Making Applications More Difficult to Make Applications More Efficient

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Equipment is not getting less sophisticated!

The Pesticide Application
Process for Pesticide Efficacy

Spray Tank → Atomization → Impaction → Retention → Deposit Formation → Biological Effect

Chemical Reactions → Pump Shear → Mixing and Agitation
Equipment/Application → Physical Properties → Atmospheric Conditions → Evaporation → Micrometeorological Effects
Spray and Surface Properties → Droplet Size and Kinetic Energy → Dynamic Spreading
Spread and Coalescence → Absorption and Translocation → Surface Activity → Encounter Probability → Pick-up and Transport to the Site-of-Action
Definition of Drift:

Movement of *spray particles* and *vapors* off-target causing less effective control and possible injury to susceptible vegetation, wildlife, and *people*.

Adapted from National Coalition on Drift Minimization 1997 as adopted from the AAPCO Pesticide Drift Enforcement Policy - March 1991
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.

Wind Speeds Gradients:

The relation between height above the canopy of a crop like cotton or soybean and the speed of wind.
Particle Drift – *Big 4*

1. Wind Speed

2. Boom Height

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**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

<table>
<thead>
<tr>
<th>Item</th>
<th>Micron Size</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pencil lead</td>
<td>2000 µm</td>
<td><img src="image" alt="Pencil lead" /></td>
</tr>
<tr>
<td>Paper clip</td>
<td>850 µm</td>
<td><img src="image" alt="Paper clip" /></td>
</tr>
<tr>
<td>Staple</td>
<td>420 µm</td>
<td><img src="image" alt="Staple" /></td>
</tr>
<tr>
<td>Toothbrush bristle</td>
<td>300 µm</td>
<td><img src="image" alt="Toothbrush bristle" /></td>
</tr>
<tr>
<td>Sewing thread</td>
<td>150 µm</td>
<td><img src="image" alt="Sewing thread" /></td>
</tr>
<tr>
<td>Human hair</td>
<td>100 µm</td>
<td><img src="image" alt="Human hair" /></td>
</tr>
</tbody>
</table>
Data Analysis

- Droplet size data were statistically analyzed using a full factorial response surface model
- Four main model factors along with potential interaction effects were evaluated
  - Nozzle
  - Application Volume Rate
  - Orifice Size
  - Formulation
- All possible factorial combinations of the four main factors were tested
- Percent fine droplets to relate to drift potential – Vol < 150 µm (%)
- $D_{v0.5}$ (VMD) relates to efficacy
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

0.2% Fines < 150 µm

Effect of Various Herbicides & Adjuvants on a “Medium” Spray Quality

* Tee Jet Droplet Size Classifications
Volume Median Diameter (VMD)

Relationship Between Drift and Efficacy
How far will particles go?

<table>
<thead>
<tr>
<th>Droplet</th>
<th>Diameter (in (\mu\m))</th>
<th>Time to fall 10 ft</th>
<th>Travel distance in 3 mph wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fog</td>
<td>5</td>
<td>66 min</td>
<td>15,840 ft</td>
</tr>
<tr>
<td>Very fine</td>
<td>20</td>
<td>4.2 min</td>
<td>1,100 ft</td>
</tr>
<tr>
<td>Fine</td>
<td>100</td>
<td>10 sec</td>
<td>44 ft</td>
</tr>
<tr>
<td>Medium</td>
<td>240</td>
<td>6 sec</td>
<td>28 ft</td>
</tr>
<tr>
<td>Coarse</td>
<td>400</td>
<td>2 sec</td>
<td>8.5 ft</td>
</tr>
<tr>
<td>Fine rain</td>
<td>1,000</td>
<td>1 sec</td>
<td>&lt; 5 ft</td>
</tr>
</tbody>
</table>

