Investigations of the Potential Interactions Between Pre-emergence Residual Herbicides and Seed Treatments in Soybean

Blake Barlow & Kevin Bradley
University of Missouri
Introduction

- Earlier planting and greater use of pre-emergent (PRE), residual herbicides has led to an increase in the number of reports of early-season soybean injury.

- The use of seed treatments on soybean has also increased in recent years.

- Further research is needed to determine if interactions exist between soybean seed treatments and PRE residual herbicides.
Objectives

Identify any interactions that exist between varieties, seed treatments, and PRE residual herbicides in soybean.

Determine if any of these interactions lead to soybean stand, height, biomass, or yield reductions.
## Materials and Methods (treatment structure)

<table>
<thead>
<tr>
<th>Variety</th>
<th>Seed Treatment*</th>
<th>Herbicide Treatments (2X)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pioneer P35T58R (PPO-tolerant)</td>
<td>Gaucho</td>
<td>9 ozs Fierce XLT</td>
</tr>
<tr>
<td>Pioneer P34T07R2 (PPO-sensitive)</td>
<td>Clariva</td>
<td>16 ozs Trivence</td>
</tr>
<tr>
<td></td>
<td>Cruiser</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ILeVO</td>
<td>16 ozs Authority XL</td>
</tr>
<tr>
<td></td>
<td>Gaucho</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-treated</td>
<td>Non-treated</td>
</tr>
</tbody>
</table>

*Each seed treatment had a base blend of insecticides, fungicides, and biologicals
Materials and Methods

- Soybeans planted May 4 in 30-inch rows at 150,000 seeds/A (conventional seedbed)
- Applications made with a CO₂-powered backpack sprayer delivering 15 GPA with XR8002 flat fan nozzles at 17 p.s.i. (two innermost soybean rows only)
- Factorial arrangement of treatments. Individual plots 10 x 30 ft, arranged in a RCB design with six replications.
- Measurements taken on soybean 10 and 30 days after emergence (DAE)
  - stand counts: 2, 1-m length of row
  - Height: 5 representative plants per plot
  - Biomass: 5 representative plants per plot; dried at 50 C for 5 days, weighed
Materials and Methods

- Trial maintained weed-free through applications of glyphosate following 10 and 30 DAE measurements; any weed escapes hand removed throughout the season

- Yield determined by harvesting the center 2 rows in each plot with a small plot combine

- All data analyzed using PROC GLIMMIX procedure in SAS. Means separated using Fisher’s Protected LSD at the 5% level of significance.
## Summary of Effects

<table>
<thead>
<tr>
<th></th>
<th>Stand Count</th>
<th>Height</th>
<th>Biomass</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 DAE</td>
<td>30 DAE</td>
<td>10 DAE</td>
<td>30 DAE</td>
</tr>
<tr>
<td>Variety</td>
<td>&lt;.0001</td>
<td></td>
<td>&lt;.0001</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Herbicide</td>
<td>&lt;.0001</td>
<td>&lt;.0001</td>
<td>&lt;.0001</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Seed Treatment</td>
<td>0.0002</td>
<td>0.0122</td>
<td>&lt;.0001</td>
<td>0.0342</td>
</tr>
<tr>
<td>Variety x Herbicide</td>
<td>&lt;.0001</td>
<td>&lt;.0001</td>
<td>0.0111</td>
<td>0.0006</td>
</tr>
<tr>
<td>Variety x Seed Treatment</td>
<td>0.0683</td>
<td>0.0535</td>
<td>0.0240</td>
<td>0.3352</td>
</tr>
<tr>
<td>Herbicide x Seed Treatment</td>
<td>0.0351</td>
<td>0.4603</td>
<td>0.7489</td>
<td>0.7299</td>
</tr>
<tr>
<td>Variety x Herbicide x Seed Trt</td>
<td>0.3422</td>
<td>0.8356</td>
<td>0.3331</td>
<td>0.7133</td>
</tr>
</tbody>
</table>

**Note:** Statistically Significant

Not Significant
Early-season Effects of PRE Herbicides, Seed Treatments, and Varieties on Soybean Stand
Influence of Seed Treatments on Soybean Stand 10 Days After Emergence (Columbia 2015)

*Results summarized across 2 soybean varieties and 4 herbicide treatments.
**There was a significant effect of seed treatments on soybean yield, P=0.0002.
***Means followed by the same letter are not different, LSD=0.05.
Influence of Seed Treatments on Soybean Stand 30 Days After Emergence (Columbia 2015)

*Results summarized across 2 soybean varieties and 4 herbicide treatments.
**There was a significant effect of seed treatments on soybean yield, P=0.0002.
***Means followed by the same letter are not different, LSD=0.05.
Varietal Sensitivity to 2X Rates of PRE Herbicide Treatments (Soybean Stand 10 Days after Emergence; Columbia 2015)

*Results summarized across 4 soybean seed treatments.
**There was a significant herbicide by variety interaction, P<0.0001
***Means followed by the same letter are not different, LSD=0.05.
Varietal Sensitivity to 2X Rates of PRE Herbicide Treatments *(Soybean Stand 30 Days after Emergence; Columbia 2015)*

*Results summarized across 4 soybean seed treatments.*

**There was a significant herbicide by variety interaction, P<0.0001**

***Means followed by the same letter are not different, LSD=0.05.*
Herbicide and Seed Treatment Effects on Soybean Stand 10 Days After Emergence (Columbia 2015)

*Results summarized across 2 soybean varieties.
**There was a significant seed treatment by herbicide interaction, P=0.03.
***Means followed by the same letter are not different, LSD=0.05.
Early-season Effects of PRE Herbicides, Seed Treatments, and Varieties on Soybean Height
Influence of Seed Treatments on Soybean Height 10 Days After Emergence (Columbia 2015)

