Glyphosate Resistant Weed Management In American Crystal Growing Area
Agenda

• Before RR Resistant Crops
• RR Resistant Weeds in ACSC
• Corn, Soybeans, Canola & Beets are Weeds
• What You Can Do
• Summary
Resistance Before Roundup
SU Resistant Kochia
Conventional Herbicides

- Many times less than adequate control
- Timing an issue – extended rain events
- Labor intensive
  - Multiple sprays 3-5 times
  - Multiple Cultivations and Mechanical Control
Percent Of Roundup Ready Sugarbeets In ACSC

2008: 55%
2009: 82.5%
2010: 88%
2011: 84%
2012: 95%?
Areas and counties of ND and MN having known and suspected glyphosate-resistant weeds

- Gly-R common ragweed
- Gly-R giant ragweed
- Gly-R waterhemp

2006

Black symbols: confirmed resistant cases; Blue: highly suspected

Provided by: Drs. Jeff Stachler and Mike Christoffers
Areas and counties of ND and MN having known and suspected glyphosate-resistant weeds

- Gly-R common ragweed
- Gly-R giant ragweed
- Gly-R waterhemp

2007

Black symbols: confirmed resistant cases; Blue: highly suspected

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Areas and counties of ND and MN having known and suspected glyphosate-resistant weeds

- Gly-R common ragweed
- Gly-R giant ragweed
- Gly-R waterhemp

< 5% soybean fields gly-R C. Rag.
40 to 75% all acres have gly-R G. Rag. & 20 to 40% all acres have gly-R waterhemp

5 to 20% all acres gly-R waterhemp
15 to 40% all acres gly-R C. Rag.

2008

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Black symbols: confirmed resistant cases; Blue: highly suspected
Areas and counties of ND and MN having known and suspected glyphosate-resistant weeds:

- **Gly-R common ragweed**
- **Gly-R giant ragweed**
- **Gly-R waterhemp**

- 25 to 40% soybean fields gly-R C. Rag.
- 30 to 95% all acres have gly-R G. Rag.
- 5 to 20% all acres gly-R waterhemp
- 30 to 60% all acres gly-R C. Rag.

- 10 to 30% soybean fields gly-R C. Rag.

Black symbols: confirmed resistant cases; Blue: highly suspected

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Areas and counties of ND and MN having known and suspected glyphosate-resistant weeds:

- **Gly-R common ragweed**
- **Gly-R giant ragweed**
- **Gly-R waterhemp**

- **25 to 40% soybean fields gly-R C. Rag.**
- **50 to 90% all acres have gly-R waterhemp**
- **50 to 95% all acres have gly-R G. Rag.**

- **10 to 40% soybean fields gly-R C. Rag.**
- **30 to 60% all acres gly-R C. Rag.**
- **5 to 80% all acres gly-R waterhemp**
- **30 to 90% all acres have gly-R waterhemp**

Black symbols: confirmed resistant cases; Blue: highly suspected

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Areas and counties of ND and MN having known and suspected glyphosate-resistant weeds

- 5 to 50% soybean fields gly-R C. Rag.
- 70 to 95% all acres have gly-R waterhemp
- 60 to 95% all acres have gly-R G. Rag.

- Black symbols: confirmed resistant cases
- Blue: highly suspected

Provided by: Drs. Jeff Stachler and Mike Christoffers

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2011
Glyphosate Resistant Weeds In MN & ND Sugarbeet Producing Counties.

- Common Ragweed
- Waterhemp
- Giant Ragweed
- Horseweed
- Suspect - Common Lambsquarters
Glyphosate Resistant Ragweed

Where’s The Beans?
Glyphosate Resistant Ragweed

2 Different Farmers With
2 Different Management Styles
Glyphosate Resistant Ragweed
Glyphosate Resistant Ragweed
Glyphosate Resistant Waterhemp
Glyphosate Resistant Horsetail
Suspected Glyphosate Resistance
Or High Tolerance

• Common Lambsquarters
• Wild Buckwheat
• Dandelion
• Common Mallow
• Horsetail
• Smartweed

• Clover
• Cinquefoil
• Kochia
• Nightshade
• Nutsedge
• Prickly Lettuce
• Waterhemp
Dandelion
Wild Buckwheat & Dandelion
Glyphosate Resistant Crops As Weeds In Beets

- Corn – Use Assure II or Select
- Soybeans – Use Stinger
- Canola – Use UpBeet

The use of these herbicides in beet fields will also help in controlling Glyphosate resistant weeds
RR Canola & RR Corn
Annual RR Beets As Weeds In Other Crops
Strategies to Combat Resistant Weeds

• Scout fields to identify escapes
• Herbicide tank mixes with multiple MOA
• Rotate different MOA in consecutive years
• Rotate crops to enable different MOA
• Use labor and mechanical weed control
• Prevent seed production
What Can You Do?

