Do you know how to calculate nitrogen use efficiency?

A. Yes
B. No
Do you calculate and utilize nitrogen use efficiency to make N recommendations?

A. Yes
B. No

79%
21%
Do you request protein on your soft white wheat?

A. Yes
B. No

43% Yes
58% No
Soft white wheat maximum yield is achieved at _____% grain protein

A. 8  
B. 9  
C. 10  
D. 11  
E. 12
I am very comfortable using soil samples to make nitrogen recommendations.

A. Strongly Agree
B. Agree
C. Somewhat Agree
D. Somewhat Disagree
E. Disagree
F. Strongly Disagree

23% Strongly Agree
28% Agree
28% Somewhat Agree
13% Somewhat Disagree
10% Disagree
0% Strongly Disagree

http://www.lincoln-adams.wsu.edu/agriculture/index.html
Background

- Dryland Winter Wheat EB 1987E
  - Rich Koenig

Nutrient management is essential to the economical production of high-yielding, high-quality crops, and to preserving soil, air, and water quality. As the term implies, nutrient management includes activities such as sampling to monitor soil nutrient levels and adjust application rates; altering practices such as the placement, application timing, and source of nutrients to maximize plant availability and uptake; and conducting a placement assessment of yield, grain protein levels, and nutrient use efficiency.

Eastern Washington is unique in that diverse environment, soil, and topography result in variations in crop yield across the region as well as across farms and individual fields within farms. Due to the inherent variability associated with eastern Washington dryland crop production, a one-size-fits-all recommendation for the management of any one nutrient is of little value. Recommendations must be based on individual grower practices, achievable yields, and current soil test data. This document presents guidelines for managing major nutrients in eastern Washington dryland winter wheat and emphasizes how producers can tailor recommendations to their own production systems. It also identifies opportunities where information such as crop yield and protein and soil test nutrient levels can help refine and improve nutrient management practices.

Nutrient uptake and removal by dryland wheat

High-yielding wheat absorbs large quantities of nutrients from soil. Box A shows average values for nutrient uptake and removal in the grain and straw of wheat. This table can be used as a guide to forecast nutrient removal from the field with the grain and straw portions of the crop. Note that the majority of nitrogen and sulfur in straw is lost if a field is burned; other nutrients generally remain in the ash.

Nutrient (N) recommendations

Nitrogen recommendations are based on the potential yield for a site, the amount of N required to achieve yield and protein goals for a desired wheat class, and an inventory of soil N contributions. A worksheet is included in this guide to aid in developing an N recommendation and a record-keeping tool. The following paragraphs refer to specific sections of the worksheet. A separate Microsoft Excel® spreadsheet is also available to make these calculations electronically.

http://www.lincoln-adams.wsu.edu/agriculture/index.html
Why is Nitrogen Use Efficiency Important

**Fig. 7.** The response of irrigated wheat yield and protein to increasing fertilizer N in a central Oregon study.
Why is Nitrogen Use Efficiency Important?

**WSU Wilke Farm Spring Fertilizer Price**

- **y = 0.0249x + 0.3851**
- **R² = 0.2162**

Fertilizer Price ($/lb N)

Year:
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014

http://www.lincoln-adams.wsu.edu/agriculture/index.html
Why is Nitrogen Use Efficiency Important?

- Nitrogen fertilizer management has the single biggest impact on your yield and overall profitability!
Calculating NUE

- Crop: DNS
- Soil Test N: 91 lb N/ac
- Applied N: 77 lb N/ac
- Total N: lb N/ac
- Yield: 20.9 bu/ac
- Protein: 16.4%
- Factor: 0.15 for SW 0.13 for DNS, HRW, HW
Calculating NUE

• Nitrogen Uptake

• Yield x Protein x Factor

20.9 x 16.4 x 0.13 = __________
Calculating NUE

- Nitrogen Remaining

- Total N Available – Nitrogen Uptake

\[ 168 - 44.6 = \phantom{0} \]
Calculating NUE

- Lb N/bu

- Total N Available / Yield

$$\frac{168}{20.9} = \underline{_______}$$
Calculating NUE

• Nitrogen Use Efficiency (NUE)

