Pesticide Drift Management

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Who is the applicator?

Most consider the applicator to be the person who is driving the spray rig or flying the airplane while the crop protection products are being applied to the given area.

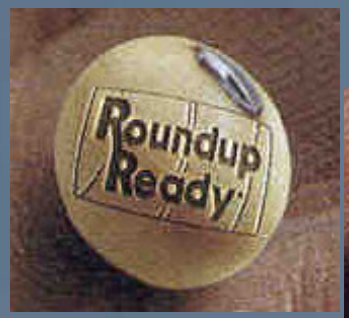
Applicators should be more broadly defined as anyone who is involved in the decision making process about an application of the crop protection product.

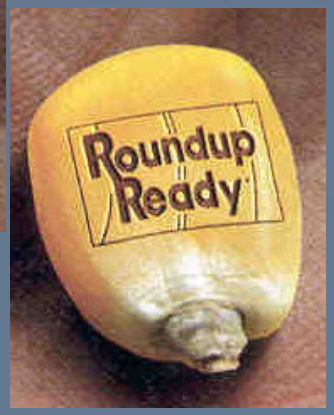
Why is drift a problem?

- Drift is costly and results in:
  - A waste of product
  - Reduces the effectiveness of your application
  - Can damage crops that are economically important.
  - Can hurt wildlife and contaminate water supplies

Why is drift a problem?

- GMO vs. conventional crops
  - Roundup-ready crops
  - Clearfield rice
  - Dicamba-resistant soybeans
  - 2,4-D-resistant cotton

