The Profitability of Irrigating Corn in Tennessee: Implications of Field Size and Energy Costs

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BACKGROUND

The Mid-South region of the U.S. receives sufficient annual rainfall to grow corn without irrigation in most years, but irrigation of corn is common because rainfall is not always timely for the crop (Vories et al., 2009). Rolling upland topography of western TN causes the corn fields to be smaller and more irregularly shaped than corn fields in the MS Delta. Thus, TN has the smallest percentage of irrigated acres among any other state in the Mid-South region (USDA-NASS, 2012). Investment in irrigation systems in western TN, however, has been increasing in recent years. Little is known about the breakeven corn price for investing in supplemental irrigation systems in TN.

OBJECTIVE

To determine the breakeven price of corn where investment in center-pivot irrigation would be profitable in TN.

FRAMEWORK & ESTIMATION

The producer’s objective was
\[ E(\pi) = E[px - Nf - rN - \gamma (cw + f + m)] \]
where \( E(\pi) \) is the expected net return in $/acre; \( \gamma \) is a binary variable that is 1 for irrigation and 0 for non-irrigation; \( x \) is the price of corn in $/bu, \( y \) is yield in bu/acre and is a function of the nitrogen (N) fertilizer rate N, in lb/acre; \( r \) is price of N fertilizer in $/lb; \( c \) is the cost of energy for pumping water in $/inch/acre; \( w \) is the irrigation water rate in inches/acre; I is the labor cost for monitoring soil water status and other labor activities related to irrigation in $/acre; and \( m \) is irrigation maintenance and repair costs in $/acre.

INPUT & IRRIGATION COST DATA

Table 1. Breakeven corn price ($/bu) to invest in a center-pivot by energy source, cost, and field size.

<table>
<thead>
<tr>
<th>Field Size</th>
<th>Diesel Energy</th>
<th>Electric Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 acres</td>
<td>$6.97</td>
<td>$7.19</td>
</tr>
<tr>
<td>125 acres</td>
<td>$7.27</td>
<td>$7.28</td>
</tr>
<tr>
<td>200 acres</td>
<td>$7.58</td>
<td>$7.38</td>
</tr>
</tbody>
</table>

RESULTS

1. The experimental design was a RCB with four replications and annual N rates of 0, 55, 110, 165, and 220 lb/acre in 2006 and 2007, and 275 lb/acre beginning in 2008.

**KEY CONCLUSIONS**

- Breakeven corn prices for investing in a center-pivot irrigation system ranged from $4.02/bu to $7.94/bu depending on the energy source and field size.
- N rates for the breakeven prices ranged from 178 to 188 lb/acre for irrigated corn and 143 to 161 lb/acre for non-irrigated corn.
- Expected yields for the breakeven prices ranged from 213 to 215 bu/acre for irrigated corn and 149 to 152 bu/acre for non-irrigated corn.
- As field size increased, electrical power became more economically viable relative to diesel.
- Future research is needed on the tradeoff between financial risk and production risk from irrigation investment.
- Implications of historically high corn prices on future water planning for agricultural water in TN needs to be addressed.
- At current corn prices, irrigating corn in TN is profitable; however, current corn prices are much higher than the historic average.

REFERENCES

- Verbree, D. Personal communication. Assistant Professor, Department of Plant Science. West Tennessee Research and Education Center, University of Tennessee, Jackson, TN. 2012.