Source: *Herbicide Spray Drift*, NDSU Extension

**TEEJET XR11003-VP**
## TEEJET TTI11004

<table>
<thead>
<tr>
<th></th>
<th>Herbicide</th>
<th>Fungicide</th>
<th>Insecticide</th>
<th>Liquid Fertilizer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Incorporated</td>
<td>Pre-Emergence</td>
<td>Contact</td>
<td>Systemic</td>
</tr>
<tr>
<td>Turbo TeeJet</td>
<td>Good</td>
<td>Good</td>
<td>Good+</td>
<td>Good</td>
</tr>
<tr>
<td>Air Induction</td>
<td>Good+</td>
<td>Good+</td>
<td>Good+</td>
<td>Good+</td>
</tr>
<tr>
<td>Extended Range flat fan</td>
<td>-</td>
<td>-</td>
<td>Good+</td>
<td>Good</td>
</tr>
<tr>
<td>Pre-orifice flat fan</td>
<td>Good+</td>
<td>Good+</td>
<td>Good</td>
<td>Good+</td>
</tr>
<tr>
<td>Standard flat fan</td>
<td>-</td>
<td>-</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Twin orifice flat fan</td>
<td>-</td>
<td>-</td>
<td>Good+</td>
<td>-</td>
</tr>
<tr>
<td>Turbo Flood Jet</td>
<td>Good+</td>
<td>Good+</td>
<td>-</td>
<td>Good</td>
</tr>
<tr>
<td>Turfjet</td>
<td>Good+</td>
<td>Good+</td>
<td>-</td>
<td>Good</td>
</tr>
<tr>
<td>Solid Cone</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Good</td>
</tr>
</tbody>
</table>

Pgs. 2-3
Know the Label – The Label is the Law!

**APPLICATION INFORMATION**
Uniform through spray coverage is important to achieve consistent weed control. Select nozzle and pressure that deliver LAUDIS spray droplets as indicated in nozzle manufacturer’s catalog and in accordance with AESC Standard 577. Nozzles that deliver COARSE spray droplets may be used to reduce spray drift. Pressure spray volume per acre (PSV) is increased to maintain coverage of weeds. Flat fan nozzles of 50°-110° are recommended for optimum results.

- Do not use nozzles that produce fine (e.g. Cone) or EXTRA COARSE (e.g. Flat fan) spray droplets.

**Spray Application**
LAUDIS can be applied broadcast in a minimum of 10 gallons per acre or a higher volume as required for better coverage. For severe weeds, please refer to your application or other adverse growing conditions, 15 to 30 gallons per acre is recommended. Good coverage is essential to achieve optimum weed control.

- For flat fan nozzles calibrated at 30-80 PSI will deliver MEDIUM spray droplets, providing optimum spray coverage and economy generation. Lower pressure settings (and higher volume) flat fan nozzles typically deliver COARSE spray. Refer to nozzle manufacturer’s catalog.
- Boom height should be based on the height of the crop – at least 10 inches above the crop canopy.
- An induction nozzles should be used at or near 45 psi to produce a medium droplet size.
- Proper agitation should be maintained within the tank to keep the product dispersed.

See the 30-Mp or CM Management section on this label for additional information on proper application of LAUDIS.

**Mixing Instructions**
LAUDIS should be applied with clean and properly-functioning equipment. Prior to adding LAUDIS, ensure that the sprayer 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; begin agitation.
2. Open the LAUDIS product container thoroughly by shaking, stirring or adding water to the hybrid 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 through dispersion and sufficient agitation during both mixing and spraying.
4. If tank mixing with another pesticide, add the tank mix product first (except in the case of non铎-compatible products).
5. Add nitrogen fertilizer.
6. Add the adjuvant.
7. Add the appropriate amount of LAUDIS slowly to the spray tank or mixing system and ensure complete dispersion. Maintain and ensure through dispersion and sufficient agitation during both mixing and spraying.

Know the Label – The Label is the Law!
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

Mode of Action
Aim® herbicide is a plant growth regulator that inhibits photosynthesis in susceptible plants. It is effective against a wide range of weeds and grasses in various crops.

Rescue Management
If rescue is necessary, contact a BASF representative for guidance. For more information, visit www.BASF.com/Aim or call 1-888-727-4473.

Application Methods and Equipment
Aim® may be applied to ground or aerial equipment. For aerial application, consult the product label for recommendations on equipment and applicator settings. Ensure proper calibration and adjustment of the equipment to achieve the desired droplet size and coverage.

Aerial Application Requirements
Aerial application of Aim® is not recommended for use inolls or other areas where drift could cause damage. Use only equipment and methods approved for aerial application.

Ground Application Requirements
For ground application, use equipment and methods approved for ground application. Ensure proper calibration and adjustment of the equipment to achieve the desired droplet size and coverage.

