KANSAS FARM MANAGEMENT & MARKETING HANDBOOK

KSU Farm Management Guide MF-836

Irrigation Capital Requirements and Energy Costs

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Irrigation allows producers to grow high volume crops that otherwise would not be possible due to low rainfall. In addition, the production risk associated with those crops is reduced. However, producers must weigh the costs of irrigating with the ben efits received. The costs associated with irrigation will vary depending on well depth, delivery system, energy costs, and management ability.

Table 1 outlines average capital requirements for those items other than the actual delivery system. The cost of these items will be similar for the different system types. Irrigated land values often include the well, pump and gearhead in the per acre cost. It is beneficial to break this value down into the individual components for budgeting purposes. Also, the well, pump and gearhead costs will generally be the same regardless of how many acres are irrigated. Thus, the well and pump and gearhead per acre costs change as the amount of irrigated acres increase or decrease.

The value of irrigated land will vary depending on slope and soil type. Flood and drip systems require a relatively flat field whereas pivot systems can operate on rougher terrain. In the following irrigation tables and budgets, total land value was assumed to be the same for flood and center pivot land. However, when well, pump and gearhead costs are subtracted, flood land was priced at a slight premium to pivot land. The cost of the well was based on a 300-foot well, while the cost of the pump and gearhead was based on an 8-inch pump at a 245-foot setting. The motor cost was based on the power required given the depth of the well and the pump used. These costs will increase as the depth and capacity of the well is increased.

Table 1. Irrigation Capital Requirements for Land, Well, Pump-Gearhead, and Power Unit*

Item	Budgeted Total	Acres/Field 160 $ Per Acre	Acres/Field 126*** $ Per Acre	Your Farm Total	Your Farm Per Acre
Land**	XXXXX	$ 675.00	$ 600.00	____________	____________
Well	$16,500	103.00	131.00	____________	____________
Pump & Gearhead	20,000	125.00	159.00	____________	____________
Power Unit	4,500	28.00	36.00	____________	____________
Water Meter	1,000	6.25	7.94	____________	____________
Connectors	750	4.69	5.95	____________	____________
Total per Irrigated Acre		$ 941.94	$ 939.89	____________	____________

** Revised October 1994 and 1995.*
***Land values are shown for yield level II.*
****Land value = $830 - value of well, pump and gearhead.*

Irrigation Delivery Systems

The type of delivery system used will have a big impact on the size of the investment. Tables 2, 3, and 4 list average costs of center pivot, flood irrigation (gated pipe), and drip irrigation. While flood and center pivot irrigation systems are very common in Kansas, drip irrigation is relatively new. The costs of all three systems are based on a quarter of ground with the well located at the edge of the field.

There are many factors to consider when comparing the different systems in addition to total investment costs. Some of these are:

1. Available capital;
2. Labor available during growing season;
3. Well capacity;
4. Topography;
5. Soil type;
6. Pumping cost; and
7. Management ability

The investment cost of flood irrigation is significantly lower than center pivot or drip systems. However, labor requirements can be as much as 1 hour/acre less for a sprinkler system compared to flood irrigation. Well capacity and application efficiencies also need to be considered. Research indicates application efficiency with flood irrigation is generally in the range of 50 to 75 percent depending on management abilities.

This application efficiency compares to a range of 75 to 95 percent for center pivot and approximately 99 percent with drip. Therefore, a more efficient system, if managed properly, may increase yields and/or allow for more acres to be irrigated from the same well.

Topography also can dictate which system is used. Both flood and drip systems require relatively flat land, whereas pivots can be used on uneven terrain. The more efficient systems will also realize larger savings from less water pumped if pumping costs are high. While hard to measure, the producer's management ability is one of the more important factors in choosing which system is best.

Table 2. Capital Requirements: Center Pivot Irrigation System (126 acres)[1]

Item	Items by Foot Feet	Price/ft	Other Items	Total	Your Farm Total
Standard 8' Tower Pivot					
System Base Price	1,320		$32,500		____________
Drops on 60" Spacing			2,100		____________
Low Drift Nozzles			2,400		____________
32" x 11.2 Tires			3,000		____________
Sprinkler System Total				$40,000	____________
8" Underground Pipe	1,320	$ 2.40		3,168	____________
Electrical Wiring	1,320	$ 2.10		2,772	____________
Connectors			$ 350	350	____________
12 KVA Generator			$ 2,200	2,200	____________
Total				$ 48,490	____________
System Costs Per Irrigated Acre				$ 384.84	____________

[1]*All charges on an installed basis. Revised October, 1994.*

Table 3. Capital Requirements: Flood Irrigation System (160 acres)[1]

Item	Items by Foot Feet	Price/ft	Single Items	Total	Your Farm Total
8" Pipe	0	$ 0.00		0	____________
Gated Pipe	2,640	$ 1.30		$ 3,432	____________
Surge Valve			$ 1,700	1,700	____________
Connectors			150	150	____________
Total				$ 5,282	____________
System Costs Per Irrigated Acre				$ 33.01	____________

[1]*All charges on an installed basis. Revised October, 1994.*

Table 4. Capital Requirements: Drip Irrigation System (160 acres)[1]

