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Sprayer Technology and Pesticide Applications in the 21st Century

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Equipment is not getting smaller!

2014

Future?

Courtesy of Dr. Joe Luck
Automatic Swath Control
Why Now?

10/8/10
Drift of 100 miles
$20,000,000 lawsuit
EPA-HQ-OPP-2009-0628-0002
Drift minimization labeling
Medium to coarse spray droplets
10 MPH winds or less
50’ buffer from downwind edge
Buffer Zone Impacts

2,640 ft.

160 Acre Field
1/4 Section

6.1 Acres

50 ft.

Prevailing Winds
Buffer Zone Impacts

160 Acre Field
¼ Section

2,640 ft.

11.9 Acres

100 ft.

Prevailing Winds
Buffer Zone Impacts

160 Acre Field
¼ Section

2,640 ft.

23.3 Acres

Prevailing Winds

200 ft.
Know the Label – The Label is the Law!

APPLICATION INFORMATION
Uniform, thorough spray coverage is important to achieve consistent weed control. Select nozzles and pressure that deliver MEDIUM spray droplets as indicated in nozzle manufacturer's catalogs and in accordance with ASAE Standard S-572. Nozzles that deliver COARSE spray droplets may be used to reduce spray drift provided spray volume per acre (GPA) is increased to maintain coverage of weeds. Flat fan nozzles of 60° or 110° are recommended for optimum post emergence coverage.

• Do not use nozzles that produce FINE (e.g. - Cone) or EXTRA COARSE (e.g. - Flood jet) spray droplets.

Ground Application
LAUDIS can be applied broadcast in a minimum of 10 gallons of water per acre (unless a higher volume is specified for a tank-mix partner). For weed control in dense weed populations or under adverse growing conditions, 15 to 20 gallons of water per acre is recommended. Good coverage is essential to achieve optimum weed control.

Typically, flat-fan nozzles operated at 30-60 PSI will deliver MEDIUM spray droplets, providing optimum spray coverage and canopy penetration. Lower pressure operation and/or higher volume flat fan nozzles typically deliver COARSE sprays. Refer to nozzle manufacturer catalogs.

• Boom height should be based on the height of the crop – at least 15 inches above the crop canopy.

• Air induction nozzles should be used at or near 80 psi to produce a medium droplet size.

• Proper agitation should be maintained within the tank to keep the product dispersed.

• See the Spray Drift Management section of this label for additional information on proper application of LAUDIS.

Mixing Instructions
LAUDIS must be applied with clean and properly calibrated equipment. Prior to adding LAUDIS, ensure that the spray tank, filters and nozzles have been thoroughly cleaned and that agitation system is properly working.

1. Fill spray tank with 50% of the required volume of water, and begin agitation.

2. Agitate the LAUDIS product container thoroughly by shaking, circulating or stirring prior to adding the herbicide into the spray tank.

3. Add the appropriate amount of LAUDIS slowly to the spray tank or mixing system and ensure complete dispersion. Maintain and ensure thorough dispersion and sufficient agitation during both mixing and spraying.

4. If tank mixing with another pesticide, add the tank mix product next (except in the case of glyphosate which should be added after the nitrogen fertilizer is dispersed).

5. Add nitrogen fertilizer.

6. Add the adjuvant.

7. Fill the spray tank with balance of water needed.
Know the Label – The Label is the Law!

Medium Spray Droplets
Flat fan nozzles are recommended (30-60 psi).
Do not use Fine or Extra Coarse Spray Droplets.
10 GPA minimum
AI nozzles should be used at or near 80 psi.

APPLICATION INFORMATION
Uniform, thorough spray coverage is important to achieve consistent weed control. Select nozzles and pressure that deliver MEDIUM spray droplets as indicated in nozzle manufacturer’s catalogs and in accordance with ASAE Standard S-572. Nozzles that deliver COARSE spray droplets may be used to reduce spray cost provided spray volume per acre (GPA) is increased to maintain coverage of weeds. Flat fan nozzles of 80° or 110° are recommended for optimum post emergence coverage.
• Do not use nozzles that produce FINE (e.g. Cone) or EXTRA COARSE (e.g. Floodjet) spray droplets.

