Potato Fertilization

Dale J. Tomasiewicz, AAFC-CSIDC

ICDC Agronomy Information Workshop
Outlook  -  April 9, 2013
Fertilization – What does the potato crop need?

Nutrient uptake and removal by crops (lb/ac)

<table>
<thead>
<tr>
<th>Crop</th>
<th>Yield</th>
<th>Uptake</th>
<th>Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>P₂O₅</td>
</tr>
<tr>
<td>Potato</td>
<td>15 ton/ac</td>
<td>171</td>
<td>50</td>
</tr>
<tr>
<td>Canola</td>
<td>60 bu/ac</td>
<td>191</td>
<td>88</td>
</tr>
<tr>
<td>Wheat (CWRS)</td>
<td>75 bu/ac</td>
<td>158</td>
<td>60</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>4.5 ton/ac</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- High potassium need and removal
- Calcium and magnesium need also higher than for wheat/canola
- Low sensitivity to deficiencies of most micronutrients (except high to manganese and moderate to zinc)
Irrigated soils in SK are generally:

**Sufficient to high in:**
- Potassium – K (with exceptions) . . .
- Sulfur – S (possible exceptions)
- Calcium - Ca
- Magnesium - Mg
- Micronutrients - Cu, Fe, Zn, Mn (?), B (by potato standards)

**Deficient in:**
- Nitrogen – N . . .
- Phosphorus – P . . .
Special considerations for the irrigated potato crop

 Seed pieces are large (so provide nutrients)

 Irrigation – maintains good conditions for nutrient uptake
 - important for P, K, and some micros
Potatoes are slow starters – period of maximum demand later & extended.
Special considerations for the irrigated potato crop

Rooting depth less than most other field crops
Special considerations for the irrigated potato crop

😊:NO
😊: Aggressive/frequent tillage
Special considerations for the irrigated potato crop

😊 Sad potatoes are a high-value crop

Figures from Irrigation and Agronomics Saskatchewan 2012. ICDC. *Target* yields were used.
Potassium - K

Possible responses where:
History of high K removal (esp. alfalfa)

<table>
<thead>
<tr>
<th>Crop</th>
<th>Yield</th>
<th>Uptake</th>
<th>Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>P$_2$O$_5$</td>
<td>K$_2$O</td>
</tr>
<tr>
<td>Potato</td>
<td>15 ton/ac</td>
<td>171</td>
<td>50</td>
</tr>
<tr>
<td>Canola</td>
<td>60 bu/ac</td>
<td>191</td>
<td>88</td>
</tr>
<tr>
<td>Wheat (CWRS)</td>
<td>75 bu/ac</td>
<td>158</td>
<td>60</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>4.5 ton/ac</td>
<td>261</td>
<td>62</td>
</tr>
</tbody>
</table>
Potassium - K

Possible responses where:
History of high K removal (alfalfa)
Soil very sandy
Soil eroded or graded
Potassium - K

The soil test for K works!

K recommended to ~300-400 lb/ac soil test K level (0-6”)

Substantial response below ~250 lb/ac K test - application rates >100 lb/ac K$_2$O

Labs often recommend K for potatoes at high soil test levels

K fertilizer (esp. KCl – 0-0-60) at substantial rates often reduces tuber specific gravity (dry matter content)
Phosphorus - P

P deficiency is more *the norm*, but unlikely where:
- History of high P fertilization
- History of manure application

P response less predictable, except at very low or high P test levels

Need high $P_2O_5$ rates at low test levels (e.g. eroded/graded areas)
At least *replacement* $P_2O_5$ rates (~30 lb/ac) recommended to moderately high test levels.

Low rates should be banded if possible.
Nitrogen - N

Typically need 100-150 lb/ac N; except less when:
- following legume (esp. alfalfa)
- soil test high

Need ~8-10 lb of N per ton of tuber yield
(soil test + fertilizer; soil nitrate-N to 24” depth)
Nitrogen - N

Splitting of N preferred
- at hilling
- fertigation?

Effect of Timing of N Fertilizer Application on Marketable Yield (>3 oz)

Spring soil test NO$_3$-N (kg ha$^{-1}$ to 60 cm) = 36, 40, 54, 42 for 2003, 04, 05, 06
Nitrogen - N

N Placement and Source

In-hill banding

Controlled/slow-release N sources may have a fit. (coatings; urease and nitrification inhibitors)
Nitrogen - N

Petiole test can be helpful if unsure of sufficiency.
Nitrogen - N

Petiole test – a current work in progress.

Petiole Nitrate test levels in several N studies

[Diagram showing concentration of nitrate-N (ppm) over sampling date (adjusted for planting date) - Day of the year]

July
Negative effects of excess N:
- delayed development/maturity
- excess vines
- low tuber sg
- environment issues

(soil test!)