Item	Items by Foot Feet	Items by Foot Price/ft	Other Items	Total	Your Farm Total
8" Mainline Pipe	1,980	$1.30		$ 2,574	____________
8" Submain Pipe	2,640	$1.30		3,432	____________
6" Submain Pipe	1,360	$0.70		952	____________
4" Submain Pipe	1,280	$0.61		781	____________
4" Flushline Pipe	10,560	$0.61		6,442	____________
Driptape	1,399,200	$0.0318		44,495	____________
Driptape connectors (supply tubing & sleeve locks)			$3,168	3,168	____________
2—8" PIP Crosses			147	147	____________
4—8" PVC wafer bufferfly valves			1,336	1,336	____________
4—8-6"PVC reducers			70	70	____________
4—6-4" PVC reducers			38	38	____________
12—4" PVC elbows			117	117	____________
12—4" PVC removable endcaps			190	190	____________
PVC glue and solvent			250	250	____________
Filter—900 GPM, automated sand media			7,974	7,974	____________
18—Pressure Gauges (0-30 PSI)			390	390	____________
Trenching	15,180	$0.675		10,247	____________
Producer Labor (995 hrs @ $8/hr)			$7,960	7,960	____________
Producer Provided Tractor (62 hrs)			433	433	____________
Total				$ 90,995	____________
System Costs Per Irrigated Acre				$ 568.72	____________

[1]*All charges based on producer installing system. Revised October 1994.*

Table 5 compares the total investment required for a quarter of land and all irrigation equipment for center pivot, flood and drip systems. The land cost with a center pivot system is adjusted to include the cost of the nonirrigated corners. While the total cost of the flood and center pivot are not tremendously different, the number of acres being irrigated needs to be considered.

Table 5. Capital Requirements by Irrigation System[1]

Acres = = > Item	126 Center Pivot /Ac.	126 Center Pivot /Qtr.	160 Flood /Ac.	160 Flood /Qtr.	160 Drip System /Ac.	160 Drip System /Qtr.
Land	$ 600.00	$ 75,600	$ 675.00	$ 108,000	$ 675.00	$ 108,000
Well	131.00	16,500	103.00	16,500	103.00	16,500
Pump & Gearhead	159.00	20,000	125.00	20,000	125.00	20,000
Power Unit	36.00	4,500	28.00	4,500	28.00	4,500
Water Meter	8.00	1,000	6.00	1,000	6.00	1,000
At Well Connectors	6.00	750	5.00	750	5.00	750
System	385.00	48,490	33.00	5,282	569.00	90,995
Total per Irrigated Acre	$1,325.00		$ 975.00		$1,511.00	
Quarter Adjustment[2]		$ 17,850				
Total per Quarter		$185,180		$156,032		$241,745
Total per Acre	$1,157.38		$ 975.00		$1,511.00	

[1]*Revised October, 1994, 1995, and 1997.*

[2]*Adjustment is for value of nonirrigated corners.*

Pumping Costs

Energy source, price, and Total Dynamic Head (TDH) are the important facts affecting pumping costs. Total Dynamic Head is determined by the amount of lift, pressure, and any friction losses. Table 6 lists the pumping costs per acre inch at various levels of TDH and different prices of natural gas, diesel, electricity, and propane.

Table 6. Energy Pumping Cost Per Acre Inch[1]

	Total Dynamic Head (TDH)[2]						
	100	200	300	400	500	600	700
Natural Gas ($/mcf)							
$2.00	0.49	0.99	1.48	1.98	2.47	2.97	3.46
$3.00	0.74	1.48	2.22	2.97	3.71	4.45	5.19
$4.00	0.99	1.98	2.97	3.96	4.94	5.93	6.92
$5.00	1.24	2.48	3.72	4.96	6.20	7.44	8.68
Diesel ($/gal)							
$0.50	0.61	1.22	1.83	2.44	3.05	3.66	4.27
$0.75	0.92	1.83	2.75	3.66	4.58	5.49	6.41
$1.00	1.22	2.44	3.66	4.88	6.10	7.32	8.54
$1.25	1.53	3.05	4.58	6.10	7.63	9.15	10.68
Electricity ($/KWH)							
$0.04	0.69	1.38	2.07	2.76	3.45	4.14	4.83
$0.06	1.03	2.07	3.10	4.14	5.17	6.20	7.24
$0.08	1.38	2.76	4.14	5.52	6.89	8.27	9.65
$0.10	1.72	3.45	5.17	6.89	8.62	10.34	12.06
Propane ($/gal)							
$0.40	0.89	1.77	2.66	3.54	4.43	5.31	6.20
$0.65	1.44	2.88	4.32	5.76	7.19	8.63	10.07
$0.90	1.99	3.98	5.98	7.97	9.96	11.95	13.95
$1.15	2.55	5.09	7.64	10.18	12.73	15.28	17.82

[1]Basis for fuel calculations are Nebraska Fuel Test Standards @ 75% efficiency. Revised October 1994 and 1995.
[2]TDH = Feet lift + 2.31 × PSI + Friction losses.

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