Minimizing Pesticide Spray Drift

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Sections of this program have been adapted from programs written by
Dr. Kevin Bradley, State MU Extension Weed Scientist

Improper Application of Dicamba
A Look Back at 2017

In 2017, thousands of acres were damaged in Missouri.

Dicamba
Tell-tale Symptom: Leaf Cupping

Dicamba vs. 2,4-D
Differences in Symptomology

✓ Dicamba

2,4-D

Crop Injury
Example: Potential for Injury on Non-Tolerant Soybean

<table>
<thead>
<tr>
<th>Non-treated, Control (healthy, non-injured soybean comparison)</th>
<th>Dicamba</th>
<th>2,4-D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1/20,000 of the 1x Use Rate (0.000025 lb ae/A) 14 days after V3 application</td>
<td>1/40 th of the 1x Use Rate (0.025 lb ae/A) 14 days after V3 application</td>
</tr>
</tbody>
</table>

Dicamba Complaints in Missouri
Number of Complaints and Reports of Crop Damage* in 2017

- 108,758 acres of soybean
- 18,904 tomato plants
- 758 acres of peaches
- 132 acres of vineyards
- 130 acres of alfalfa
- 12 acres of apple trees
- 11 acres of commercial gardens
- 10 acres of cantaloupes
- 2 acres of pumpkins
- 960 mums
- 40 residential properties (gardens/trees/shrubs)

* Crops damaged as identified by complainant (as of 10/26/2017)

Total: 310 complainants (355 complaints) across 52 counties (as of 10/26/2017)
U.S. Injury Investigations

Dicamba-related Injury Investigations as Reported by State Departments of Agriculture

*Total: 2,708

[As of October 15, 2017]

Injured U.S. Acreage

Estimates of Dicamba-injured Soybean Acreage in the U.S. Reported by State Extension Scientists

*Total: ~3.6 million

[As of October 15, 2017]

Approved Products

Only Use Approved Herbicides

- Three approved dicamba herbicide products in Missouri
  - Engenia
  - XtendiMax
  - FeXapan

- All registered as Restricted Use Pesticides with EPA

- Only certified applicators with training may purchase and apply

- MDA issued a 24c Special Local Need label with state-specific requirements

Required Training

In-person or Online

- Prior to purchase, applicators must complete mandatory synthetic auxin training provided by the University of Missouri.

  - Jan 10th – Springfield
  - Jan 22nd – Blue Springs
  - Feb 9th – Columbia
  - Feb 12th – Hannibal
  - Feb 13th – Sikeston

A Black Eye for the Ag Industry

Potential Problems with Improper Application

Who’s responsible for avoiding drift at the site of application?

Applicator
Herbicide salesperson
Land owner of treated field
Herbicide product
Sprayer manufacturer
Potential Problems
Improper Application Can Have Serious Consequences

- Crop injury
- Yield loss
- Damage to nearby sensitive species
- Harm to neighbor relationships
- Lawsuits and fines
- Black eye for the agriculture industry
- Improper use jeopardizes access to future traits, herbicides, and tools

Driftwatch.org
An online specialty crop registry that helps Missouri pesticide applicators and specialty crop growers communicate more effectively to protect pesticide-sensitive areas. Managed by Missouri Dept. of Agriculture.

Which of these factors can influence off-target movement of pesticides?

- Wind speed
- Nozzle type
- Droplet size
- Sprayer speed
- Boom height
- Herbicide volatility
- Temperature
- Dust
- Water runoff
- Tank type
- Hose type
- Tank cleanout

Common Methods of Off-Target Movement

- Wind speed
- Nozzle type
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- Tank cleanout
Physical Drift
Definition and How it Occurs

- Physical drift occurs when the droplets leaving the sprayer do not reach the intended target.
- Physical drift is influenced by:
  - Wind speed
  - Boom height
  - Nozzle Selection
  - Droplet Size
  - Sprayer Speed

Physical Drift
Distinguishing Characteristics

Physical drift can usually be distinguished as clear patterns of injury that are more severe closest to the spray source.

Important!
Do Not Rely on Formulation Alone to Prevent Drift

Check the Wind

Nozzles and Droplet Size
Sources of Physical Drift

How are you checking the wind speed?