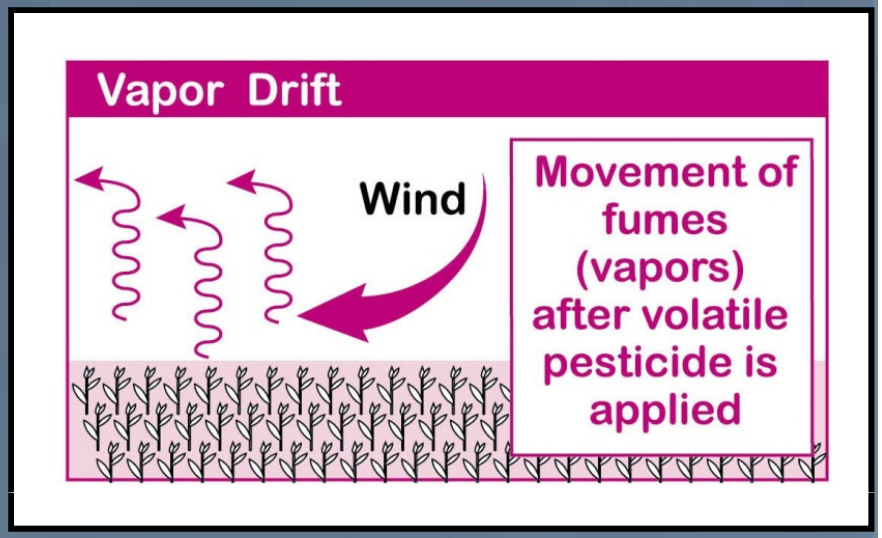




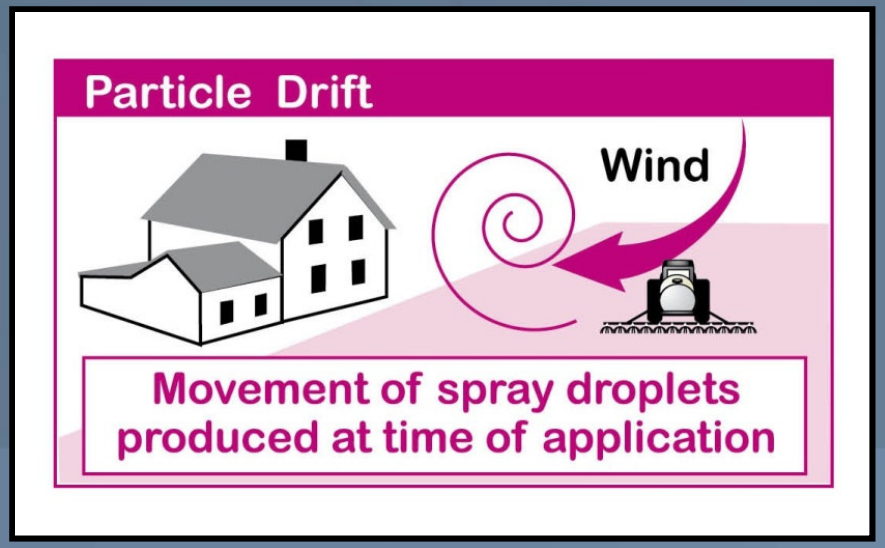
- Urban Sprawl
  - Non-rural population not used to farming equipment, ag planes, etc. Less likely to agree/support practices that are viewed as non-healthy

Types of Drift

Vapor Drift: associated with volatilization (gas, fumes)



Particle Drift: occurs during application



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

Evaluate the Site

- Inspect and document potential problems
- Identify sensitive areas
  - Susceptible crops
  - Bodies of water
  - Wetlands
- Topography of area can create microclimates where temperature, wind, air flow, and humidity can be different from adjacent areas
- Leave untreated buffer zones between treated areas and sensitive areas

