New Technologies: Products and Additives

Dale Leikam ... pinch hitting for

Bryan Hopkins
Nutrient Uptake For High Yield Corn
(R. Flannery - 308 Bu/A)

- N: 11.0 lb/day
- P₂O₅: 2.85 lb/day
- K₂O: 15.3 lb/day
Higher Yields & High Population: Impact on Root Mass & Nutrient Uptake?
Law of The Minimum

The wooden bucket represents the soil's nutrient supplying capacity.

100 Bu/A
150 Bu/A
200 Bu/A
250 Bu/A
50 Bu/A
300 Bu/A

350 Bu/A

Potassium Supply per Day
Magnesium
Genetics
Nitrogen
Phosphorus
Boron
Zinc
Plant Stand/Uniformity
Potassium
Sulfur
Plant Population
Phosphorus Uptake
Evaluation Of New Technologies

- **We Should Be Somewhat Skeptical**
  - Has The Company Invested In Product Research?
    - Research with Universities, Private Contractors and In-House Personnel
  - Does It Make Sense?
    - But Keep In Mind That New Ground Has Is Continually Being Broken
  - Is It Benefiting from Past Inputs/Management?
    - For Example, Nutrient Soil Tests That Have Been Previously Been Built
Evaluation Of New Technologies

• We Should Also Be Open Minded, Willing To Sometimes Change Our Ingrained Viewpoints and Progressive

  ▪ Everything Is New At Some Time
    ▪ Internet, N-Serve, GPS, Fungicides
  ▪ Things Are Not Necessarily The Same As Before
    ▪ Yield Levels Are Much Higher
  ▪ Companies Invest Huge Amounts Of Dollars In Research and Development
    ▪ Research with Universities, Private Contractors and In-House Personnel
Relationship between Bray P and relative corn yield in three long-term Iowa studies over 30 years

Consistency?
### Consistency?

| Calculating Corn Nitrogen Rate | Finding the Maximum Return To N and Most Profitable Rates Using a Regional (Corn Belt) Approach to N Management |

**Illinois Map**

<table>
<thead>
<tr>
<th>How to Use</th>
<th>More Info</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Calculate</strong></td>
<td><strong>Reset</strong></td>
</tr>
</tbody>
</table>

**Set corn and nitrogen prices**

<table>
<thead>
<tr>
<th>Nitrogen price (lb N)</th>
<th>$/lb N</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2.40</td>
<td>$4.00</td>
</tr>
</tbody>
</table>

**Anhydrous Ammonia (82% N)**

| Corn price ($/bu) | $300 |

Include non-responsive sites

---

*Iowa State University*
Corn Nitrogen Rate Calculator

**Finding the Maximum Return To N and Most Profitable N Rate**

A Regional (Corn Belt) Approach to Nitrogen Rate Guidelines

| State: Iowa | Number of sites: 188 | Nitrogen Price ($/lb): 0.63 |
| Rotation: Corn Following Soybean | Corn Price ($/bu): 4.00 | Price Ratio: 0.16 |
| Non-Responsive Sites Included | MRTN Rate (lb N/acre): 110 |

| Profitable N Rate Range (lb N/acre): 99 - 122 |
| Net Return to N at MRTN Rate ($/acre): $130.02 |
| Percent of Maximum Yield at MRTN Rate: 98% |
| UAN (28% N) at MRTN Rate (lb product/acre): 393 |
| UAN (28% N) Cost at MRTN Rate ($/acre): $69.30 |

Most profitable N rate is at the maximum return to N (MRTN).
Profitable N rate range provides economic return within $1/acre of the MRTN.

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**Iowa**

**C/S Rotation**

28% UAN @ $ 350/ton
Corn @ $ 4.00/bu
Consistency and/or Predictability?
N-Serve, Instinct & DCD

*Nitrification Inhibitors*
Effect of N Serve on Nitrification

Maddux et al., 1985 (SSSAJ)  Three Sites in Kansas

150 lb N/acre as spring-applied NH₃
Minnesota: N-Serve 1999

Corn Grain Yield (bu/ac)

NH3 fall
- w/o N-serve: 109
- w/ N-Serve: 154

NH3 spring
- w/o N-serve: 187
- w/ N-Serve: 178
Instinct

Encapsulated *Nitrapyrin*
UAN solution and liquid manure
Urea-Formaldehyde and Triazone Products

- **Urea Containing Polymers**
  - Combinations of various urea-formaldehyde polymers such as methylene urea, methylene diurea, dimethylene triurea, triazone, etc.
  
