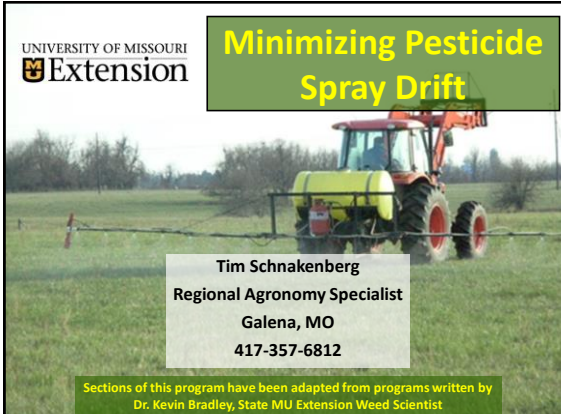


UNIVERSITY OF MISSOURI Extension


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

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

Dicamba Complaints in Missouri

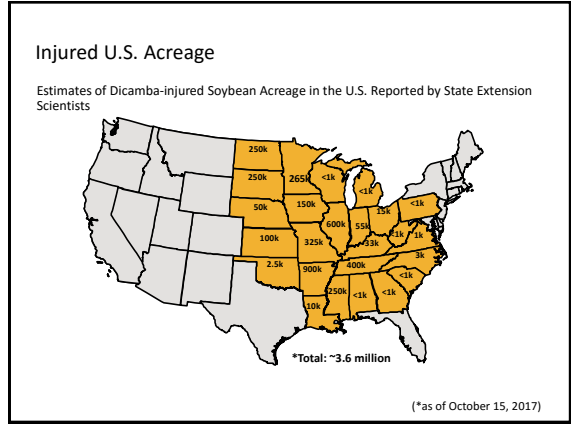
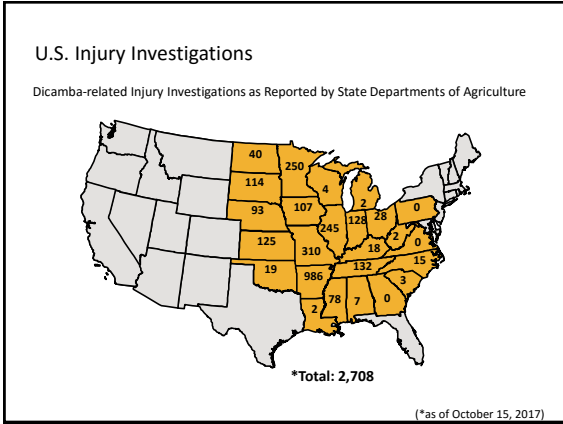
Number of Complaints and Reports of Crop Damage* in 2017



- 108,758 acres of soybean
- 18,904 tomato plants
- 758 acres of peaches
- 132 acres of vineyards
- 130 acres rice
- 122 acres of watermelons
- 35 acres of alfalfa
- 24 acres certified organic vegetables
- 15 acres of pecan trees
- 12 acres of apple trees
- 11 commercial gardens
- 10 acres of cantaloupes
- 2 acres of pumpkins
- 900 mums
- 40 residential properties (gardens/trees/shrubs)

Total: 310 complainants (335 complaints) across 52 counties
(as of 10/26/2017)

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



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

Use Rate & Application

Tank Mixtures & Handling

Equipment & Sprayer

Proper Cleaning & Hygiene

Buffer Zones & Sensitive

Weather Conditions &

Record Keeping & Notice

Required Training

In-person or On-line

- 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

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

- Applicator
- Herbicide salesperson
- Land owner of treated field
- Herbicide product
- Sprayer manufacturer

A Black Eye for the Ag Industry

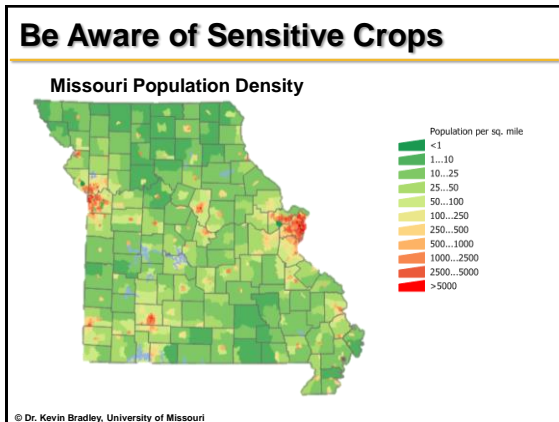
Potential Problems with Improper Application

EPA executes search warrants related to Dicamba

According to a news release obtained by the DDD Friday from the Environmental Protection Agency, EPA has executed federal search warrants at several locations in Missouri as part of an investigation into alleged misuse of auxin herbicide products containing Dicamba. EPA's investigation is ongoing and addresses widespread complaints of damage to various crops across Missouri and several states in the Midwest and Southeast.

