Alternative N-fertilizers: Do They Work Better?
Nitrogen Management

Goal:
- Match crop need with fertilizer and/or manure applied to optimize production economics
- Ensure maximum nutrient use efficiency by timing and placement of N in such a way as to reduce losses to the environment
- Use the more effective source of nitrogen

• How can we manage to improve nitrogen use efficiency (NUE)?
Nitrogen Use Efficiency is Increasing

- U.S. corn grain production has increased
- Fertilizer N use has leveled off since 1980

From Cassman et al., 2002
Optimizing Nitrogen Use

- Exploit improvements in nitrogen use efficiency (NUE) from genetics and cultural practices

- Manage N to avoid losses
  - Improve N rate decisions
  - Placement - Control NH$_3$ and NO$_3$ loss
  - Timing - Use sidedress or delayed applications if leaching or denitrification risk is high
  - Use effective sources
Importance of Timing Nitrogen Fertilizer to Crop Growth Stage

- Early Growth
- Rapid Growth
- Maturing
- Late Loss

Seasonal Nitrogen Uptake, %

May June July Aug Sept

80% of requirement after V8 - 10 Sidedress
Alternative Nitrogen Fertilizer Products

Slow Release
- Coated fertilizers
- More complex materials

Additives
- Microbial inhibitors
- Others
Products and Treatment Evaluated

- ESN: Polymer coated Urea Driven by temp/moist
- Nfusion/Nitamin: Slow release N
- CoRoN: Slow release Liquid N
- N Demand: Slow release Liquid N
- N Sure: Slow release Liquid N
- Agrotain: Urease Inhibitor
- Nutrisphere: Urease and Nitrification Inhibitor
- CaCl: Stabilizes N
Objectives of Southern Region Water Program: Nutrient Management Team

Within each state:

- Compare yields from replicated studies for different N fertilizer sources (alternative N fertilizers vs the standard N fertilizer used in that state).

- Each state will compare Nutrisphere and ESN, where appropriate. Some states will compare additional slow release fertilizers or additives.
Individual State Nitrogen Fertilizer Trials
Wheat Results
2010 Wheat Yield: Oklahoma

Conv.: There was no significant yield benefit of using a product or additive compared to UREA at the same rate. Significant rate difference. Optimum yield at 75 lb N/ac.

No-till: There was no significant yield benefit of using a product or additive compared to UREA at the same rate. Optimum yield at 75 lb N/ac.
2011 Wheat Yield: Oklahoma

Conv.: There was no significant yield benefit of using a product or additive compared to UREA at the same rate. Significant rate difference. Optimum rate at 100 lb N/ac.

No-Till: There was no significant yield benefit of using a product or additive compared to UREA at the same rate. Significant rate difference. Optimum rate at 75 lb N/ac.
Wheat Protein: Oklahoma

- Across both locations and years there was no significant difference in grain protein when a product or additive was added when compared to UREA at the same nitrogen rate.
Wheat Yields: Piedmont, North Carolina

*Year, Rate, Source UAN > UFP 95 lb N

UAN better than Nitamin. Optimum rate at 95 lb N/ac.

All fertilizers were the same except ESN (one year). Optimum N rate, 95-145 lb N/ac.
Corn Results
Relative Corn Yield: Alabama, 2008-2011

Relative Corn Grain Yield

\[ \text{LSD}_{p<0.05} = 0.15 \]
ESN produced greater yields than UAN. Yield increased up to 180 lb N/ac.
Corn Yield: New Mexico

UAN, Urea, and Agrotain with Urea performed the same under irrigated conditions.
All fertilizers performed the same except Nitamin. Optimum rate, 175 lb N/acre.
Corn Grain Yield: North Carolina, 2008 and/or 2009

All fertilizers performed the same. Rate differences. Optimum rate, 145 lb N/ac.

Mountains

Coastal Plain

*Rate 145 lb N

*Rate x Year
180 lb N

All fertilizers performed the same. Rate differences. Optimum rate, 180 lb N/ac.
## Corn Yield: Texas Blacklands, 2010

<table>
<thead>
<tr>
<th>Nitrogen Rate (lbs/A)</th>
<th>Grain Yield*†bu/A</th>
<th>UAN</th>
<th>UAN + Nutrisphere (0.5% v/v)</th>
<th>UAN + Agrotain Ultra (0.2% v/v)</th>
<th>UAN + N-Sure (50/50)</th>
<th>UAN + CoRoN (50/50)</th>
<th>UAN + NDemand (50/50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>74 ‡</td>
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<td>50</td>
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<td>75</td>
<td>86</td>
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<td>77</td>
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<td>125</td>
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<td>74</td>
<td>82</td>
<td>83</td>
<td>78</td>
<td>79</td>
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</table>

* Yields corrected to 15.5% moisture.
† Means within the UAN column and rows are not significantly different (P=0.05).
Cotton Yields
Seed Cotton Yield Response: Arkansas 2010

- **Control**
- **ESN**
- **Urea**
Cotton Yields: New Mexico

UAN, Urea, and Agrotain performed the same under irrigated conditions, except the 1X Agrotain Urea.
## Cotton Yields: Texas Blacklands, 2010

<table>
<thead>
<tr>
<th>Nitrogen Rate (lbs/A)</th>
<th>UAN</th>
<th>UAN + Nutrisphere (0.5 % v/v)</th>
<th>UAN + Agrotain Ultra (0.2% v/v)</th>
<th>UAN + N-Sure (50/50)</th>
<th>UAN + CoRoN (50/50)</th>
<th>UAN + NDemand (50/50)</th>
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<tr>
<td>40</td>
<td>1053</td>
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<tr>
<td>60</td>
<td>971</td>
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<tr>
<td>80</td>
<td>1057</td>
<td>984</td>
<td>926</td>
<td>937</td>
<td>961</td>
<td>974</td>
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<tr>
<td>100</td>
<td>1040</td>
<td>937</td>
<td>1073</td>
<td>1020</td>
<td>1010</td>
<td>1064</td>
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</tbody>
</table>

† Yield based on five replications.
‡Means within the UAN (only) column and rows are not significantly different (P=0.05).
Cotton Lint Yield: Texas
Brazos River Valley, 2007

P>F = 0.8099
CV% = 5.2
Mean = 846 lbs/acre

All treatments (including untreated) received recommended soil fertility based on soil test.