Evaluate the Weather

- Wind
- Temperature
- Humidity
- Temperature Inversions

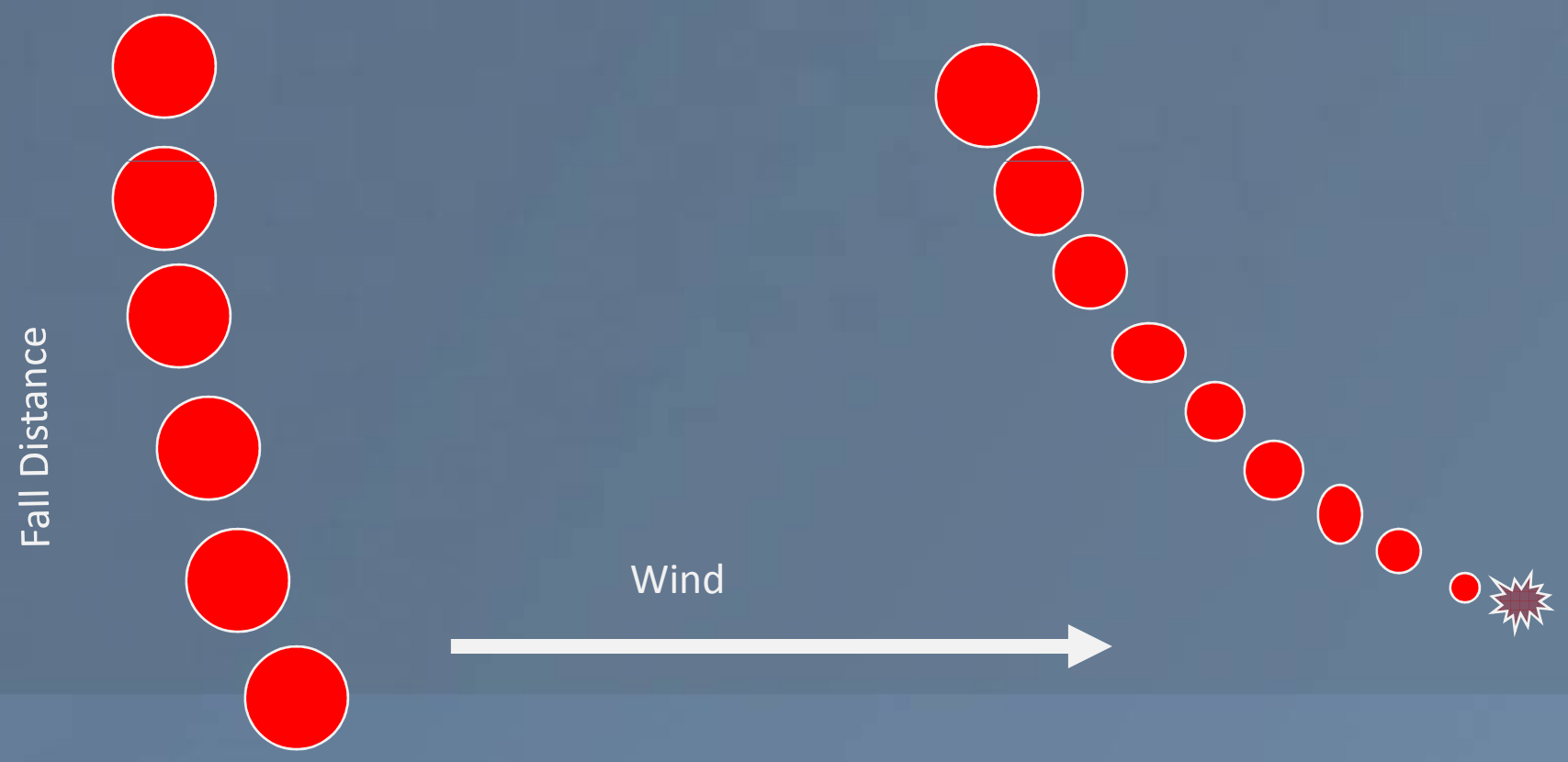
Evaluate the Weather: Wind

- Most common contributor to pesticide particle drift
- Be attentive to wind speed and wind direction
- Wind speeds above 8 mph significantly increase the risk of particle drift to downwind areas
- Wind speeds below 3 mph are often variable and may change direction rapidly
- No wind may be indicative of a temperature inversion

