Benson

FARM MANAGEMENT SERIES FM 608

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ANALYZING THE PROFITABILITY OF OWNING AND LEASING IRRIGATION SYSTEMS ON THE SANDY SOILS IN WEST CENTRAL MINNESOTA

by

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A farmer contemplating the purchase of an irrigation system should make two cost and return analyses. First, the long term profitability of the investment should be evaluated. Second, the effect of the investment on the short-term cash flow of the farming business should also be estimated.

An Example Situation: John Farmer is considering investing in a self-propelled center pivot irrigation system to use in producing a quarter section of corn. The following information is given.

			Your Farm
Estimated Well Depth	140	feet	_____
Estimated Lift	100	feet	_____
Engine Size Needed	140	H.P. internal combustion or 90 H.P. electric motor	_____
Tillable Acres in Quarter	150		_____
Acres Irrigated	130		_____
Inches of Water Applied/Acre	12		_____
Acre Inches of Water Pumped/Yr.	1,560		_____
Hours of Operation Per Year = $\frac{450}{GPM}$ x Ac. in. per year	780		_____
Interest Rate	9%		_____
GPM	900		_____

I. The Long-Run Profitability

A. Estimate Investment and Annual Ownership Costs

System Component	EXAMPLE Initial Investment Cost	Years Useful Life	Depreciation Per Year	YOUR FARM Initial Cost	Depreciation Per Year
Well, Casing, Screen and Gravel Pack	$ 8,560	25	$ 342.40	_____	_____
Turbine Pump	5,172	15	344.80	_____	_____
Electric Motor & Controls	5,118	25	204.72	_____	_____
Pump Base	300	25	12.00	_____	_____
1,000 Ft. Mainline	2,000	20	100.00	_____	_____
C. P. Sprinkler	28,000	15	1,866.67	_____	_____
1. Total Initial Investment	$ 49,150			_____	
2. Annual Depreciation			$ 2,870.59		_____
3. Interest on the Average Investment			2,211.75		_____
$\frac{\text{Total Initial Investment}}{2}$ x Interest Rate					
4. Insurance			202.95		_____
Avg. Investment (excluding well) x .01					
5. Total Annual Ownership Cost			$ 5,285.29		_____

B. Estimate Annual Operating Costs of Irrigation System

		Example	Your Farm
1.	Energy 75.472 KW/Hr. x 780 hrs. x $.024	$ 1,412.84	
2.	Lubrication	25.35	
3.	Repairs Motor	44.50	
	Pump	87.06	
	Sprinkler System	450.00	
4.	Labor 130 A. Irr. x 12 Irr. Annually x .1 Hr. x $3.00/Hr.	468.00	
5.	Total Operating Costs of Irrigation System	$ 2,487.75	

C. Estimate Average Annual Cost and Returns Per Acre

John Farmer is planning to use the center pivot system to irrigate corn. Estimates of the average annual costs and returns per acre for both dryland and irrigated production are given in the crop budget for corn.

The budget for irrigated corn production includes the irrigation costs estimated above. The energy, lubrication and repair costs are listed as one of the operating costs. The labor required for irrigation is included as part of the direct labor. The depreciation interest and insurance costs are included in the overhead costs section.

Given the yield, price and cost assumptions listed, returns above costs shown per acre are $-18.06 for dryland and $57.85 for irrigation. These figures suggest the long term profitability of irrigation is good. However, each individual should modify the figures to fit his situation before reaching a conclusion on the long-term profitability of irrigation on his farm.

