# Keys to Spray Drift Management

FLOYD INGRAM
COUNTY EXTENSION AGENT – MILAM COUNTY

October 28, 2019
Pridgeon Community Center
Franklin, Texas

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## Pesticide drift is…

…the unintentional airborne movement of pesticides outside of the target area.

Glyphosate damage on soybean

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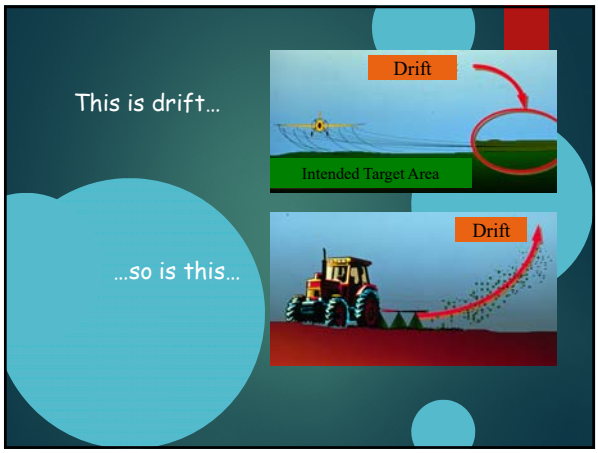
This is drift…
Drift
Intended Target Area
…so is this…
Drift

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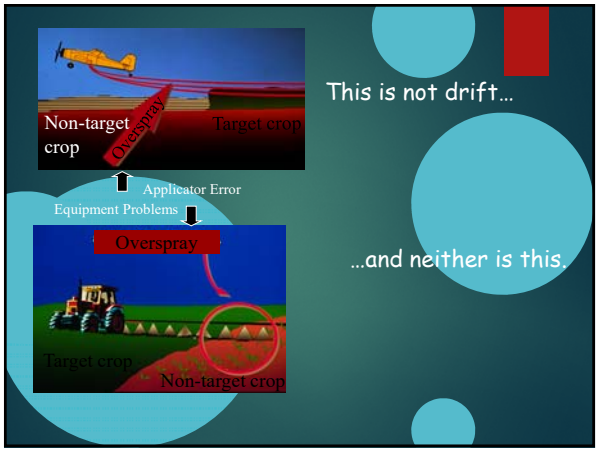
Non-target crop
Overspray
Target crop
Applicator Error
Equipment Problems
Overspray
Target crop
Non-target crop
This is not drift…
…and neither is this.

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Why is drift a problem?
Poor Pest Control
Wasted Chemicals
Damage to Off-Target Sites
Environmental Concerns
Water Quality
Air Quality
Public Awareness

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## Should YOU be concerned about spray drift?

- Are there drift-susceptible, or organic, crops nearby?
- Are you using highly active or nonselective herbicides?
- Are there sensitive areas (rural homes, schools, honeybee colonies, surface streams, etc.) close by that you should protect from drift?
- Are you trying to avoid litigation or conflict with your neighbors?

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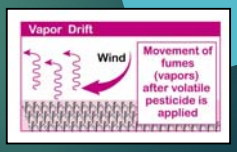
## There are Two Types of Drift

1. 


...

...and, 2. 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## Avoiding Vapor Drift

- Follow label directions!
- Several active ingredients such as those in 2,4-D, Banvel, and Command are quite volatile and pose harm when the vapor moves off target
  - Labels may state cut-off temperatures for application
  - Labels may require pesticide to be incorporated into the soil

Temperature ⇧
Humidity ⇩
= Higher Volatility

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## A Co$tly Case of Vapor Drift

From the Piedmont of North Carolina

- Grassy area sprayed with broad-leaf herbicide in early July, 2007
- 6 days later, farmer of neighboring tobacco field noticed "2,4-D smell" when checking his field and saw deformed upper leaves
- Owner of grassland failed to check directions on label and admitted wrongdoing
- Tobacco buyer would not accept 8 acres of affected tobacco


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## Grassland sprayed with herbicide adjacent to tobacco

Plant damage 50 ft from field edge

Plant damage 400 ft from field edge

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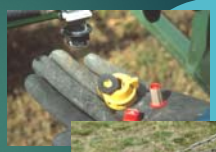
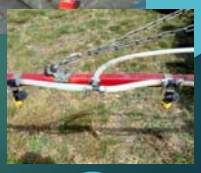
## Factors Affecting Particle Drift

- Equipment and Application
  - Nozzle Type
  - Nozzle Size
  - Nozzle Pressure
  - Boom Height





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## Factors Continued

- Spray Characteristics
  - Droplet size
  - Chemical
  - Formulation
  - Additives