Temperature and Humidity: Evaporation of Droplets

High Relative Humidity
Low Temperature

Low Relative Humidity
High Temperature



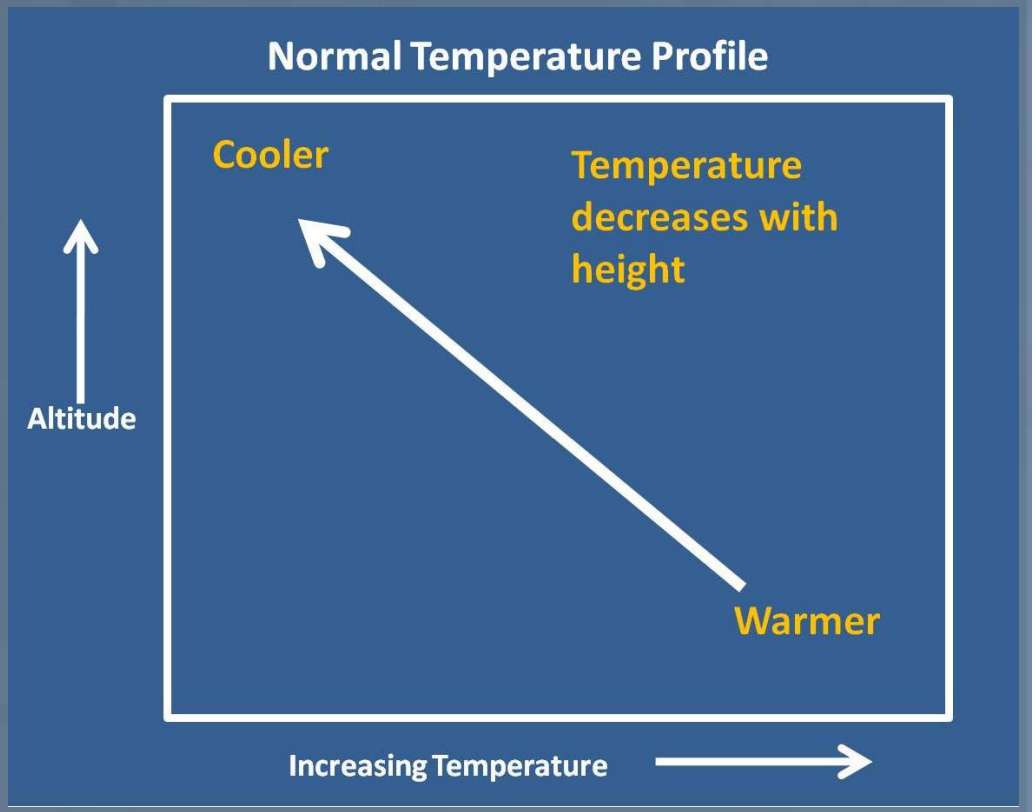
Basic Concepts

During the Day –
The sun heats the ground and the ground heats the air above it

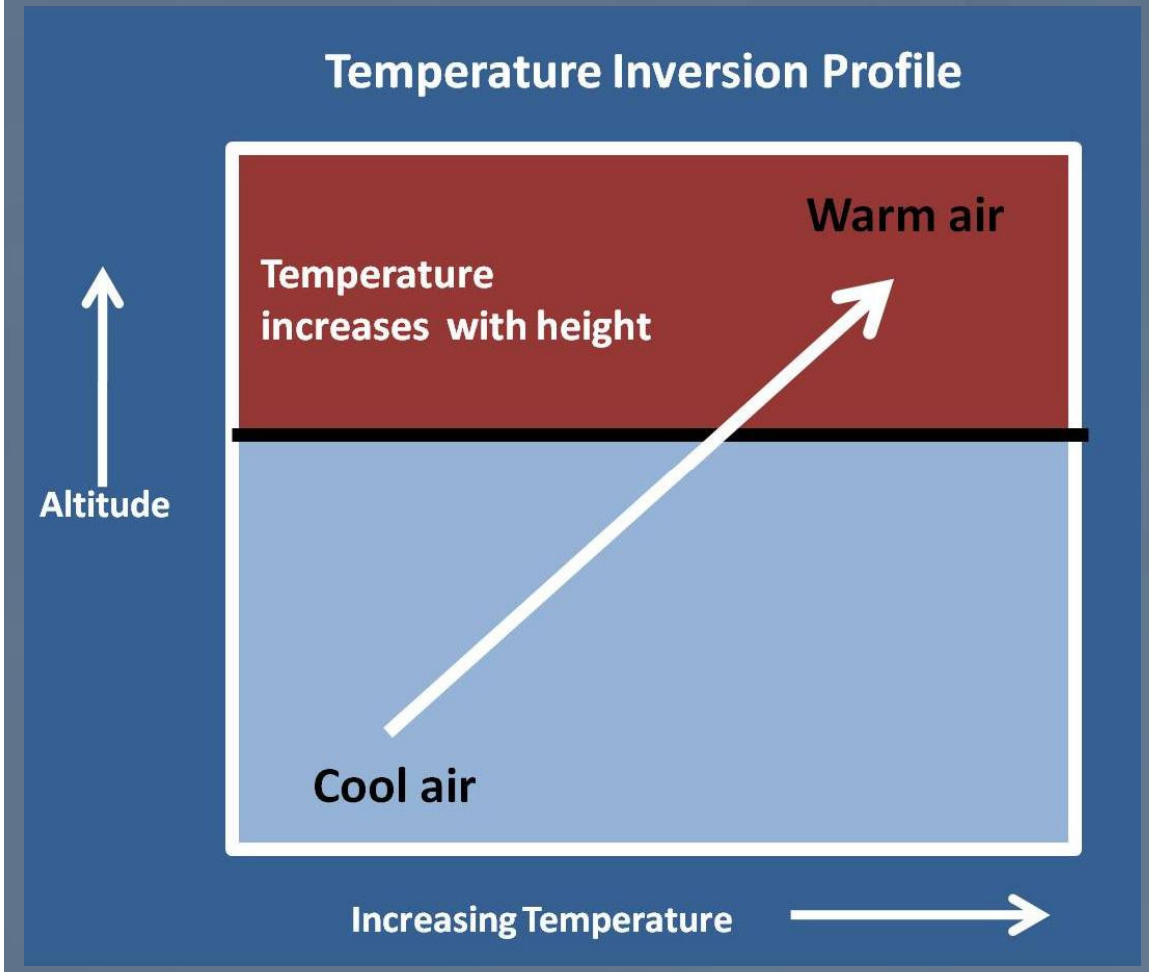
At Night –
The ground cools and cools the air in contact with it