CORN BUDGET
Per Acre, Sandy Soils

Returns	Dryland			Irrigated (12 inches)		
	Quantity	Price	Amount	Quantity	Price	Amount
Corn	35 bu.	2.50	87.50	125 bu.	2.50	312.50
Total Returns			87.50			312.50
Operating Costs						
Machinery Fuel, Lube and Repair Costs			7.83			8.87
Corn Seed			8.50			13.00
Nitrogen	40 lb.	.23	9.20	150 lb.	.23	34.50
Phosphate	20 lb.	.20	4.00	50 lb.	.20	10.00
Potash	40 lb.	.08	3.20	100 lb.	.08	8.00
Herbicides			10.00			18.00
Insecticides						4.00
Crop Insurance	87.50	.025	2.19	312.50	.025	7.81
Irrigation, Energy, Lube & Repair Costs				12.0 A.I.	1.295	15.54
Drying	35 bu.	.125	4.38	.125 bu.	.125	15.62
Direct Labor	1.54 hr.	3.00	4.62	3.04 hr.	3.00	9.12
Interest on Operating Capital	26.96	.09	2.43	72.23[a]/	.09	6.50
Total			56.35			150.96
Ownership Costs						
Machinery Depreciation, Interest, Ins. & Housing			12.83			14.91
Dryer Depreciation, Interest Ins. & Housing			4.38			15.62
Irrigation Depreciation, Interest & Insurance						40.66
Interest on Land	400.00	.07	28.00			28.00
Taxes on Land	400.00	.01	4.00			4.00
Total			49.21			103.19
Total Costs Shown			105.56			254.15
Returns Above Costs Shown			-18.06			57.85

[a]/Sum of the operating costs above divided by 2.

Machinery Operating and Ownership Costs Per Acre For Corn

Operation	Costs Per Hour			Dryland			Irrigated 12"		
	Tractor HP	Fuel, Lube and Repairs	Ownership	Hrs/Ac.	Fuel, Lube & Repair Costs/Ac.	Ownership Costs/Ac.	Hrs/Ac.	Fuel, Lube & Repair Costs/Ac.	Ownership Costs/Ac.
Plow 5-16"	75	5.24	7.15	.34	1.78	2.43	.34	1.78	2.43
Disk 16' w/Harrow	75	4.84	9.52	.12	.58	1.14	.12	.58	1.14
Corn Planter 6-30"	75	5.61	10.45	.17	.95	1.78	.17	.95	1.78
Tractor to Spread Fert.	60	2.26	2.34	.08	.18	.19	.1	.23	.23
Spraying 30'	60	3.09	4.18	.07	.22	.29	.07	.22	.29
Cultivation 6-30"	75	4.15	6.23	.17	.71	1.06	.17	.71	1.06
Combining 6-30"		13.78	22.01	.18	2.48	3.96	.24	3.30	5.28
Hauling		.75	3.25	.18	.13	.58	.40	.30	1.30
Shred Stalks - 12'	60	3.47	6.07	.23	.80	1.40	.23	.80	1.40
Irrigation Labor				--	--	--	1.2	--	--
Total				1.54	7.83	12.83	3.04	8.87	14.91

II. The Cash Flow

A. Estimating the Cash Flow With Constant Yields

The effect of the investment on the annual cash flow of the business can be estimated by repeating the calculations for each year using cash flow costs rather than annual costs. The effect of the investment on the income taxes paid (through investment credit, depreciation and interest paid on borrowed funds) is also an important consideration.

Only the effect on net cash costs is considered in the analysis that follows. Then the additional returns required per acre to cover these costs is computed for each year.

The following information was used in making the estimates for a 15 year period.

The amount borrowed is $49,150.
The financing method is a 7 year amortized loan at 9% interest.
The annual loan payment is $9,766.
The investment is depreciated for tax purposes at the double declining balance rate.
The tax bracket is 40%.

Change in net cash income from the quarter section:

This assumes that 150 acres are planted, but only 130 acres are irrigated. The remaining 20 acres has the same planting and chemical costs as the irrigated acreage. However, this 20 acres has the same yield, insurance cost, drying expense and labor charge as dryland production. Of course, there is no irrigation expense on this 20 acres.

