Evaluation of Net Profits from Surge Irrigation in Row Crops in Louisiana

Introduction

The goal of this document is to help farmers and other interested parties understand the economics of irrigation efficiency improvements in furrow irrigation. Irrigation using surge valves in furrow irrigation is the focus of this analysis.

Surge valves in furrow irrigation are used to run water down the field with on-and-off cycles of water delivered at the head of the furrow (Izuno and Podmore, 1986; Schaible and Aillery, 2012). Surge valves have proven to improve irrigation water use efficiency in gravity systems (Horst et al., 2007; Shock et al., 1997), to increase infiltration uniformity (Podmore and Duke, 1982), reduce nutrient loss to runoff from agricultural fields (Evans et al., 1995), and improve long-term farm profitability (Adusumilli et al., 2016).

Examples of agronomic results from literature show that:

- Irrigation using surge valves in the Lower Rio Grande Valley produced water savings of 50% in sugarcane and around 25% in cotton and corn compared to continuous irrigation as reported in the Texas Ag Water Efficiency publication (TexasAWE, 2013).
- Research comparing surge to continuous watering in furrow irrigation on fine loam soils in Oregon has shown water savings in the range of 40 to 50% (Mitchell and Stevenson, 1993).
- On-farm demonstrations in the Mississippi Delta Region have shown water savings in row crops of 50% and 40% in mixed to heavy soils and silt loam soils, respectively (Krutz, 2014).

This document specifically focuses on the economics of adopting surge valves in furrow irrigation of row crops in Louisiana.

Methods

Irrigation water savings from using surge valves is used as a measure to estimate the economics. Since fuel costs are the only costs associated with pumping water in Louisiana, water savings are assumed to represent energy costs savings. The water savings achieved through surge irrigation are converted to fuel costs savings using the National Resources Conservation Service (NRCS) energy costs estimator. The savings in energy costs are then accounted for during estimation of net returns. Net annual crop returns estimated take into account the yield and crop price received and all the related production costs.

The cropping system considered for analysis is a corn-soybean rotation on a 40-acre farm. Both crops are widely grown in the state, and majority of their acreage is irrigated. Soybeans in south Louisiana require about 8.0 to 9.0 inches of irrigation water during their growing period (Heatherly,

Surge valve in a soybean field. (Courtesy of Bruce Garner, ANR agent West Carroll parish.)

2014; Kebede et al., 2014). Similarly, corn requires 13 inches of irrigation water during its growing period (Kebede et al., 2014). Accounting for the efficiency of furrow irrigation systems around 50% (Amosson et al., 2011), 16 and 26 inches of water needs to be pumped to deliver the necessary irrigation water required for soybeans and corn, respectively.

Water savings from surge valves in furrow irrigation in northeast Louisiana have ranged from 10 to 40%, similar to that in the Delta Region of the Mississippi. As a result, baseline estimates of water savings in the range of 25% were used for the economic analysis, which indicates that water savings from using surge valves in soybeans and corn are approximately 4.0 and 6.5 inches, respectively. Two additional scenarios are evaluated in addition to the baseline scenario: a 10% decrease in water use and a 40% decrease in water use.

For the long-term economic analysis, Net Present Value is used to determine the overall profitability of using surge valves for irrigation. NPV is commonly used to make

Table 1. Simulated NPV for various levels of reduction in water (energy) use for a 40-acre corn-soybean rotation given mean energy price.					
Mean energy price	**Measure**	**Continuous flow irrigation**	**10% reduction in water application**	**25% reduction in water application**	**40% reduction in water application**
$3.75/gal	Mean	$89,951	$125,513	$132,709	$136,759
	St. Dev.	$33,851	$35,002	$33,514	$35,521
	Minimum	$(1,923)	$(2,272)	$(7,270)	$(11,545)
	Maximum	$194,902	$243,429	$234,876	$239,084
$3.00/gal	Mean	$93,892	$134,037	$134,754	$143,311
	St. Dev.	$36,404	$36,570	$34,947	$35,133
	Minimum	$(1,403)	$(17,843)	$(14,629)	$(3,038)
	Maximum	$193,228	$243,833	$245,665	$254,715
The numbers in the columns are rounded to the nearest whole number.					

agriculture decisions, especially when making first-time investment decisions. NPV, a long-term financial tool, helps an individual or business decide whether to make an investment. To determine discounted cash-flow (i.e., converting future annual crop net returns to present value terms), a discount rate of 5% is used for the analysis.

Results

Based on the assumptions and input parameters considered for a 40-acre farm, Table 1 shows the summary statistics for the simulated NPVs for three different expected water use reduction scenarios under two energy price levels. As expected, mean NPV increases with greater savings in water use for irrigation, while the variance remains largely unchanged. At lower fuel prices, NPV is relatively higher and tends to get bigger with an increase in water savings.

Conclusions

Most farmers sensibly aim to not over or under irrigate their crop; however, irrigation is often driven by the need to attain maximum yields, which often leads to applying irrigation more than the required agronomic demand. As a result, the increased costs of irrigation nullify the returns attributable from increased yield. Based on the handful of existing demonstration results, scenarios are evaluated to describe the potential economic effects of using surge valves in furrow irrigation.

Photo 2. Surge valve in a corn field. (Courtesy of Bruce Garner, ANR agent West Carroll parish.)

The analysis shows that surge valves reduce irrigation use, which is translated to a reduction in energy use. Such reduction in energy use improves long-term profitability in crop production, which indicates that it is profitable to invest in irrigation efficiency practices. Mean 10-year NPV at $3.00 per gallon was in the range of $134,000 to $143,000 on a 40-acre farm. Changing regulations, lower crop prices and changing climate should provide the necessary incentive to invest in irrigation efficiency improvement, as the long-term benefits of such investments are positive. A diversity of factors influences the adoption of such practices, and the variability in production and market conditions suggests that policy approaches, such as providing incentives along with a strong outreach program, are necessary strategies to promote the long-term adoption of such tools.

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