  - The longer/more complex the polymer, the longer the residual (slower the release).
  
  - The higher the SRN content, the longer the residual soil availability.

- **N-Sure, N-Pact, CoRoN, Nitamin, KQ-XRN, Gradual N, etc.**
Urea Formaldehyde Condensate Products

Urea + Formaldehyde →

Monomethylene Urea (MMU)

Methylene Diurea (DMU)
**Triazone Formation**

\[
\text{Urea} + \text{Formaldehyde} + \text{Ammonia} \rightarrow \text{Triazone}
\]

R = H, CH₂ NHCONH₂
Triazone/Urea-Formaldehyde Characteristics

- **Slow-release N properties**
  - Requires soil microbial activity; temperature and moisture sensitive
  - After 24 days @ 72°F only 41% had converted to ammonium (Kissel, 1988)
  - Soil at 78°F is four times as active as soil at 42°F (J. N. Booze-Daniels and R. E. Schmidt, Virginia Tech)
  - Commonly stated availability at 8-10 weeks, less at cool temperatures

---

Low-Solubility Compounds (UF, MU)

- N release by microbial mineralization (soil temperature, moisture, pH, etc)
- Longer chains = slower release
- Typical release 8-12 weeks
Triazone/Urea-Formaldehyde Characteristics

- Less leaf burn potential than urea or other N sources

**N Source Effect On Foliar Leaf Injury**

St. Augustine Grass, Florida

- Urea-Triazine
- Urea
- UAN

Leaf Burn (0=none, 5=maximum)

Lbs N/1000 sq. ft.
Triazone/Urea-Formaldehyde Characteristics

- Remains on leaf tissue in liquid phase longer than urea
  - Potential foliar absorption is greater than for urea alone
    (Clapp and Parham, Fertilizer Research, Vol. 28, 1991)

- Less initial potential for N volatilization than urea
  - Potentially important for unincorporated soil application
Triazone, Methylene Urea, Urea Formaldehyde, etc.

N-Sure®

N-Pact

GRADUAL-N

K. Nelson, P. Motavalli and B. Burdick
University of Missouri
Effect Of CoRoN on Corn
Kristi Thompson, University of Wisconsin-River Falls

Control

Treated with 28.17 liters CoRoN®

CoRon 25-0-0-0.5B @ V6 to V8 (~25% SRN)

Treated with 28.17 liters CoRoN®

Control
Foliar Urea-Triazine Application To Corn
Dorivar, KSU, 2010

![Bar chart showing corn yield comparison between control and slow release N for Clay Center and Scandia.]
Relative Dry Matter vs. N Uptake

- V10 (~30% of total N uptake)
- Silking (60% completed)
- 40% remaining

J. Schepers, USDA-ARS, Nebraska
Agrotain (NBPT)

• Disrupts urease activity from 7 to 14 days and decreases potential volatilization loss.

✓ Primary use is on surface applied urea

✓ Combined with DCD (Agrotain Plus/Super U) slows nitrification when urea or UAN are incorporated into soil.
N Source and Additive Effects On Laboratory Ammonia Volatilization

Cumulative Ammonia Loss (% of applied)

Days After Treatment

Source: Dr. W. Thornberry, Sturgis, KY; Dr. S. Ebelhar, Univ of Illinois
# Utilization of AGROTAIN Treated Urea In A Corn Cropping System In Alabama

**AUBURN UNIVERSITY (ALABAMA) - C. W. Wood, C. G. Cummings, R. Duffield**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>N Rate (lb/acre)</th>
<th>Yield (bu/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>AGROTAIN Urea</td>
<td>110.8</td>
<td>116.0</td>
</tr>
<tr>
<td>Urea</td>
<td>102.1</td>
<td>107.3</td>
</tr>
<tr>
<td>Ammonium Nitrate</td>
<td>98.8</td>
<td>99.0</td>
</tr>
</tbody>
</table>
Nitrogen and Agrotain Effects On No-Till Corn

University of California – 2007 No-Till Corn Data

Yield (tons/A)

No Nitrogen | 100 lbs N/Acre | 200 lbs N/Acre | 300 lbs N/Acre
---|---|---|---
2.68 | 5.03 | 5.21 | 6.66
6.32 | 6.47 | 6.44 | 6.66
6.77 | 7.22 |

Treatment
Soil: Yolo Clay Loam
pH: 7.0
UAN shallow incorporated followed by furrow irrigation.
1994 Nitrogen Source Study on No-till corn, Poplar Hill Research and Education Facility, University of Maryland

No-till corn into a small grain (wheat) double cropped soybean stubble. All liquid materials were broadcast between rows when corn was 12” tall.