Southern Illinois farmer's grapevines destroyed by dicamba; four years of work lost

Boothel man arrested following fatal dispute shooting allegedly sparked by dicamba



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
- Temperature
- Dust
- Water runoff
- Tank type
- Hose type
- Tank cleanout

Common Methods of Off-Target Movement

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




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Physical Drift

Distinguishing Characteristics

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



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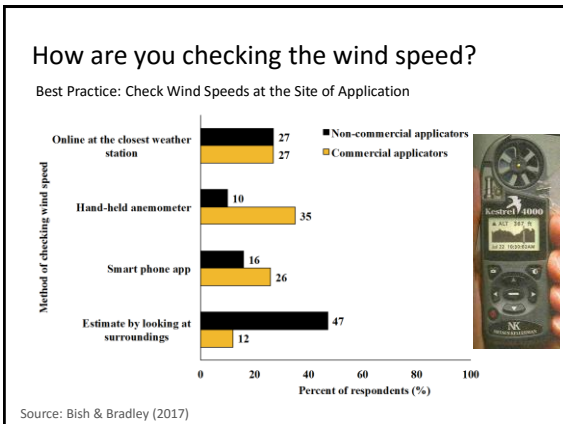
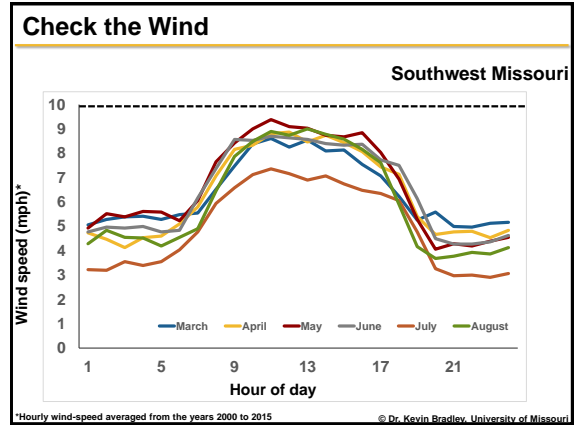
Important!

Do Not Rely on Formulation Alone to Prevent Drift




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

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Nozzles and Droplet Size

Sources of Physical Drift



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

Relationship of Nozzle Type and Droplet Size

Comparison of Two Different Nozzle Types

TXDL-11003 40PSI TT111004 40PSI

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

Droplet Size	Diameter (in μm)	Time to fall 10 ft	Travel distance in 3 mph wind
Fog	5	66 min	15,840 ft
Very fine	20	4.2 min	1,100 ft
Fine	100	10 sec	44 ft
Medium	240	6 sec	28 ft
Coarse	400	2 sec	8.5 ft

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

Source: Hofman & Solseng (2017)

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

Nozzle Type	3.7 MPH	7.5 MPH
XR11004	6.4	8.25 (+1.3X)
DG11004	1.47	5.73 (+3.9X)

Source: Van de Zande et al., (2004) * (1-5 m from last nozzle)

Boom Height

Sources of Physical Drift

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

Boom Height

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

Common Methods of Off-Target Movement

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

Herbicide Volatility

Definition and How it Occurs

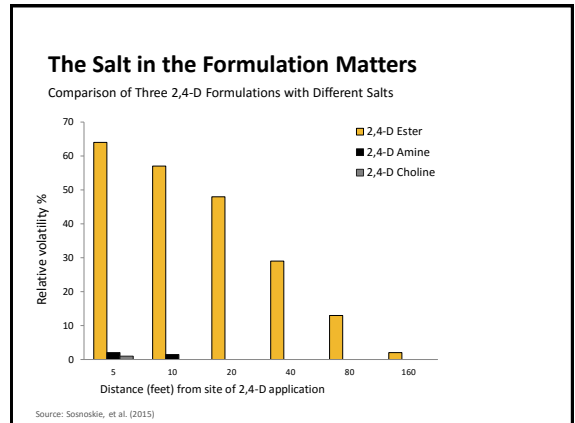
- Occurs when the herbicide lands on the intended target, but evaporates and moves off-target before absorption
- Injury due to volatility is less discernable than injury due to physical drift
- New formulations reduce, but do not eliminate, drift due to herbicide volatility