- Keep small grains in your crop rotation
- Use Pre-Emerge Herbicides in rotational crops (corn and soybeans)
- Tank-mix other Herbicides with Glyphosate
- Use Liberty Link Technology in corn & soybeans
Small Grains in the Rotation

ACSC 2011 Top 5 Preceding Crops

<table>
<thead>
<tr>
<th>Crop</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat/Barley</td>
<td>78%</td>
</tr>
<tr>
<td>Soybeans</td>
<td>10%</td>
</tr>
<tr>
<td>Edible Beans</td>
<td>6%</td>
</tr>
<tr>
<td>Potatoes</td>
<td>3%</td>
</tr>
<tr>
<td>Corn</td>
<td>1.50%</td>
</tr>
</tbody>
</table>
Sugarbeet 1st Two Roundup Applications Up To 8-Leaf Stage

• Roundup PowerMax®
  1st Two Sprays:
  Use 28 oz/A (0.98 lbs./A Acid Equivalent)
  -OR-
  1st Spray: Use 32 oz./A (1.125 lbs./A AE)
  2nd Spray: Use 24 oz./A (0.84 lbs./A AE)

• Tank-mix 3 oz./A of Stinger
  – Do not mix if using Quadris in Roundup tank-mix
• Refer to Roundup® label to maximize control
On The Following Slides
Herbicides Were Selected Based On:

• No Pursuit or Atrazine Present
• Labeled in Both ND and MN
• Short Rotation Restriction to Sugarbeets
• Effectiveness
• Spur Discussion with your Local Ag Suppliers
**Pre-Emerge In Corn & Soybeans**

**Corn Pre-Emerge:**

<table>
<thead>
<tr>
<th>Pre-Emerge Herbicides for RR Corn</th>
<th>Sugarbeet Rotation Restrictions</th>
<th>Common Ragweed</th>
<th>Giant Ragweed</th>
<th>Lambsquarters</th>
<th>Kochia</th>
<th>Waterhemp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verdict @ &gt; 10 fl oz/A</td>
<td>NCS</td>
<td>G/E</td>
<td>G</td>
<td>G/E</td>
<td>G/E</td>
<td>G/E</td>
</tr>
<tr>
<td>Harness / Surpass</td>
<td>NCS</td>
<td>F</td>
<td>P</td>
<td>F/G</td>
<td>F</td>
<td>G/E</td>
</tr>
<tr>
<td>Callisto</td>
<td>18 mth</td>
<td>G/E</td>
<td>G</td>
<td>G/E</td>
<td>P</td>
<td>G/E</td>
</tr>
</tbody>
</table>

**Soybean Pre-Emerge:**

<table>
<thead>
<tr>
<th>Pre-Emerge Herbicides for RR Soybeans</th>
<th>Sugarbeet Rotation Restrictions</th>
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<th>Kochia</th>
<th>Waterhemp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valor</td>
<td>NCS</td>
<td>N/F</td>
<td>N/P</td>
<td>G/E</td>
<td>G/E</td>
<td>G/E</td>
</tr>
<tr>
<td>Verdict @ 5 fl oz/A</td>
<td>NCS</td>
<td>P/F</td>
<td>P</td>
<td>P/G</td>
<td>P/F</td>
<td>F/G</td>
</tr>
<tr>
<td>Boundary (Sencor+Dual)</td>
<td>18 mth</td>
<td>G</td>
<td>P/F</td>
<td>G</td>
<td>P</td>
<td>G/E</td>
</tr>
</tbody>
</table>
# Tank-mixes In Corn & Soybeans

