UMC

*Science and Technology*

GUIDE

*Published by the University of Missouri - Columbia Extension Division*

EXTENSION CONTINUING EDUCATION — The State is the Campus

# Irrigation Cost and Return Analysis: Summary

*Mark Peterson and C. F. Cromwell, Jr., Department of Agricultural Engineering*
*Herman Workman, Department of Agricultural Economics, College of Agriculture*

Four Guides provide a procedure for complete economic analysis of an irrigation system. Use this Guide with others on General Information, Annual Ownership Costs, and Annual Operating Costs.

Follow the step-by-step procedure in this Guide for completing a cost analysis and then use information from your farm to complete your analysis.

**Item 1:** Transfer annual ownership costs (total and per acre) for the example from Guide 1691.

**Item 2:** Transfer annual operating costs (total and per acre) for the example in Guide 1692.

**Item 3:** Add items 1 and 2 to determine total and per acre annual irrigation costs.

**Item 4:** Total cost per acre-inch of water pumped is calculated by dividing the total annual irrigation cost, $4,113.00, by the volume of water pumped in one year, 720 acre-inches, to obtain $5.71 per acre-inch.

**Item 5:** Determine total cost per hour of pumping by dividing the total annual irrigation cost, $4,113.00 by the annual hours of pumping, 270. Total cost per pumping hour is $15.23.

**Item 6:** Calculate the expected gross income per acre of dryland crop to compare with irrigation. In this example we assume an average dryland corn yield of 80 bushels per acre for the 120 acres, at $1.15/bushel.

**Item 7:** Determine the total gross income per acre of irrigated crop needed to make irrigation at least as profitable as dryland, by adding per acre values for Items 3 and 6.

**Item 8:** Divide total gross income per acre in Item 7 by price per unit of crop to determine total irrigated crop production or yield needed to break even with dryland production.

**Item 9:** Estimate increased yield per acre due to irrigation.

**Item 10:** Calculate the increase in gross income per acre due to irrigation. Multiply the added yield per acre times the price per unit.

**Item 11:** Calculate the estimated increase in returns per acre irrigated by substracting the added cost per acre in Item 3 from the estimated added gross income per acre.

**Item 12:** Multiply the added returns per acre in Item 11 by the number of irrigated acres to obtain the estimated total added returns due to irrigation.

Sample - Irrigation Cost and Return Analysis Summary

| | | Total | Per Acre |
|---|---|---|---|
| 1. | Annual ownership costs | $1674 | $13.95 |
| 2. | Annual operating costs | $2439 | $20.32 |
| 3. | Total added irrigation costs (1+2) | $4113 | $34.27 |
| 4. | Total cost per acre-inch | $ 5.71 | |
| 5. | Total cost per hour pumping | $15.23 | |
| | Comparing Dryland vs. Irrigation | | |
| 6. | Gross income per acre from dryland crop: 80 yield/acre x $1.15 price/unit = | | $ 92.00/acre |
| 7. | Break even gross income per acre from irrigated crop: (item 3, per acre) + (item 6); ($34.27 + $92.00) = | | $126.27/acre |
| 8. | Break even yield per acre from irrigated crop: $126.27 (item 7) ÷ $1.15 price/unit = | | 110 bu./acre |
| 9. | Estimated added yield per acre above dryland yield from irrigated crop = | | 50 bu./acre |
| 10. | Estimated added gross income per acre from irrigated crop: 50 units (item 9) x $1.15 price/unit = | | $ 57.50/acre |
| 11. | Estimated added returns per acre from irrigated crop: (item 10) - (item 3) $57.50 - $34.27 = | | $ 23.23/acre |
| 12. | Estimated total added returns from irrigation $23.23 per acre (item 11) x 120 acres irrigated = | | $2,788 |

Irrigation Cost and Return Analysis Summary

| | | Total | Per Acre |
|---|---|---|---|
| 1. | Annual ownership costs | $_____ | _____ |
| 2. | Annual operating costs | $_____ | _____ |
| 3. | Total added irrigation costs (1 + 2) | $_____ | _____ |
| 4. | Total cost per acre-inch | $_____ | |
| 5. | Total cost per hour pumping | $_____ | |

