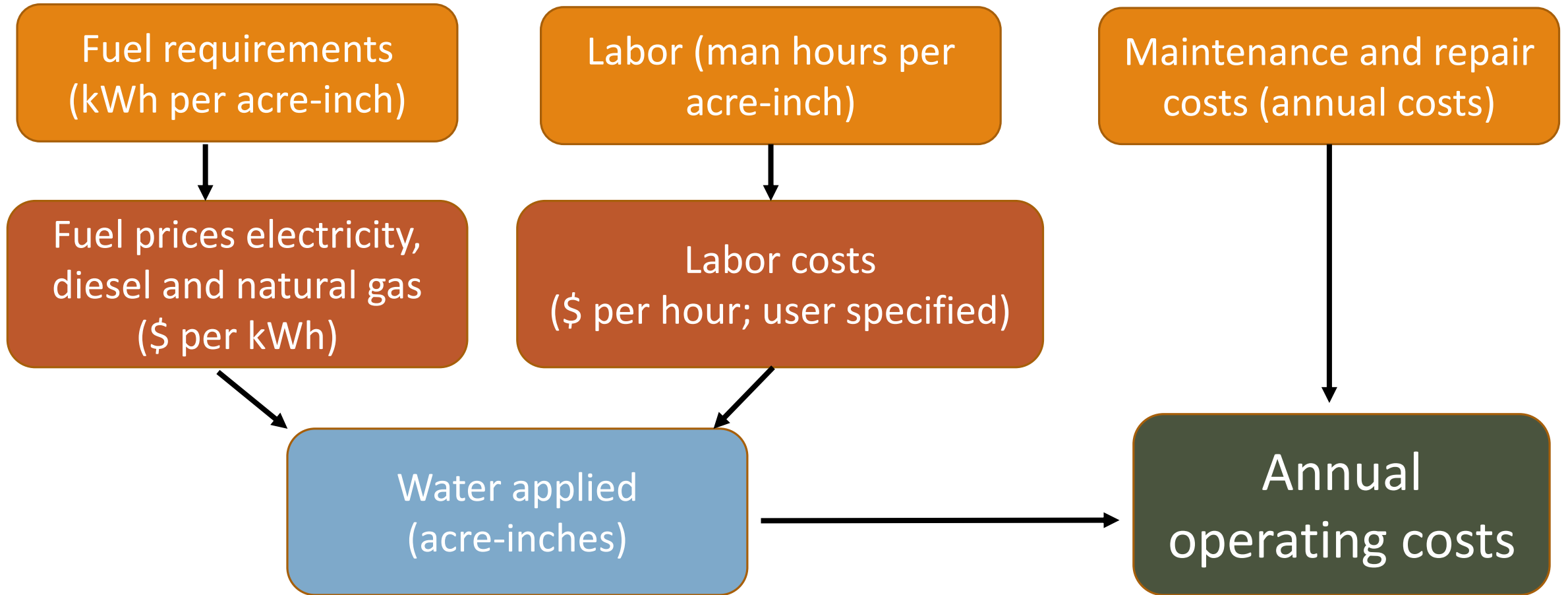


How IFET works – capital costs

Reviewed extension, research and industry literature for capital costs

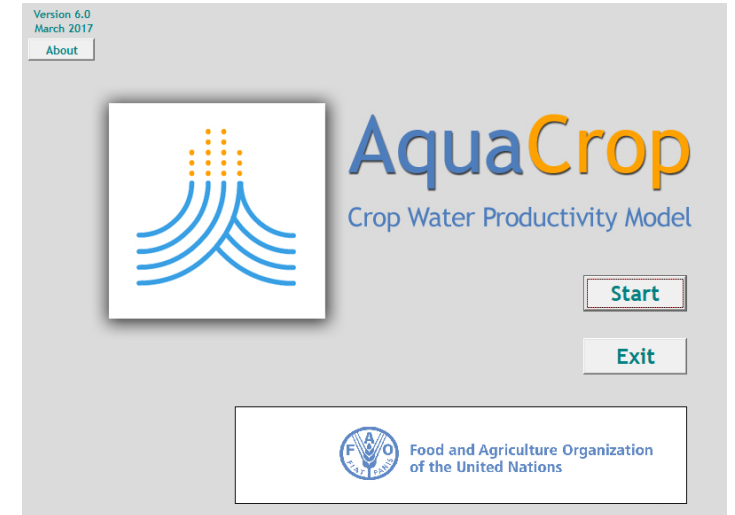
System Type	Minimum capital cost per acre	Maximum capital cost per acre
Center Pivot	\$900	\$1300
Lateral	\$1000	\$1600
Big Gun	\$500	\$900
Drip	\$900	\$1600

