Evaluation of Late Season Application of Foliar N’s Impact on Grain Yield and Milling Qualities of HRWW

Brian Arnall: Oklahoma State University
Brad Seaborn: ARS, Manhattan Kansas
Funding: Fluid Fertilizer Foundation
Background

  - UAN applied at Pre and Post Anthesis significantly increased protein.
    - Rates of 10, 20, 30, 40
    - Best was Post at 30

- Thomason et al
  - Application of 30 to 40 lb N/A between GS 45 and 54 to winter bread wheat cultivars grown in humid, high rainfall areas likely will result in consistent increases in grain protein concentration.

- Recent work with Low Salt N at flag leaf showed inconsistent results. www.npk.okstate.edu

- Plains Grains Inc. Expressed interest in more in-depth work due to low protein values of 2010 Harvest.
Objectives

• Evaluate the use of UAN and specialty product for foliar N applied at flag leaf and post-flowering to improve Great Plains hard red winter wheat grain yield, protein, and milling and baking characteristics.
Materials & Methods

- Lake Carl Blackwell (LCB)
  - (Port Silt Loam – fine-silty, mixed, superactive, thermic Cumulic Haplustoll)
- Lahoma
  - (Grant Silt Loam – fine-silty, mixed, superactive, thermic Udic Agriustoll)
- 40 lbs N ac\(^{-1}\) preplant
- 40 lbs N ac\(^{-1}\) topdress at hollow stem
  - UAN applied with streamer nozzles for both.
Materials and Methods

- Foliar applications—flag leaf & post-anthesis (PA)
- Foliar Sources
  - UAN (28-0-0)
  - CoRoN derived from urea, methylene diurea and methylene ureas (25-0-0)
- CO₂ backpack sprayer with offset boom
- 10 gallon ac⁻¹ flow; Water added as carrier
# Treatments

<table>
<thead>
<tr>
<th>Rate (lb N ac)</th>
<th>Source</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Check</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Recommended Standard Fertility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>UAN</td>
<td>Flag Leaf</td>
</tr>
<tr>
<td>12</td>
<td>UAN</td>
<td>Flag Leaf</td>
</tr>
<tr>
<td>24</td>
<td>UAN</td>
<td>Flag Leaf</td>
</tr>
<tr>
<td>6</td>
<td>CoRoN</td>
<td>Flag Leaf</td>
</tr>
<tr>
<td>12</td>
<td>CoRoN</td>
<td>Flag Leaf</td>
</tr>
<tr>
<td>24</td>
<td>CoRoN</td>
<td>Flag Leaf</td>
</tr>
<tr>
<td>6</td>
<td>UAN</td>
<td>Post Anthesis</td>
</tr>
<tr>
<td>12</td>
<td>UAN</td>
<td>Post Anthesis</td>
</tr>
<tr>
<td>24</td>
<td>UAN</td>
<td>Post Anthesis</td>
</tr>
<tr>
<td>6</td>
<td>CoRoN</td>
<td>Post Anthesis</td>
</tr>
<tr>
<td>12</td>
<td>CoRoN</td>
<td>Post Anthesis</td>
</tr>
<tr>
<td>24</td>
<td>CoRoN</td>
<td>Post Anthesis</td>
</tr>
</tbody>
</table>
# Summary Table, Lahoma

<table>
<thead>
<tr>
<th>Variable</th>
<th>Rate</th>
<th>Source</th>
<th>Time</th>
<th>Rate*Source</th>
<th>Rate*Time</th>
<th>Source*Time</th>
<th>Rate<em>Source</em>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain Yield</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Protein</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>*</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Mix Tolerance</td>
<td>NS</td>
<td>***</td>
<td>NS</td>
<td>NS</td>
<td>***</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Loaf Volume</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

*, **, *** - significant at the 0.1, 0.05, 0.01% level, respectively
2011 Lahoma Results

- No significance in grain yield, protein, and loaf volume
- 12 lb N post-anthesis – highest protein
- UAN treatments – significantly higher mixing tolerance
## Summary Table, LCB

<table>
<thead>
<tr>
<th>Variable</th>
<th>Rate</th>
<th>Source</th>
<th>Time</th>
<th>Rate*Source</th>
<th>Rate*Time</th>
<th>Source*Time</th>
<th>Rate<em>Source</em>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain Yield</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Protein</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Mix Tolerance</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Loaf Volume</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>
2011 LCB Results

- No main effects or interactions significant

- LCB – 3% protein increase over check
  - 1% increase over standard fertility with 24 lbs UAN post-anthesis