<table>
<thead>
<tr>
<th>TREATMENTS</th>
<th>YIELD BU/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check P&amp;K only</td>
<td>77.5</td>
</tr>
<tr>
<td>Urea (46-0-0)</td>
<td>150.5</td>
</tr>
<tr>
<td>Urea with AGROTAIN</td>
<td>176.5</td>
</tr>
<tr>
<td>30% UAN Solution Broadcast</td>
<td>166.9</td>
</tr>
<tr>
<td>30% UAN Solution Injected</td>
<td>173.9</td>
</tr>
<tr>
<td>UAN with AGROTAIN</td>
<td>182.3</td>
</tr>
<tr>
<td>UAN with AGROTAIN &amp; DCD</td>
<td>173.7</td>
</tr>
<tr>
<td>UAN with 8-0-0-9 (ammonium sulfate)</td>
<td>185.4</td>
</tr>
<tr>
<td>SuperU</td>
<td>176.8</td>
</tr>
</tbody>
</table>

F. R. Mulford, Mryland
Experiments were established at two Illinois locations to evaluate the effect of N rate and AGROTAIN on the N concentration of ear leaf corn samples collected at tasseling and on corn yield at maturity when applied with urea and UAN solutions. N treatments were 0, 80, 120, 160, and 200 lb/acre N. Due to an abnormally wet spring and summer, treatment applications were delayed in hopes of finding a rain-free period. Summary: Limited yield response associated with the surface applications and receipt of rain (1.65") within 5 days of applications did not allow the AGROTAIN an opportunity to express its effectiveness as a Nitrogen Stabilizer. Out of 8 NBPT comparison, it significantly increased yield at 2,120 lb/acre N (+14) and 200 lb/acre N (+20.5).

<table>
<thead>
<tr>
<th>N Source</th>
<th>120 lb/acre N</th>
<th>200 lb/acre N</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGROTAIN Urea</td>
<td>120.9</td>
<td>131.4</td>
</tr>
<tr>
<td>Urea</td>
<td>106.8</td>
<td>110.9</td>
</tr>
<tr>
<td>Advantage</td>
<td>+14.1</td>
<td>+20.5</td>
</tr>
</tbody>
</table>
• Polymer coatings applied to soluble fertilizer
• Release by diffusion through coating
• Release rate determined by
  – Polymer chemistry, thickness, coating process
  – Temperature and moisture
• Controlled release vs delayed release
N Source and Ammonia Volatilization
Washington, 2007

Field study; spring top-dress application on winter wheat
Source: R Koenig, Washington State Univ
Comparisons of pre-plant PCU with urea and UAN at equal N rates

Compilation of data from source-rate studies and trials in the US Corn Belt, 2000-2005
A. Blaylock, personal communication
ESN 100 #N/ac
Pre-plant
147 bu/ac

AS 150 #N/ac
Pre-plant
126 bu/ac

Hancock, WI, July 8
Sandy soils + excessive rain
Variable-Source N Fertilization
Greenley, MO, 2005

N applied before planting (mid-April) at 150 lbs N/ac

NutriSphere-N

- Thought to complex multivalent cations removing them from biochemical processes.
  - Combines with Ni to reduce urease activity.
  - Combines with Fe and Cu to reduce micro-organism metabolic activity delaying nitrification.
Effect Of Nutrisphere-N On Nitrification
M. Coyne, Univ. of Kentucky

Paired T Test

None vs. 0.1% Nutrisphere-N
\[ t \text{ stat} = 6.55, \quad p = < 0.01 \]

None vs. 0.2% Nutrisphere-N
\[ t \text{ stat} = 4.25, \quad p = < 0.01 \]
## Nutrisphere-N Potato Research Study