How IFET works – operating costs



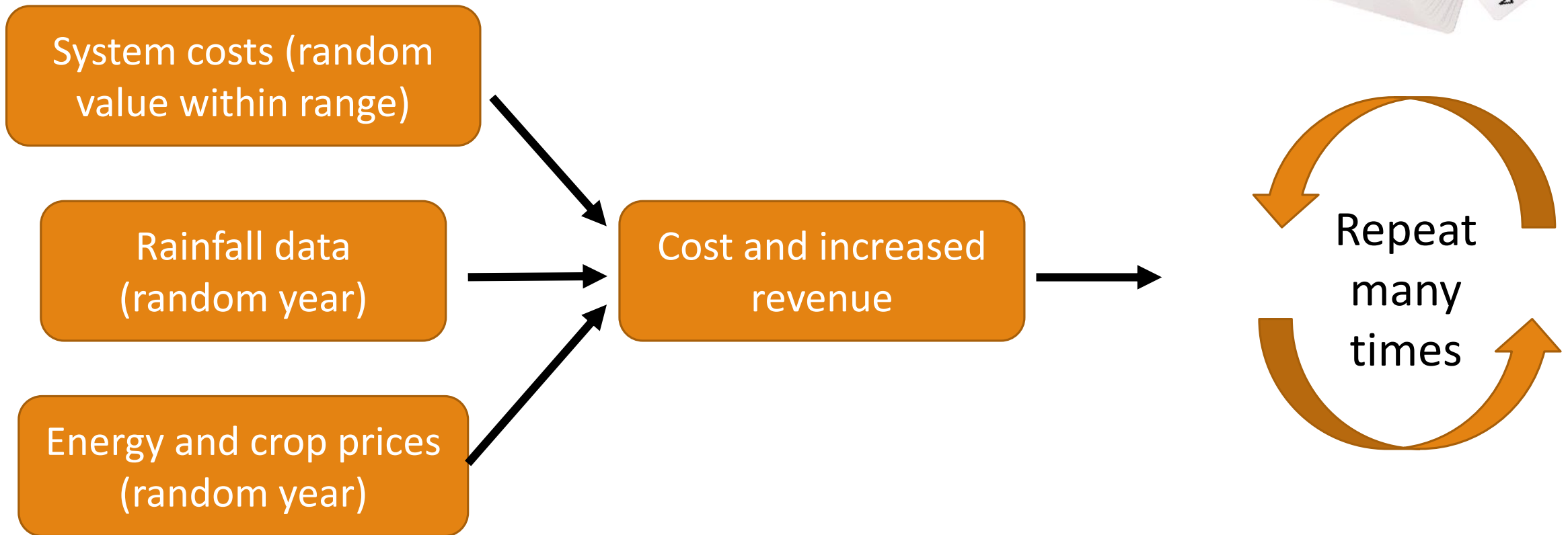
How IFET works – increased revenues

- Used AquaCrop model to estimate rainfall/yield relationships
- Compare to NASS yields to validate
- Developed governing equations that predict yield based on:
 - Crop and soil type
 - Growing season rainfall
 - Occurrence of dry periods (e.g., 10 days with no rainfall)
- Estimate yields three ways:
 - Rainfall only
 - Scheduled irrigation (user specified)
 - Rainfall deficit (optimized)



Increased revenue =
(Irrigated Yield – Rainfed Yield) x price

How IFET works - uncertainty



IFET – Example Calculations

Agricultural and Finance Information	User Inputs
County	Suffolk city
Crop	Cotton
Acres	100
Soil	Loamy Sand
System	Center Pivot
Power	Diesel
Irrigation Style	Rainfall Deficit
Labor Cost (\$/hr)	\$12.00
Repayment Period (years)	6
Useful Life of System	20
Interest (%)	4

