Spray Drift Management

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COOPERATIVE EXTENSION
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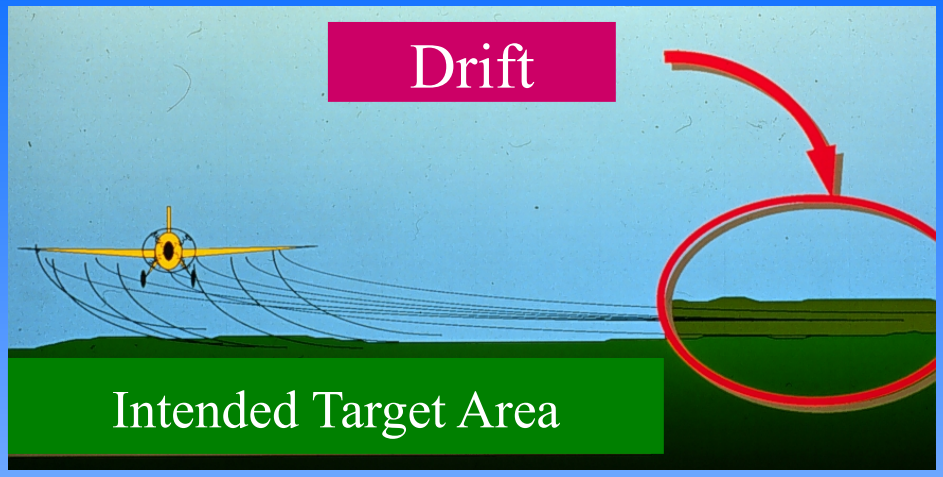
Pesticide drift is…

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

Glyphosate damage on soybean

This is drift…

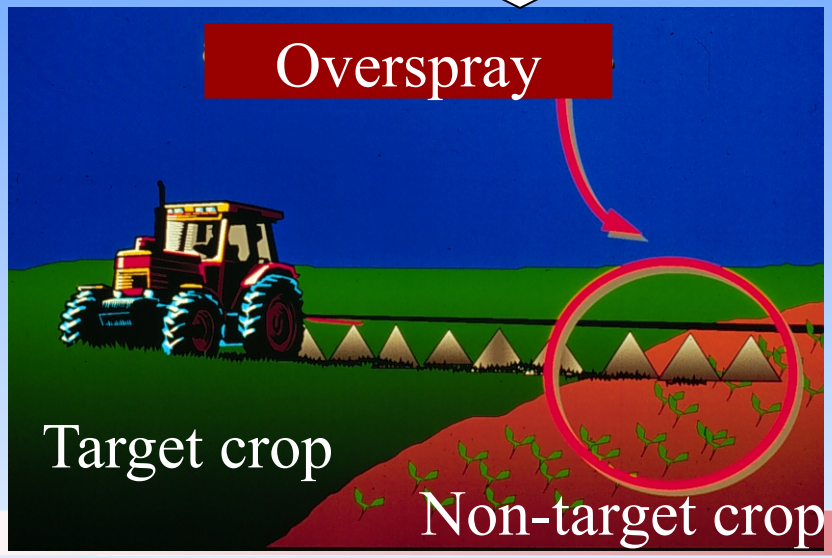


…so is this…

This is not drift…

Applicator Error

Equipment Problems



…and neither is this.

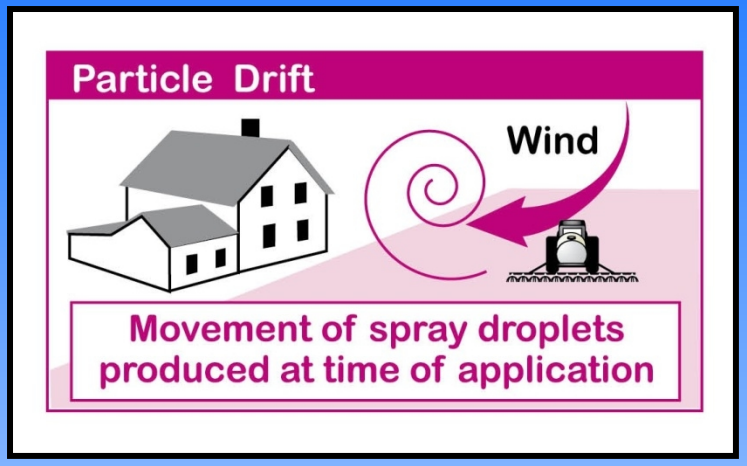
Why is drift a problem?

