Herbicide Drift injury to Potato and Potential Seed Issues

Keystone Potato Producers Assoc.
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Herbicide Injury possible through:

- Drift from nearby application
- Mis-timed – a bit late when there is already some emergence and ground has cracks due to just emerging sprouts or other reasons
- Improperly cleaned spray tank after herbicide application
- Mis-application – wrong field or product
- Soil residue – persistent herbicides
Is it COLD or HERBICIDE issue?
• In some cases appears as virus disease
• The whole or part of plant may have abnormal leaves
• In some cases the newer foliage becomes normal
2011 Simulated Drift Spraying
On Field Plants

1. Russet Burbank plants (5 weeks old)

2. Herbicides solutions at 0, 1, 10 and 20 % of application rate for a specific crop

3. Tubers were harvested and put in cold storage for 2012 planting.
## Herbicides Field Tested in 2011

<table>
<thead>
<tr>
<th>Group</th>
<th>Herbicide</th>
<th>Crop</th>
<th>Rate / acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Odyssey 35% imazamox</td>
<td>Clearfield Canola, lentils</td>
<td>320 ml</td>
</tr>
<tr>
<td>2</td>
<td>Odyssey 35% imazethapyr</td>
<td>Clearfield Canola, lentils</td>
<td>320 ml</td>
</tr>
<tr>
<td>2</td>
<td>Odyssey 35% imazamox</td>
<td>Clearfield Canola, lentils</td>
<td>320 ml</td>
</tr>
<tr>
<td>4</td>
<td>2, 4 - D Ester 700 g/L</td>
<td>Cereals</td>
<td>17.3 g</td>
</tr>
<tr>
<td>9</td>
<td>Round-Up Weather Max</td>
<td>RR crops</td>
<td>500 ml</td>
</tr>
<tr>
<td>9</td>
<td>Round-Up Weather Max</td>
<td>RR crops</td>
<td>500 ml</td>
</tr>
<tr>
<td>10</td>
<td>Liberty 150 SN Glufosinate ammon 150 g/L</td>
<td>Liberty Link Canola</td>
<td>1.35 L</td>
</tr>
<tr>
<td>10</td>
<td>Liberty 150 SN Glufosinate ammon 150 g/L</td>
<td>Liberty Link Canola</td>
<td>1.35 L</td>
</tr>
</tbody>
</table>

### Concentrations

<table>
<thead>
<tr>
<th>Concentrations</th>
<th>0 % (Water)</th>
<th>1%</th>
<th>10%</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 % (Water)</td>
<td>0%</td>
<td>1%</td>
<td>10%</td>
<td>20%</td>
</tr>
</tbody>
</table>
Field Sprayed, 5 weeks after emergence

1. Odyssey
2. 2,4-D
3. Glyphosate
4. Liberty
# 2011 & 2012 Herbicides

## Herbicide Drift Exposure Demo Trials

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>2011 Trials</th>
<th>2012 Trials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odyssey (G2)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2,4-D (G4)</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Glyphosate (G9)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Liberty (G10)</td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>

## Treatment Pairs

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Pair 1</th>
<th>Pair 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontline (G2,4)</td>
<td>2 ppm</td>
<td>1 ppm</td>
</tr>
<tr>
<td>Infinity (G27,46)</td>
<td>2 ppm</td>
<td>1 ppm</td>
</tr>
</tbody>
</table>

## Exposure Sites

- Frontline: 4 m
- Infinity: 4 m

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**Manitoba**
Glyphosate in seed

1. Slow emergence
2. Removes apical dominance – causing Multiple shoots (Candelabra)
No multiple shoots observed, from seed with 2,4-D
Emergence of Daughter Tubers of 2011 Drift Exposed Plants, Winkler 2012 crop

% Emergence 4 wks after planting

Concentration of herbicide, as % of recommended rate for a field crop

From 2 rows, with 12 tubers planted per row.
Yield (% of Control) from Daughter Tubers of 2011 Drift Exposed Plants, Winkler 2012 crop

Yield from 2 rows, with 12 tubers planted per row.
2012 Seed Planted for 2012 Spray

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Odyssey, 20%

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Seed from Odyssey exposed plants, unemerged in 2012 at Harvest.
2012 Sprayed Odyssey & Harvested