Example Calculations – Results summary

Results - System Costs

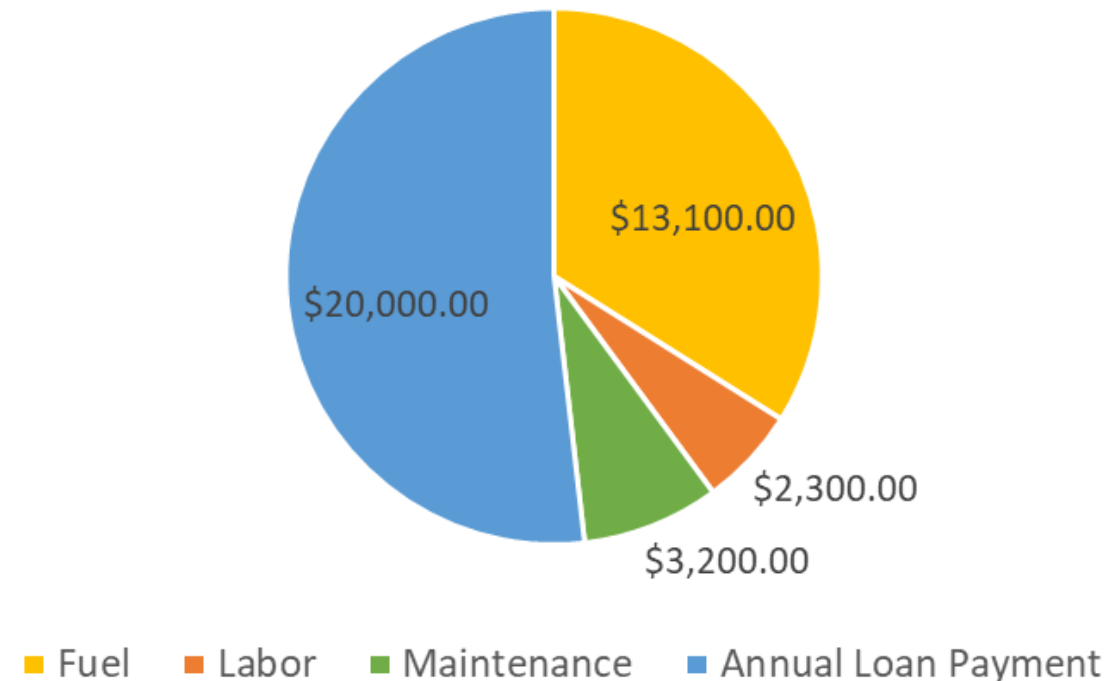
Investment Costs	
Total Investment Cost	\$104,700
Annual Loan Repayment	\$20,000

Operating Costs	
Average Annual Fuel Cost	\$13,100
Average Annual Labor Cost	\$2,300
Average Annual Maintenance Cost	\$3,200
Total Annual Operating Costs	\$18,600
Total Annual Costs	\$38,600

Results - Increased Revenues

Average Additional Income with Irrigation	\$26,600
Average Net Revenue (including loan repayment)	-\$12,000
Average Net Revenue(not including loan repayment)	\$8,000