- Poor Pest Control
- Wasted Chemicals
- Damage to Off-Target Sites
- Environmental Concerns
  - Water Quality
  - Air Quality
- Public Awareness

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?

There are Two Types of Drift

1. 

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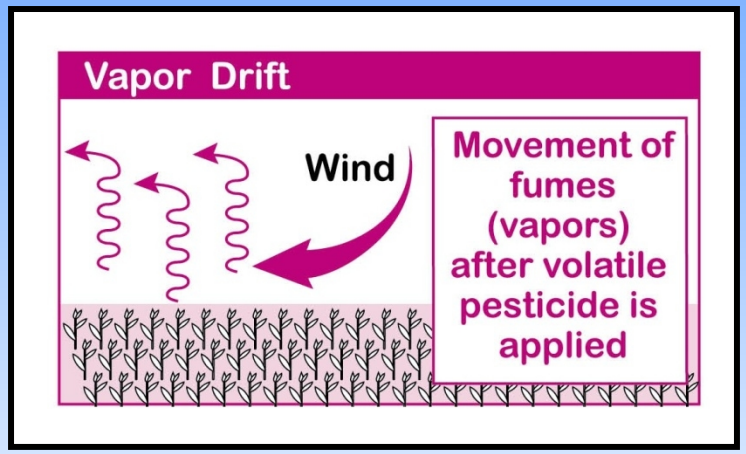
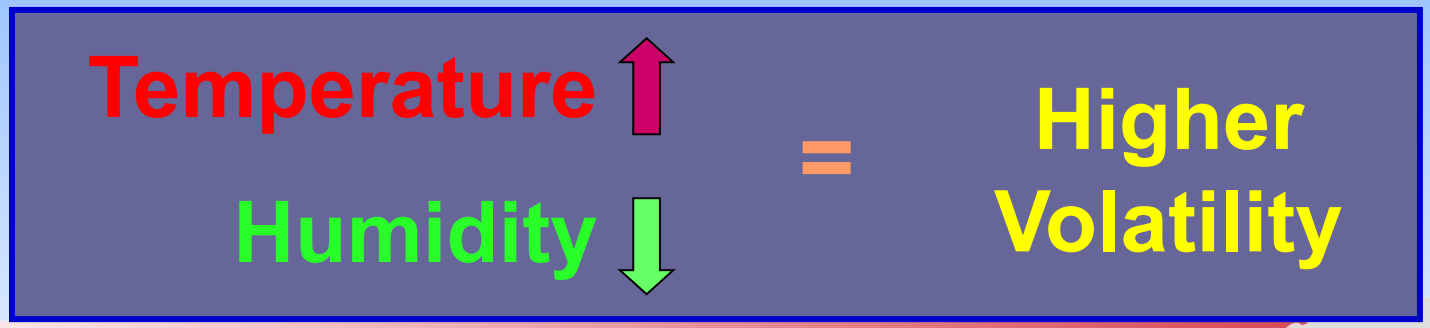
...and, 2. 