Factors that Influence Herbicide Volatility

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

- Temperatures:** Higher temperatures generally leads 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)

Sources: Behrens & Lueschen (1979); Long & Young (2017)

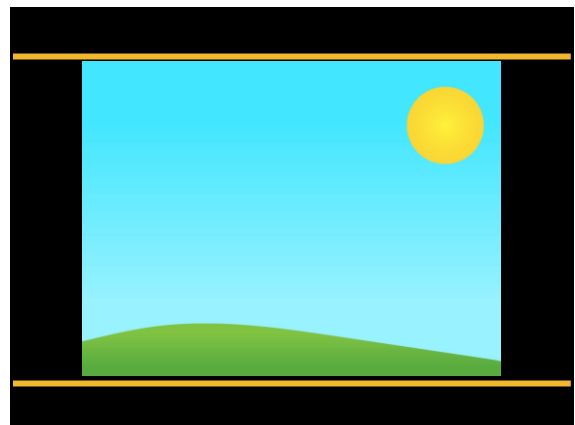


Temperature Inversions

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

- Herbicide
- Temperature
- Dust
- Water Runoff



Recognizing Temperature Inversions

Conditions, Indicators, and Duration

⚡ Usual conditions at onset:

- Sunset
- Clear to partly cloudy skies
- Light winds



⚡ Often indicated by:

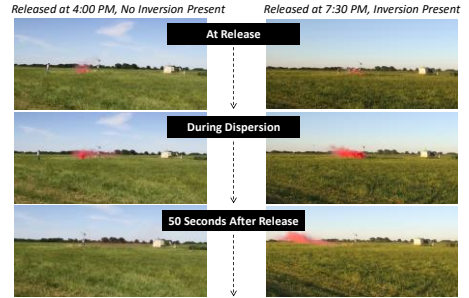
- Ground fog
- Smoke not rising
- Dust hanging over road
- Dew or frost



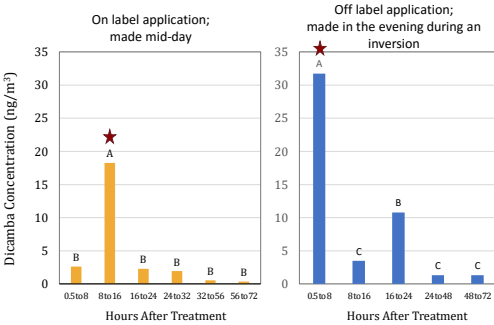
⚡ May continue until surface temperature and wind increase

Detecting Surface Inversions

Using Smoke Grenades to Validate Inversion Conditions



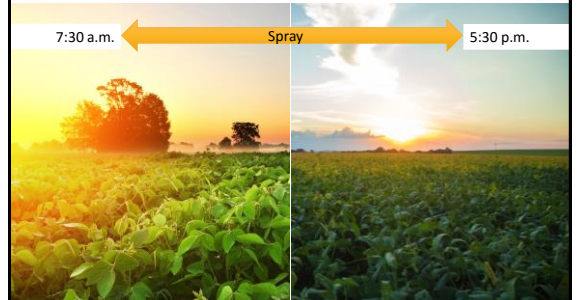
Time of Application



Daytime and nighttime application experiments conducted twice, with 3 air samplers per experiment
 © Dr. Kevin Bradley, University of Missouri

Time of Day Requirement

Missouri-Specific Application Window Restrictions



Real Time Monitoring for Inversion-like Conditions

mesonet.missouri.edu



Funding for this project made possible by the Missouri Soybean Merchandising Council

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



Herbicide temperature
 Dust
 Water Runoff

Common Methods of Off-Target Movement

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

Spray Tank Contamination

Tank Contamination Can Lead to Crop Injury

Leaving as little as 8 fl oz of solution in a 1,200 gallon spray tank can result in significant injury to a subsequent sensitive soybean variety!

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Spray Tank Cleanout Procedures

Improper Cleanout Procedures can Lead to Yield Loss

Comparison of Three Equipment Cleanout Procedures Following Dicamba Application

Procedure	Yield (Bu/A)
Non-treated control	48 Bu/A
Single rinse water	37 Bu/A
Double Rinse (1 st rinse water; 2 nd rinse ammonia)	44 Bu/A
Triple Rinse (1 st rinse water; 2 nd rinse ammonia; 3 rd rinse water)	48 Bu/A

Common Methods of Off-Target Movement

Which of these do you need to be more mindful of during the upcoming application season?

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

Questions / Comments?

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