Fall 2018 soil nutrient supply rates, what do the trends show?

Edgar Hammermeister, PAg
2019 Soils and Crops Conference
Plant Root Simulator (PRS®) Probes

Anion probe

Cation probe

Patented in Australia, Canada, Europe, New Zealand and the United States.

UNIVERSITY OF SASKATCHEWAN

College of Agriculture and Bioresources

Inventor:
Dr. Jeff Schoenau,
Professor and Ministry of Agriculture Strategic Research Chair

US patent #6,242,261
PRS Probes
Patented technology that adsorbs nutrients like a plant root.
PRS Probes are used worldwide!
For agriculture purposes, the soil sample is wet to field capacity, warmed to room temperature, and probed for 24 hours.

The soil supply rate of nutrients is measured under standardized conditions to limit variability.
**Total Available Water**

- Soil Moisture: 3.5
- Precipitation: 7.1
- Irrigation: 11

**Growing Degree Days**

- 1295

**HO Spring Wheat**

- Max Yield: 78.9
- Yield: 72.6

**Gross Income**

- $/bushel: $6.25
- $/acre: $453.85

**Other Expenses**

- $200.00

**Fertilizer Cost**

- N: $0.50
- P: $0.45
- K: $0.40
- S: $0.35

- Total: $80.25

**Grow More Profit**

- Net $/acre: $173.60
- Production Cost $/bu: $3.86
Different rooting characteristics, different supply rates – Canola.

<table>
<thead>
<tr>
<th>Element</th>
<th>SW 25-08-01 W2</th>
<th>%</th>
<th>ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>20.7</td>
<td></td>
<td>182.9</td>
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<tr>
<td>P₂O₅</td>
<td>10.1</td>
<td></td>
<td>59.1</td>
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<tr>
<td>K₂O</td>
<td>116.6</td>
<td></td>
<td>146.3</td>
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<tr>
<td>S</td>
<td>15.4</td>
<td></td>
<td>36.6</td>
</tr>
<tr>
<td>Ca</td>
<td>708.3</td>
<td></td>
<td>32.9</td>
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<tr>
<td>Mg</td>
<td>110.5</td>
<td></td>
<td>45.7</td>
</tr>
<tr>
<td>Cu</td>
<td>0.07</td>
<td></td>
<td>0.15</td>
</tr>
<tr>
<td>Zn</td>
<td>0.30</td>
<td></td>
<td>0.30</td>
</tr>
<tr>
<td>Mn</td>
<td>0.78</td>
<td></td>
<td>0.37</td>
</tr>
<tr>
<td>Fe</td>
<td>1.08</td>
<td></td>
<td>0.37</td>
</tr>
<tr>
<td>B</td>
<td>0.44</td>
<td></td>
<td>0.29</td>
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Different rooting characteristics, different supply rates – Wheat.

<table>
<thead>
<tr>
<th>Element</th>
<th>N</th>
<th>P$_2$O$_5$</th>
<th>K$_2$O</th>
<th>S</th>
<th>Ca</th>
<th>Mg</th>
<th>Cu</th>
<th>Zn</th>
<th>Mn</th>
<th>Fe</th>
<th>B</th>
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<tbody>
<tr>
<td>Value</td>
<td>17.8</td>
<td>5.8</td>
<td>61.5</td>
<td>13.2</td>
<td>607.8</td>
<td>11.1</td>
<td>0.06</td>
<td>0.26</td>
<td>0.67</td>
<td>0.93</td>
<td>0.38</td>
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<tr>
<td>Units</td>
<td>129.7</td>
<td>42.0</td>
<td>98.8</td>
<td>16.1</td>
<td>94.8</td>
<td>15.4</td>
<td>0.09</td>
<td>0.31</td>
<td>0.37</td>
<td>0.31</td>
<td>0.04</td>
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</table>
Different rooting characteristics, different supply rates - Oats

<table>
<thead>
<tr>
<th>Element</th>
<th>SW 25-08-01 W2</th>
</tr>
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<tbody>
<tr>
<td>N</td>
<td>38.4</td>
</tr>
<tr>
<td>P₂O₅</td>
<td>12.5</td>
</tr>
<tr>
<td>K₂O</td>
<td>132.9</td>
</tr>
<tr>
<td>S</td>
<td>28.5</td>
</tr>
<tr>
<td>Ca</td>
<td>1312.4</td>
</tr>
<tr>
<td>Mg</td>
<td>204.8</td>
</tr>
<tr>
<td>Cu</td>
<td>0.13</td>
</tr>
<tr>
<td>Zn</td>
<td>0.55</td>
</tr>
<tr>
<td>Mn</td>
<td>1.45</td>
</tr>
<tr>
<td>Fe</td>
<td>2.00</td>
</tr>
<tr>
<td>B</td>
<td>0.82</td>
</tr>
</tbody>
</table>