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



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

Grassland sprayed with herbicide adjacent to tobacco

Plant damage 50 ft from field edge

Plant damage 400 ft from field edge

Factors Affecting Particle Drift

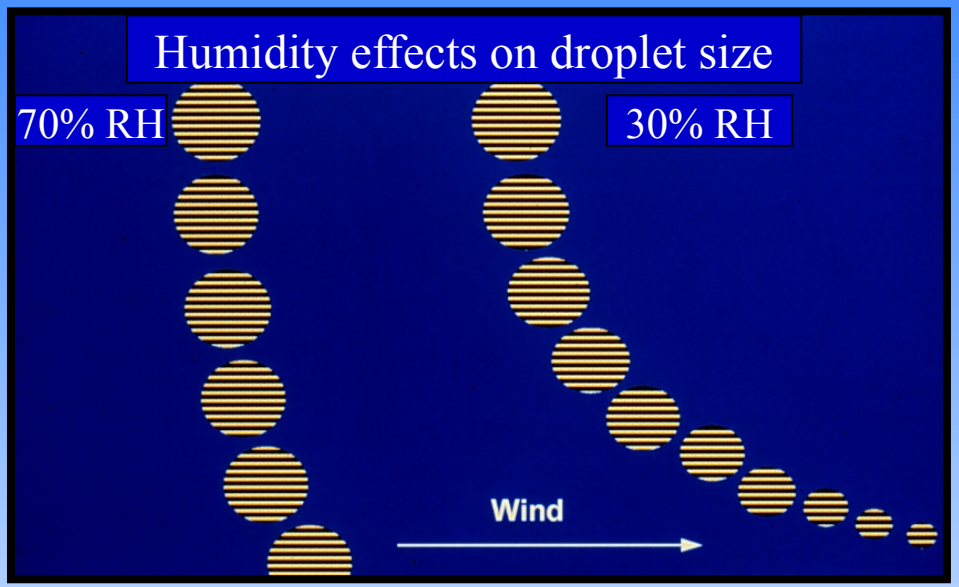
- Equipment and Application
  - Nozzle Type
  - Nozzle Size
  - Nozzle Pressure
  - Boom Height

Factors Continued

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

Factors Continued

- Weather
  - Wind
  - Temp.
  - Humidity
  - Inversions



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

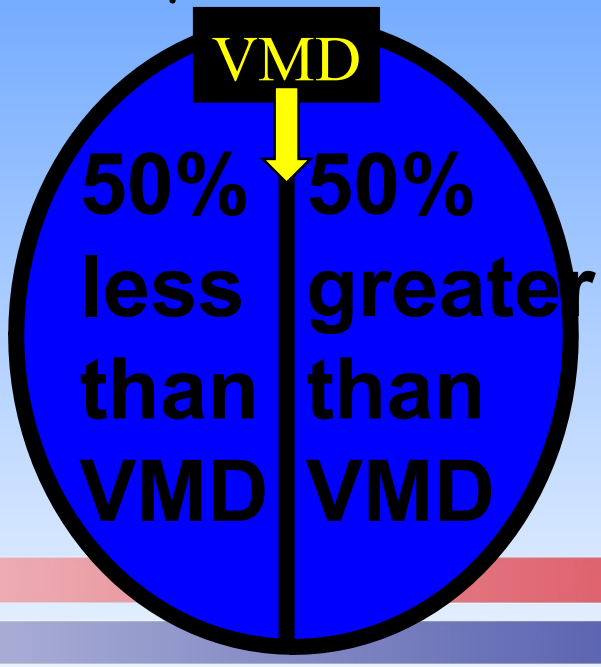
One micron (µm) =1/25,000 inch

Human hair is 100 microns in diameter

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.

50% of the volume of liquid in all the droplets from one nozzle is less than the VMD



50% of the volume of liquid in all the droplets from one nozzle is greater than the VMD

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**

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)

