ECONOMIC FEASIBILITY OF SUPPLEMENTAL IRRIGATION IN CENTRAL MISSOURI

Prepared by
Carl Schwinke

in cooperation with
Department of Agricultural Economics
University of Missouri

Paper contributed to the Student Section of the American Agricultural Economics Association, July 31 - August 3, 1977 at San Diego, California.

ECONOMIC FEASIBILITY OF SUPPLEMENTAL IRRIGATION IN CENTRAL MISSOURI

Today, throughout the agricultural community of central Missouri, a trend is taking place which could substancially effect, or alter investments, corn yields and prices, and long range planning for its farmers. Drought conditions over most of this gentle, sloping land have triggered a search for alternatives to maintain high levels of productivity. Rather than turn to dry land farming techniques, supplemental irrigation has been used extensively in reducing the risk of limited rainfall when producing corn or soybeans. It is through this decision to irrigate that necessitates a careful, well-planned proceedure to properly examine all aspects of this large investment in capital and equity. As experienced farm managers can readily testify, a certain amount of "pencil-pushing" or preplanning must be performed in order to insure profitabilty and feasibility. Premature decisions with insufficient data to draw conclusions from could lead to a very slow and unpleasant financial recovery. However, with proper planning and sound, rational judgement, intelligent choices can be made if supplemental irrigation yields a profitable and practical alternative to dryland farming methods. It is the purpose of this paper to present a method by which the farm manager may analyze his potential to use supplemental irrigation as a risk reduction practice. By evaluating the major facets, a clearer understanding is given of its personal economic impacts.

In a publication by Michigan State University, Agricultural Economists Gerry Swab and Ernest Kidder list six important items to consider when preparing plans to irrigate. They are as follows:

1. Acres irrigated
2. Water requirement

3. Capital investment
4. Financing
5. Increased variable costs
6. Impacts on returns

Much of the available information pertaining to irrigation in Missouri is gathered from its central regions of Audrain and Calloway counties. Since supplemental irrigation is a relatively recent practice, published material concerning this is somewhat limited to these two counties.

Now, returning once more to the six criteria, I would like to discuss each of these in greater detail. By using these guidelines, the farm manager will be better prepared to make decisions that he can live with.

ACRES IRRIGATED

The Calloway county farm to be examined can comfortably irrigate 232 acres of corn. The mechanics of this particular system involve the purchase of a single center pivot sprinkler to be moved between two separate pivot pads. One full circle will cover 133 acres and the remaining 99 acres will require approximately a three-fourths revolution by the pivot. Land terrain will have an insignificant effect since average slope is between two to five percent. The water will be transported between the two pivot pads and the reservior by 4860 feet of eight inch pipe.

WATER REQUIREMENT

Water is supplied from a man-made reservior with a capacity of twenty-five feet and receives runoff from a watershed of 120 acres. An average of 5.1 inches of water per acre will be applied during the growing season. Once the reservior is filled, it

should have enough capacity to supply needs during normal years. However, continuous drought conditions could warrant the use of alternatives for additional water sources such as a deep well or other resreviors. Inclusion in the initial investment is unnecessary but can be justified for consideration in future plans.

CAPITAL INVESTMENT

Investment for the center pivot and reservior totals $75,834, using 1976 prices. An itemized budget, shown on Table I, gives the total capital requirements. A reservior of this size is estimated to have a life of twenty years. To move water between the two pivot circles and reservior requires 4860 feet of eight inch Poly-vinyl Cloride pipe at $3.00 per foot - $14,580. Electrical wire; 4860 feet times fifteen cents per foot equals $729. Three, $30 air relief valves for each of the three risers gives a total of $30,834 for the reservoir and equipment. For the center pivot sprinkler; $4,000 for a generator and motor and water pump; and $500 for pipe and fittings at the pump which gives a price tag of $42,000. On the final figure, $3,000 is allotted to meet miscellaneous expences such as brush removal and moving obstructing poles. This helps to avoid an unnecessary burden of operating expenses during the growing season of the first year. On a per acre basis, this amounts to an investment of $327 per acre.

Financing

Terms for payment are based on a ten year, 5% loan with the lending organization supporting all of the equity. In other words, no part of the owner's assets or equity is used to supplement his investment. Depending on the sources of capital, interest rates and years of repayment can vary. As mentioned before, the movable sprinkler will fully depreciate in ten years. This

will enable the loan to be fully repaid when the equipment depreciates.