Ground Application
• Do not use the above recommendations for less than 10 gallons per acre.
• Do not use nozzles that produce fine droplets. The use of ground application may reduce the volume of water per acre.
• Adverse growing conditions 15 to 20 gallons of water per acre is recommended.

Air Nozzles
• AI nozzles should be used at or near 80 psi to produce a medium volume of flat fan nozzles delivering COARSE spray droplets, providing optimum spray coverage and canopy penetration. Lower pressure operation and/or higher volume flat fan nozzles typically deliver COARSE sprays. Refer to nozzle manufacturer’s catalog.
• Boom height should be based on the height of the crop – at least 15 inches above the crop canopy.
• Air induction nozzles should be adjusted to the highest the keep the product dispersed. For additional information of LAUDIS:

Mixing Instructions
LAUDIS must be applied with clean and properly calibrated equipment. Prior to applying LAUDIS, ensure that the spray tank, filters and nozzles have been thoroughly cleaned and that agitation system is properly working.
1. Fill spray tank with 50% of the required volume of water, and begin agitation.
2. Agitate the LAUDIS product container thoroughly by shaking, circulating or stirring prior to adding the herbicide into the spray tank.
3. Add the appropriate amount of LAUDIS slowly to the spray tank or mixing system and ensure complete dispersion. Maintain and ensure thorough dispersion and sufficient agitation during both mixing and spraying.
4. If tank mixing with another pesticide, add the tank mix product next (except in the case of glyphosate which should be added after the nitrogen fertilizer is dispersed).
5. Add nitrogen fertilizer.
6. Add the adjuvant.
7. Fill the spray tank with balance of water needed.
A broadleaf herbicide for use in the following field and row agricultural crops: chickpea (garbanzo beans), corn (field, pop, silage), cotton, fallow and postharvest, field pea, small grains, sorghum (grain), soybean, sunflower (harvest aid/desiccation only); and noncropland areas

Active Ingredient:
Safener: N-[2-chloro-4-fluoro-5-(3-methyl-2,6-dioxo-1H-pyrimidin-4-yl)-N-isopropyl-N-methyl] formamide 29.74%
Other Ingredients: 70.26%

Total: 100.00%

Contains 2.85 ounces active ingredient safener per gallon formulated as a water based suspension concentrate.

EPA Reg. No. 7969-178
EPA Est. No.

KEEP OUT OF REACH OF CHILDREN
CAUTION/PRECAUCION
(Si usted no entiende la etiqueta, busque a alguien para que se le explique a usted en detalle. If you do not understand the label, find someone to explain it to you in detail.)

See inside for complete First Aid, Precautionary Statements, Directions For Use, Conditions of Sale and Warranty, and state specific crop and/or use site restrictions.

In case of an emergency endangering life or properly involving this product, call day or night 1-800-832-HELP (4657).

Not Contents:
BASF Corporation
25 Davis Drive, Research Triangle Park, NC 27709

Mode of Action
Sharpen™ herbicide is a potent inhibitor of protoporphyrinogen-oxidase belonging to herbicide mode of action Group 14 (WWSA)/Group E (R-AC). Sharpen™ is rapidly absorbed by roots and foliage. Following inhibition of protoporphyrinogen-oxidase, plant death is the result of membrane damage. Under active growing conditions, susceptible emerged weeds usually develop chlorotic and necrotic injury symptoms within hours and die within a few days. Susceptible emerging weed seedlings will usually die as they reach the soil surface or shortly after emergence.

