Within-Field Profitability Assessment: Impact of Weather, Field Management and Soils

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Outline

1. Spatial crop budget and profitability metrics.
2. Central Iowa:
   a) Potholes vs upland areas
   b) Early season rainfall effect
3. Eastern Iowa:
   a) Soil drainage and within-field profitability
   b) Mid season rainfall effect
Commodity Prices and Input Costs

**Average Corn Market Year Price ($/bu) vs. Est. Crop Production Costs in IA ($/bu)**

- **Production Cost Cn/Cn**
- **Production Cost Cn/Sb**
- **Sale Price Corn**

<table>
<thead>
<tr>
<th>Year</th>
<th>Cn/Cn</th>
<th>Cn/Sb</th>
<th>Sale Price Corn</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>$4.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>$4.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>$3.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>$5.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>$6.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>$6.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>$6.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>$3.64</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Avg. Soybean Market Year Price ($/bu) vs. Est. Crop Production Costs in Iowa ($/bu)**

- **Production Cost Soybean**
- **Sale Price Soybean**

<table>
<thead>
<tr>
<th>Year</th>
<th>Soybean Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>$11.00</td>
</tr>
<tr>
<td>2008</td>
<td>$10.26</td>
</tr>
<tr>
<td>2009</td>
<td>$9.55</td>
</tr>
<tr>
<td>2010</td>
<td>$12.08</td>
</tr>
<tr>
<td>2011</td>
<td>$13.08</td>
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<tr>
<td>2012</td>
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<tr>
<td>2013</td>
<td>$13.38</td>
</tr>
<tr>
<td>2014</td>
<td>$10.33</td>
</tr>
</tbody>
</table>

Iowa State University Extension and Outreach, USDA, NASS
Objectives

1. Quantify within-field profitability using crop budget and environmental modeling.

2. Study how soil variability, field management and weather affect within-field profit and return on investment (ROI) over time.
Profit = Revenue minus cost.
Estimated costs in Crop Production in Iowa (Iowa State University)
Temporal Variability in Profitability Indices

Resolution 10 x 10 meters
Data Used in Analyses

**Farmer Data**
- Field Management Data
- Yield Monitor Data

**Commercial Tool**
- Profitability Rasters
- ROI Rasters
- Multi-Year SD Rasters
- Soil Erosion
- Soil Conditioning Index

**Public**
- SSURGO Soils
- NED Elevation
- NED derived Slope & Aspect
- DNR NWI LiDAR derived Pothole Wetlands Raster
- Iowa Environmental Mesonet Rainfall data
- ISU Est. Production Costs
Central Iowa: Des Moines Lobe

Central Iowa: 270 site years, 52 fields, 2007-2014
Within-Field Profit–Central Iowa

Des Moines Lobe
- Soybean
- Corn after Soybean
- Corn after Corn

10 x 10 meter grid cells
Pothole Areas of Central Iowa

Potholes: poorly drained areas that are remnants of the last glaciation.
Central Iowa: Potholes vs Upland Areas

wet spring:
30 cm rainfall
March through May.

Data: 2007-2014
Early-Season Rainfall Decreases Profits

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Graphs showing the relationship between May and June rainfall and field median profit for soybean and corn after soybean and corn crops. The graphs indicate a negative correlation between rainfall and profit, with regression equations and R-squared values provided for each crop.
Central Iowa: Return on Investment

Return on Investment (%)

- Pothole
- Upland


ROI: -40% to 80%
Key Observations: Central Iowa

• Larger economic losses in potholes than in uplands.

• Corn fields were more likely to have larger profit than soybean during normal springs.

• Profitability of soybean was less affected by excessive spring rainfall.
Eastern Iowa: Iowa Surface

Iowa Surface: 111 site years, 28 fields, 2007-2014
Eastern Iowa: Profitability and Soil Drainage

[Graphs showing the relationship between soil drainage and profitability for soybeans and corn]

- Soybean
  - Excessive Drainage
  - Poorly Drained
  - Well Drained

- Corn after Soybean

- Corn after Corn
  - Excessive Drainage
  - Poorly Drained
  - Well Drained

Field Level Population Profit ($ ha$^{-1}$)
Eastern Iowa: Rainfall and Median Field-Level Profit

Soybean

Field Median Profit ($ha⁻¹)

Spring Rainfall (cm)

Corn after Soybean

Field Median Profit ($ha⁻¹)

Spring Rainfall (cm)

Corn after Corn

Field Median Profit ($ha⁻¹)

Spring Rainfall (cm)

Soybean

Field Median Profit ($ha⁻¹)

July Rainfall (cm)

y = -14.4 - 20x

r² = 0.14

Corn after Soybean

Field Median Profit ($ha⁻¹)

July Rainfall (cm)

y = -21.2 - 42x

r² = 0.26

Corn after Corn

Field Median Profit ($ha⁻¹)

July Rainfall (cm)

y = -18.3 - 43x

r² = 0.31
Key Observations: Eastern Iowa

• Excessively drained soils had larger economic losses.

• Fields with higher mid-season rainfall had higher profit.

• Each additional cm of July rainfall increased profit by $43 ha\(^{-1}\).