Increased Variable Costs

Variable expenses for any enterprise can be very informative and accurate indicator of costs on a per unit basis. Table II gives an itemized account of variable and fixed expenses for dry land and irrigated and the increases resulting from supplemental irrigation. Consideration should be given to certain items under cash operating costs. Cash outlays for fertilizer, seed, machine repairs, and drying fuels must be increased in order to insure adequate and timely adjustments due to increased yields. Overall, variable operating costs show an increase of $40 resulting from a 50 bushels per acre yield gain. This gives a ten cent per bushel reduction in variable costs.

Fixed ownership costs are similarly encouraging. Added costs per acre now total $92 with increases of $48 and $4 realized from irrigation equipment depreciation and labor, respectively. This shows a favorable total cost per bushel of $1.95 or six cents less than corn produced under dryland conditions.

IMPACTS ON RETURNS

The sixth, and final point, if not the most important probably attracts more attention from the farm manager. The added expected returns must adequately cover the added fixed and variable costs. In order to help justify such a large investment, planning for dry years as well as average years should be included.

Table III shown here gives a dollar figure for returns over total in an average year. A price of $2 per bushel will net a negative $1 return on investment from non-irrigated corn while irrigated corn yields a $7 return on management for an increase of $8 per acre. Looking at the remainder of the table confirms that as price per bushel increases, returns from this particular model farm, will increase.

Dry year figures also show definite economic advantages to irrigated over dryland corn. Per acre yields of 50 bushels for dryland and 120 bushels for irrigated corn result in costs per bushel of $3.62 and $2.31 respectively. Return over total costs show that with a price range of $1.75 to $2.78 per bushel, at no time do returns for dryland corn surpass the break-even price. Irrigated corn reaches a break-even level between $2.25 and $2.50 per bushel. Supplimental irrigation, depending on price, can aid in reducing the severity of financial loss during a dry year.

To provide an overall outlook of the total farm, Table IV shows a cost analysis sheet prepared by Nolin Hein, farm management specialist from University of Missouri Extension Division. The figures were obtained by multiplying increased per acre income or expenses times 232 irrigated acres on the model farm. Using a price of $2.25 per bushel, added income is $112.50, minus $40 per acre operating costs gives a return over operating costs of $72.50 An investment of $327 per acre or $75,334 for total acres is shown. Added fixed costs which include equipment, depreciation, taxes, and labor are $52 per acre; which gives a total cost figure of $92 per acre or $21,344. Returns over total costs show $20.50 or $4,756 for 232 acres.

Supplemental irrigation can be an important factor in long term row crop farming. By using irrigation as a production improvement practice, the farmer can substancially reduce the risk of drought linited yields. With the assurance of a stable crop yield, he can apply more fertilizer and increase seed population knowing these practices can directly benefit yields. Financial stability is also maintained because of the certainty of a crop.

The economic feasibility of this system is evident. Presented with these figures, our Farmer Jones" would be in an excellent position to reap the benefits of supplemental irrigation. The 232 acres of land provide suitable acceptance for the center pivot system. The water supply is adequate and feasible from the 25 acre feet reservoir.. The investment, although $75,000 does seem high, provides enough capital and flexibility to insure smooth operation. A ten year loan at 5% interest rate is acceptable and within range for this system. Increased costs as shown by tables III and IV, could cause unpleasantly high operating costs during the early years of operation. However, increased returns should be able to more than compensate for these expenses. Returns for total acres show an expected increased earning of $4,756 during an average year. This coupled with a breakeven price level of approximately $2.35 provides sufficient economic benefits to warrent the investment.

Thus, by a systematic apprach to supplemental irrigation, the farmer-operator-owner can clearly see the economic advantages, or disadvantages to such a large capital investment, Without such an approach, decisions might become biased by quick, desperate solutions subjected to community and financial pressure. This overall view can now be used by the farmer to help him decide if such a plan can be used to the best advantage of his particular operation and future goals.

Table I.

