Late glyphosate applications alter yield and yield components in glyphosate-resistant canola (Brassica napus L.)

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Background

90% of all canola grow in Canada is GM (Beckie et al. 2011) - 48% is glyphosate-resistant (Beckie et al. 2011)

Early/On-label glyphosate applications = optimal yields (Clayton et al. 2002)

Crop injury from late glyphosate applications in cotton and soybean (Pline et al. 2002, Krausz and Young 2001)

Increasingly wet weather during growing season in the Prairies since 2010 (Environment Canada, 2015)
Objective

Determine effects of late or sequential herbicide applications of glyphosate on glyphosate-resistant canola yield and yield components.
Materials and Methods

Canola 45H28 (RR)

Lacombe, Alberta 2010-2012
St. Albert, Alberta from 2010-2011
Lethbridge, Alberta from 2011-2012
Saskatoon, Saskatchewan in 2012

Plots were hand weeded
RCBD

4 reps/treatment

Plot size 2 x 6 m

Stubble (St. Albert, Lethbridge)

Fallow (Lacombe, Saskatoon)
two-leaf (2L), six-leaf (6L), bolt (B), early bloom (EB), 2L&6L, 2L&B, 2L&EB
Data Collection

- Yield
- Seeds/Pod
- Aborted Pods
- Thousand-Seed Weight (TSW)
<table>
<thead>
<tr>
<th>Site-Year</th>
<th>Burnoff (trifluralin)</th>
<th>Seeding</th>
<th>Glyphosate</th>
<th>Insecticide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lacombe-2010</td>
<td>1705 g ai ha(^{-1})</td>
<td>150 seeds m(^{-2})</td>
<td>450 g ae</td>
<td>-</td>
</tr>
<tr>
<td>Lacombe-2011</td>
<td>1705 g ai ha(^{-1})</td>
<td>150 seeds m(^{-2})</td>
<td>450 g ae</td>
<td>-</td>
</tr>
<tr>
<td>Lacome-2012</td>
<td>1705 g ai ha(^{-1})</td>
<td>150 seeds m(^{-2})</td>
<td>450 g ae</td>
<td>Deltamethrin (6.2)</td>
</tr>
<tr>
<td>St. Albert-2010</td>
<td>1705 g ai ha(^{-1})</td>
<td>150 seeds m(^{-2})</td>
<td>450 g ae</td>
<td>-</td>
</tr>
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<td>St. Albert-2011</td>
<td>1705 g ai ha(^{-1})</td>
<td>150 seeds m(^{-2})</td>
<td>450 g ae</td>
<td>-</td>
</tr>
<tr>
<td>Saskatoon-2012</td>
<td>1705 g ai ha(^{-1})</td>
<td>150 seeds m(^{-2})</td>
<td>450 g ae</td>
<td>-</td>
</tr>
<tr>
<td>Lethbridge-2010</td>
<td>1705 g ai ha(^{-1})</td>
<td>150 seeds m(^{-2})</td>
<td>450 g ae</td>
<td>-</td>
</tr>
<tr>
<td>Lethbridge-2011</td>
<td>1100 g ai ha(^{-1})</td>
<td>150 seeds m(^{-2})</td>
<td>450 g ae</td>
<td>Lambda-Cyhalothrin (10.1)</td>
</tr>
<tr>
<td>Lethbridge-2012</td>
<td>1100 g ai ha(^{-1})</td>
<td>150 seeds m(^{-2})</td>
<td>450 g ae</td>
<td>Lambda-Cyhalothrin (10.1)</td>
</tr>
</tbody>
</table>
St. Albert 2010 - Yield

19%
Lethbridge 2011 - Yield

UDL=4624.45
Control LS Mean = 3811.65
LDL=2998.85

34%
Lethbridge 2012 - Yield

Control LS Mean = 4957.78

16%
## Contrasts - Yield

<table>
<thead>
<tr>
<th></th>
<th>St. Albert 2010</th>
<th>Lethbridge 2011</th>
<th>St. Albert 2011</th>
<th>Lethbridge 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kg ha(^{-1})</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On Label vs. Control</td>
<td>65.9</td>
<td>-289.4</td>
<td>-276.1</td>
<td>-522*</td>
</tr>
<tr>
<td>Off Label vs. Control</td>
<td>-816 *</td>
<td>-614.7 *</td>
<td>-886.1 *</td>
<td>-322.1</td>
</tr>
<tr>
<td>Single vs. Double</td>
<td>275.0</td>
<td>-30.1</td>
<td>305.1</td>
<td>226.5</td>
</tr>
<tr>
<td>Single-early vs. Control</td>
<td>81.1</td>
<td>-285.6 *</td>
<td>-131.8</td>
<td>-374.4</td>
</tr>
<tr>
<td>Single-late vs. Control</td>
<td>-721.4 *</td>
<td>-690.9</td>
<td>-856.1 *</td>
<td>-247</td>
</tr>
<tr>
<td>Double-early vs. Control</td>
<td>35.6</td>
<td>-297</td>
<td>-564.9</td>
<td>-817.3*</td>
</tr>
<tr>
<td>Double-late vs. control</td>
<td>-910.6 *</td>
<td>-538.6 *</td>
<td>-916.1 *</td>
<td>-397.2</td>
</tr>
</tbody>
</table>
St. Albert 2010 – Seeds/pod

UDL = 30.83
Control LSMean = 26.85
LDL = 22.87

23%
St. Albert 2011 – Seeds/pod

System Timing

2L
2L&B
2L&EB
6L
B
EB

# of seeds/pod from 5 plants average

UDL = 29.42
Control LSMean = 26.60
LDL = 23.78

12%
Lethbridge 2011 – Seeds/pod

System Timing

# of seeds/pod from 5 plants average

Control LS Mean = 30.00

UDL = 32.98

LDL = 27.02

11%
St. Albert 2010 – TSW

31%
Lethbridge 2011 - TSW
St. Albert 2010 – Aborted Pods

76%
St. Albert 2011 – Aborted Pods

52%
Lethbridge 2012 – Aborted Pods

42%
Discussion

- Stubble (St. Albert, Lethbridge) vs. Fallow (Lacombe, Saskatoon)
- Local Seasonal Weather – site/year differences
- Taco Bell?
Conclusion

- Potential for reduced tolerance in GR canola to late and sequential applications
- Possible significant economic impact (~20bu/ac)
- Important to stay on-label
- Yield effects if late or sequential applications are needed
Thank you!

Captain Canola!