Resistance Management
White weed resistance to protoporphyrinogen-oxidase inhibiting herbicides is relatively infrequent, populations of resistant biotypes are known to exist. Resistance management practices include:
1. Following labeled application rate and weed growth stage recommendations
2. Avoiding repeated applications of herbicides with the same mode of action
3. Utilizing tank mixes and sequential applications with other effective herbicides possessing different modes of action
4. Using crop rotation so that crop competition, tillage or herbicides with alternative modes of action can be used to control weed escapes

Crop Tolerance
Crops are tolerant to Sharpen™ when applied according to label directions as a postemergence treatment and under normal environmental conditions. Crop injury may occur under stressful growing conditions (e.g. low soil fertility, seedling disease, extreme hot or cold weather, extended cloud cover, high soil pH, high soil salt concentration, or drought).

Severe crop injury will result if Sharpen™ is applied pre-emergence (over the top) to any crop.

Application Instructions
Sharpen™ may only be applied prior to crop emergence, except for harvest aid/desiccation uses.

Application Rates
Application rates of Sharpen™ may vary depending on soil texture and organic matter. Refer to Table 3 for soil texture groups used in this label.

Table 3. Soil Texture Groups

<table>
<thead>
<tr>
<th>Coarse</th>
<th>Medium</th>
<th>Fine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>Silt</td>
<td>Sandy clay</td>
</tr>
<tr>
<td>Loamy sand</td>
<td>Silt loam</td>
<td>Silty clay</td>
</tr>
<tr>
<td>Sandy loam</td>
<td>Loam</td>
<td>Silty clay loam</td>
</tr>
<tr>
<td>Clays</td>
<td>Sandy clay loam</td>
<td>Clay</td>
</tr>
</tbody>
</table>

Application Methods and Equipment
Sharpen™ may be applied by ground or air. Thorough spray coverage is required for optimum broadleaf weed control and can be improved with proper adjuvant, nozzle and spray volume selection.

Use and configure application equipment to provide an adequate spray volume, an accurate and uniform distribution of spray droplets over the treated area, and to avoid spray drift to nontarget areas. Equipment should be adjusted to maintain continuous agitation during spraying with good mechanical or bypass agitation. Avoid overlaps that will increase rates above the use rates specified in this label.

Sharpen™ may be applied using either water or sprayable fluid nitrogen fertilizer solutions as the spray carrier. Additionally, Sharpen™ may be incorporated on and applied with dry bulk fertilizer.

Aerial Application Requirements
Water Volume. Use 3 or more gallons of water per acre for weed control applications. Use a minimum of 5 gallons of water per acre for harvest aid/desiccation applications.

The following measures must be followed to reduce the potential of spray drift to nontarget areas from aerial applications:
1. The distance of the outermost nozzles on the boom must not exceed 3/4 the length of the fixed wingspan or 90% of rotor blade diameter.
2. Use low-drift nozzles such as straight-stream nozzles (G-8 or larger), DO NOT use nozzles producing a mist droplet spray.
3. Nozzles must always point backward parallel with the airstream and never be pointed downward more than 45 degrees.
4. Without compromising aircraft safety, applications should be made at a height of 10 feet or less above the crop canopy or tilled plants.
5. DO NOT apply during periods of temperature inversions or stable atmospheric conditions.
6. Avoid potential adverse effects to nontarget areas by maintaining a 100-foot buffer between the point of direct application and the closest downwind edge of sensitive terrestrial habitats (such as grasslands, forested areas, shelter belts, woodlots, hedgerows, riparian areas, and shrub lands).

Ground Application Requirements
Spray Carrier Volume. Use 5 or more gallons of water per treated acre or 20 or more gallons of sprayable fluid nitrogen fertilizer per treated acre for weed control applications. Thorough spray coverage is required for control of emerged broadleaf weeds. High populations and/or variations in size can prevent adequate spray coverage. Controlling fall-germinated weeds in the spring (e.g. horseweed/marestail) will also require thorough spray coverage. Use higher spray volumes (e.g. 15 to 20 gallons of water per acre) in these situations to increase spray coverage and optimize burnup activity. Use a minimum...
Controlling Droplet Size. The most effective way to reduce drift potential is to apply the largest droplets that provide sufficient coverage and control.

Volume. Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.