- Nitrogen (N): 38.4
- Phosphorus (P₂O₅): 12.5
- Potassium (K₂O): 132.9
- Sulfur (S): 28.5
- Calcium (Ca): 1312.4
- Magnesium (Mg): 204.8
- Copper (Cu): 0.13
- Zinc (Zn): 0.55
- Manganese (Mn): 1.45
- Iron (Fe): 2.00
- Boron (B): 0.82
Different rooting characteristics, different supply rates – Peas.
Three Year Trend Comparison
Sulphur Supply Rate

41% of 2018 samples insufficient
Three Year Trend Comparison
Potassium Supply Rate

25% of 2018 samples insufficient
Three Year Trend Comparison
Phosphorus Supply Rate

27% of 2018 samples insufficient

P Supply Rate (ug/10 cm²/day)
Three Year Trend Comparison
Nitrogen Supply Rate

87% of 2018 samples insufficient 26%

N Supply Rate (μg/10cm²/day)
April - June
Mostly received over 10 days early June
Percent of Average Precipitation

April 1, 2018 to July 31, 2018

April - July
Percent of Average Precipitation

April 1, 2018 to August 31, 2018

April - August
2018
Common Ground Growing Project
Agronomy Comparison

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<tr>
<td></td>
<td>Plot Yield (Bu/ac)</td>
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</tr>
<tr>
<td>1</td>
<td>45.2</td>
<td>49.0</td>
<td>45.6</td>
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<tr>
<td>2</td>
<td>43.3</td>
<td>48.7</td>
<td>40.2</td>
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<tr>
<td>3</td>
<td>46.4</td>
<td>42.2</td>
<td>45.7</td>
</tr>
<tr>
<td>4</td>
<td>46.4</td>
<td>42.0</td>
<td>42.6</td>
</tr>
<tr>
<td>5</td>
<td>47.7</td>
<td>41.9</td>
<td>45.0</td>
</tr>
<tr>
<td>6</td>
<td>51.8</td>
<td>43.5</td>
<td>46.8</td>
</tr>
<tr>
<td>Ave</td>
<td><strong>46.8</strong></td>
<td><strong>44.6</strong></td>
<td><strong>44.3</strong></td>
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</tbody>
</table>

Seeding Rate

<table>
<thead>
<tr>
<th>Seeding Rate</th>
<th>Farm Blend, 120-35-10-0</th>
<th>WAPA Blend - Low N, 100-35-40-0-2</th>
<th>WAPA Blend - High N, 120-35-40-0-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 lb/ac</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>160 lb/ac</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>160/ac</td>
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</tbody>
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What is driving these “good” yields?

- Varieties improved
- Crop care improved
  - Earlier seeding
  - Improved weed control
  - Improved disease control
- Other factors?
Global Greenhouse Gas Trends

Carbon Dioxide \(\text{CO}_2\)

Methane \(\text{CH}_4\)

Nitrous Oxide \(\text{N}_2\text{O}\)

Source: Emission Database for Global Atmospheric Research Ver. 3.2, Fast Track 2000 project
Recent Monthly Average Mauna Loa CO₂

January 2019: 410.83 ppm
January 2018: 407.96 ppm

Source:
https://www.esrl.noaa.gov/gmd/ccgg/trends/

https://upload.wikimedia.org/wikipedia/commons/5/5f/AIRS_Carbon_Dioxide_Vertical.png
The Great Compromise

- Stomatal pore
- CO₂
- Light
- Glucose (C₆H₁₂O₆)
- H₂O
1989, 350 ppm

2019, 410 ppm
What is the Potential Impact on Wheat Yields?
Can soil testing be better integrated into adaptive management decision support systems?

Site factors:
- Crop
- Soil
- Grower
- Nutrient inputs
- Water quality
- Climate
- Weather
- Technology
- Economics

Decision Support:
- Stakeholder input
- Based on scientific principles

Recommendation of right source, rate, time, place

Output -> Decision

Action

Outcome

Feedback loop:
- Productivity, profitability, durability, environmental impact (nutrient use efficiency)

“Backcasting”

“The Plan...”
“The Reality...”
In summary

• Soil nutrient supply rates have settled down after 2016 (very wet), 2017 (very dry).
• 2018 crops were pretty good despite dry growing season conditions.
• Atmosphere is changing; hypothesis being tested around concept of CO$_2$ Fertilization.
• Can quickly update fertilizer agronomy to changing environment using “backcasting” process in simulation models.
Discussion?
Contacting Western Ag:

www.GrowMoreProfit.com

1-877-978-1777
Thank you

westernag.ca
Temperature responses of photosynthesis in $C_3$, $C_4$, CAM plants

Arizona Honeysweet (C4) vs Chaparral (C3)
What is the Potential Impact on Wheat Yields?

Some factors:

- Drought
- Heat stress
- Flooding
- Frost
- Hail
- Weeds, disease, insects
- Nutrition
- Wheat yield components, quality