Investigations of Early-Season Herbicide, Fungicide, & Fertilizer Co-Applications in Field Corn

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Presentation Outline

- Intro/Background
- Objectives
- Materials & Methods
- Results
- Conclusions
Introduction

• The use of foliar fungicides on field corn has increased dramatically over the past five years in the U.S. Corn Belt (Paul et al. 2011).

• Historically profitable in seed corn production, where crop value can be 10 times higher than in grain production (Paul et al. 2011).

• Traditionally made at tasseling (VT); however pesticide manufacturers have recently promoted early-season fungicide co-applications with POST herbicide treatments.
Bradley 2010 reported average corn yield response of 7.4 Bu/A for VT-R1 fungicide applications as compared to a 1.2 Bu/A response to V6 stage applications.
University trials indicate fungicides are most profitable in corn when a combination of factors are present:

- Weather conditions are favorable for disease development
- Hybrids susceptible to foliar disease
- Continuous corn
- No-till or reduced tillage systems
- Late-planted corn
- Irrigation
- Disease develops
## Assessing Yield Loss Due to GLS

<table>
<thead>
<tr>
<th>Percentage Ear Leaf Area Affected by Early Dent Stage (R5)</th>
<th>Approximate Yield Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>5% or less</td>
<td>0-2%</td>
</tr>
<tr>
<td>6-25%</td>
<td>2-10%</td>
</tr>
<tr>
<td>25-75%</td>
<td>5-20%</td>
</tr>
</tbody>
</table>

**Source:** Pat Lipps, OSU, 1998

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Gray leaf spot severity assessment

% of ear leaf affected at R4-R5

5%

25%

50%

70%

Severity Pro, Nutter, Iowa State University
Mature gray leaf spot lesions

Rectangular shaped lesions characteristic of early gray leaf spot

Young gray leaf spot lesions
Northern leaf blight – large, tan, cigar-shaped lesions

Eyespot – numerous small round spots, frequently encircled by a yellow halo

Northern corn leaf spot – grayish-tan narrow linear lesions
• Corn is also a nitrogen-demanding crop and nitrogen (N) uptake is often limited in poorly-drained claypan soils, or in fields where losses from denitrification, volatilization, and/or leaching are more likely to occur.

• Noellsch et al. (2009) found that the targeted use of slow-release N products across claypan landscapes could increase grain yields and profitability compared to conventional N fertilizers.
Foliar applications of urea have been shown to be an effective method of nitrogen fertilization for grain crops (Finney et al. 1957).

Can result in rapid absorption and efficient utilization.

The timing of these slow-release N products could coincide with early-season applications of post-emergence herbicides in corn.
N deficiency on lower corn leaves
Classical N deficiency – hunger sign is yellowing that starts at the tip and moves along the middle of the leaf.
Objectives

Determine the effects of V5 herbicide and fungicide, or herbicide, fungicide, and slow-release N co-applications on corn injury and yield.

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Materials & Methods

- Two separate field studies conducted in 2011 and 2012; one to investigate herbicide and fungicide co-applications; one to investigate herbicide, fungicide, and slow-release N co-applications.

- Pioneer P1395XR glyphosate-resistant corn planted in 30-inch rows at 32,000 seeds/A on May 5, 2011 and April 4, 2012.

- Individual plots 10 by 30 feet in length; treatments arranged in a RCB design with 6 replications.
Materials & Methods

- Trials received a blanket application of atrazine plus S-metolachlor prior to planting.
- All non-herbicide treated plots were kept weed-free by hand-hoeing.
- All herbicide, fungicide, and slow-release N co-applications were made at the V5 stage of corn growth (June 8, 2011; May 16, 2012).
- All treatments applied with a self-propelled small-plot sprayer with XR8002 flat fan nozzles at 17 psi.
Materials & Methods

- Visual injury ratings taken 1, 2 and 4 weeks after treatment (WAT).

- Corn height was measured from the soil surface to the tip of the uppermost vertically extended leaf 1, 2 and 4 WAT.

- Corn yield determined by harvesting the center 2 rows in each plot with a small plot combine.

- Data analyzed using PROC MIXED in SAS and means separated using Fisher’s protected LSD (0.05).
# Treatments Evaluated in the Herbicide-Fungicide Experiment

<table>
<thead>
<tr>
<th>Herbicide Treatments</th>
<th>Rate (product/A)</th>
<th>Product Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rimsulfuron + Mesotrione</td>
<td>4 ozs</td>
<td>Realm Q</td>
</tr>
<tr>
<td>Thiencarbazone + Tembotrione</td>
<td>3 ozs</td>
<td>Capreno</td>
</tr>
<tr>
<td>Mesotrione</td>
<td>3 ozs</td>
<td>Callisto</td>
</tr>
<tr>
<td>S-metolachlor + Glyphosate + Mesotrione</td>
<td>4 pts</td>
<td>Halex GT</td>
</tr>
<tr>
<td>Thiencarbazone + Tembotrione + Glyphosate</td>
<td>3 ozs + 22 ozs</td>
<td>Capreno + Roundup</td>
</tr>
<tr>
<td>Glyphosate + Atrazine</td>
<td>22 ozs + 1 qt</td>
<td>Roundup + Atrazine</td>
</tr>
<tr>
<td>Glyphosate</td>
<td>22 ozs</td>
<td>Roundup</td>
</tr>
<tr>
<td>Glufosinate</td>
<td>22 ozs</td>
<td>Ignite</td>
</tr>
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<tr>
<th>Fungicide Treatments</th>
<th>Rate (product/A)</th>
<th>Product Name</th>
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<tbody>
<tr>
<td>Trifloxystrobin + Prothioconazole</td>
<td>4 ozs</td>
<td>Stratego YLD</td>
</tr>
<tr>
<td>Azoxystrobin + Propiconazole</td>
<td>10.5 ozs</td>
<td>Quilt Xcel</td>
</tr>
<tr>
<td>Pyraclostrobin + Metconazole</td>
<td>10 ozs</td>
<td>Headline AMP</td>
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Influence of V5 Herbicide and Fungicide Co-Applications on Visual Chlorosis 7 Days After Treatment