EXAMPLE FARM

CENTER PIVOT INVESTMENT

20 YEAR LIFE		
RESERVOIR	$15,000	
PIPE 8 INCH PVC 4860' x 3.00/FT. INCLUDES TRENCHING	14,580	
WIRE 4860' x .15/FT.	729	
PRESSURE RELIEF VALVES $70 x 3	210	
AIR RELIEF VALVES $30 x 3	90	
RISERS 3 x $75	225	
		$30,834
10 YEAR LIFE		
CENTER PIVOT SPRINKLER INCLUDES PAD, ERECTION & FREIGHT	$30,000	
GENERATOR AND MOTOR	4,000	
PUMP AND MOTOR	7,500	
FITTING & PIPE AT PUMP	500	
		$42,000
TOTAL INVESTMENT		$72,834
ADDITIONAL EXPENSE BRUSH REMOVAL & MOVING OF POLES AND MISCELLANEOUS	$ 3,000	
TOTAL MONEY NEEDED FOR IRRIGATION	$75,834	
INVESTMENT PER ACRE	$ 326.87	

TABLE II. Typical Per Acre Cost And Returns from Producing Dry Land vs. Irrigated Corn in Missouri[3]

	Dry Land Corn	Irrigated Corn	Added from Irrigation
Average Yield	90	140	50
Cash Operating Costs			
Seed	$ 10	$ 12	$ 2
Fertilizer	40	60	20
Chemicals	14	14	--
Machine, Fuel, Oil, Repairs	16	22	6
Drying, Fuel & electricity	6	9	3
Irrigation: Fuel		5	5
Repairs	2	2	2
Miscellaneous	7	7	--
Operating Interest	4	6	2
TOTAL CASH OPERATING COSTS	$ 97	$137	$ 40
Operating Cost/Bu.	1.08	.98	.80

Hein, Norlin A Department of Agricultural Economics, University of Missouri-Columbia, January, 1976.

	Dry Land Corn	Irri-gated Corn	Added from Irri-gation
Ownership Costs			
Machinery, Depr. & Taxes ($80 x .22 - 6 yr. life)	$ 18	$ 18	--
Irrigation, Depr. & Taxes ($300 x .16 - 10 yr. life)		48	48
Real Estate Taxes, Depr., Inst. ($600/acre x .08)	48	48	52
Labor Costs	18	22	4
TOTAL COST/ACRE	$181	$273	$ 92
TOTAL COST/BU.	2.01	1.95	1.84

Table III

		Dry Land Corn	Irrigated Corn	Added from Irrigation
Return Over Total Cost In Average Year				
Price Per Bu.:	$1.75	-23.50	-28.00	-4.50
	2.00	- 1.00	7.00	8.00
	2.25	21.50	42.00	20.50
	2.50	44.00	77.00	33.00
	2.75	66.50	112.00	45.50
In A Dry Year				
Yield		50	120	70
Total Cost		$181	$278	$97
Total Cost/Bu.		3.62	2.31	1.39
Return Over Total Costs				
Price Per Bu.:	$1.75	-$93.50	-68.00	$25.50
	2.00	- 81.00	-38.00	43.00
	2.25	- 68.50	- 8.00	60.50
	2.50	- 56.00	22.00	78.00
	2.75	- 43.50	52.00	95.50

EXAMPLE FARM

Center Pivot Irrigation Cost Analysis

	Per Acre	232 Acres
Change in Income $2.25x50	$112.50	26,100
Added Operating Costs	40.00	9,280
Return Over Operating Costs	72.50	16,820
Investment	$327.00	$75,834
Fixed Cost	52.00	12,064
Total Cost (Operating & Fixed)	92.00	21,344
Return Over All Cost Income Minus All Costs)	20.50	$ 4,756

Hein, Norlin A. Department of Agricultural Economics, University of Missouri, March, 1977.

Bibliography

Hein, Norlin A. "Evaluating the Economic Feasibility of Irrigation Systems." Department of Agricultural Economics, University of Missouri, March, 1977.

Hein, Norlin A. "Economic Outlook for Supplemental Irrigation in Missouri." Department of Agricultural Economics, University of Missouri. Prepared for Irrigation Short Course, January, 1976.

"Is Irrigation for You?" Dekalb Crop Management, Spring, 1977.

Schwab, Gerry and Ernest Kidder. "Irrigation-Some Consideration." Department of Agricultural Economics, Michigan State University-Lansing. July, 1976, No.402.