Surge Irrigation of Bliss Spring Wheat

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Introduction

Surge irrigation of furrow-irrigated spring wheat was investigated at the Malheur Experiment Station in 1991. The project studied the feasibility of implementing surge as an irrigation management method for increasing irrigation efficiency and reducing deep percolation of irrigation water from furrow-irrigated fields in Malheur County.

Surge irrigation is a process where water is applied to an irrigation furrow intermittently, whereas in continuous-flow (or conventional) irrigation, water is applied to the furrow during the entire irrigation set (Yonts et al., 1991). With surge irrigation, water is cycled from one half of the field to the other half during an irrigation set, using a switch valve.

Surge irrigation has been studied in the Grand Valley of Colorado as a method to reduce salt loading of the Colorado River (Bartholomay, 1991). The results indicated that deep percolation was reduced by about 50 percent with surge and that 790 tons of salt were prevented from entering the river with the return flow. A surge irrigation study conducted in Carbon County, Montana showed that irrigation efficiency increased by about 15 percent (USDA SCS). "Fertigation" (the practices of adding liquid fertilizer in the irrigation water) with surge has also been shown to be effective at increasing fertilizer application efficiency and reducing deep percolation losses (Champion and Bartholomay, 1991).

Groundwater quality is an important environmental issue in areas where irrigated agriculture is practiced. Excessive runoff and deep percolation can cause high levels of dissolved salts and fertilizer residues to enter the groundwater. Groundwater contamination can be acute where inefficient irrigation and fertilizer management methods are practiced together. Irrigation management alternatives are needed for groundwater protection. Growers are also concerned with how to stretch limited supplies of water to adequately meet crop irrigation needs.

Procedures

A six acre field of silt loam soil was planted February 21 to Bliss spring wheat at 125 lb/ac. Planting followed fall moldboard plowing and spring groundhog soil preparation. The field was bedded with 30 inch furrows 640 feet long on February 26. The furrows had a 0.56 foot per 100 feet slope. The Owyhee silt loam at the upper end of the field graded into Greenleaf silt loam halfway -down the length of the furrow run.

For the purposes of comparing irrigation systems, the field was divided into thirds, with the northern third (2 acres) served by conventional furrow irrigation using gated pipe. The southern two-thirds (4 acres) were served with two lines of gated pipe radiating out from a P and R Star Surge Controller (P and R Surge Systems, Lubbock, Texas). The surge was set so that irrigation would oscillated between the two irrigation lines, each serving 2 acres.

During each irrigation, the water inflow rate was measured at each of four gates in both the surge and conventional irrigation system. Inflow rate was determined by recording the time for the water to fill a 3.18 liter can in each measured furrow. Repeated measurements were made during the duration of all three irrigations. Water outflow rate was measured for the entire system over time by recording the time to fill a 5 gallon bucket. Calculations of applied water infiltration, and water loss were made using the Lotus software program Infilcal 4.0 (Shock and Shock, 1991).

Weeds were controlled by the use of one quart/ac of Bronate and one pint/ac of 2-4D applied June 10. The crop received no fertilizer. Aphids were controlled July 3 by flying on 1/2 pint/acre of Dimethoate.

Wheat was harvested in four replicated strips in both the conventional and surge irrigated areas to estimate yield and bushel weight.

Results and Discussion

Irrigation onset was delayed until May 9 because of spring rains. Irrigation frequency would have been increased without the fortuitous rainfall. During the three irrigations 28.2 acre-inches of water were applied on each acre using conventional irrigation practices. Water application was reduced to 12.9 acre-inches per acre using surge irrigation

Surge irrigated furrows finished more uniformly at each irrigation. For example, during the first irrigation, water in 22 of the 56 conventionally irrigated furrows failed to reach the end of the furrows (39 percent), while water in only 18 off the 112 surge irrigated furrows failed to reach the end of furrows (16 percent).

Both systems were efficiently designed so that most of the applied water infiltrated into the field. Under conventional irrigation 26.7 acre-inches of the 28.2 applied infiltrated into the field (94.7 percent). Under the surge irrigation 11.8 acre-inches of the 12.9 applied infiltrated into the field (91.5 percent). The water that did not infiltrate was lost as runoff. Water would not normally be this closely managed in commercial surface irrigated fields.

Bliss spring wheat yields were equivalent under conventional and surge irrigation, with less than half of the water use under surge irrigation (12.9 acre/inch) compared to conventional surface irrigation (28.2 aces/inches).

Water losses under conventional irrigation in this trial are attributed to deep percolation. The extra water was of no benefit to the crop. While 12.9 acre-inches was sufficient for spring wheat under surge irrigation in this trial, results will vary depending on soil depth, soil moisture at planting, spring rain, and the appropriateness of the field for the application of surge irrigation.

Literature Cited

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