*Error bars represent the standard error of the mean.

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Influence of V5 Herbicide and Fungicide Co-Applications on Corn Height Reduction 7 Days After Treatment

*Error bars represent the standard error of the mean.*

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Influence of V5 Herbicide and Fungicide Co-Applications on Corn Yield

*Error bars represent the standard error of the mean.*

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Influence of V5 Herbicide Applications on Corn Yield When Averaged Across all Fungicide Treatments (Columbia, MO)

*Error bars represent the standard error of the mean.*

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# Treatments Evaluated in the Herbicide, Fungicide, and Fertilizer Experiment

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<tr>
<th>Slow-Release N Treatment</th>
<th>Rate (product/A)</th>
<th>Product Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea N + Triazine-Methylene Urea</td>
<td>2 gal</td>
<td>Nitamin</td>
</tr>
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</table>
Influence of V5 Herbicide, Fungicide, and Slow-Release N Co-Applications on Visual Chlorosis 7 Days After Treatment

*Error bars represent the standard error of the mean.
Influence of V5 Herbicide, Fungicide, and Slow-Release N Co-Applications on Corn Height 7 Days After Treatment

*Error bars represent the standard error of the mean.

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Influence of V5 Herbicide, Fungicide, and Slow-Release N Co-Applications on Corn Yield

*Error bars represent the standard error of the mean.

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Influence of V5 Herbicide Applications on Corn Yield When Averaged Across all Fungicide and Nitamin Treatments (Columbia, MO)

- Weed-Free Control: 99
- Halex GT: 100
- Capreno + Glyphosate: 97
- Glyphosate: 98
- Liberty: 95

*Error bars represent the standard error of the mean.

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Influence of V5 Slow-Release N Applications on Corn Yield (averaged across all herbicide and fungicide treatments)

*Error bars represent the standard error of the mean.*
Other Results from the Experiments

• In 2011, when averaged across all herbicide treatments, gray leaf spot severity was lower in both trials with treatments that contained a fungicide (0.32-0.41, 0.93-1.08%) compared to those that did not (0.53, 1.36%).

• In 2012, disease pressure in both trials was less than 0.1%.

• In both experiments, when averaged across all herbicide and/or slow-release N fertilizer treatments, there were no differences in corn yield between treatments that contained a fungicide compared to those that did not.
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• In both experiments, chlorophyll content (ear leaf, leaf above the ear, leaf below the ear) and stalk strength were similar between treatments that contained a fungicide and/or slow-release N fertilizer compared to those that did not.
Conclusions

• Significant corn height reductions can occur with Capreno or Realm Q treatments.

• Although disease severity may be slightly reduced, V5 herbicide and fungicide co-applications in corn are not likely to increase corn grain yields in comparison to herbicide treatments alone.

• The addition of a slow-release N fertilizer to these co-applications is not likely to provide additional corn yield in comparison to the non-treated control.
• Previous research suggests a single VT application will provide the same yield benefits as a V6+VT application.

**Figure 1.** Yield response to fungicides applied at V6, VT, and V6+VT growth stages in a 2009 experiment in Iowa.

Tennessee cross-resistance

- Samples of fungus from Tennessee were less sensitive to all three major strobilurin fungicides

<table>
<thead>
<tr>
<th>Strobilurin active ingredient</th>
<th>Component of Fungicide</th>
<th>Reduction in fungal sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azoxystrobin</td>
<td>Quadris, Quilt, Quilt Xcel</td>
<td>Isolates were 200 to 7000 times less sensitive to all strobilurin fungicide active ingredients tested</td>
</tr>
<tr>
<td>Pyraclostrobin</td>
<td>Headline</td>
<td></td>
</tr>
<tr>
<td>Trifloxystrobin</td>
<td>Stratego, Stratego YLD</td>
<td></td>
</tr>
</tbody>
</table>
• Means that if a fungus is resistant to one fungicide in the strobilurin group, it is likely resistant to ALL fungicides in the strobilurin group
  – Even if a certain fungicide a.i. was never sprayed!
Estimated cost per product:

- **Trifloxystrobin + Prothioconazole**
  - Stratego Yld (4 fl oz/A) = $18/A

- **Azoxystrobin + Propiconazole**
  - Quilt Xcel (10.5 fl oz/A) = $20/A

- **Pyraclostrobin + Metconazole**
  - Headline AMP (10 fl oz/A) = $20/A

Minimum 3-4 bu/A yield increase required to breakeven for product only.

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QUESTIONS?

Thank You