An Application of Economics & Environmental Planning:
The Impacts of Variable Rate Irrigation (VRI) Technology on Net Farm Income

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RWBJV Informational Seminar
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This map was developed with spatial data from the Playa Lakes Joint Venture Nebraska Playa Decision Support Tools.
Landowner 1

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Landowner 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pivot Acres</td>
<td>252 (100 = VRI)</td>
</tr>
<tr>
<td>Wetland Area</td>
<td>55</td>
</tr>
<tr>
<td>Predominant Soil Types</td>
<td>Scott, Butler, &amp; Fillmore</td>
</tr>
<tr>
<td>Ponding Frequency</td>
<td>0.91</td>
</tr>
<tr>
<td>Crop History</td>
<td>Corn</td>
</tr>
</tbody>
</table>

### Landowner 2

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Landowner 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pivot Acres</td>
<td>105</td>
</tr>
<tr>
<td>Wetland Area</td>
<td>70</td>
</tr>
<tr>
<td>Predominant Soil Types</td>
<td>Scott, Fillmore, &amp; Massie</td>
</tr>
<tr>
<td>Ponding Frequency</td>
<td>0.73</td>
</tr>
<tr>
<td>Crop History</td>
<td>Corn, grassland, pasture</td>
</tr>
</tbody>
</table>

Data Collection

Quantitative Data

Crop Input Costs
1. Revenue & Yield
2. Seed & Fertilizer
3. Irrigation
4. Maintenance
5. Machinery
6. Overhead management
7. Labor
8. Property Taxes or Cash Rent

VRI Sites 2014-2017

Reference Sites 2014-2016

Pre-VRI 2014 & 2015
Post-VRI 2016-2017

Data collection form
Enterprise budgets used to allocate expenses & analyze net income
NASS statistics on market & weather related conditions 2000-2017
Landowner 1

2017
Price Differential: $23.00/ac.
VRI Yield: 172 bu./ac.
Non-VRI Yield: 172 bu./ac.

Landowner 1 Payback Based on 2017 Corn VRI Data
2017
Price Differential: $33.81/ac.
VRI Yield: 248 bu./ac.
Non-VRI Yield: N/A
## Changes in Yield

<table>
<thead>
<tr>
<th>Year</th>
<th>Percent Difference between L1 &amp; L2</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>3.65%</td>
</tr>
<tr>
<td>2015</td>
<td>10.80%</td>
</tr>
<tr>
<td>2016</td>
<td>-20.00%</td>
</tr>
<tr>
<td>2017</td>
<td>44.19%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pre &amp; Post VRI</th>
<th>Percent Change in Yield between L1 &amp; L2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-VRI</td>
<td>7.23%</td>
</tr>
<tr>
<td>Post VRI</td>
<td>12.09%</td>
</tr>
</tbody>
</table>

### Corn Yield Differences Between L1 (Non-VRI Field) & L2 (VRI Field)

- **Pre-VRI**:
  - 2014: 219, 2014: 227
  - 2015: 213
  - 2016: 205, 2016: 164
  - 2017: 172

- **Post VRI**:
  - 2014: 219, 2014: 227
  - 2015: 213
  - 2016: 205, 2016: 164
  - 2017: 172

- **Percent Change**:
  - Pre-VRI: 7.23%
  - Post-VRI: 12.09%
Landowner 2 – 10% Price & Yield Increase

Price Differential: $33.81/ac.
Market Price: $3.10
Yield: 248 bu./ac.

Price Differential: $65.03/ac.
10% Price Increase: $3.41
10% Yield Increase: 272.8 bu./ac.
Landowner 2 Marginal Benefit without Landowner 1 Maintenance Costs in 2017

<table>
<thead>
<tr>
<th>Price Differential</th>
<th>Comparison with Maintenance Costs – No Change in Price &amp; Yield</th>
<th>Comparison without Maintenance Costs – Averaged Price &amp; Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landowner 2 – $33.81/ac.</td>
<td></td>
<td>No Benefit</td>
</tr>
</tbody>
</table>

Landowner 1 Maintenance Costs in 2017 - $25,986
Scenario 1: Natural Gas for VRI Acres instead of Electricity

Marginal Benefit
Price Differential: $23.00/ac.

Marginal Benefit
Price Differential: $32.37/ac.
Scenario 2: Reduced Irrigation Application

**Marginal Benefit**

Price Differential: $23.00/ac.
Original Application Rate: 2.25 inches

**20% Reduction**

Price Differential: $29.00/ac.
20% Reduction Rate: 1.8 inches
# Landowner 1 Grazing Opportunities

<table>
<thead>
<tr>
<th>VRI Crop Acres</th>
<th>Wetland Acres</th>
<th>Grazing Revenue</th>
<th>Per Acre Crop Benefit</th>
<th>Per Acre Net Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>55</td>
<td>$4,230.00</td>
<td>$42.30</td>
<td>$34.00</td>
</tr>
<tr>
<td>80</td>
<td>75</td>
<td>$5,767.50</td>
<td>$72.09</td>
<td>$61.00</td>
</tr>
<tr>
<td>60</td>
<td>95</td>
<td>$7,305.50</td>
<td>$121.76</td>
<td>$108.00</td>
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The pie charts illustrate the distribution of crop and wetland acres for each of the scenarios listed above.
### Alternative Grazing Opportunities

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#### Marginal Benefit
Price Differential: $50.00/ac.

#### Landowner 1 Payback with Grazing Opportunities

![Graph showing payback with cost-share levels and discount rates](image-url)
Takeaways:

1. More time is necessary to fully learn how to use the technology
2. Grazing is critical for profitability of this investment
3. Altering yield, market, and irrigation variables; shows profitability at some levels of cost-share assistance
4. Some variables cannot be controlled (market fluctuations)
5. Results do not include social/conservation benefits of wetland restoration

Further Research:

1. Larger sample size
2. Longer tracking period
3. Consistent & detailed information is imperative for further analysis