- All mixing tolerance below quality target

- All foliar treatments larger loaf volume than standard fertility
  - Late application increased volume by 55cc
2011 Conclusions

- Both Locations – no trend in yield developed
  - Environment

- Foliar N – potential increase in Protein and loaf volume even at lower N levels.
Lahoma

- Proc GLM
  - Pr>F

<table>
<thead>
<tr>
<th>Variable</th>
<th>TRT</th>
<th>Rate</th>
<th>Source</th>
<th>Time</th>
<th>Rate* Source</th>
<th>Rate* Time</th>
<th>Source* Time</th>
<th>Rate* Source* Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Test Wt</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>.06</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Protein</td>
<td>.05</td>
<td>NS</td>
<td>NS</td>
<td>.03</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Flour Yld</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>.02</td>
<td>NS</td>
<td>.005</td>
<td>NS</td>
<td>.02</td>
</tr>
<tr>
<td>Mix_Time</td>
<td>.007</td>
<td>NS</td>
<td>.01</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Mix_Tol</td>
<td>NS</td>
<td>NS</td>
<td>.04</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

- Protein and Flour Yield
  - P Anthesis 13.02 %  72.9%
  - Flag Leaf 12.25%  72.2%
Lahoma Yield and Protein

- 12 CoRoN post

Protein Sig greater than standard.
Lahoma

- Flour Yield Rate x Time
- Post at 12 lbs/ac
Lahoma

- Mix Time (min)
Lahoma

- Mix Tolerance (Score 0-6)
**LCB**

- **Proc GLM**
  - Pr>F

<table>
<thead>
<tr>
<th>Variable</th>
<th>TRT</th>
<th>Rate</th>
<th>Source</th>
<th>Time</th>
<th>Rate* Source</th>
<th>Rate* Time</th>
<th>Source* Time</th>
<th>Rate* Source* Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield</td>
<td>&lt;.0001</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>.009</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Test Wt</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Protein</td>
<td>.008</td>
<td>NS</td>
<td>.03</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Flour Yld</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Mix_Time</td>
<td>NS</td>
<td>NS</td>
<td>.03</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Mix_Tol</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

- **Protein**
  - UAN 11.58%
  - CoRoN 11.18%
LCB Yield and Protein

- 12 UAN Flag, 24 UAN Flag, 24 UAN Post Protein Sig greater than standard.
LCB

- Flour Yield
• Mix Time 12 lb N as UAN at Flag Sig > 6,14,7,13,3,2,1
2nd year Summary

- No impact on yield with either application.
  - Standard fertility is reaching Max yield.
- Test Weight was not impacted
- Protein increased with late N, more consistently with PA apps
- Flour Yield increased at Lahoma with PA apps
- No consistent patterns.
2012-13

• Same Locations
• Coming out of two years of extreme drought a great deal of N was mineralized in the Spring of 2013
• Samples were destroyed in shipping to Manhattan
• Yield and Test weight only measured parameters.
• Lahoma No significant increase in yield above check.
• LCB Only significant difference in yield was check.
• Test weight impacted at both locations by rate.
Lahoma

- Test Weight: 53-57.6
- Yield Bu ac\(^{-1}\): 54.3-73

Foliar Average:
- Test Weight: 55.3
- Yield Bu ac\(^{-1}\): 63.3
Lahoma

- Test Weight
  - N Rate 6 Sig > 24
  - CoRoN (56) > UAN (54.6)
LCB

- Test Weight (53.1-55.4) Foliar average: 54.2
- Yield (47.7-56.9) Foliar average: 53.7
LCB

- Test weight
  - N: 24 lb Sig > 6
  - CoRoN (53.9) = UAN (54.4)
2012-2013 Summary

- Lahoma
  - Test Weight: Sig 12 > 3, 8, 13, 4, 5, 11
  - Yield: NS

- LCB
  - Test Weight: Sig 8 > 4, 6, 2, 1, 9, 12
  - Yield: Check Sig lower than all other trts

- Trt12: 24 CoRoN at Post Anthesis
- Trt 8: 24 CoRoN at Flag Leaf
Conclusions

• Yield was never impacted by foliar application above Standard Fertility
• All other factors extremely variable and not consistent.
• Oklahoma’s environment post flag leaf may be too variable to say conclusively Foliar Application will improve ............

• Will re-establish the trial in 2014 in hopes of 3rd year of quality data.
Thank you!!!

Brian Arnall
373 Ag Hall
405-744-1722
b.arnall@okstate.edu
Presentation available @
www.npk.okstate.edu
Twitter: @OSU_NPK
Facebook: OSUNPK
YouTube Channel: OSUNPK
Blog www.osunpk.com