## Corn Post Tank-Mixes:

<table>
<thead>
<tr>
<th>Post Tank Mixes with Glyphosate for RR Corn</th>
<th>Common Ragweed</th>
<th>Giant Ragweed</th>
<th>Lambsquarters</th>
<th>Kochia</th>
<th>Waterhemp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>4 mth</td>
<td>G/E</td>
<td>G/E</td>
<td>E</td>
<td>G</td>
</tr>
<tr>
<td>Banvel /Clarity</td>
<td>NCS</td>
<td>G/E</td>
<td>G</td>
<td>G/E</td>
<td>G</td>
</tr>
<tr>
<td>Impact</td>
<td>18 mth</td>
<td>G</td>
<td>G</td>
<td>E</td>
<td>G/E</td>
</tr>
<tr>
<td>Laudis</td>
<td>18 mth see label</td>
<td>G</td>
<td>G</td>
<td>E</td>
<td>G/E</td>
</tr>
<tr>
<td>Callisto</td>
<td>18mth</td>
<td>F</td>
<td>G</td>
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<tbody>
<tr>
<td>Flexstar</td>
<td>18 mth</td>
<td>G/E</td>
<td>G</td>
<td>P/F</td>
<td>G</td>
</tr>
<tr>
<td>Cobra</td>
<td>NCS</td>
<td>G/E</td>
<td>G</td>
<td>P</td>
<td>P/F</td>
</tr>
</tbody>
</table>
More Options In Corn

• As you can see corn herbicides provide the most effective options

Liberty Link Technology

• In soybeans or corn
• Provides new mode of action to cropping system
• Liberty needs ideal hot days and high rates and possible tank mixes for good control
Work With Ag Suppliers

• Work with your local Ag Supplier to help you develop a plan for Roundup Resistance Management in your rotational crops
• Many have been talking with their customers already
Summary

• ACSC is seeing some resistant cases
• ACSC is encouraging growers to adopt resistant breaking strategies
• Growers best option is in controlling resistance in rotational crops
• Continue a large percentage of small grain production
• Corn has the most resistance options
  – Due to more effective & economical herbicides
Tips to Keep Roundup® Ready Technology Working In Your Sugarbeet Fields

Above photos show Roundup Ready Resistant Common Ragweed in sugarbeets and soybeans.

Strategies to Combat Resistant Weeds

- Scout fields to identify escapes.
- Tank mix herbicides with multiple MOA (Modes Of Action).
- Rotate different MOA in consecutive years.
- Rotate crops to enable different MOA.
- Use labor and mechanical weed control.
- Prevent weed seed production.

What You Can Do

- Keep small grains in your rotation.
- Use Pre-Emerge Herbicides in Rotational Crops (corn & soybeans).
- Tank-mix other herbicides with Glyphosate/ Roundup®.
- Use Liberty Link corn and/or soybean varieties.

1st Two RR Beet Sprays Up To 8-leaf Stage

- Use 28 oz./A Roundup PowerMax® Rate (0.98 lbs./acre Acid Equivalent).
- OR
- Use 32 oz./A 1st spray and 24 oz./A 2nd spray Roundup PowerMax®. (1.125 lbs./acre and 0.84 lbs./acre Acid Equivalents).
- Tank-mix 3 oz./Acre of Stinger.
- Refer to Roundup® label for ways to maximize control.

Pre-Emerge & Post Herbicide Options in RR Corn

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Post Tank Mixes with Glyphosate for RR Corn

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<td>E</td>
<td>G/E</td>
</tr>
<tr>
<td>Ladisa</td>
<td>18 mth use label</td>
<td>G/E</td>
<td>G/E</td>
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<td>E</td>
<td>G/E</td>
<td></td>
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Pre-Emerge & Post Herbicide Options in RR Soybeans

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<td>NCS</td>
<td>N/P</td>
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<td>G/E</td>
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</tr>
<tr>
<td>Verdict @ &gt; 10 fl oz/A</td>
<td>NLC</td>
<td>P/P</td>
<td>P</td>
<td>P/F/G</td>
<td>P/C</td>
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Post Tank Mixes with Glyphosate for RR Soybeans

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NCS = Next Cropping Season  2CS = Two Cropping Seasons
N = None   P = Poor    F = Fair   G = Good  E = Excellent

As shown, there are more effective options in Corn.
Liberty Link® Corn and Soybeans Varieties are Options also.
Main Message:

Keep Glyphosate Working In Sugarbeets!
Your Comments & Questions