Best Practice: Check Wind Speeds at the Site of Application

Source: Bish & Bradley (2017)
**Relationship of Nozzle Type and Droplet Size**

Comparison of Two Different Nozzle Types

- Extended Range Flat Fan Spray Tip
- Turbo TeeJet Induction Nozzle

Videos Provided by Dr. Greg Kruger, University of Nebraska

**How far will spray particles move?**

**Relationship of Droplet Size to Distance Traveled**

<table>
<thead>
<tr>
<th>Droplet Size</th>
<th>Diameter (in μm)</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>
</tbody>
</table>

**Bottom line? Using nozzles that produce droplets smaller than the labeled requirements will likely cause significant problems with drift!**

**Sprayer Speed**

Sources of Physical Drift

- Wind speed
- Nozzle type
- Droplet size
- Sprayer speed
- Boom height

**Influence of Sprayer Speed on Spray Drift Deposition**

Increasing Tractor Speed Can Increase Drift Potential

Drift (% of application rate)

- XR11004
- DG11004

- 3.7 MPH: +1.3X
- 7.5 MPH: +3.9X

* (1 - 5 m from last nozzle)


**Boom Height**

Sources of Physical Drift

- Wind speed
- Nozzle type
- Droplet size
- Sprayer speed
- Boom height

**Boo**

Increasing Boom Height Can Increase Drift Potential

- 18 inch increase
- 350% increase in drift
- 90 ft. downwind

**Always read and follow the labeled boom height requirements!**

Illustration Provided by Dr. Greg Kruger, University of Nebraska
**Factors that Influence Herbicide Volatility**

2,4-D and dicamba volatility are influenced by:

- **Temperatures:** Higher temperatures generally lead to ↑ volatility
- **Humidity:** Lower humidity generally leads to ↑ volatility
- **Surface:** Volatility is generally greater from leaves vs. soil
- **Formulation (salt):** Acids are generally the most volatile; only use approved formulations
- **Carrier Volume (GPA):** Lower carrier volumes lead to ↑ volatility
- **Droplet Size:** Fine droplets can result in ↑ volatility than coarse or ultra coarse droplets
- **Tank Mixes:** Other products can ↑ volatility of specific herbicides (e.g., AMS can increase the volatility of dicamba)

**The Salt in the Formulation Matters**

Comparison of Three 2,4-D Formulations with Different Salts

![Graph showing relative volatility% vs. distance from site of 2,4-D application for 2,4-D Ester, 2,4-D Amine, and 2,4-D Choline.]

**Temperature Inversions**

Sources of Secondary Drift

- During an inversion, herbicide droplets may be trapped in air masses that settle-in above the earth’s surface
- If the air mass moves, the trapped herbicide droplets may land off-target when it dissipates

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**Common Methods of Off-Target Movement**

- Physical Drift
- Secondary Drift & Movement
- Tank Contamination

**Herbicide Volatility**

**Definition and How it Occurs**

- Occurs when the herbicide lands on the intended target, but evaporates and moves off-target before absorption
- Injury due to volatility is less discernable than injury due to physical drift
- New formulations reduce, but do not eliminate, drift due to herbicide volatility
Recognizing Temperature Inversions
Conditions, Indicators, and Duration

- Usual conditions at onset:
  - Sunset
  - Clear to partly cloudy skies
  - Light winds
- Often indicated by:
  - Ground fog
  - Smoke not rising
  - Dust hanging over road
  - Dew or frost
- May continue until surface temperature and wind increase

Detecting Surface Inversions
Using Smoke Grenades to Validate Inversion Conditions

Released at 4:00 PM, No Inversion Present
Released at 7:30 PM, Inversion Present

Real Time Monitoring for Inversion-like Conditions
mesonet.missouri.edu

Real Time Monitoring for Inversion-like Conditions

Dust and Water Movement
Sources of Secondary Drift

- Excessive dust can carry herbicide particles away from the intended target
- Heavy rainfall events can cause movement due to runoff from nearby fields

Time of Application

On label application; made mid-day
Off label application; made in the evening during an inversion

Time of Day Requirement
Missouri-Specific Application Window Restrictions

Real Time Monitoring for Inversion-like Conditions

Dust and Water Movement
Sources of Secondary Drift
**Common Methods of Off-Target Movement**

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- Tank type
- Hose type
- Tank cleanout

**Spray Tank Contamination**

Tank Contamination Can Lead to Crop Injury

![8 oz solution in a 1,200 gallon spray tank can result in significant injury to a subsequent sensitive soybean variety!]

**Spray Tank Cleanout Procedures**

Improper Cleanout Procedures can Lead to Yield Loss

Comparison of Three Equipment Cleanout Procedures Following Dicamba Application

- Non-treated control
- Single rinse water
- Double Rinse: 1st rinse water; 2nd rinse ammonia
- Triple Rinse: 1st rinse water; 2nd rinse ammonia; 3rd rinse water

Yield: 48 Bu/A

- 37 Bu/A
- 44 Bu/A
- 48 Bu/A

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**Questions / Comments?**

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