Winter Wheat
Each region has diversity in planting, harvesting, Soils, water availability, winter weather and fertilization.
Times change as do our farming practices

Air Seeding
No-Till with Yielder Drill
We have come a long way in applying fertilizer
We can broadcast, use streamers or fly it on
And of course drilling seed and liquid fertilizer together
Lots of research has been done on placement and application methods by AgroLiquid.
Research has proven seed and fertilizer placement makes a big difference

AgroLiquid is a safer and can be placed closer to the seed

High NG-N and Pro-Germinator

High salts and higher application levels of conventional fertilizer can restrict root growth

32% UAN and 10-34-0
Where should we focus our efforts on Winter Wheat (Yield per county)
Percent of total national production

United States: Winter Wheat

Yellow numbers indicate the percent each state contributed to the total national production. States not numbered contributed less than 1% to the national total.

- Major areas combined account for 75% of the total national production.
- Major and minor areas combined account for 99% of the total national production.
- Major and minor areas and state production percentages are based upon averaged NASS county-level and state production data from 2000-2004.

Note: The agricultural data used to create the map and crop calendar were obtained from the National Agricultural Statistics Service at: http://www.usda.gov/nass/.

Crop calendar dates are based upon MARS crop progress data from 2000-2004. The red, yellow, and green development stages illustrated in the crop calendar represent the average time period when national progress advanced from 10 to 50 percent.
How can AgroLiquid perform better than the rest?

• The Right Balance
• The Right Timing
• The Right Placement
• The Right Amount
• The Right Product (and science)
The Right Balance

- **NUTRIENT BALANCE** is a major factor in a proper fertility program.

- A crop’s yield potential is determined by the “most limiting nutrient.”
The Right Time

![Graph showing nutrient uptake over time](image)

- Potash (POTASH)
- Nitrogen (NITROGEN)
- Phosphate (PHOSPHATE)

Key:
- **PEAK UPTAKE**
- **Flowering**
- **Grain + Straw Offtake**
- **Grain Only Offtake**

**Axes:**
- x-axis: Month (Mar to Aug)
- y-axis: kg/ha K₂O

**Legend:**
- Blue line: Potash
- Pink line: Nitrogen
- Green line: Phosphate
The Right Placement

Effect Of Fertilizer Application Method on Soil N & P

- **Broadcast & Disked**
  - 11 ppm N
  - 19 ppm P

- **Surface Banded**
  - 750 ppm N
  - 128 ppm P

- **Root Zone Banding**
  - 6,200 ppm N
  - 1,200 ppm P

Application Rate: 100 lbs. N & 40 lbs. P$_2$O$_5$ per acre
The Right Amount

- Soil and Tissue Testing
- 30+ years of research across multiple cropping conditions and geographies
- AgroLiquid provides a talented staff of agronomists, researchers, salesmen, and retailers to help bring together all components of your fertility program!
The Right Products: What to Look For

• Consistent manufacturing
• Quality raw materials
• Clean, easy to use, and less corrosive
• Low potential for plant injury
• Research proven technology

• With many products hitting the market with these qualities, what separates AgroLiquid?
Flavonol Polymer Technology
## Nutrient Uptake

### Box A

**Average Nutrient Content in Dryland Wheat: Total Uptake and Removal in Grain and Straw.**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Total Uptake</th>
<th>Removal in grain</th>
<th>Removal in straw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen (N)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.0% protein (soft white)</td>
<td>1.35</td>
<td>0.95</td>
<td>.40²</td>
</tr>
<tr>
<td>11.5% protein (hard red)</td>
<td>1.50</td>
<td>1.20</td>
<td>0.30</td>
</tr>
<tr>
<td>12.5% protein (hard white)</td>
<td>1.65</td>
<td>1.32</td>
<td>0.33</td>
</tr>
<tr>
<td>Phosphorus (P₂O₅)³</td>
<td>0.62</td>
<td>0.5</td>
<td>0.12</td>
</tr>
<tr>
<td>Potassium (K₂O)⁴</td>
<td>1.55</td>
<td>0.35</td>
<td>1.2</td>
</tr>
<tr>
<td>Sulfur (S)</td>
<td>0.30</td>
<td>0.13</td>
<td>0.17</td>
</tr>
<tr>
<td>Chloride (Cl)</td>
<td>0.20</td>
<td>0.0</td>
<td>0.20</td>
</tr>
</tbody>
</table>

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2. Based on a N harvest index of 0.7 for soft white and 0.8 for hard red and hard white.
3. To convert to lbs of elemental P multiply values by 0.44.
4. To convert to lbs of elemental K multiply values by 0.83.
How Can AgroLiquid Help

- Reading the soil samples and tissue samples
- Making educated recommendations to help Balance the soil, improve base saturations
- Improving soil health with Bio-actives.
- Supplying efficient research proven nutrients

Right Nutrient, Right Place, Right Time, Right Amount.
What Nitrogen products do we have that fit?