*Bryan Hopkins, Univ. of Idaho, 2006*

<table>
<thead>
<tr>
<th>N Treatment vs. Recommended N Rate</th>
<th>Total Yield</th>
<th>Marketable Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-   -   % of recommended   -   -   -   -   -   -   cwt/a   -   -   -</td>
<td></td>
</tr>
<tr>
<td>100% At Emergence</td>
<td>341</td>
<td>281</td>
</tr>
<tr>
<td>100% with NSN At Emergence</td>
<td>394</td>
<td>318</td>
</tr>
<tr>
<td>85% with NSN At Emergence</td>
<td>405</td>
<td>313</td>
</tr>
<tr>
<td>100% Split</td>
<td>376</td>
<td>276</td>
</tr>
</tbody>
</table>
# Effect Of Nitrogen and Nutrisphere-N On Malting Barley

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Protein %</th>
<th>Yield Bu./A</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Urea PP</td>
<td>11.7</td>
<td>113</td>
</tr>
<tr>
<td>100 Urea PP + NutriSphere-N</td>
<td>11.7</td>
<td>132</td>
</tr>
<tr>
<td>100 Urea (80% PP, 20% Joint)</td>
<td>11.9</td>
<td>123</td>
</tr>
<tr>
<td>100 Urea (80% PP, 20% Joint) + NutriSphere-N</td>
<td>11.4</td>
<td>140</td>
</tr>
<tr>
<td>130 Urea PP</td>
<td>12.4</td>
<td>134</td>
</tr>
</tbody>
</table>

Jeff Stark, Univ. Idaho, Aberdeen Research Center, 2009
Biomass R1: Pamlico County - 2009

- Biomass, (lbs acre\(^{-1}\))
- N Applied (lb N acre\(^{-1}\))

- UAN at Plant
- UAN+Nutrisphere at Plant
- UAN at Sidedress
- UAN+Nutrisphere at Sidedress

Department of Crop Science
College of Agriculture and Life Sciences
The addition of Nutrisphere-N to the N sources increased yields by 8.5 bu/a on average across N rates and sources. The addition of Nutrisphere-N to AS and ASN gave both an agronomic and economic response.

S.A. Ebelhar & C.D. Hart
Nitrogen Treatment Effect On Corn Yield
Gordon, 2010 KSU Fertilizer Report, 3 yr. average

N applied broadcast preplant
Average across 3 rates (80, 160, 240 lb/A)
MicroEssentials granules, containing N, P, S and Zn (SZ), eliminate component segregation to ensure uniform distribution of nutrients.
Soybean Yield Results

Four-Year Fertility Study
21 locations
Locations: IA, IL, IN, MN, SD, NE, ND, WI, ON, MB

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield --- bu/acre ---</th>
<th>ME SZ Advantage --- bu/acre ---</th>
</tr>
</thead>
<tbody>
<tr>
<td>MicroEssentials SZ</td>
<td>53.7</td>
<td></td>
</tr>
<tr>
<td>MAP</td>
<td>48.7</td>
<td>+ 5.0</td>
</tr>
<tr>
<td>DAP</td>
<td>48.2</td>
<td>+ 5.5</td>
</tr>
</tbody>
</table>

Note: Nutrient rates equalized across plots for each year.
P$_2$O$_5$ rate: 40 lbs/acre
All differences are significant at the 0.1 level
# Corn Yield Results

## One Year Fertility Study
19 locations
Locations: IA, IL, IN, MN, SD, MO, NE, WI, ON, MB

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield</th>
<th>ME SZ Advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>MicroEssentials SZ</td>
<td>155.9</td>
<td></td>
</tr>
<tr>
<td>DAP + ZnSO4 (Zn @ 1.8 #/a)</td>
<td>149.2</td>
<td>+ 6.7</td>
</tr>
<tr>
<td>DAP + ZnSO4 (Zn @ 5 #/a)</td>
<td>153.2</td>
<td>+ 2.7</td>
</tr>
<tr>
<td>DAP (Check)</td>
<td>150.6</td>
<td>+ 5.3</td>
</tr>
</tbody>
</table>

*Note: Nutrient rates equalized across plots for each year.*

**Zn @ 1.8 #/a equals zinc rate in MESZ**

**Zn @ 5 #/a represents farmer rate**

**P₂O₅ rate: 70 lbs/acre**
MicroEssentials SZ for complete soil coverage

Typical Zinc Blend

Zinc as granules in **bulk blend** through **broadcast** application (5 lbs/A Zn).

0.66 granules/sq ft

MicroEssentials SZ

Zinc incorporated in phosphate fertilizer (65 lbs/A P$_2$O$_5$ and 1.6 lbs/A Zn).