Pressure. DO NOT exceed the nozzle manufacturer’s recommended pressures. For many nozzle types, lower pressure produces larger droplets. When higher flow rates are needed, use higher flow rate nozzles instead of increasing pressure.
Medium to Coarse Spray Droplets
10 MPH Winds or Less
50’ Set back from the Downwind Edge of Susceptible Species
Controlling Spray Droplet Size

VMD – VMD is the expression of the droplet size of the spray cloud. The VMD value means that 50% of the droplets are larger than the expressed value and 50% of the droplets are smaller than the expressed value. Optimum Aim EW spray clouds should be 450 microns with fewer than 10% of the droplets being 200 microns or less.
Enlist Duo™
HERBICIDE
with COLEX-D™ Technology

For control of annual and perennial weeds and use on Enlist™ corn and soybeans; use as a non-selective burndown; chemical fallow; and use as a preplant or preemergence or postemergence herbicide on listed crops, for control of emerged weeds only.

2,4-D products that do not contain COLEX-D™ Technology are not authorized for use in conjunction with Enlist corn and soybeans.

Do not allow contact of herbicide with foliage, green stems, exposed non-woody roots or fruit of crops, desirable plants and trees because severe injury or destruction may result.

<table>
<thead>
<tr>
<th>Group</th>
<th>4</th>
<th>9</th>
<th>HERBICIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Ingredient(s):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>glyphosate</td>
<td>22.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dimethylammonium salt</td>
<td>24.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,4-Dichlorophenoxyacetic acid</td>
<td>53.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>choline salt</td>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Ingredients</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2,4-dichlorophenoxyacetic acid equivalent – 16.62% - 1.6 lb/gal
glyphosate acid equivalent – 17.48% - 1.7 lb/gal

Keep Out Of Reach Of Children

WARNING AVISO
Si usted no entiende la etiqueta, busque a alguien para que le explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

Precautionary Statements
Hazards to Humans and Domestic Animals

Causes Substantial But Temporary Eye Injury • Harmful If Swallowed • Prolonged Or Frequently Repeated Skin Contact May Cause Allergic Reactions In Some Individuals

Do not get in eyes or on clothing.

Personal Protective Equipment (PPE)
Some materials that are chemical-resistant to this product are barrier laminate, butyl rubber ≥14 mils, nitrile rubber ≥14 mils, neoprene rubber ≥14 mils, natural rubber ≥14 mils, polyethylene, polyvinyl chloride (PVC) ≥14 mils, or viton ≥14 mils. If you want more options, follow the instructions for category A on an EPA chemical-resistance category selection chart.

All mixers, loaders, applicators, flaggers, and handlers must wear:
15 MPH Winds or Less
Wind cannot be blowing towards tomatoes or other fruiting vegetables, cucurbits, grapes or cotton
30’ Set back from the Downwind Edge

Except: Roads and drives, Other ag fields (non-sensitive), unplanted fields, buildings