N-Suite™

Response

eNhance

High N

http://www.agroliquid.com/products/n-suite/
The PrimAgro line contains our proven plant nutrient products plus beneficial bacteria and fungi for soil life.
# Phosphorus Opportunity

## Table 1

<table>
<thead>
<tr>
<th>Soil Test P (ppm) 0 to 12-inch depth</th>
<th>Application rate lb P₂O₅/acre¹</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acetate method</strong></td>
<td><strong>Bicarbonate (Olsen) method</strong></td>
</tr>
<tr>
<td>0 to 2</td>
<td>0 to 4</td>
</tr>
<tr>
<td>2 to 4</td>
<td>4 to 8</td>
</tr>
<tr>
<td>4 to 6</td>
<td>8 to 12</td>
</tr>
<tr>
<td>6 to 8</td>
<td>12 to 16</td>
</tr>
<tr>
<td>&gt; 8</td>
<td>&gt; 16</td>
</tr>
</tbody>
</table>

¹ These recommendations assume fertilizer is banded below the soil surface. For broadcast or broadcast-incorporated applications multiply Table 1 rates by 2.

² Higher rates of P may be applied to build soil test levels for subsequent crops in the rotation. If desired, apply up to 1/2 crop removal rates in the categories indicated. Use the yield potential established earlier and estimates of P removal from Box A. Removal rates must be based on the grain only, unless straw is also removed from the field.
Phosphorus and other products

Pro-Germinator®
Micro 500™
Micro 600
Zinc

http://www.agroliquid.com/products/
<table>
<thead>
<tr>
<th>Product</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>High NRG-N</td>
<td>2 gal</td>
</tr>
<tr>
<td>RD-13</td>
<td>2.5 gal</td>
</tr>
<tr>
<td>eNhance</td>
<td>0.375 gal</td>
</tr>
<tr>
<td>Zinc</td>
<td>1 pt</td>
</tr>
<tr>
<td>PM-13</td>
<td>1 qt</td>
</tr>
<tr>
<td>Boron</td>
<td>1 qt</td>
</tr>
</tbody>
</table>

- **High NRG-N**: 2 gal
- **RD-13**: 2.5 gal
- **eNhance**: 0.375 gal
- **Zinc**: 1 pt
- **PM-13**: 1 qt
- **Boron**: 1 qt

**Nutrient Composition**: 2.6-15.8-15.8-0.6Zn | 16 gal*

**Yield Comparison**:
- 120 Bu/A
- 115 Bu/A

*Date: 6/09/16*
2016-17 Winter Wheat Fertilizer Test
New Plan: Apply all of AgroLiquid in fall with drill

<table>
<thead>
<tr>
<th>Product</th>
<th>Quantity</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>High NRG-N</td>
<td>25 gal</td>
<td>32%</td>
</tr>
<tr>
<td>Pro-Germinator</td>
<td>3 gal</td>
<td>10-34-0</td>
</tr>
<tr>
<td>S-Calate</td>
<td>2 gal</td>
<td>ATS</td>
</tr>
<tr>
<td>Micro 500</td>
<td>0.25 gal</td>
<td>32% (TD):</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>11 gal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.5 gal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 gal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.5 gal</td>
</tr>
</tbody>
</table>

Wetter fall and winter than normal. Grower reported that AgroLiquid side was yellow all spring, until shortly before our visit.
Nitrogen Fertilizer Comparisons in Spring Wheat
Fehringer Agriculture Consulting, Billings, MI - 2016

Average of 3 Replications

% grain protein

Yield Bu/A

16 gal High NRG-N 14.5 49.6
16 gal High NRG-N + 1 gal accesS 13.6 57.6
16 gal High NRG-N + 2 gal accesS 14.3 57
14 gal High NRG-N + 2 gal NC-16 13.6 62
20 gal High NRG-N 13.8 60.9
156 lb Urea + 70 lb MAP 14.5 57.1

N fluids applied pre-plant with streamer nozzles. Also had 3.5 gal/A Pro-Germinator + 1 qt/A Micro 500 applied with drill. The dry fertilizer was broadcast pre-plant.
Nitrogen Fertilizer Source and Rate Comparison in Winter Wheat

North Central Research Station - 2017

<table>
<thead>
<tr>
<th>Treatment</th>
<th>% Protein</th>
<th>Yield (bu/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 gal High NRG-N</td>
<td>9.7</td>
<td>89.5</td>
</tr>
<tr>
<td>24 gal PRIMAGRO N</td>
<td>9.2</td>
<td>93.2</td>
</tr>
<tr>
<td>30 gal PRIMAGRO N</td>
<td>9.7</td>
<td>92.2</td>
</tr>
<tr>
<td>32 gal 28% + eNhance</td>
<td>9.5</td>
<td>90.8</td>
</tr>
<tr>
<td>40 gal 28%</td>
<td>10.1</td>
<td>94.5</td>
</tr>
<tr>
<td>260 lbs Urea</td>
<td>9.9</td>
<td>94.5</td>
</tr>
</tbody>
</table>