8.0 granules/sq ft
Soil Zn: MESZ improves Zn distribution

There was no difference between MESZ and the blend on soil available Zn. MESZ resulted in a significantly more uniform Zn distribution compared to the blend, even at 1/5 of the Zn rate.

Letters indicate significant differences (p<0.1)
Plant P Uptake

P fertilizer application increased P uptake.

MESZ increased P uptake by 17% compared to the blend.

Letters indicate significant differences (p<0.1)
DAP in storage

MESZ in storage
AVAIL

- An extremely high cation exchange capacity – about 1800 meq/100 gms.
- Structure is very specific to attracting and adsorbing multivalent cations.
- Polymer affects only very small portion of soil volume
Cation Adsorption Strength

Cations with greater adsorption strengths are held on exchange sites more tightly, are more difficult to replace and are released into the soil water solution less easily than others.

<table>
<thead>
<tr>
<th>Cation</th>
<th>Adsorption Strength</th>
<th>Ionic Radius (picometer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hydrogen</td>
<td>Strongest</td>
<td>25</td>
</tr>
<tr>
<td>2. Aluminum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron*</td>
<td></td>
<td>53</td>
</tr>
<tr>
<td>Nickel*</td>
<td></td>
<td>77</td>
</tr>
<tr>
<td>Copper*</td>
<td></td>
<td>83</td>
</tr>
<tr>
<td>3. Calcium</td>
<td></td>
<td>114</td>
</tr>
<tr>
<td>4. Magnesium √</td>
<td></td>
<td>86 √</td>
</tr>
<tr>
<td>5. Potassium</td>
<td></td>
<td>152</td>
</tr>
<tr>
<td>6. Ammonium</td>
<td></td>
<td>---</td>
</tr>
<tr>
<td>7. Sodium √</td>
<td></td>
<td>116 √</td>
</tr>
</tbody>
</table>

√ Hydrated ion radius affects adsorption strength
Aluminum Effects on Wheat - Low pH: 4.5

- No AVAIL®
  - 0 umol Al
  - 200 umol Al
  - 400 umol Al

- With AVAIL®
  - 0 umol Al
  - 200 umol Al
  - 400 umol Al

Koenig, Washington State
Avail Effects On Potato Yields
B. Hopkins, Univ. of Idaho, 2004

‘Other trials conducted in Idaho in 2005-2006 showed similar results, with significant potential to improve potato yields grown on calcareous soils (Jeff Stark, University of Idaho, personal communication)’

Bryan Hopkins, March, 2008 Crop Management
# Effect Of Phosphate and Avail On Potato Yield and Profit

Stark, Univ. Idaho, 2006

<table>
<thead>
<tr>
<th>Treatment</th>
<th>P rate # $P_2O_5/A$</th>
<th>Total no. 1’s cwt/A</th>
<th>Total yield cwt/A</th>
<th>Incentive adjusted price $/cwt</th>
<th>Gross return $/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check</td>
<td>0</td>
<td>224.9 a</td>
<td>311.2 a</td>
<td>4.68</td>
<td>1456</td>
</tr>
<tr>
<td>MAP, no AVAIL</td>
<td>60</td>
<td>224.6 a</td>
<td>330.4 b</td>
<td>4.68</td>
<td>1546</td>
</tr>
<tr>
<td>MAP + AVAIL</td>
<td>60</td>
<td>241.1 b</td>
<td>338.6 b</td>
<td>4.65</td>
<td>1575</td>
</tr>
<tr>
<td>MAP, no AVAIL</td>
<td>120</td>
<td>237.8 ab</td>
<td>343.6 b</td>
<td>4.63</td>
<td>1591</td>
</tr>
<tr>
<td>MAP + AVAIL</td>
<td>120</td>
<td>270.6 c</td>
<td>368.6 c</td>
<td>4.86</td>
<td>1791</td>
</tr>
</tbody>
</table>
Improved Early Growth and Stress Tolerance

With Avail

Without Avail

Dr. Ron Heiniger
North Carolina State University
Initial Precipitate Results
Staggenborg, KSU

Precipitate % Of Test Average

<table>
<thead>
<tr>
<th>Fertilizer Product</th>
<th>No Avail</th>
<th>1% Avail</th>
<th>2% Avail</th>
</tr>
</thead>
<tbody>
<tr>
<td>6--24--6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9--18--9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10--34--0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28--0--0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tech MAP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AVAIL = 0.5% v/v
# N Source and Avail Effects On Subsurface Drip Irrigation Applied Fertilizer