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.*

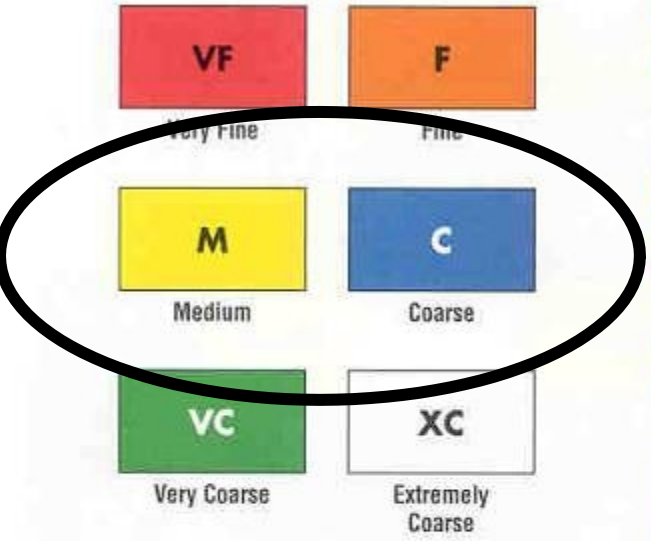
Color Codes for Droplet Size

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

Driftable Droplets*

Nozzle Type (.50 GPM Flow)	Approximate Percent of Spray Volume Less Than 200 Microns	
	15 PSI	40 PSI
XR TeeJet® 110°	14%	22%
XR TeeJet 80°	6%	12%
DG TeeJet® 110°	N/A	11%
DG TeeJet 80°	N/A	7%
TT – Turbo TeeJet®	<1%	<6%
TF – Turbo FloodJet®	<1%	<1%
AI TeeJet® 110°	N/A	<1%

Data obtained by spraying water at room temperature under laboratory conditions.



Droplet size classifications are based on BCPC specifications and in accordance with ASAE Standard S-572 at the date of printing. Classifications are subject to change.

XR8005	C	C	C	C	C	M	M
XR8006	C	C	C	C	C	C	C
XR8008	VC	C	C	C	C	C	C
XR11001	F	F	F	VF	VF	VF	VF
XR110015	F	F	F	F	F	VF	VF
XR11002	M	F	F	F	F	F	F
XR11003	M	M	M	F	F	F	F
XR11004	M	M	M	M	F	F	F
XR11005	M	M	M	M	M	M	F
XR11006	C	M	M	M	M	M	M
XR11008	C	C	M	M	M	M	M

TP8005	C	C	C	M	M		
TP8006	C	C	C	C	C		
TP8008	C	C	C	C	C		
TP11001	F	VF	VF	VF	VF		
TP110015	F	F	F	VF	VF		
TP11002	F	F	F	F	F		
TP11003	M	F	F	F	F		
TP11004	M	M	F	F	F		
TP11005	M	M	M	M	F		
TP11006	M	M	M	M	M		
TP11008	M	M	M	M	M		

TwinJet® (TJ)

	PSI				
	29	36	44	51	58
TJ60-8001	F	VF	VF	VF	VF
TJ60-8002	F	F	F	F	F
TJ60-8003	F	F	F	F	F
TJ60-8004	M	M	M	M	F
TJ60-8006	M	M	M	M	M
TJ60-8008	C	C	M	M	M
TJ60-8010	C	C	C	M	M
TJ60-11002	F	VF	VF	VF	VF
TJ60-11003	F	F	F	F	F
TJ60-11004	M	F	F	F	F
TJ60-11006	M	M	M	F	F
TJ60-11008	M	M	M	M	M
TJ60-11010	M	M	M	M	M

DG TeeJet® (DG E)

	PSI				
	29	36	44	51	58
DG95015E	M	M	F	F	F
DG9502E	C	M	M	M	M
DG9503E	C	C	M	M	M
DG9504E	C	C	C	M	M
DG9505E	C	C	C	C	M

Turbo FloodJet® (TF)

	PSI				
	29	36	44	51	58
TF-2	XC	XC	XC	XC	XC
TF-2.5	XC	XC	XC	XC	XC
TF-3	XC	XC	XC	XC	XC
TF-4	XC	XC	XC	XC	XC
TF-5	XC	XC	XC	XC	XC
TF-7.5	XC	XC	XC	XC	XC
TF-10	XC	XC	XC	XC	XC

DG TeeJet® (DG)

	PSI				
	29	36	44	51	58
DG80015	M	M	M	F	F
DG8002	C	M	M	M	M
DG8003	C	C	M	M	M
DG8004	C	C	C	C	M
DG8005	C	C	C	C	C
DG110015	M	F	F	F	F
DG11002	M	M	M	M	M
DG11003	C	M	M	M	M
DG11004	C	C	M	M	M
DG11005	C	C	C	M	M

	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)

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

Nozzle Output

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

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

Choose Nozzles to Manage Pests & Drift

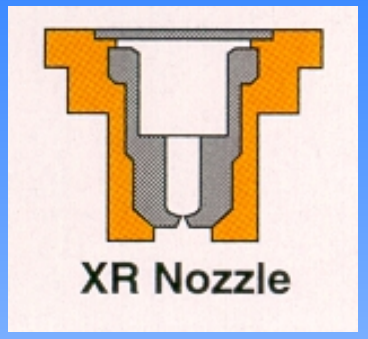
The "Nozzle Compromise": Using nozzles and pressure to produce the largest droplet size possible (> 150 microns) while achieving good target coverage sometimes involves a tradeoff.