Normal Conditions

- Warmest air is near the earth's surface
- Temperature decreases with altitude
- Sun warms the ground and crop canopy, which in turn warms the air above it
- Warm air rises and is replaced with cooler air causing a mixing action of the atmosphere
- Winds generated blow from consistent direction



Temperature Inversion



- Situation is reversed from normal conditions
- From dusk to early morning, earth's surface can lose heat causing surface air to be cooler than air above it
- Because the cool air is more dense/heavier, it sinks. The result is a stagnant layer of air that does not mix with air above

Recognizing Temperature Inversions

- Can occur at any height: low or high
- Can occur at any time

Temperature Inversions

- The major problem with inversions is that applicators perceive little wind or air movement and assume this is a good time to spray.
- ***<u>In actuality, it's the worst time.</u>***
- Favorable to long distance pesticide drift
- Low wind conditions during inversion conditions may cause small spray drops to remain suspended in the air.
- The droplets will eventually move out of the treatment area as a concentrated cloud

Temperature Inversions

- Temperature inversions must be identified before ALL pesticide applications: ***GROUND AND AERIAL***

- Drift from inversion: documented case shows damage occurring over a 15 mile area from a late afternoon application in calm wind

Temperature Inversions: Rules and Regulations from Other States

- Arkansas has set specific rules regarding temperature inversions to help minimize the risk of drift for both aerial and ground applications
- Applicators must record ambient temperature in field they will be making application to

Temperature Inversions: Rules and Regulations from Other States

- To make application:
  - Temperature must increase 3°F from the morning low at the time of application for applications made before noon
  - Temperature must not decrease more than 3°F from the afternoon high for applications made after noon.

Factors Affecting Particle Drift

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

Managing Spray Drift: Equipment/Operating Speed

- Increased operating speeds can cause the spray to be diverted
  - Upward into wind currents
  - Into vortexes behind the sprayer
- These currents trap small droplets and contribute to drift
- As wind velocities increase, reduce operating speed.

Boom Height

- Lower the boom
- The great the distance between the nozzle and the target area the greater the impact wind velocity has on drift
- Shorter the distance a droplet has to travel, the less chance for drift
- Be careful to stay within manufacturer's guidelines

Nozzle Selection

- Designed to reduce drift and improve droplet size
- Nozzles
  - Control the amount of product being applied (GPA)
  - Determine the uniformity of the application
  - Affect coverage
  - Influence drift potential

Choosing Nozzles by Droplet Size

Turbo TeeJet® (TT) and Turbo TeeJet® Duo (QJ90-2XTT)

	PSI										
	15	20	25	30	35	40	50	60	70	80	90
TT11001 QJ90-2XTT11001	C	M	M	M	M	M	F	F	F	F	F
TT110015 QJ90-2XTT110015	C	C	M	M	M	M	M	M	F	F	F
TT11002 QJ90-2XTT11002	C	C	C	M	M	M	M	M	M	M	F
TT110025 QJ90-2XTT110025	VC	C	C	C	M	M	M	M	M	M	F
TT11003 QJ90-2XTT11003	VC	VC	C	C	C	C	M	M	M	M	M
TT11004 QJ90-2XTT11004	XC	VC	VC	C	C	C	C	C	M	M	M
TT11005 QJ90-2XTT11005	XC	VC	VC	VC	VC	C	C	C	C	M	M
TT11006 QJ90-2XTT11006	XC	XC	VC	VC	VC	C	C	C	C	C	M
TT11008 QJ90-2XTT11008	XC	XC	VC	VC	VC	VC	C	C	C	C	M