Increase in Gross Receipts (130 Ac. x 90 Bu. x 2.50) =		$29,250.00
Increase in Cash Costs		
Insurance on irrigation system	$ 202.95	
+ 130 Ac. x 150.96	19,624.80	
+ 20 Ac. x 114.06	2,281.20	
- 150 Ac. x 56.35	8,452.50	
	$ 13,656.45	$13,656.45
Increase in Net Cash Income		$15,593.55

Projected Changes in Net Cash Flows After Taxes and Loan Payments for the First 15 Years of the Investment assuming ownership through borrowed capital

Year	Net Cash Income Before Taxes And Payments	Change In Taxes*	Loan Payments	Net Cash Income After Taxes And Payments
1	$ 15,594.	$ -3068.	$ 9766.	$ 8896.
2	15,594.	2389.	9766.	3440.
3	15,594.	2901.	9766.	2927.
4	15,594.	3392.	9766.	2436.
5	15,594.	3869.	9766.	1960.
6	15,594.	4337.	9766.	1491.
7	15,594.	4804.	9766.	1024.
8	15,594.	5275.	0	10,319.
9	15,594.	5403.	0	10,191.
10	15,594.	5515.	0	10,079.
11	15,594.	5611.	0	9983.
12	15,594.	5694.	0	9900.
13	15,594.	5767.	0	9827.
14	15,594.	5830.	0	9764.
15	15,594.	5884.	0	9710.

*Investment credit and tax rate (depreciation + interest payments)

Notice that the taxes are reduced $3068 in the first year even though net cash income before taxes and payments has been increased by $15,594. This is due to the tax effects of the investment. However, income taxes are increased in each of the remaining 14 years as a result of the additional net cash income. The final column indicates making the investment increases the operator's net cash income after taxes and payments in each of the 15 years under the stated conditions.

B. Estimating the Cash Flow With Lower Yields During the Initial Three Years

Many irrigators receive the higher yields used in the above analysis only after several years of experience managing the irrigation system. The same situation analyzed in part A is evaluated again assuming somewhat lower yields are received during the first three years of operation.

Year	Irrigated Yield	Increase In Gross Receipts	Increase In Cash Costs	Increase in Net Cash Income
1	95	$ 19,500.	$ 13,656.	$ 5,844.
2	110	24,375.	13,656.	10,719.
3	120	27,625.	13,656.	13,969.
4-15	125	29,250.	13,656.	15,594.

Projected Changes in Net Cash Flows After Taxes and Loan Payments for the First 15 Years of the Investment with reduced yields expected in first years of operation.

Year	Net Cash Income Before Taxes And Payments	Change in Taxes*	Loan Payments	Net Cash Income After Taxes And Payments
1	$ 5,844.	$ -6968.	$ 9766.	$ 3046.
2	10,719.	439.	9766.	515.
3	13,969.	2251.	9766.	1952.
4	15,594.	3392.	9766.	2436.
5	15,594.	3869.	9766.	1960.
6	15,594.	4337.	9766.	1491.
7	15,594.	4804.	9766.	1024.
8	15,594.	5275.	0	10,319.
9	15,594.	5403.	0	10,191.
10	15,594.	5515.	0	10,079.
11	15,594.	5611.	0	9983.
12	15,594.	5694.	0	9900.
13	15,594.	5767.	0	9827.
14	15,594.	5830.	0	9764.
15	15,594.	5884.	0	9710.

*Investment Credit and tax rate (depreciation + interest payments)

As expected, net cash income after taxes and payments is much lower during the first three years. However, the values are positive for each year even though the lower yields are assumed.

III. Leasing the Irrigation Equipment Versus Ownership

Whether to buy or lease irrigation equipment involves making a decision involving long periods of time. The decision of leasing versus buying can only be properly evaluated by studying the cash flows after taxes and payments and net present value ~~analysis~~ of the systems value in terms of today's dollars.