Expected Annual Costs



Example Calculations – Detailed Costs

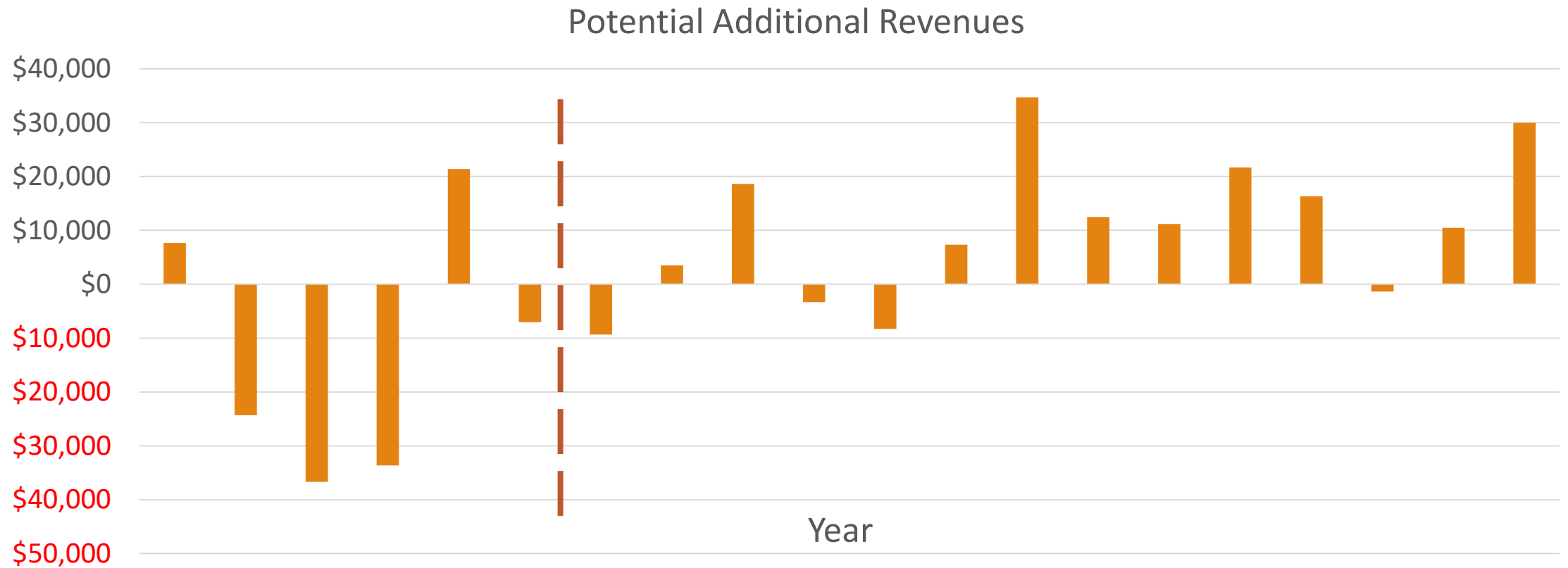
Operating Costs	Low Estimate	Average Estimate	High Estimate
Fuel	\$9,900	\$13,100	\$16,300
Labor	\$1,900	\$2,300	\$2,700
Maintenance	\$2,600	\$3,200	\$3,600
Total	\$14,400	\$18,600	\$22,600

System Cost	Low Estimate	Average Estimate	High Estimate
Total Investment	\$89,200	\$107,900	\$120,600
Annual Loan Payment	\$17,000	\$20,000	\$23,000

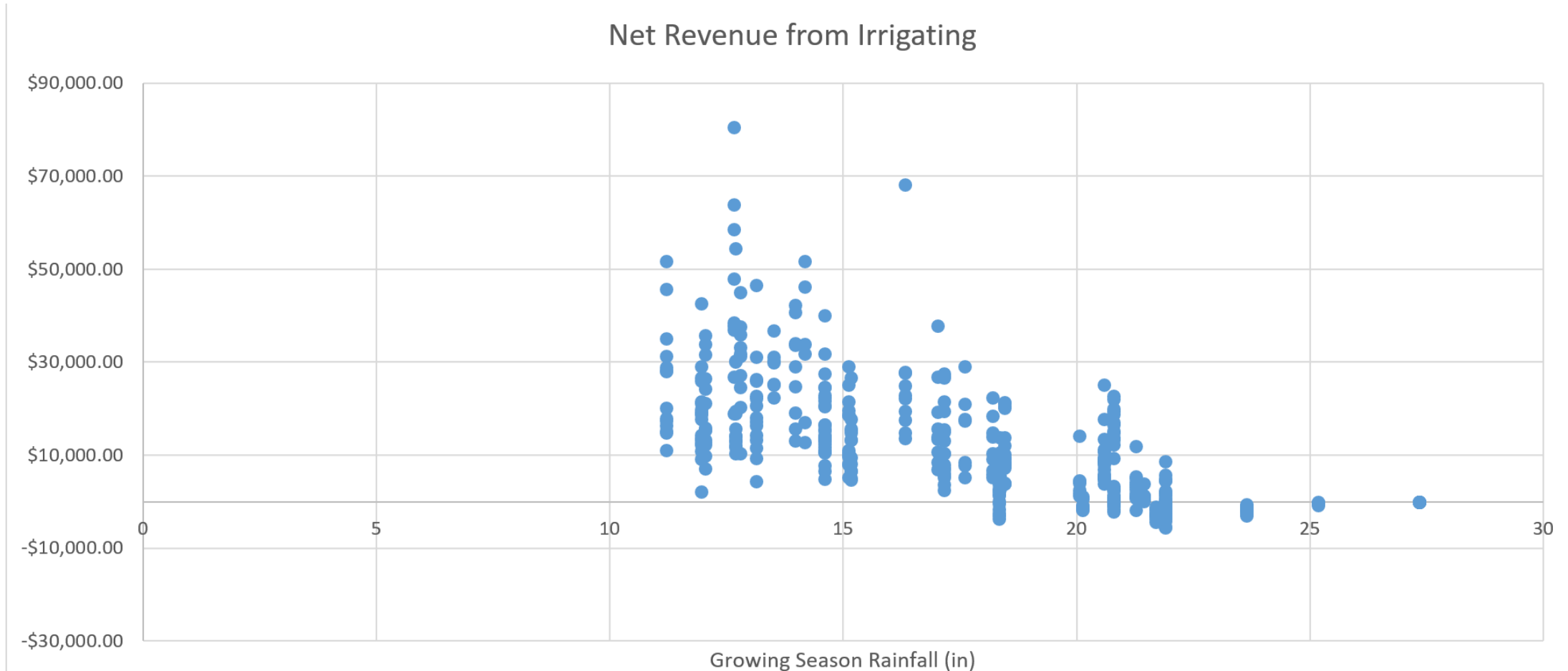
Example calculations – detailed revenues