Comparing Dryland vs. Irrigation

6. Gross income per acre from dryland crop_____yield/acre x $_____ price/unit = $_____/acre

7. Break even gross income per acre from irrigated crop: (item 3, per acre) + (item 6); $_____+ $_____= $_____/acre

8. Break even yield per acre from irrigated crop $_____(item 7) ÷ $_____price/unit = _____bu./acre

9. Estimated added yield per acre from irrigated crop _____bu./acre

10. Estimated added gross income per acre from irrigated crop_____(item 9) x $_____price/unit = $_____/acre

11. Estimated added returns per acre from irrigated crop: (item 10) - (item 3, per acre); $_____- $_____= $_____/acre

12. Estimated total added returns from irrigation $_____(item 11) x _____acres irrigated = $_____

# Irrigation Cost and Return Analysis

**(from UMC Guides 1690, 1691, 1692, & 1693)**

General Information

1. Pumping rate, gpm . . . . . _____gpm

2. Pumping head

   a. Elevation from water level at source to high point on irrigated acres . . . . . _____feet

   b. Pipe friction loss . . . . . _____feet

   c. Flexible hose friction loss:_____psi x 2.31 = _____feet

   d. Sprinkler discharge pressure:_____psi x 2.31 = _____feet

   e. Miscellaneous friction losses: elbows, riser height, traveling sprinkler machine, etc. . . . . _____feet

   f. Total operating head . . . . . _____feet

3. Continuous brake horsepower required by the pump, bhp

$$bhp = \frac{(\_\_\_\_\_\text{total feet of head})\ (\_\_\_\_\_\text{gpm})}{(4000)\ (\_\_\_\_\_\text{pump efficiency})\ (\_\_\_\_\_\text{drive efficiency})} = \_\_\_\_\_ \text{bhp}$$

4. Engine size needed:_____bhp x _____Horsepower adjustment factor = _____Maximum corrected horsepower (See UMC Guide 1690)

5. Volume of water pumped in one year:_____acres x _____inches = _____ac.in.

6. Estimated annual pumping hours:

$$\text{Pumping Hours} = \frac{(\_\_\_\_\_\text{ac.in.})\ (450)}{(\text{pumping rate,}\_\_\_\_\_\text{gpm})} = \_\_\_\_\_ \text{hours}$$

7. Fuel,_____, cost per unit . . . . . $_____

8. Interest rate . . . . . _____%

## Annual Ownership Costs

| | | Est. yrs. of life | Investment | | Cost Factor | | Annual Cost |
|---|---|---|---|---|---|---|---|
| 1. | Well | _____ | $_____ | x | _____ | = | $_____ |
| 2. | Reservoir | _____ | $_____ | x | _____ | = | $_____ |
| 3. | Pump | _____ | $_____ | x | _____ | = | $_____ |
| 4. | Power unit | _____ | $_____ | x | _____ | = | $_____ |
| 5. | Power transmission | _____ | $_____ | x | _____ | = | $_____ |
| 6. | Electric switches | _____ | $_____ | x | _____ | = | $_____ |
| 7. | Fuel lines or tanks | _____ | $_____ | x | _____ | = | $_____ |
| 8. | Land plane | _____ | $_____ | x | _____ | = | $_____ |
| 9. | Pipe, main or gated | _____ | $_____ | x | _____ | = | $_____ |
| 10. | Pipe trailer | _____ | $_____ | x | _____ | = | $_____ |
| 11. | Sprinkler system | _____ | $_____ | x | _____ | = | $_____ |
| 12. | Other equip. | _____ | $_____ | x | _____ | = | $_____ |
| | Total Investment | | $_____ | | | | |