All treatments included: 4 gal Pro-Germ. + 2 gal Kalibrate + 2 qt Miro 500 (drill)
Nitrogen Source and Rate Comparison on Winter Wheat
North Central Research Station - 2017

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield - bu/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 gal High NRG-N</td>
<td>90.1</td>
</tr>
<tr>
<td>32 gal 28% + eNhance</td>
<td>92.9</td>
</tr>
<tr>
<td>30 gal PRIMAGRO N</td>
<td>91.6</td>
</tr>
<tr>
<td>40 gal 28% UAN</td>
<td>94.6</td>
</tr>
<tr>
<td>360 lbs Urea</td>
<td>95.7</td>
</tr>
</tbody>
</table>

Average of 4 Replications
Top bar: 17-508
Bottom bar: 17-718

All treatments included: 4 gal Pro-Germ. + 2 gal Kalibrate + 2 qt Micro 500 (drill)
Winter Wheat Fertilizer Method of Application Comparison
North Central Research Station - 2017

Average of 4 Replications

- **Nitrogen Only**: 87.6
- **Drill**: 97.4
- **PRE Emergence**: 94.4
- **Fall 2" Growth**: 93.5
- **Feekes 4**: 93.9

All treatments included: 4 gal Pro-Germ. + 2 qt Micro 500; 30 gal PrimAgro N (Feekes 4)
Fall Fertilizer Program Additives on Winter Wheat  
*North Central Research Station - 2017*

- **Nitrogen Only**: 87.6
- **4 gal Pro-Germ.**: 93.5
- **+ 2 gal Sure-K**: 97.3
- **+ 10 gal PrimAgro N***: 90.5

Yield - bu/A

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All treatments topdressed with 30 gal PRIMAGRO N (Feekes 4)  
*Topdress rate reduced to 20 gal*
Late Foliar Applications on Winter Wheat

North Central Research Station - 2015

Yield - Bu/A

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Foliar</td>
<td>89.8</td>
</tr>
<tr>
<td>1 qt Mn + 1 qt Fe</td>
<td>93.7</td>
</tr>
<tr>
<td>1 gal NResponse</td>
<td>95.2</td>
</tr>
</tbody>
</table>

Average of 4 Replications

CEC: 10.3  pH: 7  OM: 2.1%
All treatments received Pro-Germ. + Sure-K + Micro 500 (Drill) 28 gal High NRG-N (TD)
Foliar applications made at flowering
Phosphorus Source and Rate Comparison on Winter Wheat
North Central Research Station - 2016

Nitrogen only: 100.1
6 gal Pro-Germinator: 112.5
6 gal PRIMAGRO P*: 112.5
10 gal 6-24-6: 108.9
10 gal 10-34-0: 108.0

Average of 3 Replications

All treatments included: Topdressed with 30 gal High NRG-N.
*without biological components
Foliar N products with Fungicide

Brian Waugh, SAM
Location – Oakley Ks
Cooperator – Terry Hockersmith
Testing Facts

• Sprayed with 4-Wheeler sprayer
  • Not the best application equipment
  • Too large of droplet size compared to an airplane
  • Sprayed at 20 psi

• Fungicide – Quilt @ 14 oz / acre

• Sprayed 4/21/2010 , 4:00 pm, 67 degrees

• Tried to replicate using speed and pressure
  • Therefore volume might have exceeded desired rates
NResponse – 2 gpa

Slight burn, more from poor coverage
XRN - 2 gpa

Slight burn, more from poor coverage
XRN – 2 gpa

Slight tip burn
ferti-Rain – 2 gpa

No Burn at all from ferti-Rain

[Dividing Line]
NResponse – 3 gpa

Slightly more burn at 3 gpa, showed more than both ferti-Rain and Competitive XRN.
NResponse – 3 gpa

Slightly more burn at 3 gpa, showed more than both ferti-Rain and Competitive XRN
Slightly more burn at 3 gpa, showed more than ferti-Rain but slightly less than NResponse
ferti-Rain – 3 gpa

No Burn at all from ferti-Rain

[Dividing Line]
NResponse – 5 gpa

Showed a lot of tissue damage, when applying 5 gpa
XRN – 5 gpa

Showed more tissue damage at 5 gpa, but less than the NResponse on the left of the arrow.
ferti-Rain – 5 gpa

Showed slightly more tissue damage at 5 gpa, but less than the NResponse or XRN
Conclusion

• ferti-Rain had the least amount of tissue damage. Had to go to 5 gpa rate with strait product before any damage was noted.
  • Questioned mix ability with the fungicide as strait product

• NResponse showed the same tissue damage as XRN at the 2 gpa rate, but slightly more damage than XRN at the 3 and 5 gpa rate.

• I believe at the lower rate (2gpa) very little damage would be expected, recommendations would be to add at least 1 gpa water for application.