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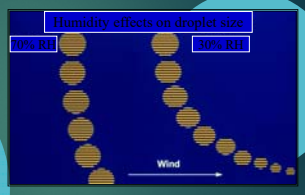
## Factors Continued

- Weather
  - Wind
  - Temp.
  - Humidity
  - Inversions

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## Drift and Droplet Size Relationship

- All nozzle tips produce a range of droplet sizes that depend on the size of the nozzle tip opening and nozzle pressure
- Spray droplets are measured in microns using laser beams

One micron (μm) =1/25,000 inch

Human hair is 100 microns in diameter

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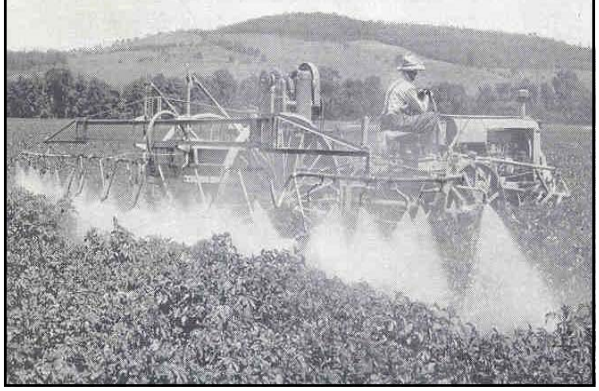
## Technical Aspects of Spray Drift



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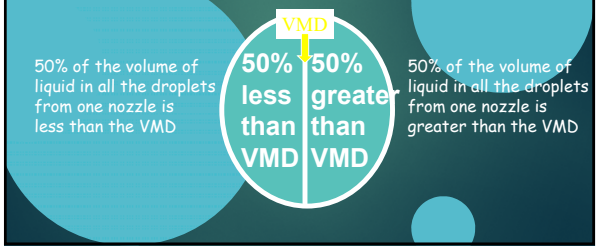
## Volume Median Diameter

- The "Midpoint" of the range of droplets formed from a single nozzle where half of all the droplets are larger and half are smaller is called the Volume Median Diameter (VMD)
- VMD is an important indicator of the potential for drift and successful pest control.

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## Pesticide Effectiveness is Based on Droplet Size

| Droplet Class | VMD range | Pesticide Application |
|---|---|---|
| Very Fine | <119 | Insecticides and Fungicides |
| Fine | 119-216 | |
| Medium | 217-353 | Herbicides and Postemergence |
| Coarse | 354-464 | |
| Very Coarse | >464 | Soil Applications of Herbicides |

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## Droplets: Large vs. Small

- Large Droplets: less potential to drift
  - Fall more quickly
  - Evaporate more slowly
  - Are less affected by wind
- Small Droplets result from:
  - High spray pressure
  - Small nozzle tips
  - Wind shear across the nozzles (aerial)

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## The bigger they are the faster they fall…

| Droplet | Width (in μm) | Time to fall 10 feet | Travel distance in 3 mph wind |
|---|---|---|---|
| Fog | 5 | 66 min | 3 miles |
| Very fine | 20 | 4 min | 1100 ft |
| Fine | 100 | 10 sec | 44 ft |
| Medium | 240 | 6 sec | 28 ft |
| Coarse | 400 | 2 sec | 8.5 ft |
| Xtra Coarse | 1,000 | 1 sec | 4.7 ft |

Source: *Akesson and Yates, 1964, Annual Rev. Ent.*

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## Color Codes for Droplet Size

| Category | Symbol | Color Code | Approximate VMD Range |
|---|---|---|---|
| Very Fine | VF | Red | < 150 |
| Fine | F | Orange | 150 – 250 |
| Medium | M | Yellow | 250 – 350 |
| Coarse | C | Blue | 350 – 450 |
| Very Coarse | VC | Green | 450 – 550 |
| Extremely Coarse | XC | White | > 550 |

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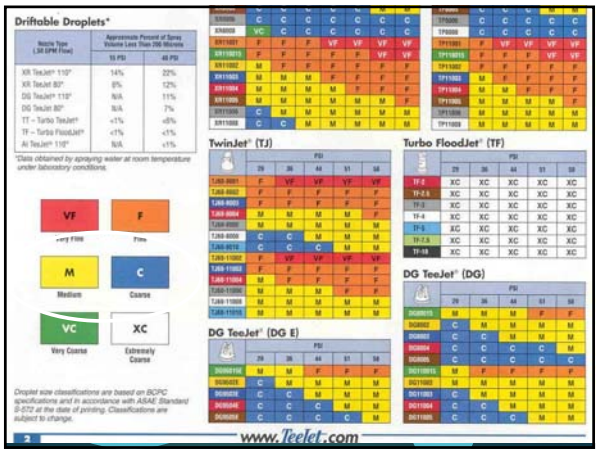
Driftable Droplets*
VF
F
M
C
VC
XC
Very Coarse
Extremely Coarse
TwinJet® (TJ)
Turbo FloodJet® (TF)
DG TeeJet® (DG)
DG TeeJet® (DG E)
www.TeeJet.com

