5.7 Surge Flow Irrigation for Field Water Distribution Systems

Applicability

This BMP is applicable to agricultural producers that currently use gated pipe or flexible pipe to distribute water to furrow irrigated fields and who have soil types that swell and reduce infiltration rates in response to irrigation.

Description

A surge irrigation system applies water intermittently to furrows so as to create a series of on-off periods of either constant or variable time intervals. Surge flow can also increase the amount of water delivered to each row and reduce deep percolation of irrigation water near the head of the field. Surge irrigation is typically applicable to agricultural fields with medium soils. Surge irrigation may have limited applicability to fields with heavy clay soils or light sandy soil. If improperly used, surge irrigation can increase the volume of water that runs off the tail of a field during irrigation. Under this BMP, the agricultural water user will install and maintain a surge irrigation system. The system will, at a minimum, include butterfly valves or similar equipment that will provide equivalent alternating flows with adjustable time periods and a solar or battery-powered timer. The agricultural producer should consider field slope, soil type, texture, and infiltration rates to maximize effectiveness of the system. Surge flow has also been shown to reduce runoff in some fields by increasing the uniformity of infiltration and by reducing the duration of flow as the water reaches the end of the field.

Implementation

This BMP is often implemented simultaneously with replacement of an on-farm ditch with a gated pipeline. The steps required to implement this BMP are:

1) Selection of the timer and valve equipment for the system based upon the type of gated pipe and soil type;
2) Purchase, installation and use of the surge flow equipment; and
3) Use of soil probes and trialing set times to determine optimal use for each field.

Schedule

This BMP can be implemented in one or two days if the on-farm water delivery system is adaptable to gated or flexible pipe. If the surge flow system is installed at the same time the gated or flexible pipe BMP is implemented, it should add less than one day to the installation time of the new irrigation system.

Scope

The surge flow system is integral to the gated pipe or flexible pipe systems which are laid out after the rows or borders are prepared and removed after the last irrigation of the season. Surge flow valves have a life cycle of between 5 and 15 years; this results in different life cycle costs based upon the use of gated versus poly pipe and should be considered when doing a

cost-effectiveness analysis. Surge irrigation is commonly used with gated pipe rather than with flexible pipe.

Documentation

To document this BMP, the agricultural water user will maintain one or both of the following records:

1) Photographs of the surge flow system installed; and
2) Receipts or other documentation.

Determination of Water Savings

The amount of water saved by switching to surge flow is estimated to be between 10 percent and 40 percent and is dependent upon soil type and timing of operations. The savings from installing the surge flow at the same time as replacing an unlined ditch with gated or flexible pipe should be considered separately as a factor in implementing that BMP. Experience has shown that differences in soil texture and field slope have a significant impact on actual water savings. Estimation of the amount of water saved from increasing the irrigation application efficiency can be made by measuring the amount of water delivered to the field prior to installing surge flow and comparing it to the amount of water delivered to the field by using surge flow.

Cost-Effectiveness Considerations

Cost for a surge valve with an automated controller will range between $800 and $2,000 depending on the size of the valve and the controller options. If installed at the same time as gated pipe, the cost for those systems is outlined in the Gated or Flexible Pipe BMP. Assuming that 0.25 acre-foot per acre per year of water is saved by using a surge valve, the annual cost per acre-foot of water saved ranges from $20 to $25.

References for Additional Information

1) Irrigation Water Conveyance, Rigid Gated Pipe, Natural Resources Conservation Service, United States Department of Agriculture, October 1985, National Conservation Practice Standards No. 430HH.
2) Estimated Efficiency Improvements Expected from Irrigation System Improvements, Natural Resources Conservation Service, United States Department of Agriculture, September 1997, Natural Conservation Practice Standards No. 210-vi-NEH.
3) Surge Irrigation, Yonts, C.D., et al., Nebraska Cooperative Extension NF. 94-176, January 1994. http://ianrpubs.unl.edu/irrigation/nf176.htm