States approved: IL, IN, IA, OH, SD, W
Provisional states: AR, KA, LA, MN, MS, MO, NE, OK, TN, ND
(Comment period open until December 15th)
<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model</th>
<th>Maximum Operating Pressure (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABJ AgrI</td>
<td>ABJ11004</td>
<td>MAX 40</td>
</tr>
<tr>
<td></td>
<td>ABJ10006</td>
<td>MAX 30</td>
</tr>
<tr>
<td>GreenLeaf</td>
<td>TDXL11003</td>
<td>MAX 40</td>
</tr>
<tr>
<td></td>
<td>TDXL11004</td>
<td>MAX 45</td>
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<tr>
<td></td>
<td>TDXL11006</td>
<td>MAX 75</td>
</tr>
<tr>
<td></td>
<td>TDXL11003-D</td>
<td>MAX 30</td>
</tr>
<tr>
<td></td>
<td>TDXL11004-D</td>
<td>MAX 30</td>
</tr>
<tr>
<td></td>
<td>TDXL11006-D</td>
<td>MAX 100</td>
</tr>
<tr>
<td></td>
<td>TDXL11008-D</td>
<td>MAX 80</td>
</tr>
<tr>
<td>Hypro</td>
<td>ULD12004</td>
<td>MAX 70</td>
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<tr>
<td></td>
<td>ULD12006</td>
<td>MAX 50</td>
</tr>
<tr>
<td>Lechler</td>
<td>ID11004</td>
<td>MAX 40</td>
</tr>
<tr>
<td></td>
<td>ID11005</td>
<td>MAX 60</td>
</tr>
<tr>
<td></td>
<td>ID11006</td>
<td>MAX 60</td>
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<td></td>
<td>ID11008</td>
<td>MAX 70</td>
</tr>
<tr>
<td>TeeJet</td>
<td>AI11004</td>
<td>MAX 60</td>
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<td></td>
<td>AI11006</td>
<td>MAX 60</td>
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<td></td>
<td>AI11008</td>
<td>MAX 70</td>
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<td></td>
<td>AI11003</td>
<td>MAX 40</td>
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<td></td>
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<td>MAX 40</td>
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<tr>
<td></td>
<td>AI11006</td>
<td>MAX 40</td>
</tr>
<tr>
<td></td>
<td>AIXR11004</td>
<td>MAX 40</td>
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<tr>
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<td>AIXR11006</td>
<td>MAX 40</td>
</tr>
<tr>
<td></td>
<td>AIXR11004</td>
<td>MAX 40</td>
</tr>
<tr>
<td></td>
<td>TTI11004</td>
<td>MAX 85</td>
</tr>
<tr>
<td></td>
<td>MR11006</td>
<td>MAX 60</td>
</tr>
<tr>
<td></td>
<td>MR11008</td>
<td>MAX 60</td>
</tr>
</tbody>
</table>
ASABE S-572.1
Droplet Size Standard

Example Reference Graph

- Extra Fine/Very Fine (XF/VF)
- Very Fine / Fine (VF/F)
- Fine / Medium (F/M)
- Medium/Coarse (M/C)
- Coarse/Very Coarse (GVC)
- Very Coarse / Extra Coarse (VC/EC)
- Ultra Coarse / Extra Coarse (UC/EC)

Cumulative Volume Fraction

Drop Size (microns, μm)

0 100 200 300 400 500 600 700 800 900 1000 1100 1200

UC

XC

VMD
Types of Drift:

Vapor Drift - associated with volatilization (gas, fumes)

Particle Drift - movement of spray particles during or after the spray application
Particle Drift – *Big 4*

1. Wind Speed
Wind Speed

When the wind speed doubles, there is almost a 700% increase in drift when readings are taken from 90 feet downwind from the sprayer. Hence the recommendation of spraying in 10 mph winds or less.
Particle Drift – *Big 4*

1. Wind Speed
2. Boom Height
Boom Height

When the boom height was increased from 18 to 36 inches, the amount of drift increased 350% at 90 feet downwind.
Particle Drift – *Big 4*

1. Wind Speed
2. Boom Height
3. Distance from Susceptible Vegetation
Distance Downwind

If the distance downwind is doubled, the amount of drift decreases five-fold. If the distance downwind increases from 100 to 200 feet, you have only 20% as much drift at 200 feet as at 100 feet.

80% Decrease

200 ft.
Particle Drift – *Big 4*

1. Wind Speed
2. Boom Height
3. Distance from Susceptible Vegetation
4. Spray Particle Size
XR110025 at 60 psi using Water