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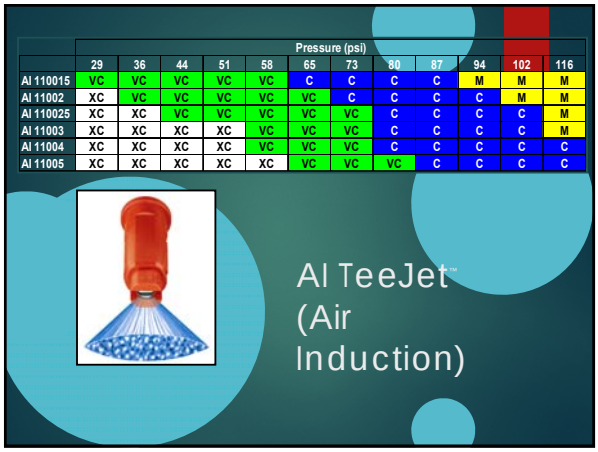
Pressure (psi)
29 36 44 51 58 65 73 80 87 94 102 116
AI 110015 VC VC VC VC VC C C C C M M M
AI 11002 XC VC VC VC VC VC C C C C M M
AI 110025 XC XC VC VC VC VC VC C C C C M
AI 11003 XC XC XC XC VC VC VC C C C C M
AI 11004 XC XC XC XC VC VC VC C C C C C
AI 11005 XC XC XC XC XC VC VC VC C C C C
AI TeeJet™ (Air Induction)

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Choosing nozzles by droplet size
Turbo TeeJet® Flat Spray Tips
(PSI) TT11001 TT11015 TT11002 TT11003 TT11004 TT11005
15 C C VC VC VC EC
20 M C C VC VC VC
30 M M C C VC VC
40 M M M C C VC
45 M M M C C C
50 M M M C C C
60 F M M M C C
75 F M M M C C
90 F M M M C C
TT Turbo TeeJet

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## Nozzle Output

- Nozzles are color coded by output
  - All "red" nozzles pictured here have a 0.4 gallons per minute output at 40 PSI.




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## Nozzle Knowledge

Match nozzle type to the application at hand

- Type of pesticide (herbicide, insecticide, fungicide…) and whether its action is contact or systemic (coverage)
- Time of application
  - PRE or POST
- Operating Pressure
- Susceptibility to drift

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## Choose Nozzles to Manage Pests & Drift

The "Nozzle Compromise": Using nozzles and pressure to produce the largest droplet size possible (> 150 microns) while achieving good target coverage sometimes involves a tradeoff.

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## Drift reducing nozzle tips

- Low pressure (extended range)
- Pre-orifice
- Pre-orifice and turbulence chamber
- Air-induction

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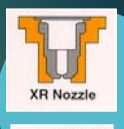
## Low Pressure and Pre-orifice Nozzles

- Extended Range
- Drift Guard





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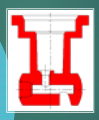
## Turbulence Chamber Nozzles

Turbo TeeJet has a pre-orifice to create pressure drop and turbulence to slow liquid velocity

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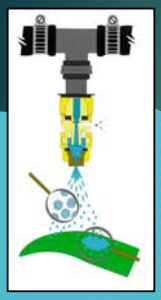
## Air Induction Nozzles



Air Induction nozzles produce air-induced, larger droplets that "splatter" on contact.

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## Massive Droplets

- The TurfJet is a low-drift nozzle that is suitable for pre-emerge, soil incorporated applications.

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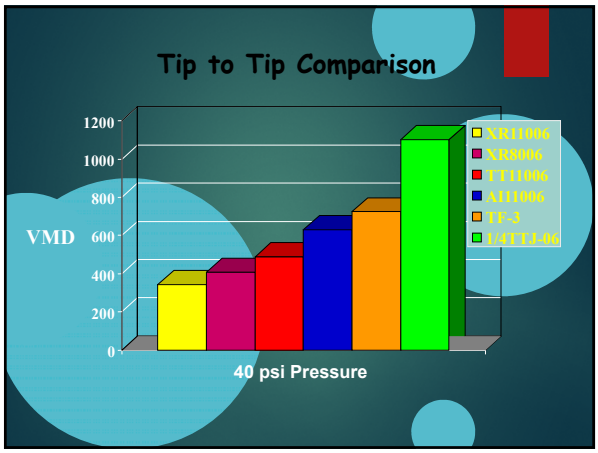


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## Chemical Drift Retardants

- Drift control agents
- Check on compatibility
- May affect nozzle pattern
- Effective?