Drift reducing nozzle tips

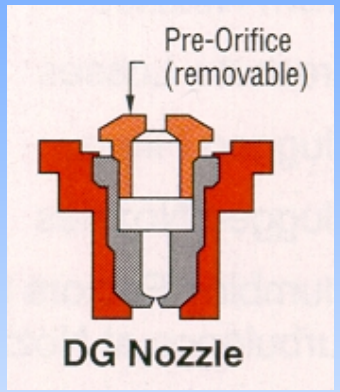
- Low pressure (extended range)
- Pre-orifice
- Pre-orifice and turbulence chamber
- Air-induction

Low Pressure and Pre-orifice Nozzles

- Extended Range

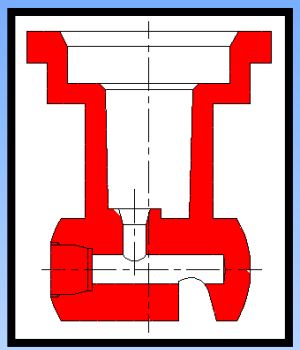


- Drift Guard

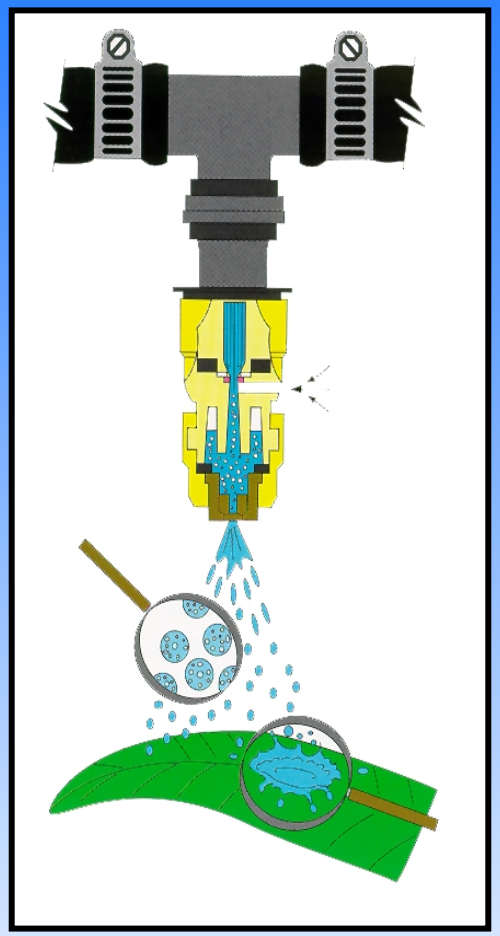


Turbulence Chamber Nozzles

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



Air Induction Nozzles

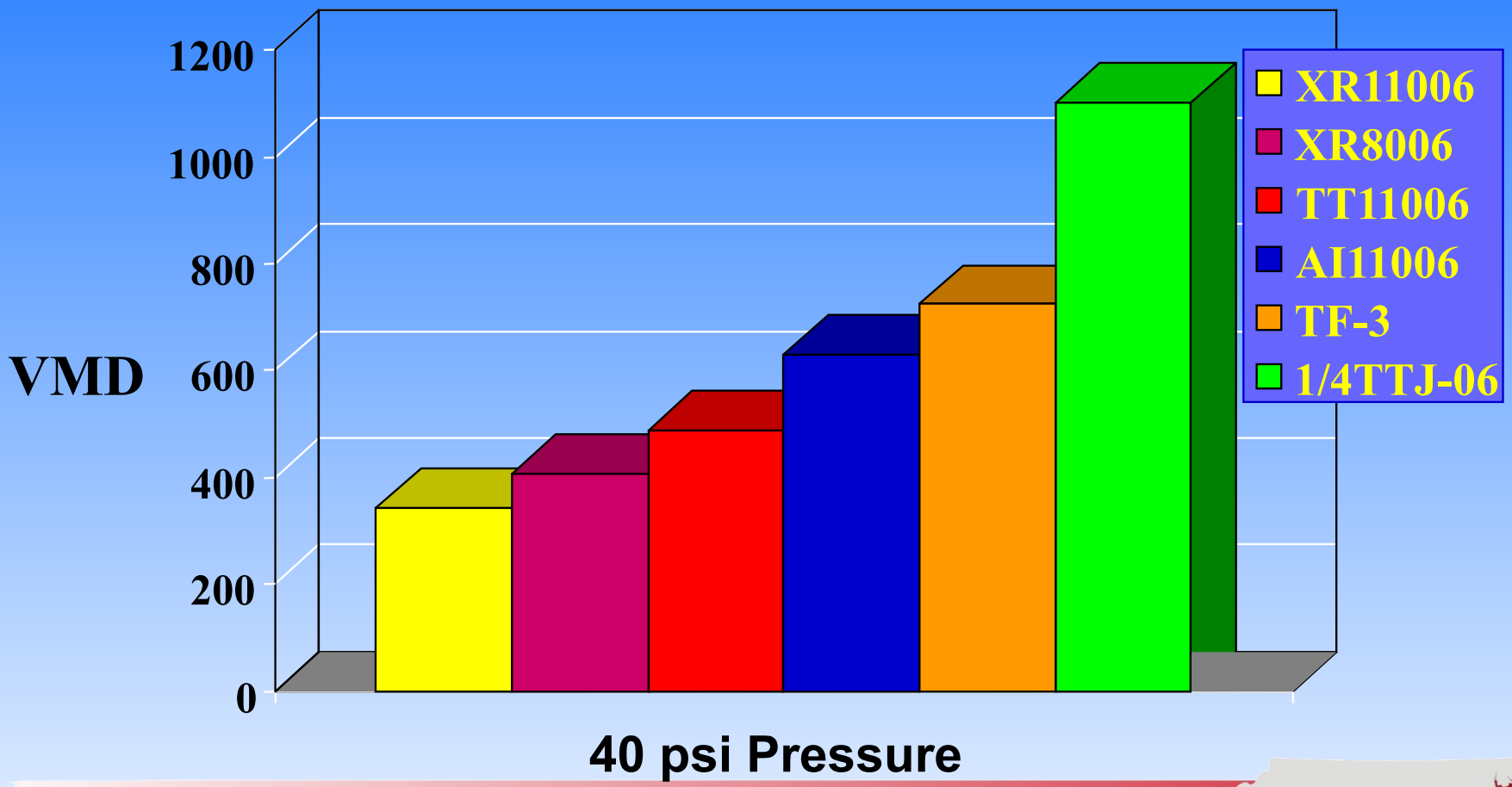


Air Induction nozzles produce air-induced, larger droplets that "splatter" on contact.

Massive Droplets

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

Tip to Tip Comparison



Chemical Drift Retardants

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

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

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

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.

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 <u>good recordkeeping</u>

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.

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

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

Stable Air Conditions: Temperature Inversion

Costlier Pursuits of Drift Reduction

Consider using these sprayer technologies:

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

1.

2.

3.

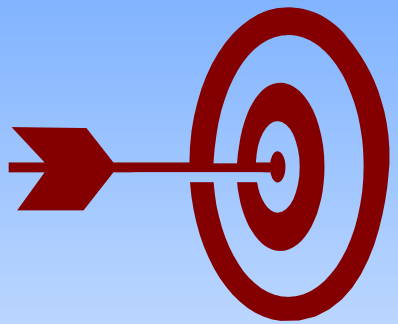
Summary

- **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!

In Conclusion

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

Do your part to keep agrichemical applications on target.



Acknowledgments

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- Choosing Drift-Reducing Nozzles, Vern Hoffman and Jim Wilson, South Dakota State University

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- No endorsement is intended, nor is criticism implied of similar products not mentioned.