AI TeeJet® (AI) and AIC TeeJet® (AIC)

	PSI											
	30	35	40	45	50	55	60	70	80	90	100	115
AI110015	VC	VC	VC	VC	VC	C	C	C	C	C	C	C
AI11002	VC	VC	VC	VC	VC	VC	VC	C	C	C	C	C
AI110025	VC	VC	VC	VC	VC	VC	VC	VC	C	C	C	C
AI11003	XC	XC	VC	VC	VC	VC	VC	VC	VC	C	C	C
AI11004	XC	XC	XC	VC	VC	VC	VC	VC	VC	C	C	C
AI11005	XC	XC	XC	VC	VC	VC	VC	VC	VC	VC	C	C
AI11006	XC	XC	XC	XC	VC	VC	VC	VC	VC	VC	C	C
AI11008	XC	XC	XC	XC	XC	VC	VC	VC	VC	VC	VC	C
AI11010	XC	XC	XC	XC	XC	VC	VC	VC	VC	VC	VC	C

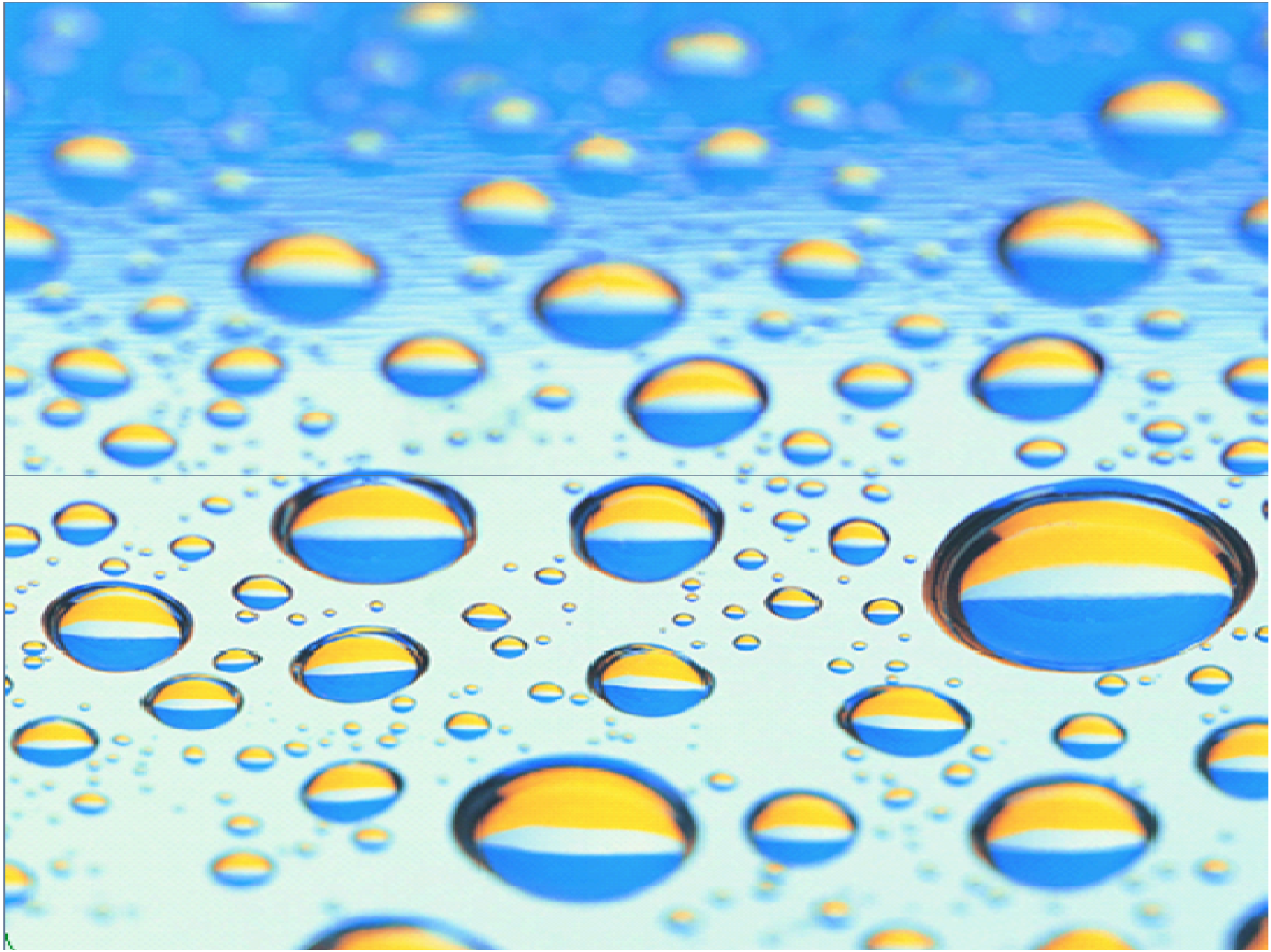
Turbo TwinJet® (TTJ60)