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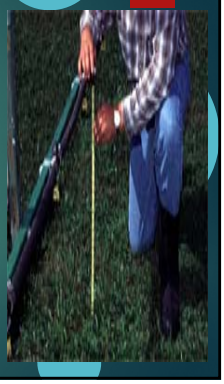
## Boom Height

- "Lower the boom"
  - Shorter the distance a droplet has to travel, the less chance for drift
  - Be careful to stay within manufacturer's guidelines



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## More Keys to Drift Management

- Avoid adverse weather conditions
  - Wind speed and direction
  - Inversions
  - High temps.
- Know the location of all sensitive areas
  - No-spray buffer zone

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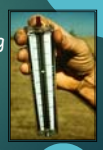
## Don't Get Blown Away!

- Drift potential usually increases with increasing wind speed.
- However, many factors (droplet size and boom height) can influence drift.
- The effects of wind are reduced if small droplets are minimized and the application is made at the proper height.
- Use a wind gauge and avoid spraying in winds above 10 mph.



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## No room for guessing

- Difficult to "guess" wind speed
- Use a wind meter for most accurate results
- Local weather station (or radio station) is a guide, but conditions can vary in a short distance

- A wind meter is a sound investment for good recordkeeping

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## Which way is the Wind Blowing?

- Wind **direction** is very important
- Drift potential is lowest at wind speeds between 3 and 10 mph (gentle but steady breeze) blowing in a safe direction **away** from sensitive areas.
- "Dead calm" (0-3 mph winds) conditions are **never** recommended.

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## Be Aware of Temperature Inversions

- Occurs when air is STABLE
  - air at ground has cooled (heavier air)
  - warm air has risen (lighter air)


- result is stagnant, stable air = inversion
- long distance drift can result from applications made during inversions

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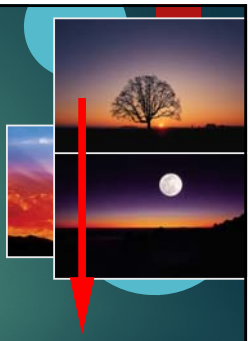
## When can a temperature inversion occur?

- Can occur anytime
- Usually develops at dusk
- May continue through night
- Breaks up when ground warms up in morning
- It may appear ideal, but is not



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## Stable Air Conditions: Temperature Inversion


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## Costlier Pursuits of Drift Reduction

Consider using these sprayer technologies:

1. Spray Shields
2. Electrostatic Sprayers
3. Air-assisted Sprayers


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## Summary

- **Drift management** depends on proper planning and decision making
- Choose the **right tip** and **pressure**.
  - The goal is to get the largest droplets without sacrificing good target coverage.
  - Drift reducing nozzles do not eliminate drift, they only reduce it.
- Lower the **boom** as far as possible
- Assess **weather** conditions
  - Deciding **not to spray** or **stopping** in the midst of poor spraying conditions is the best way to prevent drift!

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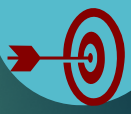
## In Conclusion

You have the most important role in lessening spray drift problems.



Do your part to keep agrichemical applications on target.

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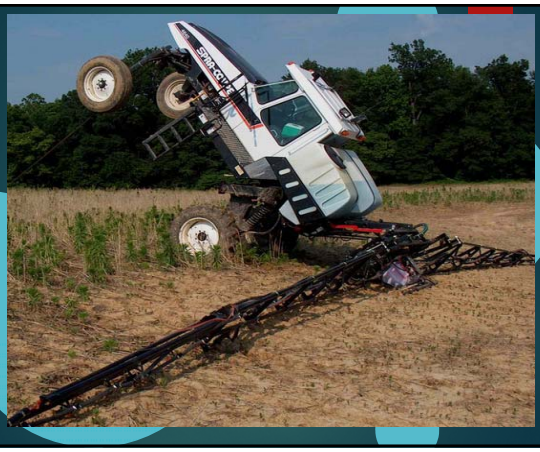

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## Acknowledgments


- Western Crop Protection Association; D. Gardisser & P. Spradley, Univ. of Ark; and, R. Wolf, Kansas State Univ.
- Spraying Systems Co.
- Brent Prignitz, Iowa State University
- Carol Ramsay, "Applying Pesticides Correctly" training materials, Washington State University
- Choosing Drift-Reducing Nozzles, Vern Hoffman and Jim Wilson, South Dakota State University


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