The following examples are worked out showing the cash flows of leasing only the central pivot system and leasing everything except the well. In both cases the lease is for 10 years and the leased equipment is purchased at the end of 10 years for 15 percent of its original value. The well and other equipment at the beginning of the period are bought with a 7 year loan at 9% interest. The equipment at the end of the 10 year lease is purchased with a 5 year loan at 9% interest. All other assumptions applying to the last problem in section 2 (7 year loan with lower yields in beginning years) apply to these situations.

The following information was used in making the estimates for the 15 year period.

	Lease Central Pivot Only	Lease Everything Except Well
Lease lengths	10 yrs.	10 yrs.
Annual lease payment	$ 4,861	$ 7,047
Amount borrowed (year 1)	21,150	8,560
Amount borrowed (year 11)	4,200	6,089
Annual loan payment (1st loan)	4,202	1,701
Annual loan payment (2nd loan)	1,080	1,565
Investment credit taken by farmer	4,915	4,915

Change in net cash income from the quarter section:

~~This assumes~~ the same gross receipts and increases in cash costs are assumed for the system except that insurance on leased equipment would be included in the lease.

	Lease CP	Lease All
Increase in Gross Receipts	$29,250.00	$29,250.00
Increase in Cash Costs		
Insurance on owned ~~system~~ Equipment	140.00	--
+ 130 Ac x 150.96	19,624.80	19,624.80
+ 20 Ac x 114.06	2,281.20	2,281.20
- 150 Ac x 56.33	8,452.50	8,452.50
+ lease payment	4,861.00	7,047.40
Total Increase in Cash Costs	$18,454.64	$20,500.90
Increase in Net Cash Income	$10,795.36	$ 8,749.10

Projected Changes in Net Cash Flows After Taxes and Loan Payments for the First 15 Years of Leasing the Central Pivot and Purchasing Other needed Irrigation Equipment, First Lease payment made at first of year. others at end of year.

Years	Net Cash Flow Before Taxes and Payments	Change in Taxes	Change in Payments	Net Cash Flow After Taxes and Payments
0	— 4861			
1	$ 1045.	$ ~~-6386~~. -8331	$ 4202.	$ ~~3229~~. 312
2	5920.	712.	4202.	1006.
3	9170.	2232.	4202.	2735.
4	10,795.	3094.	4202.	3499.
5	10,795.	3299.	4202.	3294.
6	10,795.	3500.	4202.	3092.
7	10,795.	3701.	4202.	2891.
8	10,795.	3904.	0	6891.
9	10,795.	3959.	0	6836.
10	~~10,795~~. 15594	~~4007~~. 5926	0	~~6788~~. 7668
11	15,594.	5481.	1080.	9033.
12	15,594.	5613.	1080.	8901.
13	15,594.	5804.	1080.	8710.
14	15,594.	5834.	1080.	8680.
15	15,594.	5866.	1080.	8648.

Notice that loan payments start again in year 11 to purchase central pivot after the lease has expired. The net cash flow increases in year 11 to indicate no lease payments. The final column indicates the net cash income after taxes and payments in each of the 15 years under the stated conditions.

Projected Changes in Net Cash Flows After Taxes and Loan Payments for the First 15 Years of Leasing All Irrigation Equipment Except the Well. First Lease Payment made at First of year, others made at end of year.

Years	Net Cash Flow Before Taxes and Payments	Change in Taxes	Change in Payments	Net Cash Flow After Taxes and Payments
0	-7047			
1	$ -1001.	$ ~~-6080.~~ -8899	$ 1701.	$ ~~3378.~~ -850
2	3874.	879.	1701.	1294.
3	7124.	2269.	1701.	3155.
4	8749.	3166.	1701.	3882.
5	8749.	3345.	1701.	3704.
6	8749.	3392.	1701.	3656.
7	8749.	3443.	1701.	3605.
8	8749.	3500.	0	5249.
9	8749.	3500.	0	5249.
10	~~8749.~~ 15594	~~3500.~~ 6238	0	~~5249.~~ 9356
11	15,594.	5532.	1565.	8497.
12	15,594.	5568.	1565.	8461.
13	15,594.	5608.	1565.	8421.
14	15,594.	5652.	1565.	8377.
15	15,594.	5699.	1565.	8330.

