

Technical Considerations of Converting from Surface Irrigation

C. Dean Yonts
Extension Irrigation Specialist
University of Nebraska
Scottsbluff, Nebraska
Voice:308-632-1246 Fax:308-632-1365
Email: cyonts1@unl.edu

Reasons for Conversions

Yield Increase Potential

The question most often asked when considering making a conversion from surface irrigation is, how much of a yield increase can I expect? The answer to that depends on the type of system you install but more importantly how efficiently you operate that new system. Equally important is to know how efficiently the system being replaced was operated.

As an example, suppose through conversion, a number of small furrow irrigated fields are combined and irrigated using a center pivot system. Total area irrigated is increased by eliminating land area once occupied by roads, ditches or pipe. The results should be an increase in total crop production. On the other hand, converting a large rectangular field that was efficiently surface irrigated may result in little additional irrigated area, and thus less opportunity to increase yield.

Another aspect that needs to be considered in a conversion is the ability of the new system to deliver water on a more timely basis than a surface system. Crop yield can be improved in many situations if water can be delivered not only on a timely basis but in the amount needed by the crop. For example, a center pivot provides the ability to apply light irrigations at seeding depth during seed germination and plant emergence. Unlike surface irrigation, water applied with a center pivot can be added without putting excess water into the soil profile that might result in deep percolation below the root zone. Irrigating with a system that can enhance plant population and improve uniformity of plant stand is very critical and for some crops is a key to improving yield potential.

Yield reduction might come through loss of irrigated acres to dryland corners on a center pivot. In other cases the new irrigation system may more uniformly apply water to ridges or slow intake soils and help to increase production. Overall, when converting to another irrigation system determine the potential change in yield based on how your current irrigation system is being operated.

Water Savings Potential

As water becomes more valuable due to shrinking surface and ground water supplies, we often look at what changes can be made to save water. Changing from surface irrigation to sprinkler irrigation is one of the most common conversions being done as a method to save water. The reason for this is that surface irrigation is a less efficient method of irrigation compared to sprinklers and as such is considered an irrigation method having great water loss.

In many cases the term "water loss" can take on a number of different meanings. To an individual producer a loss of water can be water that runs off the end of a field or water that is allowed to deep percolate below the root zone of the crop. This water is lost to the producer because they may have paid an energy charge to pump ground water or paid water rights to use water from a surface supply system. Either way, the use of the runoff water or the water that deep percolates into the soil is not available for the irrigator to use.

Yet if we look at this loss of water from a broader view, we see a much different picture. In many river valleys the water that is lost to runoff upstream is a water supply for a water user downstream. Deep percolation can many times reappear as a small flowing stream, return directly to the main river system or simply return to the ground water aquifer from which it was pumped. When considered on a watershed basis, runoff and deep percolation from a field is not a water loss.

If runoff and deep percolation are not contributing to water loss within a watershed, then where is water loss occurring. Some of the water is evaporated but a much larger amount is consumed by the plants growing within the watershed. Trees along a river use water that has saturated the banks of the river. Grass on field borders use water that has infiltrated the soil during field runoff. The crop itself is consuming large amounts of water through evapotranspiration. To save water within a watershed, evapotranspiration from trees, grass and crops must be reduced. It may be difficult to eliminate trees and grass growing along streams and rivers so reducing irrigation amounts become the obvious solution. Although not necessarily the most popular choice for saving water, changing crops or limiting irrigation is an effective method of saving water and extending the life of a water supply.

Conversion from surface irrigation systems allow water to be applied more efficiently. As a result of improved efficiency less water will need to be diverted from a reservoir and thus keep water upstream longer so it can be used for irrigation later or used for other purposes. The key point to remember is that saving water from running off of a field does not increase the amount of water available within a drainage system. It merely changes where the water is being stored within the drainage.

Labor Savings Potential

Although saving water is often times given as a reason to convert from a surface irrigation system, labor savings is more than likely the primary reason an individual producer makes the conversion. When a conversion is made, the cost of labor once used to lay gated pipe, open or close gates or set irrigation tubes must be eliminated as those costs are now a part of the installation and maintenance of the new irrigation system.

Additional labor savings is possible by utilizing the new irrigation system to replace other labor intensive operations. A center pivot can provide a method of incorporation of a herbicide or a method of applying an insecticide. Both center pivot and sub-surface drip systems can be used to apply nutrients to the crop. To gain the full potential for saving labor, the new system should be used to replace labor in any way possible for the crop being grown.

Energy Savings Potential

Converting from surface irrigation to sprinkler irrigation may provide little if any energy savings in pumping water. Often times surface irrigation pumps merely bring the water to the surface and discharge the water into a gravity system of pipes or ditches. In other cases water is pumped at a given pressure through pipelines or gated pipe but unless the water is pumped a long distance or significantly up hill, energy savings will be minimal, if any, when compared to a center pivot. In contrast, sub-surface drip systems apply water over a longer time period and thus have lower horsepower requirements and can result in energy savings.

Regardless of the system being converted to, the most important point to remember is that changing the operating conditions of a pump means changes in the pumping unit will likely be needed to continue operating efficiently at the lowest possible cost. Pumps are selected to operate or pump water as efficiently as possible given a designed operating pressure and flow rate. Normally gravity discharge systems discharge water at low pressure. If this same pump is converted and used on a center pivot, the pressure must be increased. If the pressure is increased on this pump without proper changes, the flow rate will go down and the operating efficiency decreased. Low operating efficiency means power costs increase even though water output is the same or even less.

Making a conversion from surface irrigation to any other system likely means a new pumping system will need to be designed. The original pump may be able to be used but if it is a number of years old, the only useable item may be the well. Proper design of an irrigation pumping plant should be planned for if conversion is being considered. Properly designed pumping systems can mean substantial savings in energy charges for years to come.