

## BEST MANAGEMENT PRACTICES PROJECT (AGRICULTURE): NUTRIENT AND IRRIGATION MANAGEMENT TO REDUCE NONPOINT SOURCE POLLUTION OF SURFACE AND GROUND WATERS

Conducted by: Northern Colorado Water Conservancy District (NCWCD)  
 On the Web: [www.ncwcd.org/ims/ims\\_bmp\\_agriculture.asp](http://www.ncwcd.org/ims/ims_bmp_agriculture.asp)  
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 Project Partners: Thompson Valley Young Farmers  
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The Nutrient and Irrigation Management Study utilized surge-valve technology to reduce nitrate pollution and labor expense, and increase irrigation efficiency in a furrow irrigation scenario.

“Surge-valve technology allowed for an overall reduction in the amount of fertilizer applied, which was more environmentally

friendly,” said Alan Halley, NCWCD Agricultural Resource Specialist.

“We cut down on the amount of fertilizer without affecting crop yield or profit,” he said. “We reduced nitrates. Too much (fertilizer) and the nitrates may leach into ground water.

The nitrogen you don’t use has to go somewhere.”

The test site is located at the Thompson Valley Young Farmers Educational Farm in Larimer County near the intersection of I-25

and Highway 402. The crops on the farm are reflective of the region and include corn, sugar beets, malting barley, oil radishes and alfalfa hay. The radishes are used for non-chemical control of nematodes in sugar beets.

Surge irrigation demonstrations and evaluations have been conducted annually since 1990. Total water applied and runoff were measured and combined with weather station data to calculate crop water use. The results were verified by moisture readings from a neutron soil probe.

Efficiency was calculated as the net water stored in the root zone divided by the gross water applied to the field. The improvement in application efficiency of surge over conventional furrow irrigation is demonstrated in the following table:

From 1996 through 1998, a U.S. Bureau of

| METHOD              | EVENTS EVALUATED<br>(1989 through 1995) | EFFICIENCY |
|---------------------|---|------------|
| Conventional Furrow | 99                                      | 31         |
| Surge Furrow        | 116                                     | 45         |

Reclamation grant made it possible to provide 50 percent cost sharing for farmers to purchase surge valves and gated pipe. A total of 31 surge valves and 37,070 feet of gated pipe have been cost shared, providing more efficient irrigation methods for approximately 1,500 acres.

NCWCD currently makes available 40 surge valves on a two-year loan basis to area farmers. This loan program also provides technical support in deployment and use of the valves.

*“Surge valve irrigation valves helped farmers meet irrigation demands, improve irrigation efficiency and decrease labor costs.”*

— Alan Halley, Agricultural Resource Specialist, NCWCD



### HOW SURGE IRRIGATION WORKS:

Surge irrigation can increase the efficiency of water usage in furrow irrigation by taking advantage of changing infiltration rates. When water is first introduced to the furrow, infiltration is high. If the water continues to run, the rate of infiltration reduces to a near constant. However, if the water is shut off and soil particles are allowed to settle they partially seal the surface. If water is then re-introduced, the infiltration rate is reduced, resulting in more water movement down the furrow.

High infiltration rates can reduce irrigation efficiency through poor distribution of water across a field – too much percolation at the top of the row and inadequate water at the bottom. Instead of manually turning the water on and off, a surge valve is used to alternate flow between open gates on either side of the valve.

The cycle times for the surge valve as well as the benefits from the process vary with soil texture, slope and field length. Surge irrigation is less effective on fine soils and steep slopes. Tight soils and heavy compaction can also reduce the benefits of surge irrigation.

In some situations surge irrigation can also be used to reduce irrigation runoff by using short duration cycles after water has reached the bottom end of the furrow. This improves uniformity of irrigation and overall effectiveness.

An additional benefit to surge irrigation, unrelated to water efficiency, is that the technology can be used to improve irrigation system management without a large increase in labor requirements – the surge controller provides a two-set automated furrow irrigation system.



Surge irrigation utilizes a valve and automated controller to alternate water between two open gates on either side of the valve. Surge valve irrigation can improve irrigation effectiveness and efficiency.