Comparison of Net Present Value of All Systems:

Studying the cash flows of each system is important to determine if the project is feasible. Studying the cash flows is important to determine if the project will provide enough cash each year to pay for itself plus other requirements you as an operator may impose. However, by analyzing each project in a manner to determine its overall value above opportunity cost, it can be determined which has the greater value in terms of today's dollars. The Net Present Value method does this and indicates what a project is worth above its ~~additional~~ costs over ~~plus~~ the indicated return required on capital (10% in this example).

The following is a summary of the Net Present Values for Various ~~the~~ situations ~~presented.~~

Situation	Net Present Value
5 yr. Loan (No Beginning Yield Decreases)	$44,453
5 yr. Loan (Beginning Yield Decreases)	35,985
7 yr. Loan (No Beginning Yield Decreases)	45,741
7 yr. Loan (Beginning Yield Decreases)	37,273
Leasing Central Pivot (Beginning Yield Decreases)	~~35,968~~ 33984
Leasing Everything Except Well (Beginning Yield Decreases)	~~35,720~~ 32816

Comparison of the Net Present Values from the 6 examples indicate a large return from not having the reduced yields in the first three years of operation. Therefore it is extremely important to do the job correctly as soon as possible. The examples on leasing assume ~~the~~ beginning yield decreases and should only be compared to the other beginning yield decreasing examples. The leasing examples indicate a reduction in Net Present Value. This can be explained by the fact that the ownership examples use a double declining balance depreciation method and can move the income stream closer to the present. The ownership example can also take additional first year depreciation if the individual's tax situation warrants. Therefore ownership can provide greater flexibility than leasing.

Leasing on the other hand, although showing a slight reduction in Net Present Value, does provide more uniform Net Cash flows over the 15 year period. In addition, leasing may very well be the answer when capital borrowing is limited. These and other considerations must be weighed by the individual in deciding whether to buy or lease irrigation equipment.

IV. Lease Arrangements Involving Irrigation Equipment

Lease arrangements are supposed to share returns in proportion to the contribution of the parties involved. In order to assure that both expenses and income from a given operation are shared equitably, the contributions of the landlord and the tenant must be appraised carefully.

Basically the greater the long-term investment, such as land and irrigation equipment, the higher the landlord's share must be since most tenants prefer not to make large long-term investments on leased land. Typically, then, the land owner is the one investing in irrigation equipment.

This example assumes the landlord provides the land and irrigation equipment. The amount of overhead contribution each provides is taken from the corn budget. The following is an estimate of the overhead contribution of the landlord and the tenant.

Contribution	Landlord	Tenant
Land	$32.00	
Irrigation Equipment & Well	40.66	
Machinery (depreciation, etc.)		$14.91
Dryer (depreciation, etc.)		15.62
Labor		9.12
Machinery, Fuel, Lube & Repair		8.87
Total	$72.66	$48.52
% of Contributions by Each	60%	40%

Establishment of a 60/40 relationship for the irrigated corn budget then allows further analysis of the allocation of costs and returns.

Costs and Returns of the Crop Share Lease

Contribution	Landlord (60%)	Tenant (40%)
Fixed Overhead	$72.66	$48.52
Variable Expense(150.96-9.12-8.87=132.97)	79.78	53.19
Total Costs (254.15)	152.44	101.71
Gross Retruns	187.50	125.00
Net Returns	35.06	23.29

The crop share lease on a 60/40 basis assumes that the landlord and tenant share the income in the same proportion as they contribute to the expense of the operation.