13. Taxes and insurance (total investment x .01) $_____

14. Fixed charges (electric motors) $_____

15. Loss of income due to acreage out of production, $_____/acres $_____

16. Land grading, interest on investment $_____

Total Annual Ownership Cost $_____

Total Annual Ownership Cost/Acre = $_____ ÷ _____ acres = $_____

## Annual Operating Costs

1. Fuel: Kind _____.

   a. From your records, amount used: _____ x $_____ per unit = $_____

   b. If records not available, estimate from Table 1: _____ bhp x _____ hrs. pumping x $_____/unit of fuel ÷ _____ bhp-hrs./unit of fuel = $_____

   c. If engineering pumping test was made, _____ fuel/hr. x hrs. used _____ x $_____/unit = $_____

2. Oil-Engine

   a. From your records, amount used _____ x $_____/gal. = $_____

   b. Estimate from Table 2: _____ bhp x _____ hrs. pumping x $_____/gal. ÷ _____ bhp-hrs./gal. = $_____

3. Oil-Gear Drive or Electric Motor $_____

   a. From your records, amount used: _____ gal. x $_____/gal. = $_____

   b. Estimate from pumping test or Table 2: _____ bhp x _____ hrs. pumping x $_____/gal. ÷ _____ bhp-hrs./gal. = $_____

4. Subtotal: Annual Pumping Costs (1. + 2. + 3.) $_____

   a. Pumping cost per acre-inch: $_____ ÷ _____ acre-inches = $_____

   b. Pumping cost per hour: $_____ ÷ _____ hours = $_____

5. Repairs and Maintenance-Power Unit

   a. Amount spent during season = $_____

   b. Estimated from Table 3:_____bhp x _____hrs. pumping x $_____/bhp-hr. = $_____

6. Repairs and Maintenance-Irrigation Equipment

   a. Amount spent during season = $_____

   b. Estimate at .005 x purchase price of irrigation equipment $_____ = $_____

7. Irrigation Reservoir Maintenance = $_____

8. Maintenance of fields put to grade:

   a. From your records: $_____

   b. Estimate: $_____/acre x _____acres = $_____

9. Labor

   a. From your records, _____ hrs. x $_____/hr. = $_____

   b. Estimate from Table 4:_____hrs./acre/application x _____applications x _____acres ÷ $_____/hr. = $_____

10. Additional seed, fertilizer, and other chemicals, plus additional harvesting costs: $_____/acre x _____acres = $_____

Total Annual Operating Costs (Add items 4. + 5. + 6. + 7. + 8. + 9.) = $_____

Total Annual Operating Costs/Acre $_____ ÷ _____acres irrigated = $_____

## Irrigation Cost and Return Analysis Summary

| | | Total | Per Acre |
|---|---|---|---|
| 1. | Annual ownership costs | $_____ | _____ |
| 2. | Annual operating costs | $_____ | _____ |
| 3. | Total added irrigation costs (1 + 2) | $_____ | _____ |
| 4. | Total cost per acre-inch | $_____ | |
| 5. | Total cost per hour pumping | $_____ | |

## Comparing Dryland vs. Irrigation

6. Gross income per acre from dryland crop_____yield/acre x $_____ price/unit = $_____/acre

7. Break even gross income per acre from irrigated crop: (item 3, per acre) + (item 6); $_____+ $_____= $_____/acre

8. Break even yield per acre from irrigated crop $_____(item 7) ÷ $_____ price/unit = _____bu./acre

9. Estimated added yield per acre from irrigated crop _____bu./acre

10. Estimated added gross income per acre from irrigated crop_____(item 9) x $_____price/unit = $_____/acre

11. Estimated added returns per acre from irrigated crop: (item 10) - (item 3, per acre); $_____- $_____= $_____/acre

12. Estimated total added returns from irrigation $_____(item 11) x _____acres irrigated = $_____

Issued in furtherance of cooperative extension work, acts of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. Carl N. Scheneman, Vice-President for Extension, Cooperative Extension Service, University of Missouri, Columbia, Mo. 65201. The University of Missouri-Columbia is an equal employment and educational opportunity institution.

*File: Agr. Engr. 4 7/69/7M, 3/71/3.5M, Rev. 7/73/8M*