S. Staggenborg and J. Olson, Kansas State Univ., 2009

<table>
<thead>
<tr>
<th>Subsurface Drip Irrigation Treatments</th>
<th>With Starter</th>
<th>Without Starter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>196</td>
<td>195</td>
</tr>
<tr>
<td>6-24-6</td>
<td>213</td>
<td>203</td>
</tr>
<tr>
<td>6-24-6 + Avail</td>
<td>226</td>
<td>200</td>
</tr>
<tr>
<td>9-18-9</td>
<td>200</td>
<td>194</td>
</tr>
<tr>
<td>9-18-9 plus Avail</td>
<td>211</td>
<td>204</td>
</tr>
</tbody>
</table>

LSD\(_{(0.05)}\) 11.0

![Crop field with and without Avail](image)
Plant Nutrition & Humic Substances

Bryan G. Hopkins & Jeff Stark

University of Idaho
College of Agriculture and Life Sciences
UI Research on Humic Acid

- 0, 15, & 30 gallons/a of 10-34-0
- 3 inches to the side of seed
- With and without Humic Acid
  - 1:10 ratio of humic acid to 10-34-0
    - check
    - 15 gal 10-34-0 ± 1.5 gal HA
    - 30 gal 10-34-0 ± 3.0 gal HA
- 3 years
- Calcareous soil
- Medium soil test P
- Russet Burbank
Humic Acid and Potato Production.
Hopkins and Stark, Univ. Idaho

<table>
<thead>
<tr>
<th>U.S. No.2</th>
<th>U.S. No.1 4-10 oz.</th>
<th>U.S. No. 1 &gt; 10 oz.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>60</td>
<td>60+HA</td>
</tr>
<tr>
<td>127</td>
<td>133</td>
<td>131</td>
</tr>
<tr>
<td>139</td>
<td>133</td>
<td>133</td>
</tr>
<tr>
<td>120</td>
<td>124</td>
<td>144</td>
</tr>
<tr>
<td>99</td>
<td>111</td>
<td>133</td>
</tr>
</tbody>
</table>

Lbs.-P2O5/a

Tuber Yield, cwt./a
Humic Acid and Potato Production.
Hopkins and Stark, Univ. Idaho

Petiole P, %

<table>
<thead>
<tr>
<th>Lbs.-P2O5/a</th>
<th>0</th>
<th>60</th>
<th>60+HA</th>
<th>120</th>
<th>120+HA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petiole P</td>
<td>0.22</td>
<td>0.25</td>
<td>0.28</td>
<td>0.27</td>
<td>0.29</td>
</tr>
</tbody>
</table>

Humic Acid and Potato Production.
Hopkins and Stark, Univ. Idaho
University research has documented positive responses to P fertilizer additives that may enhance P solubility and plant uptake, such as liquid polymer stabilizers and humic materials. Consider evaluating these materials on a portion of the field receiving fertilizer P.
2008 Corn Seed Treatment
Burwell Ne. 1.7 ppm DTPA ZN Sandy Loam soil
Effect of Seed Zn on Growth of Wheat in Central Anatolia

11 mg Zn kg\(^{-1}\)

30 mg Zn kg\(^{-1}\)

52 mg Zn kg\(^{-1}\)

## Interaction Of New Technologies/Practices With Corn Yield

University of Illinois and Mosaic

<table>
<thead>
<tr>
<th>Traditional Program</th>
<th>Enhanced Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>208 bu/a</td>
<td>274 bu/a</td>
</tr>
</tbody>
</table>

Yield Increase Attributed To Individual New Practice:

<table>
<thead>
<tr>
<th>Practice</th>
<th>Traditional Program</th>
<th>Enhanced Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional P, S, Zn (MEZ)</td>
<td>7</td>
<td>18</td>
</tr>
<tr>
<td>Additional Sidedress N</td>
<td>16</td>
<td>24</td>
</tr>
<tr>
<td>Higher Plant Population</td>
<td>-15</td>
<td>14</td>
</tr>
<tr>
<td>Fungicide Application</td>
<td>-4</td>
<td>12</td>
</tr>
<tr>
<td>Genetics - Triple Stack</td>
<td>8</td>
<td>27</td>
</tr>
</tbody>
</table>

*Traditional Program - University of Illinois Recommendations Without Any Enhanced Input
Enhanced Program - University of Illinois Recommendations Plus All Enhanced Inputs*
New Technologies: Products and Additives

Thank You

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