Another lease--the cash lease--is popular because it is simple to understand and easy to administer. Looking at the irrigated corn situation, the amount of

rent from a cash lease for this example may be determined as follows:

Landlord (60/40) Contribution	
Gross Returns	$187.50
- Expenses other than land & irrigation equipment	79.78
= Net to land and irrigation equipment	107.72
- 10 to 15% for risk	16.16
= Desired Cash Rent	91.56

The landlord might be willing to consider $92.00 as cash rent in this example. This then puts all the risk on the tenant. Other versions of a cash lease which shift some of the risk are called flexible cash leases. One might consider payment in bushels of grain or bushels of grain times an average price established at two locations during a certain month.

Establishing a flexible cash lease allows the landlord to share in both price increases and decreases. Determining the base amount of bushels is as follows:

$$\text{Rent} = \frac{\$92.00 \text{ Cash Rent}}{\$\ 2.50 \text{ Price per Bushel}} = 36.8 \text{ Bushels}$$

By receiving a 37 bushel base per acre as cash rent the landlord takes the risk in price only. At $2.50 corn the landlord would receive the same as cash rent.

By taking a percentage of the gross returns, a flexible cash lease allows the landlord to assume some risk in both price and yield.

$$\text{Rent} = \frac{\$\ 92.00 \text{ Cash Rent}}{\$312.50 \text{ Gross Return}} = 29.4\% \text{ of Gross Returns}$$

With the expected returns of the corn budget, $312.50, the landlord would receive $92.00 in rent. Variations in returns could be due to changes in both yield and price.

Another version of a cash lease not quite as risk assuming for the landlord is a combination of the above two examples.

$$\text{Rent} = \frac{\$92.00 \text{ (Cash Rent)}}{2} + \left(\frac{30}{2}\right)\% \text{ of Gross Return}$$

$$\text{Rent} = \$46 + 15\% \text{ of Gross Return}$$

For the expected returns presented in the corn budget, this version would provide $92 in rent to the landlord. However, fluctuations in gross returns do not affect the landlord's returns as greatly as the previous mentioned lease.

It is important that landlords and tenants spend time in determining what is a fair and equitable arrangement for their situation. Because there is no custom established in leasing land and irrigation equipment as a unit in Minnesota, it is extremely important to establish the contribution percentages of landlord and tenant. It is also important to make provisions for changes in the lease as more information becomes available or as conditions change.

Table 1: A Comparison of Costs of Alternative Systems Irrigating a Quarter Section Pumping From a Surficial Aquifer

Water Situation	900 Gallons Per Minute and <20' Lift				600 Gallons Per Minute and <20' Lift			
Type Fuel	Diesel		Electricity		Diesel		Electricity	
Type System	Center Pivot	Tow Line	Center Pivot	Tow Line	Center Pivot	Tow Line	Center Pivot	Tow Line
Initial Investment								
Well Development	$ 3,756	$ 3,756	$ 3,756	$ 3,756	$ 3,756	$ 3,756	$ 3,756	$ 3,756
Pump, Base and Drive	1,377	1,377	1,377	1,377	991	991	991	991
Engine and Fuel Tank or Motor and Controls	6,150	6,150	4,350	4,350	6,150	6,150	1,767	1,767
Distribution System	30,000	13,800	30,000	13,800	30,000	11,100	30,000	11,100
Total	$41,283	$25,083	$39,483	$23,283	$40,897	$21,997	$36,514	$17,614
Annual Ownership Costs								
Depreciation	2,692	1,953	2,375	1,636	2,666	1,659	2,246	1,239
Interest @ 9%	1,858	1,129	1,777	1,048	1,840	990	1,643	793
Insurance	187	107	178	98	186	91	164	69
Total	$ 4,737	$ 3,189	$ 4,330	$ 2,782	$ 4,692	$ 2,740	$ 4,053	$ 2,101
Percent of Initial Investment	11.5	12.7	11.0	11.9	11.5	12.5	11.1	11.9
Operating Costs to Apply 12" of Water								
Fuel*	1,575	1,817	1,159	1,337	1,586	1,831	1,166	1,346
Lube	122	138	19	22	154	177	26	30
Repairs	949	909	549	443	1,140	1,160	587	442
Labor @ $3.00	468	1,350	468	1,350	468	1,350	468	1,350
Total	$ 3,114	$ 4,214	$ 2,195	$ 3,152	$ 3,348	$ 4,518	$ 2,247	$ 3,168
Annual Costs Per Acre Irrigated								
Acres Irrigated	130	150	130	150	130	150	130	150
Ownership Costs	36.44	21.26	33.31	18.55	36.09	18.27	31.17	14.01
Operating Costs	23.95	28.08	16.88	21.01	25.75	30.12	17.28	21.12
Total	$ 60.39	$ 49.34	$ 50.19	$ 39.56	$ 61.84	$ 48.39	$ 48.45	$ 35.13