Vikam Bisht, MAFRI
Glyphosate 20%
2012 Sprayed Frontline-2,4-D & Harvested

Vikram Bisht, MAFRI
2012 Sprayed Infinity & Harvested

Vikram Bisht, MAFRI
2011 Margin chlorosis = Infinity Damage!
2nd generation GM soybean and other crops: with glyphosate + dicamba tolerance – so potential injury

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Yield from 2 rows, with 12 tubers planted per row.
2012 Harvest in Cold storage for 2013 summer planting
## Proposed Plan for 2013

<table>
<thead>
<tr>
<th>Group</th>
<th>Herbicide Used</th>
<th>Target Crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 Odyssey</td>
<td>Clearfield Canola</td>
</tr>
<tr>
<td>2</td>
<td>4 2, 4-D</td>
<td>Cereals</td>
</tr>
<tr>
<td>3</td>
<td>9 Roundup</td>
<td>RR crops</td>
</tr>
<tr>
<td>4</td>
<td>10 Liberty 150 SN</td>
<td>L-Link canola</td>
</tr>
<tr>
<td>5</td>
<td>2, 4 Frontline 2,4 D</td>
<td>Spring Wheat</td>
</tr>
<tr>
<td>6</td>
<td>27 + 6 Infinity</td>
<td>Cereals</td>
</tr>
<tr>
<td>7</td>
<td>4 Dicamba</td>
<td>Cereals</td>
</tr>
<tr>
<td>8</td>
<td>4, 9 Rustler (Dicamba+Glyphosate)</td>
<td>Pre-seeding cereals</td>
</tr>
</tbody>
</table>

1. **Plant seed from 2011 and 2012 crops to study effect on daughter & grand-daughter tubers**

2. **Use 8 herbicides to study impact on foliage, yield and seed performance**
Herbicide Injury in Grower Fields 2012
Group 2 Herbicides
AcetoLactate Synthetase / AHAH Inhibitors

1. Assert (imazamethabenz)
2. Odyssey (35 % imazamox, 35% imazethapyr)

Grower fields –
Group 2 injury symptoms
Potato 2012
Severely affected
in sandy areas of field

1. Delayed emergence
2. Deformed foliage

Group 2: Assert
Soil applied 2011
on sunflower
Potato 2012, Assert soil applied 2011
Group 4 Herbicides
Growth Regulators

1. 2, 4 – D
2. Dicamba

Grower fields –
Group 4 injury symptoms
Group 4 Herbicides

Growth Regulators – Dicamba, 2,4-D

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Improper clean-up of spray tank

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Group 10 Herbicides
Glutamine synthetase Inhibitors

1. Liberty 150 SN, 200 SN (glufosinate ammonium)

Grower fields –
Group 10 injury symptoms
Group 10 Herbicides
Glutamine synthetase Inhibitors

Liberty 150 SN, 200 SN (glufosinate ammonium)

Liberty Link Canola
Potato

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Group 9 Herbicides
EPSP synthetase Inhibitors

1. Glyphosate – several brands

Grower fields –
Glyphosate injury symptoms
1. Highly soluble in water, unaffected by pH

2. Adsorbed by soil particles, degradation mostly microbial

3. Accumulates in growing points; systemic movement up/down

4. Mode of Action – cessation of synthesis of amino acids, phenolic compounds and chlorophyll, followed by reduced protein synthesis, growth and premature cell death.

5. Activity in Soil – 47 days ½ life

Glyphosate application in just emerged field or with growth cracks
Field with glyphosate seed carry over
Glyphosate current season spray on a sandy field – could have had some emerged or nearly emerged sprouts or rain or irrigation soon after planting.

Daughter tubers from such plants has been collected.
Heavy and light dosage of glyphosate on neighbouring plants
Foliage sprayed showed symptoms and stayed on, new foliage did not show signs of damage.
Potential Solutions to Herbicide Injury

• Spray when drift injury potential is low – wind speed and direction
• Drift reducing supplements: nozzles, shields, adjuvants
• Ensure proper cleaning of spray equipment after herbicides
• Ensure proper timing – zero emergence & no ground cracks.
• Proper crop rotation after herbicides with soil residual activity
• Other: Follow pesticide label
Thanks for the Support and Efforts
Leon Jarvis
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Curtis Cavers, and CMCDC staff

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