25.8% Fines < 150 µm
XR110025 at 30 psi using Water

15.2% Fines < 150 µm
XR11005 at 30 psi using Water

7.6% Fines < 150 µm
TT11005 at 30 psi using Water

2.8% Fines < 150 µm
TTI11005 at 30 psi using Water

Density distribution q^3

0.2% Fines < 150 µm
# Spray droplet classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>Symbol</th>
<th>Color</th>
<th>Approx VMD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very fine</td>
<td>VF</td>
<td>Red</td>
<td>&lt;100</td>
</tr>
<tr>
<td>Fine</td>
<td>F</td>
<td>Orange</td>
<td>100-175</td>
</tr>
<tr>
<td>Medium</td>
<td>M</td>
<td>Yellow</td>
<td>175-250</td>
</tr>
<tr>
<td>Coarse</td>
<td>C</td>
<td>Blue</td>
<td>250-375</td>
</tr>
<tr>
<td>Very Coarse</td>
<td>VC</td>
<td>Green</td>
<td>375-450</td>
</tr>
<tr>
<td>Extremely coarse</td>
<td>EC</td>
<td>White</td>
<td>&gt;450</td>
</tr>
</tbody>
</table>

Source: ASAE Standard S-572
## How far will particles go?

<table>
<thead>
<tr>
<th>Droplet</th>
<th>Diameter (in μm)</th>
<th>Time to fall 10 feet</th>
<th>Travel distance in 3 mph wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fog</td>
<td>5</td>
<td>66 min</td>
<td>3 miles</td>
</tr>
<tr>
<td>Very fine</td>
<td>20</td>
<td>4.2 min</td>
<td>1,100 feet</td>
</tr>
<tr>
<td>Fine</td>
<td>100</td>
<td>10 sec</td>
<td>44 feet</td>
</tr>
<tr>
<td>Medium</td>
<td>240</td>
<td>6 sec</td>
<td>28 feet</td>
</tr>
<tr>
<td>Coarse</td>
<td>400</td>
<td>2 sec</td>
<td>8.5 feet</td>
</tr>
<tr>
<td>Fine rain</td>
<td>1,000</td>
<td>1 sec</td>
<td>4.7 feet</td>
</tr>
</tbody>
</table>

Source: *Herbicide Spray Drift*, NDSU Extension
Effect of Various Herbicides & Adjuvants on a “Medium” Spray Quality

VMD

Treatments

Size (μm)
A Simple Solution?

• Can we reduce drift with a nozzle or adjuvant alone?
Volume Median Diameter (VMD)

- Water
- RWM + 1% AMS + Polymer
- RWM + 2% AMS + Microemulsion 1
- RWM + 2% AMS + Microemulsion 2
- % less than 105 microns

- XR 11005
  - 40 psi 2.8 bar
- TT 11005
  - 40 psi 2.8 bar
- TF 2.5
  - 40 psi 2.8 bar
- AI 11005
  - 40 psi 2.8 bar
- AIXR 11005
  - 40 psi 2.8 bar

Percent of Microns

- 0
- 150
- 300
- 450
- 600

Volume Median Diameter (VMD)
<table>
<thead>
<tr>
<th>Solution</th>
<th>Pressure</th>
<th>DV0.5 (µm)</th>
<th>%Vol&lt;100 µm</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM</td>
<td>210</td>
<td>e</td>
<td>12.0</td>
</tr>
<tr>
<td>COC</td>
<td>235</td>
<td>c</td>
<td>4.0</td>
</tr>
<tr>
<td>DRT</td>
<td>261</td>
<td>a</td>
<td>2.5</td>
</tr>
<tr>
<td>MSO</td>
<td>246</td>
<td>b</td>
<td>2.9</td>
</tr>
<tr>
<td>Si</td>
<td>205</td>
<td>f</td>
<td>11.7</td>
</tr>
<tr>
<td>P1</td>
<td>261</td>
<td>a</td>
<td>7.3</td>
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<tr>
<td>P2</td>
<td>228</td>
<td>d</td>
<td>8.3</td>
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<tr>
<td>PM</td>
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<td>e</td>
<td>21.6</td>
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<tr>
<td>COC</td>
<td>189</td>
<td>c</td>
<td>12.6</td>
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<tr>
<td>DRT</td>
<td>208</td>
<td>a</td>
<td>8.8</td>
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<tr>
<td>MSO</td>
<td>202</td>
<td>b</td>
<td>9.7</td>
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<tr>
<td>Si</td>
<td>165</td>
<td>e</td>
<td>20.9</td>
</tr>
<tr>
<td>P1</td>
<td>187</td>
<td>c</td>
<td>18.1</td>
</tr>
<tr>
<td>P2</td>
<td>174</td>
<td>d</td>
<td>19.5</td>
</tr>
<tr>
<td>Solution</td>
<td>Pressure</td>
<td>DV0.5 (µm)</td>
<td>%Vol&lt;100 µm</td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
<td>------------</td>
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</tr>
<tr>
<td>PM</td>
<td>389</td>
<td>c</td>
<td>1.9</td>
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<tr>
<td>PM</td>
<td>321</td>
<td>c</td>
<td>5.5</td>
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<tr>
<td>COC</td>
<td>362</td>
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<tr>
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### TTI11003