*Results summarized across 2 soybean varieties and 4 herbicide treatments.
**There was a significant effect of seed treatments on soybean height, P<0.0001
***Means followed by the same letter are not different, LSD=0.05.
Influence of Seed Treatments on Soybean Height 30 Days After Emergence (Columbia 2015)

*Results summarized across 2 soybean varieties and 4 herbicide treatments.
**There was a significant effect of seed treatments on soybean height, P=0.0342
***Means followed by the same letter are not different, LSD=0.05.
Varietal Sensitivity to 2X Rates of PRE Herbicide Treatments (Soybean Height 10 Days after Emergence; Columbia 2015)

*Results summarized across 4 soybean seed treatments.
**There was a significant herbicide by variety interaction, P<0.0111
***Means followed by the same letter are not different, LSD=0.05.
Varietal Sensitivity to 2X Rates of PRE Herbicide Treatments *(Soybean Height 30 Days after Emergence; Columbia 2015)*

*Results summarized across 4 soybean seed treatments.*

**There was a significant herbicide by variety interaction, P<0.0006**

***Means followed by the same letter are not different, LSD=0.05.*
Early-season Effects of PRE Herbicides, Seed Treatments, and Varieties on Soybean Biomass
Influence of Seed Treatments on Soybean Biomass 10 Days After Emergence (Columbia 2015)

*Results summarized across 2 soybean varieties and 4 herbicide treatments.
**There was a significant effect of seed treatments on soybean height, P<0.0001
***Means followed by the same letter are not different, LSD=0.05.
Influence of 2X Rates of PRE Herbicide Treatments on Soybean Biomass 10 Days After Emergence (Columbia 2015)

Soybean Biomass (% of Control)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weed-free Control</td>
<td>100</td>
</tr>
<tr>
<td>Fierce XLT (9 ozs/A)</td>
<td>b</td>
</tr>
<tr>
<td>Trivence (16 ozs/A)</td>
<td>b</td>
</tr>
<tr>
<td>Authority XL (16 ozs/A)</td>
<td>c</td>
</tr>
</tbody>
</table>

*Results summarized across 2 soybean varieties and 4 seed treatments.
**There was a significant effect of herbicide treatments on soybean yield, P<0.0001
***Means followed by the same letter are not statistically different, LSD=0.05.
PPO Tolerant Variety

Non-treated Control  Fierce XLT  Trivence  Authority XL

PPO Sensitive Variety
Effects of PRE Herbicides, Seed Treatments, and Varieties on Soybean Yield
Influence of Seed Treatments on Soybean Yield (Columbia 2015)

*Results summarized across 2 soybean varieties and 4 herbicide treatments.

**There was NOT a significant effect of seed treatments on soybean yield, P=0.11.
Influence of 2X Rates of PRE Herbicide Treatments on Soybean Yield (Columbia 2015)

*Results summarized across 2 soybean varieties and 4 seed treatments.

**There was a significant effect of herbicide treatments on soybean yield, P<0.0001

***Means followed by the same letter are not statistically different, LSD=0.05.
**Results summarized across 4 soybean seed treatments.**

**There was a significant herbicide by variety interaction, P<0.0001**

***Means followed by the same letter are not different, LSD=0.05.***
Preliminary Conclusions:

**Soybean Seed Treatments**

- Clariva + Cruiser resulted in higher soybean stands than any other seed treatment and the no-seed-treatment control 10 and 30 DAE.

- Soybean heights were 7-17% lower with seed treatments compared to the no-seed-treatment control 10 DAE. By 30 DAE, only ILeVO + Gaucho resulted in height less than the no-seed-treatment control.

- Soybean biomass was 7-15% lower with ILeVO + Gaucho and Gaucho (but not Clariva + Cruiser) compared to the no-seed-treatment control 10 DAE. By 30 DAE, there was no effect of seed treatments on soybean biomass.

- There were no effects of soybean seed treatments or no seed treatment by herbicide interaction effects on soybean yield.
## Preliminary Conclusions: Varietal Sensitivity

<table>
<thead>
<tr>
<th></th>
<th>Stand Count Reduction</th>
<th>Height Reduction</th>
<th>Yield Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 DAE</td>
<td>30 DAE</td>
<td>10 DAE</td>
</tr>
<tr>
<td>P34T07R2 (PPO-sensitive)</td>
<td>12-60%</td>
<td>6-72%</td>
<td>12-39%</td>
</tr>
<tr>
<td>P35T58R (PPO-tolerant)</td>
<td>17-39%</td>
<td>19-39%</td>
<td>10-28%</td>
</tr>
</tbody>
</table>

- In terms of soybean stand, height, and yield reductions, the PPO-sensitive variety (P34T07R2) proved to be sensitive to Trivence and Authority XL compared to the PPO-tolerant variety (P35T58R), but this was **not the case with Fierce XLT**. This suggests that even “PPO-tolerant” varieties vary in their sensitivity to PPO herbicides.

- The severity of the soybean stand, height and yield loss was greater in the PPO-sensitive variety in some instances, but **still present in the PPO-tolerant** variety nonetheless.
Preliminary Conclusions: PRE Herbicide Injury

- 2X rates of all PRE herbicides led to reductions in soybean yield compared to the non-treated control.
- 2X rates of Authority XL resulted in highest soybean stand loss regardless of the variety.
- 2X rates of Authority XL resulted in highest yield loss in P34T07R2 (PPO-sensitive), but similar yield losses occurred in P35T58R (PPO-tolerant) in response to 2X rates of Authority XL and Fierce XLT.
- Even varieties labeled as “PPO-tolerant” can suffer yield loss under the right conditions.