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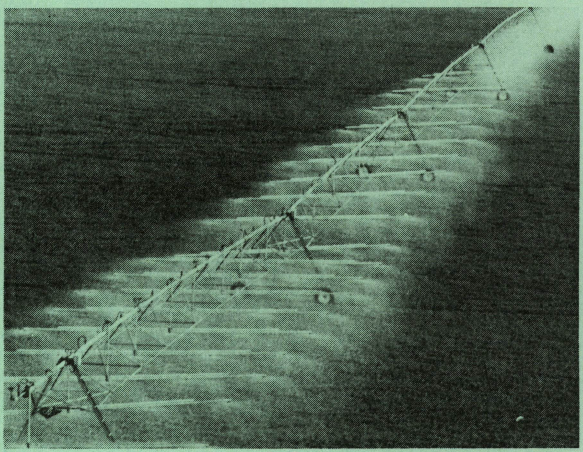

Buying a Low Energy Irrigation System

T. S. Longley, J. F. Guenthner and J. L. Boesel

Increasing power costs for irrigation pumping (and limited availability of electrical energy in some cases) have created much interest in lower pressure sprinkler systems. Nearly every manufacturer of center pivot or linear irrigation systems has available a low energy nozzling package. Reduced pressure nozzles are also available for wheelline and handline systems. While these low energy packages tend to reduce power costs, other factors may make this type of system less than an ideal choice.

Four considerations are important in the choice of a low pressure system (whether a new system or a conversion of an existing system): (1) economics, (2) the infiltration and runoff potential, (3) weather considerations and (4) the manufacturer or dealer guarantee.

In general, the selection of a low pressure irrigation system seems an economically sound investment because of its energy saving potential. However, each grower needs to make an economic analysis of the financial feasibility of such a system for his own operation.

A low pressure irrigation system will decrease a grower's energy costs each year it is used. A dollar in some future year, though, will probably be worth less than a dollar today. Present value analysis is a financial tool that uses interest rates and mathematical formulas to convert the value of all future dollars to present dollars. The financial feasibility of a low pressure irrigation system can be determined by comparing the present value of the expected cost savings to the initial investment cost. If the cost savings are greater, the investment is feasible.

Economic Feasibility

Many factors influence the economic feasibility of a low pressure irrigation system.* These include:

- Area power cost and power cost inflation.
- Expected future inflation.
- Pressure reduction.
- Efficiency of the overall system.
- Life expectancy of the system.
- Interest rates on capital investment.
- Hardware options used with the system.

Many calculations can be made using different values for one or more of the factors listed. Most dealers have techniques and devices that will simplify these calculations.

Table 1 represents an example of the economic analysis process that most dealers will go through in helping a grower select a new pivot system. The analysis is similar for reduced pressure wheel and handline systems. Power cost and annual power inflation rate are assumed to be 2 cents per KWH and 20 percent respectively. Gross seasonal water application is assumed to be 22 inches, a sufficient amount for most crops. Most conventional systems are designed with an 80 to 100 psi pressure at the pivot (to operate an end-gun). Most low pressure systems will operate at 50 psi at the pivot (allowing for some elevation changes because of hilly terrain); the pressure reduction with this low energy example is thus assumed to be 50 psi. The pumping plant efficiency is assumed to be 70

*Note that well depth does not influence this analysis because the static lift (well depth) does not change as the operating pressure is lowered.

Reference to trade names is made with the understanding that neither discrimination is intended nor endorsement implied.

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Table 1. Economic analysis of new low energy pivot.

Present value of energy cost savings		
Assumptions:		
Power cost	2¢	per KWH
Power inflation rate	20%	per year
Gross seasonal water application	22	inches
Pressure reduction	50	PSI
Pumping plant efficiency	70%	
System life	15	years
Interest rate	15%	
$135/acre × 130 acres	$17,550	
Investment cost		
Nozzle and boom package	$10,000	
Less: Bowls, motor and panel savings	-3,000	
Total	7,000	
Difference	**$10,550**	

percent with a new installation. The system life is assumed to be 15 years and the interest rate 15 percent.

Based on these assumptions and the Rain Bird™ annual energy savings calculator, approximately $135 per acre is the present value of the energy savings with a low pressure system. This translates into about $17,550 when spread over 130 acres (the assumed area the pivot would cover).**

The selection of low pressure options depends upon the soil type. An elaborate boom system to spread the water out and reduce the potential for runoff may be necessary and was so assumed in this example. The spray boom and spray nozzle package for this example cost about $10,000. This cost was reduced further by a lower bowl cost because of the lower pressure (additional bowls add pressure, not flow). The example system could operate with two less bowls than a conventional system. Reduced motor, control panel and bowl costs lowered the total extra cost of the system to $7,000.

Since the present value of the expected cost savings ($17,550) in Table 1 far exceeds the present cost of purchasing the low pressure system ($7,000), the example system would be an excellent financial investment. This analysis does assume that other irrigation costs — e.g., taxes, insurance, labor and maintenance — will be the same for low energy and conventional irrigation systems.

This analysis was also performed for interest rates varying from 10 to 18 percent and power cost inflation from 15 to 25 percent. The present value of the power saved was about $15,000 in the worst case and about $43,000 in the best case. For most growers, a low pressure irrigation system will probably be economically feasible. It may, however, not be practical.

** This analysis is appropriate to areas where the gross application is similar to the one assumed.

Water Infiltration

The next concern is difficulty with water infiltratio under a low pressure system — caused either by large droplet sizes on an impact head system or a higl average application rate with a spray nozzle system. I the area being watered has a high infiltration rate (a high sand content), a boom package is probably no necessary. Where the soil has a high silt or clay conten and a low infiltration rate, use of a boom package ma be necessary to spread the water applied with spray nozzles over a larger area. Such use reduces problem of exceeding the soil's capacity to absorb the water.

A clarification may be helpful. Reducing pressur on a conventional impact sprinkler results in large droplet sizes. The top soil layer then has a tendency to become encrusted or compacted and sealed and runof can occur. Certain new nozzle designs for low pressur impact heads have overcome this problem of large droplets at lower pressures, but length of throw i sacrificed. Thus, there is a potential for exceeding th steady state infiltration rate of the soil. Flooding ca then occur because of the soil's inability to absorl moisture rapidly enough to permit this type of irrigation.

Low pressure spray nozzles tend to have smalle droplet sizes, and soil compaction is generally not a problem. Runoff can occur, however, from grossly exceeding the soil's infiltration rate. By using th dealer information on the average application rate an the information on the steady state infiltration rate o the soil available from the Soil Conservation Service the grower should be able to determine whether a potential runoff problem exists from excessiv application with the spray nozzles.

Weather and Irrigation

The new low energy systems have generally had littl testing in areas where weather severity is an irrigation problem. Because of the smaller droplet sizes created by the spray nozzles, a tendency exists for the water to freeze in the air more quickly at low temperatures tha with the impact head. This could create problems of ic buildup on the booms or on the towers if there i significant drift.

Wind may also be a problem on the boom system even though they have been engineered to withstan high winds for a long period of time. Evaporative an drift losses in high winds may require additional application to maintain soil moisture.

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