	PSI										
	15	20	25	30	35	40	50	60	70	80	90
TTJ60-11002	VC	C	C	C	C	C	M	M	M	M	M
TTJ60-110025	XC	VC	C	C	C	C	C	C	M	M	M
TTJ60-11003	XC	VC	C	C	C	C	C	C	C	M	M
TTJ60-11004	XC	VC	C	C	C	C	C	C	C	C	M
TTJ60-11005	XC	VC	C	C	C	C	C	C	C	C	C
TTJ60-11006	XC	XC	VC	VC	C	C	C	C	C	C	C

Turbo TeeJet® Induction (TTI)

	PSI											
	15	20	25	30	35	40	50	60	70	80	90	100
TTI110015	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC
TTI11002	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC
TTI110025	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC
TTI11003	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC
TTI11004	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC
TTI11005	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC
TTI11006	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC	XC

VF	Very Fine
F	Fine
M	Medium
C	Coarse
VC	Very Coarse
XC	Extremely Coarse



Large Droplets

- have less potential to drift
- will fall more quickly
- evaporate more slowly
- are less affected by wind

- Larger droplets are excellent for drift control.
- Because of the large size,
  - the droplets cannot properly cover the target area
  - Do not provide adequate amount of crop protection products to the site.

This decreased coverage may not result with the desired efficacy.

We know we need to improve coverage to improve efficacy.

Small Droplets

- Relate to better coverage
- Culprit when it comes to drift
- Results from
  - High spray pressure
  - Small nozzle tips
  - Wind shear across the nozzle (aerial)
- Environmental factors such as wind, humidity, temperature to create a situation where the droplets may never reach the target site

Our job as applicators is to find the happy medium….the point between the larger droplets and the smaller droplets so we can attain our best efficacy.

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.*

Strategies to Reduce Drift

- Avoid adverse weather conditions
  - High winds, light & variable winds, calm air, temperature inversions
- Consider using buffer zones
- Select nozzle to increase drop size
- Use lower pressures
- Use lower spray (boom) heights
- Avoid high application speeds/rapid speed changes
- Consider using new technologies:
  - drift reduction nozzles
  - drift reduction additives
  - shields, electrostatics, or air-assisted sprayers

Summary

- Drift can be successfully managed with the right knowledge of the equipment and factors that influence it
- Every application must be balanced between managing drift and maintaining effective crop protection

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