(2X) - CoRoN applied @ 1st bloom
14 days later

(3X) - CoRoN applied @ 1st bloom
14 days later
Cotton Lint Yield: Texas Lamesa AGCARES, 2007

Lint yield, lbs./acre

P>F = 0.5366
CV% = 4.6
Mean = 1579 lbs/acre

All treatments (including untreated) received recommended soil fertility based on soil test.

(2X) – CoRoN applied @ 1st bloom 14 days later
(3X) - CoRoN applied @ 1st bloom 14 days later 14 days later
Cotton Lint Yield: Texas
St Lawrence, 2007

Lint yield, lbs./acre

P>F = 0.6333
CV% = 3.8
Mean = 1549 lbs/acre

CoRoN UNT
2x 3x

All treatments (including untreated) received recommended soil fertility based on soil test.

(2X) – CoRoN applied @ 1st bloom 14 days later
(3X) - CoRoN applied @ 1st bloom 14 days later 14 days later
Cotton Lint Yield: Texas Blacklands, 2007

Lint Yield (lb/A)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Check</th>
<th>UAN</th>
<th>Nfusion 30:70</th>
<th>Nfusion 20:80</th>
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</thead>
<tbody>
<tr>
<td>LSD = 105</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>0</td>
<td>125</td>
<td>100</td>
<td>125</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: The graph shows the cotton lint yield in pounds per acre for different treatments. The LSD value is 105, indicating the minimum difference in yield that can be considered statistically significant.
## Cotton Lint Quality: Texas Blacklands, 2007

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Micronaire (units)</th>
<th>Length (in.)</th>
<th>Uniformity (ratio)</th>
<th>Strength (g/tex)</th>
<th>Elongation (%)</th>
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</thead>
<tbody>
<tr>
<td>No N Applied</td>
<td>4.45 a*</td>
<td>1.11</td>
<td>82.6</td>
<td>28.0</td>
<td>8.5</td>
</tr>
<tr>
<td>32 UAN, 100 lb N/A</td>
<td>4.25 b</td>
<td>1.14</td>
<td>83.3</td>
<td>28.2</td>
<td>8.4</td>
</tr>
<tr>
<td>32 UAN, 125 lb N/A</td>
<td>4.18 bc</td>
<td>1.13</td>
<td>82.3</td>
<td>29.2</td>
<td>8.3</td>
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<tr>
<td>Nfusion 30:70, 100 lb</td>
<td>4.03 c</td>
<td>1.14</td>
<td>82.3</td>
<td>29.1</td>
<td>8.2</td>
</tr>
<tr>
<td>Nfusion 30:70, 125 lb</td>
<td>4.23 b</td>
<td>1.13</td>
<td>82.9</td>
<td>28.6</td>
<td>8.2</td>
</tr>
<tr>
<td>Nfusion 20:80, 100 lb</td>
<td>4.2 bc</td>
<td>1.14</td>
<td>82.9</td>
<td>28.7</td>
<td>8.3</td>
</tr>
<tr>
<td>Nfusion 20:80, 125 lb</td>
<td>4.25 b</td>
<td>1.13</td>
<td>82.7</td>
<td>27.2</td>
<td>8.6</td>
</tr>
<tr>
<td>LSD</td>
<td>0.19 NS</td>
<td>NS</td>
<td>NS</td>
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</table>

*Means within a column followed by the same letter are not different (P>0.05).*
Grain Sorghum Yields
### Grain Sorghum Yields: Texas Blacklands, 2011

<table>
<thead>
<tr>
<th>Nitrogen Rate (lbs/A)</th>
<th>Grain Yield†</th>
<th>UAN</th>
<th>UAN + Agrotral Ultra (0.2% v/v)</th>
<th>Urea (granular)</th>
<th>Super U (granular)</th>
<th>ESN (granular)</th>
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<tbody>
<tr>
<td>0</td>
<td>4442 b‡</td>
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<td>30</td>
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<td>4335</td>
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<tr>
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<td>4715</td>
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<tr>
<td>90</td>
<td>5301 a</td>
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<tr>
<td>120</td>
<td>5565 a</td>
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</tbody>
</table>

† Yields corrected to 15.5% moisture.
‡ Means within the UAN (only) column followed by the same letter are not significantly different (P=0.05).
Take Home Message

There were few differences due to Nitrogen Fertilizer Sources for any of the soils, crops, or climates in the Southeast!

- Nutrisphere, Nitamin and Agrotain did not produce better yields at any location for any crop where tested.
- ESN performed better than urea on corn and cotton in Arkansas.
- ESN performed similarly or worse to UAN or urea in Alabama (corn), North Carolina (corn and wheat), and Oklahoma (wheat).
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- Deanna Osmond, NC State University
Publications


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