Value of Investment	Low Estimate	Average Estimate	High Estimate
Average Additional Income with Irrigation	\$18,900	\$26,300	\$34,600
Average Net Revenue (not including loan repayment)	\$1,300	\$8,100	\$15,600
Average Net Revenue (including loan repayment)	-\$18,900	-\$11,900	\$1,300

Example calculations – detailed revenues



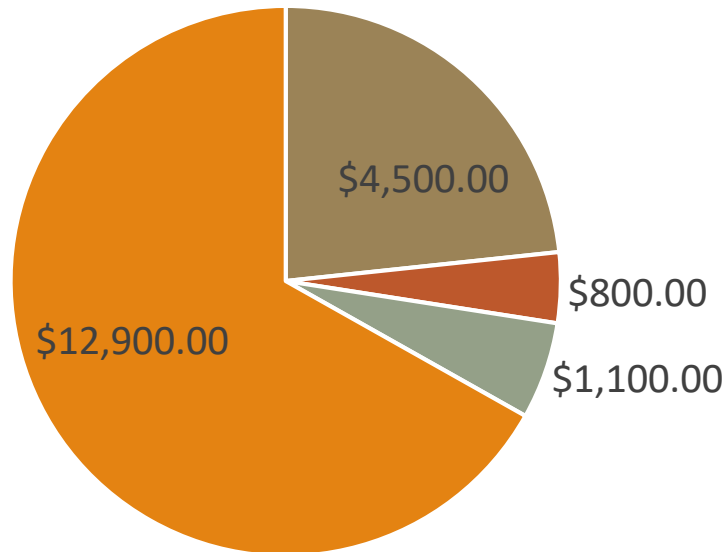
Example Calculations – detailed revenues



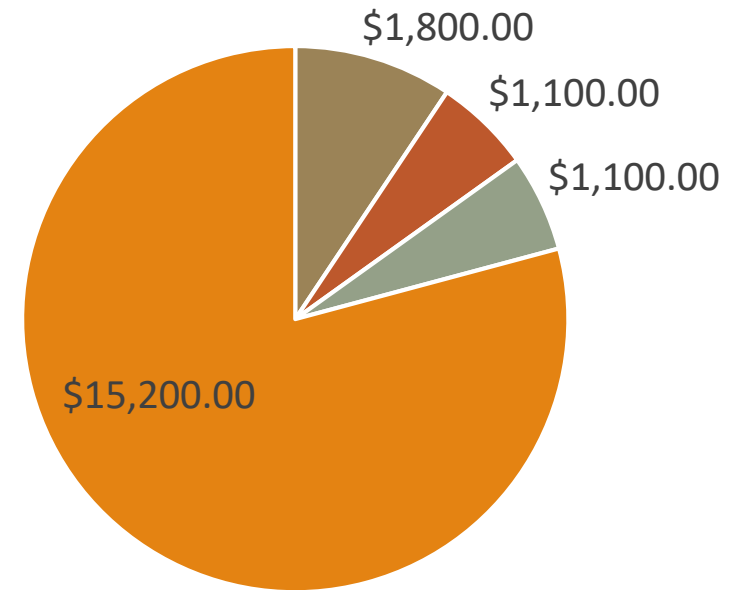
Example calculations – comparing systems