* Fuel prices used are $.38 per gallon of diesel and $.024 per KWH.

Table 2: A Comparison of Costs for Alternative Systems Irrigating a Quarter Section From a Well With 100 Feet of Lift

Water Situation	900 Gallons Per Minute and 100' Lift				600 Gallons Per Minute and 100' Lift			
Type Fuel	Diesel		Electricity		Diesel		Electricity	
Type System	Center Pivot	Tow Line	Center Pivot	Tow Line	Center Pivot	Tow Line	Center Pivot	Tow Line
Initial Investment								
Well Development	$ 8,560	$ 8,560	$ 8,560	$ 8,560	$ 8,560	$ 8,560	$ 8,560	$ 8,560
Pump, Base and Drive	7,272	7,272	5,472	5,472	5,468	5,468	4,368	4,368
Engine and Fuel Tanks or Motor and Controls	7,350	7,350	5,118	5,118	6,150	6,150	4,219	4,219
Distributor System	30,000	13,800	30,000	13,800	30,000	11,100	30,000	11,100
Total	$53,182	$36,982	$49,150	$32,950	$50,178	$31,278	$47,147	$28,247
Annual Ownership Costs								
Depreciation	3,377	2,640	2,871	2,133	3,157	2,150	2,761	1,754
Interest @ 9%	2,393	1,664	2,211	1,483	2,258	1,407	2,122	1,271
Insurance	223	142	203	122	208	114	193	99
Total	$ 5,993	$ 4,446	$ 5,285	$ 3,738	$ 5,623	$ 3,671	$ 5,076	$ 3,124
Percent of Initial Investment	11.3	12.0	10.8	11.3	11.2	11.7	10.8	11.1
Operating Costs to Apply 12" of Water								
Fuel*	1,921	2,216	1,413	1,630	1,942	2,241	1,429	1,649
Lube	214	246	25	29	218	251	29	34
Repairs	966	1,047	582	489	1,193	1,229	579	516
Labor @ $3.00	468	1,350	468	1,350	468	1,350	468	1,350
Total	$ 3,569	$ 4,859	$ 2,488	$ 3,498	$ 3,821	$ 5,071	$ 2,505	$ 3,549
Annual Costs Per Acre Irrigated								
Acres Irrigated	130	150	130	150	130	150	130	150
Ownership Costs	46.10	29.64	40.65	24.92	43.25	24.47	39.05	20.83
Operating Costs	27.45	32.39	19.14	23.32	29.39	33.81	19.27	23.66
Total	$ 73.55	$ 62.03	$ 59.79	$ 48.24	$ 72.64	$ 58.28	$ 58.32	$ 44.49

* Fuel prices used are $.38 per gallon of diesel and $.024 per KWH.