<table>
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<th>Solution</th>
<th>Pressure</th>
<th>DV0.5 (µm)</th>
<th>%Vol&lt;100 µm</th>
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Flat Fan Nozzle
Air Induction Nozzle
Relationship Between Drift and Efficacy

Drift reduction

Efficacy
Field Studies

Four locations in Nebraska
  Bancroft, Clay Center, Courtland, Elba

Four replications per location

Five planted species
  Amaranth, Flax, Velvetleaf, Soybean, Corn

Five Nozzles plus an Untreated
  XR11002 (Fine), XR11003 (Fine/Medium), TT11002 (Medium), AIXR11002 (Coarse), AI11002 (Extremely Coarse)
FirstRate

Amaranth

Efficacy (%)

Droplet size (µm)

Fine
Fine/Medium
Medium
Coarse
Extremely Coarse
Materials and Methods

• Herbicides
  – Glyphosate (RoundUp PowerMax at 32 oz/ac) – 3 GPA
  – Glufosinate (Liberty at 22 oz/ac) – 15 GPA
  – Lactofen (Cobra at 12.5 oz/ac) – 20 GPA
  – 2,4-D (Weedone at 32 oz/ac) – 10 GPA

• Plots
  – 5 ft x 10 ft

• Weed Control Ratings taken 14 and 28 DAT
## Materials and Methods

<table>
<thead>
<tr>
<th>Carrier volume GPA</th>
<th>Nozzle</th>
<th>Application speed mph</th>
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Results

Velvetleaf

Control (%) for 2,4-D, Lactofen, Glufosinate, and Glyphosate treatments, with various GPA levels indicated by different colors. NS indicates no significant difference.
Results

Amaranth

Control (%)

2,4-D  |  Lactofen  |  Glufosinate  |  Glyphosate

<table>
<thead>
<tr>
<th>5 GPA</th>
<th>7.5 GPA</th>
<th>10 GPA</th>
<th>15 GPA</th>
<th>20 GPA</th>
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NS

Bars marked with the same letter are not significantly different at the 5% level.
Results

Corn

Control (%)

2,4-D  Lactofen  Glufosinate  Glyphosate

5 GPA  7.5 GPA  10 GPA  15 GPA  20 GPA

NS  B  B  B  A

ABAB

A

NS

Legend:

- 5 GPA
- 7.5 GPA
- 10 GPA
- 15 GPA
- 20 GPA
Results

Soybean

Control (%)

2,4-D  Lactofen  Glufosinate  Glyphosate

5 GPA  7.5 GPA  10 GPA  15 GPA  20 GPA

NS  NS

A  B  B  AB  AB

5 GPA: Light gray
7.5 GPA: Dark gray
10 GPA: Medium gray
15 GPA: Gray
20 GPA: Black
UNL Ground Spray App
Take Home Messages!

- Particle drift can be influenced by formulation.
- Nozzle selection has the greatest influence on particle size.
- Adjuvants can reduce drift potential, but must be tested.
- There is no substitute for common sense – if the wind is blowing, droplets will move.
- Pay attention to sensitive vegetation in surrounding areas.
- Drift WILL happen! Mitigating drift is essential!
Questions?