Effects of Seed Spacing and Nitrogen Rates on Dry Land Potato Production

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Background

• N is most abundant element after C, H, O in biomass.

• Used in proteins, amino acids, etc.

• Too little N leads to reduced growth, too much N lead to unwanted increase in shoot:root growth.

• Nitrogen needed for early crop growth to develop canopy and for tubers growth
  – 60-65% of total plant N is contained in tubers
ND and MN Potato Acres Planted

\[ y = 137x - 241,297 \quad \text{R}^2 = 0.02 \]

\[ y = -3490x + 7E+06 \quad \text{R}^2 = 0.96 \]

\[ y = -2777x + 6E+06 \quad \text{R}^2 = 0.89 \]
Production of Dryland Potatoes

\[ y = 13.36x - 26,381 \]
\[ R^2 = 0.92 \]

\[ y = 4.87x - 9388 \]
\[ R^2 = 0.48 \]

\[ y = 0.65x - 1112 \]
\[ R^2 = 0.03 \]
## 2012 Cost of Production in SW ID

<table>
<thead>
<tr>
<th>Operating Inputs</th>
<th>2012</th>
<th>% of Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed</td>
<td>$370</td>
<td>13.0</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>$720</td>
<td>25.3</td>
</tr>
<tr>
<td>Pesticides &amp; Chemicals</td>
<td>$627</td>
<td>22.0</td>
</tr>
<tr>
<td>Custom &amp; Consultants</td>
<td>$337</td>
<td>11.8</td>
</tr>
<tr>
<td>Irrigation</td>
<td>$117</td>
<td>4.1</td>
</tr>
<tr>
<td>Machinery</td>
<td>$178</td>
<td>6.3</td>
</tr>
<tr>
<td>Labor</td>
<td>$173</td>
<td>6.1</td>
</tr>
<tr>
<td>Transload</td>
<td>$82</td>
<td>2.9</td>
</tr>
<tr>
<td>Other</td>
<td>$150</td>
<td>5.3</td>
</tr>
<tr>
<td>Operating Interest</td>
<td>$92</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Nitrogen Requirement for Non-Irrigated Potatoes

<table>
<thead>
<tr>
<th>Yield goal (cwt/acre)</th>
<th>Nitrogen required (lbs/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>80</td>
</tr>
<tr>
<td>250</td>
<td>100</td>
</tr>
<tr>
<td>300</td>
<td>120</td>
</tr>
<tr>
<td>350</td>
<td>140</td>
</tr>
<tr>
<td>400</td>
<td>160</td>
</tr>
</tbody>
</table>
Cultural Practices

• Most important and least expensive considerations that affect yield
  – Planting/harvest date
  – Crop rotations
  – Seeding rate
  – Cultivar selection
  – Fertilization
What was Done

• Location: Grand Forks, ND
• RCBD with 3 replications
• Red Norland planted on 4 June 2012
• In-row spacing: 6, 9, and 12 inches
  – 36 inch-wide rows
• N rates: 80, 120, 160, 200 lb N/acre
  – ESN broadcast prior to hilling
What was Done

• Other fertility and pest management practices conducted according NDSU recommendations

• Vined killed by frost on 23 Sept. 2012

• Harvest: 2 center rows of each plot

• ANOVA used to determine difference between treatments ($P = 0.05$)
Sizing of Potatoes

- Potatoes sized with Kerian Speed Sizer
  - C: <1.5 in
  - B: 1.5 to 2.25 in
  - A: 2.25 to 3.5 in
  - Jumbo: >3.5 in
Grand Forks, ND Weather

![Temperature and Rainfall Graph](image)

- **Daily maximum temperature**
- **Daily minimum temperature**
- **Rainfall (in)**

The graph shows the temperature and rainfall data for Grand Forks, ND, from June to October.
N Rate on Yield

- Nitrogen rate only affected total yield

<table>
<thead>
<tr>
<th>Nitrogen rate (lb/acre)</th>
<th>Yield (cwt/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>197 AB</td>
</tr>
<tr>
<td>120</td>
<td>205 A</td>
</tr>
<tr>
<td>160</td>
<td>200 AB</td>
</tr>
<tr>
<td>200</td>
<td>183 B</td>
</tr>
</tbody>
</table>
Seed Spacing

- Seed spacing affected total yield and each size of potato
  - Jumbo size was greatest at 6 and 9 inch spacing.
  - A size was highest at 9 and 12 inch spacing.
  - B and C size were maximized at 12 inch spacing.

Table 2. Effect of seeding rate on tuber yield. Means followed by the same letter are not significantly different within column (P<0.05).

<table>
<thead>
<tr>
<th>Seeding rate (in)</th>
<th>Total yield</th>
<th>Jumbo size</th>
<th>A size</th>
<th>B size</th>
<th>C size</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>172 B</td>
<td>20 AB</td>
<td>112 B</td>
<td>38 B</td>
<td>2 B</td>
</tr>
<tr>
<td>9</td>
<td>202 A</td>
<td>21 A</td>
<td>131 A</td>
<td>47 B</td>
<td>3 B</td>
</tr>
<tr>
<td>12</td>
<td>215 A</td>
<td>13 B</td>
<td>126 AB</td>
<td>72 A</td>
<td>4 A</td>
</tr>
</tbody>
</table>
Conclusions

• Dryland potatoes are affected by precipitation. At higher plant populations more water is needed for plant growth.

• The 12 inch spacing encouraged more tubers growth, causing more small sized potatoes.

• A lower tuber set from higher plant population resulted in larger sized potatoes.
Thoughts on 2012

• Glyphosate in potatoes continues to be a problem
• Low disease pressure
• Elevated populations of many insects
  – Aster leafhoppers
  – Potato psyllids
• Harvest was challenging, but yields were high