Table 3: A Comparison of Costs for Alternative Systems Irrigating a Quarter Section From a Well With 250 Feet of Lift

Water Situation	900 Gallons Per Minute and 250' Lift				600 Gallons Per Minute and 250' Lift			
Type Fuel	Diesel		Electricity		Diesel		Electricity	
Type System	Center Pivot	Tow Line	Center Pivot	Tow Line	Center Pivot	Tow Line	Center Pivot	Tow Line
Initial Investment								
Well Development	$13,360	$13,360	$13,360	$13,360	$13,360	$13,360	$13,360	$13,360
Pump, Base and Drive	10,981	10,981	9,181	9,181	8,453	8,453	6,653	6,653
Engine and Fuel Tanks or Motors and Controls	10,150	10,150	6,321	6,321	7,350	7,350	5,118	5,118
Distribution System	30,000	13,800	30,000	13,800	30,000	11,100	30,000	11,100
Total	$64,491	$48,291	$58,862	$42,662	$59,163	$40,263	$55,131	$36,231
Annual Ownership Costs								
Depreciation	4,049	3,313	3,358	2,261	3,647	2,641	3,141	2,135
Interest @ 9%	2,902	2,173	2,649	1,920	2,662	1,816	2,481	1,630
Insurance	256	175	228	147	229	135	209	114
Total	$ 7,207	$ 5,661	$ 6,234	$ 4,688	$ 6,539	$ 4,592	$ 5,831	$ 3,879
Percent of Initial Investment	11.2	11.7	10.6	11.0	11.1	11.4	10.6	10.7
Operating Costs to Apply 12" of Water								
Fuel*	2,978	3,435	2,190	2,528	2,978	3,436	2,190	2,528
Lube	325	376	35	40	326	376	38	44
Repairs	1,340	1,371	647	564	1,391	1,457	653	599
Labor @ $3.00	468	1,350	468	1,350	468	1,350	468	1,350
Total	$ 5,111	$ 6,532	$ 3,340	$ 4,482	$ 5,163	$ 6,619	$ 3,349	$ 4,521
Annual Costs Per Acre Irrigated								
Acres Irrigated	130	150	130	150	130	150	130	150
Ownership Costs	55.44	37.74	47.95	31.25	50.30	30.61	44.85	25.86
Operating Costs	39.31	43.55	25.69	29.88	39.72	44.13	25.76	30.14
Total	$ 94.75	$ 81.29	$ 73.64	$ 61.13	$ 90.02	$ 74.74	$ 70.61	$ 56.00

* Fuel prices used are $.38 per gallon of diesel and $.024 per KWH.

Table 4: Summary of Irrigation Costs For Alternative Systems

Water Situation GPM	Ft. Lift	Type Fuel	Type System	Ownership Cost/Acre	Fuel, Lube And Repairs Per Acre Inch	Hours Labor Per Irrigation
900	<20	Diesel	C.P.	$ 36.44	1.696	.1
			T.L.	21.26	1.591	.25
		Electricity	C.P.	33.31	1.107	.1
			T.L.	18.55	1.001,	.25
600	<20	Diesel	C.P.	36.09	1.846	.1
			T.L.	18.27	1.760	.25
		Electricity	C.P.	31.17	1.140	.1
			T.L.	14.01	1.010	.25
900	100	Diesel	C.P.	46.10	1.988	.1
			T.L.	29.64	1.949	.25
		Electricity	C.P.	40.65	1.295	.1
			T.L.	24.92	1.193	.25
600	100	Diesel	C.P.	43.25	2.149	.1
			T.L.	24.47	2.067	.25
		Electricity	C.P.	39.05	1.306	.1
			T.L.	20.83	1.222	.25
900	250	Diesel	C.P.	55.44	2.977	.1
			T.L.	37.74	2.879	.25
		Electricity	C.P.	47.95	1.841	.1
			T.L.	31.25	1.740	.25
600	250	Diesel	C.P.	50.30	3.010	.1
			T.L.	30.61	2.927	.25
		Electricity	C.P	44.85	1.847	.1
			T.L.	25.86	1.762	.25