Physical/Chemical Properties
Type: Herbicide
Active Ingredient: FMC 150007
Trade Name: Aim®
Physical Form: Liquid
Solubility: Water-soluble
pH: Neutral

Precautionary Statements
For Agricultural or Commercial Use Only
DO NOT FOR SALE OR USE IN CALIFORNIA

STORAGE
Store in original container, out of reach of children, in a cool, dry place. Protect from direct sunlight and excessive heat.

Table of Contents
TABLE OF CONTENTS
For Agricultural or Commercial Use Only
STORAGE
STORAGE
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.

Carrier Rate

- Herbicides
  - Glyphosate (RoundUp PowerMax) – 3 GPA
  - Glufosinate (Liberty) – 15 GPA
  - Lactofen (Cobra) – 20 GPA
  - 2,4-D (Weedone) – 10 GPA
- Plots
  - 10’ x 30’
- Weed Control Ratings taken 14 and 28 DAT
- Four locations
Materials and Methods

<table>
<thead>
<tr>
<th>Carrier volume</th>
<th>Nozzle</th>
<th>Application speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>XR11001</td>
<td>4</td>
</tr>
<tr>
<td>7.5</td>
<td>XR11001</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>XR11001</td>
<td>4</td>
</tr>
<tr>
<td>15</td>
<td>XR110015</td>
<td>4</td>
</tr>
<tr>
<td>20</td>
<td>XR11002</td>
<td>4.8</td>
</tr>
</tbody>
</table>

Results

![Bar chart showing Velvetleaf control percentages for different treatments and carrier volumes. The chart includes bars for 2,4-D, Lactofen, Glufosinate, and Glyphosate, with letters indicating significant differences. The control percentages range from 0% to 90%. The chart also includes a legend for the treatments and carrier volumes.]
Results

Amaranth

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Control (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,4-D</td>
<td>70</td>
</tr>
<tr>
<td>Lactofen 5 GPA</td>
<td>80</td>
</tr>
<tr>
<td>Lactofen 10 GPA</td>
<td>85</td>
</tr>
<tr>
<td>Glufosinate</td>
<td>90</td>
</tr>
<tr>
<td>Glyphosate</td>
<td>95</td>
</tr>
</tbody>
</table>

Lactofen 5 GPA

Lactofen 10 GPA
Amaranth

Glufosinate
5 GPA
14 DAA
Dicamba
5 GPA
14 DAA

Optimum droplet sizes for maximum Palmer amaranth control

<table>
<thead>
<tr>
<th></th>
<th>Dicamba</th>
<th>Glufosinate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5 GPA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>150 µm</td>
<td>Fine</td>
<td>270 µm</td>
</tr>
<tr>
<td>626 µm</td>
<td>Extremely Coarse</td>
<td>488 µm</td>
</tr>
<tr>
<td><strong>20 GPA</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


How droplet size affects droplets per square inch

<table>
<thead>
<tr>
<th>Droplet Size (microns)</th>
<th>2 GPA</th>
<th>10 GPA</th>
<th>15 GPA</th>
<th>20 GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>289</td>
<td>1,445</td>
<td>2,167</td>
<td>2,890</td>
</tr>
<tr>
<td>500</td>
<td>18</td>
<td>90</td>
<td>135</td>
<td>180</td>
</tr>
<tr>
<td>1,000</td>
<td>2</td>
<td>12</td>
<td>18</td>
<td>24</td>
</tr>
</tbody>
</table>
XtendiMax Alone – TTI11004 @ 40 PSI

10 GPA  
12 MPH

15 GPA  
8 MPH

20 GPA  
6 MPH
XtendiMax Alone – TDXL-D11004 @ 40 PSI

10 GPA
12 MPH

15 GPA
8 MPH

20 GPA
6 MPH

XMAX + PMAX + SELECTMAX + WARRANT + INTACT
TT111004 @ 40 PSI

10 GPA
12 MPH

15 GPA
8 MPH

20 GPA
6 MPH
XMAX + PMAX + SELECTMAX + WARRANT + INTACT
TDXL-D11004 @ 40 PSI

XMAX + PMAX + INTENSITY + WARRANT + REIGN
TTI11004 @ 40 PSI
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?