100 acres, Suffolk, corn, sandy loam

Pivot: \$19,400



Drip: \$19,200

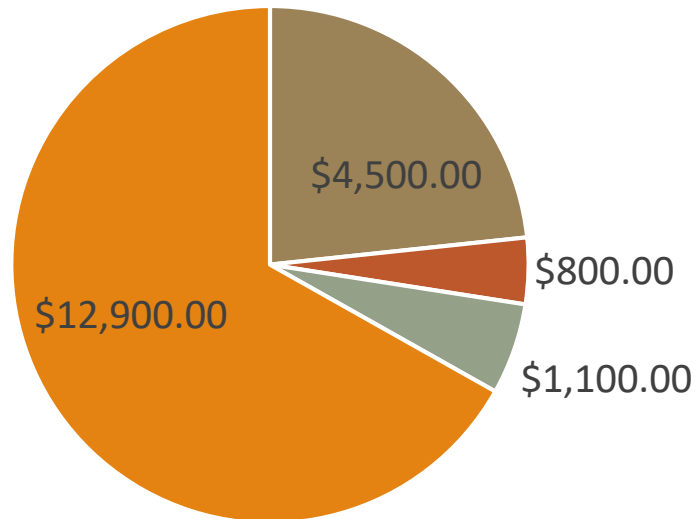


■ Fuel ■ Labor ■ Maintenance ■ Annual Loan Payment

Example calculations – comparing scheduling

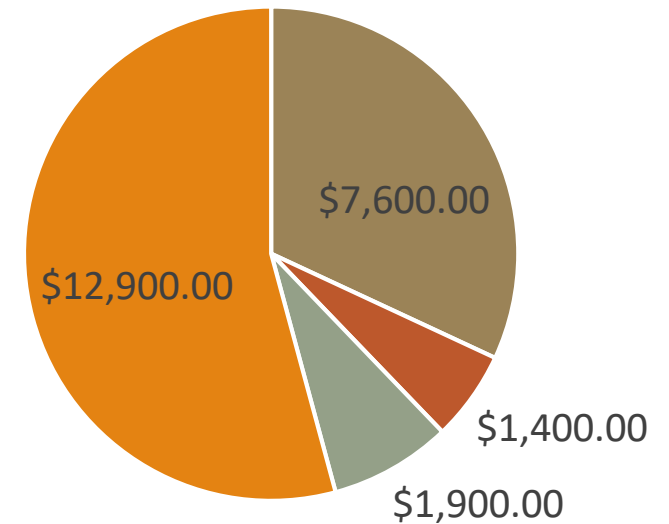
100 acres, Suffolk, corn, sandy loam, center pivot