• Nitrogen Uptake / Total N Available

\[
\frac{44.6}{168} = _________\% 
\]
Calculating NUE

• Summary
  – Nitrogen Uptake: 45 lb N/ac
  – Nitrogen Remaining: 123 lb N/ac
  – NUE: 0.27%
WSU COOPERATIVE EXT.
AARON ESSER
210 W BROADWAY
RITZVILLE, WA  99169
Laboratory #:  514-27387

Date Received:  10/6/2014
Grower:  WILKE
Sampled By:  NORTH
Field:  NORTH
Customer Account #:  
Customer Sample ID:

Soil Test Results

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Method</th>
<th>mg/kg</th>
<th>1:1</th>
<th>1:1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphorus</td>
<td>Olsen</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td>Olsen</td>
<td>346</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| pH              | 1.1    | 5.8   |
| E.C.            | 1.1 m.mhos/cm | 0.15 |
| Est Sat Paste E.C. | m.mhos/cm | 0.39 |
| Effervescence   |        |       |

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>mg/kg</th>
<th>Lbs/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonium - N</td>
<td>9.9</td>
<td>32</td>
</tr>
</tbody>
</table>

Organic Matter W.B. %  2.0
ENR:  40

<table>
<thead>
<tr>
<th>Depth (inches)</th>
<th>Nitrate-N</th>
<th>Sulfate-S</th>
<th>Moisture</th>
<th>Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 12</td>
<td>10.0</td>
<td>32</td>
<td>8</td>
<td>0.5</td>
</tr>
<tr>
<td>13 - 24</td>
<td>2.1</td>
<td>7</td>
<td>5</td>
<td>0.7</td>
</tr>
<tr>
<td>25 - 36</td>
<td>1.5</td>
<td>5</td>
<td>8</td>
<td>1.0</td>
</tr>
<tr>
<td>37 - 48</td>
<td>6.3</td>
<td>20</td>
<td></td>
<td>1.2</td>
</tr>
<tr>
<td>Totals</td>
<td>19.9</td>
<td>64</td>
<td>21</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Sum of Tested N:  136 Lbs/acre N

http://www.lincoln-adams.wsu.edu/agriculture/index.html
Nitrogen Management Tools

http://smallgrains.wsu.edu

http://dev-wheattools.wsu.edu/Applications/Fertilizer%20Use%20Calculator/PostHarvestEfficiency

http://www.lincoln-adams.wsu.edu/agriculture/index.html
Why is nitrogen use efficiency important?

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield (bu/ac)</th>
<th>Protein (%)</th>
<th>NUE (%)</th>
<th>Lb N/bu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xerpha T+T</td>
<td>54.7</td>
<td>7.4</td>
<td>39.9%</td>
<td>2.8</td>
</tr>
<tr>
<td>Otto T+T</td>
<td>61.8</td>
<td>7.5</td>
<td>47.6%</td>
<td>2.5</td>
</tr>
<tr>
<td>Xerpha</td>
<td>46.8</td>
<td>7.6</td>
<td>34.9%</td>
<td>3.2</td>
</tr>
<tr>
<td>Otto</td>
<td>59.8</td>
<td>7.7</td>
<td>45.5%</td>
<td>2.4</td>
</tr>
<tr>
<td>Mean</td>
<td>55.8</td>
<td>7.6</td>
<td>42.0%</td>
<td>2.7</td>
</tr>
</tbody>
</table>
# Nutrient Balance

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>P</th>
<th>K</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applied (credit)</strong></td>
<td>94</td>
<td>8</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>64</td>
<td>35</td>
<td>87</td>
<td>17</td>
</tr>
<tr>
<td><strong>Grain (debit)</strong></td>
<td>45</td>
<td>28</td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td><strong>Straw</strong></td>
<td>19</td>
<td>7</td>
<td>67</td>
<td>10</td>
</tr>
<tr>
<td><strong>Balance</strong></td>
<td>+49</td>
<td>-20</td>
<td>-20</td>
<td>+8</td>
</tr>
</tbody>
</table>
Why is Nitrogen Use Efficiency Important?

- AT WSU Wilke Farm
  - Total expenses in 2013: $52,528 (100%)
  - Fertilizer expenses in 2013: $17,158 (33%)
  - Soil sampling expense in 2013: $641 (1.2%)
Why is Nitrogen Utilization Efficiency Important?

• If you don’t measure it, how can you change it!
  – Great baseline
    • Is nitrogen fertilization your most limiting factor?
  – Is precision nitrogen application feasible?
  – Is fall fertilization feasible