Rainfall Deficit



■ Fuel ■ Labor ■ Maintenance ■ Annual Loan Payment

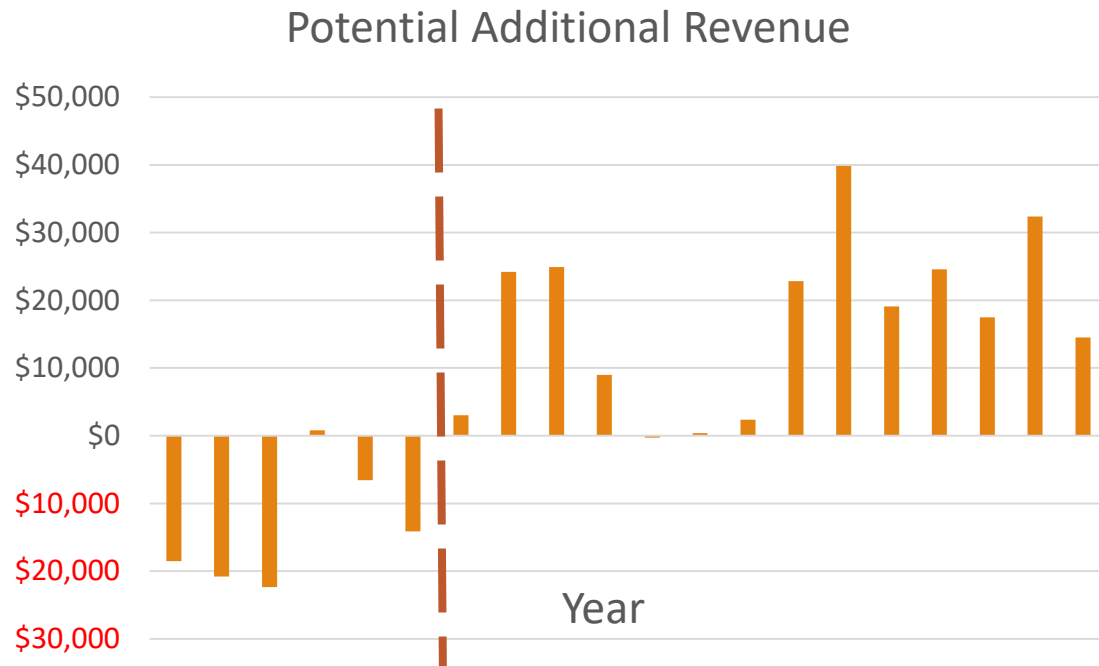
Scheduled: 0.5" per week



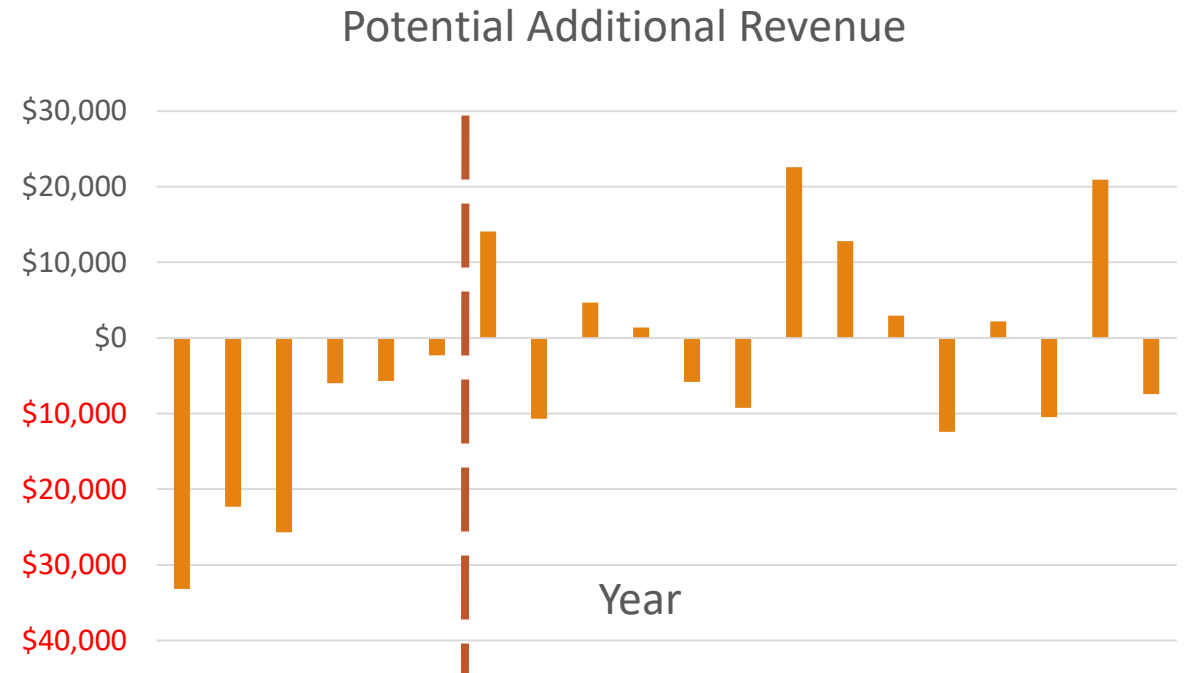
■ Fuel ■ Labor ■ Maintenance ■ Annual Loan Payment

Example calculations – comparing scheduling

Rainfall Deficit



Scheduled: 0.5" per week



Conclusions and Plans for Future Development

- Conclusions
 - Preliminary/ballpark information
 - Profitability varies with rainfall, prices
- Future Development
 - Additional crops
 - Groundwater/surface water
 - More refined finance information
 - Web-based version
 - Documentation (extension bulletin): will be completed this summer



Thank you!

Download tool at:

<https://sites.google.com/vt.edu/jshortridge/irrigation-workshop>

Julie Shortridge

Assistant Professor and
Extension Specialist
Biological Systems Engineering
Virginia Tech

jshortridge@vt.edu

540-231-2797

