SFMA SPORTS FIELD MANAGEMENT ASSOCIATION

Pre-Conference Education Sessions

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DLF

Drift Basics

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West Research Scientist | PBI Gordon Corporation


Successful Turf Mgmt.
Insect Control
Disease Control
Weed Control
Mowing
Cultivation
Fertilization
Irrigation
Proper Establishment

Drift Management Basics

- **Pesticide spray drift** is the movement of pesticide dust or droplets through the air at the time of application or soon after, to any site other than the area intended. – Source: US EPA
- Drift can be in the form of a spray droplet or dust moved by wind, or it can be from **volatility** of the pesticide.
- **Volatility** occurs when an herbicide converts to a gas. When this happens, the herbicide in a gaseous form can leave the application site and damage plants where it lands. Volatility occurs due to the high vapor pressure of some herbicides. Common examples include 2,4-D and dicamba.
- Formulations of herbicide affect their volatility. Esters are generally more volatile than amine salt and other forms of the same active ingredient.

What are Auxinic Herbicides?

- synthetic auxins
- post-emergence
- broadleaf herbicides
- most ubiquitous are 2,4-D and Dicamba

Chemical family	Common name	Trade name
Phenoxyacetic acid		
	2,4-D	2,4-D, Salvo, Savage, Weedone, etc.
	2,4-DB	Butyrol, Butoxone, Butyrac
	MCPA	MCPA amine, MCPA ester, Rhomene, etc.
	MCPB	Thistrol
	Mecoprop	MCPP
Benzoic acid		
	dicamba	Banvel, Clarity, Oracle, Rifle, Brash, Rangestar, Weedmaster, Distinct, Vanquish
Pyridine – carboxylic acid		
	aminopyralid	Milestone, ForeFront R&P, ForeFront HL, GrazonNet
	clopyralid	Stinger, Reclaim, Transline
	fluroxypyr	Starane, Vista
	picloram	Tordon, Surmount, Grazon P+D
	triclopyr	Garlon, Remedy

*This list is only a reference and is not a complete list.

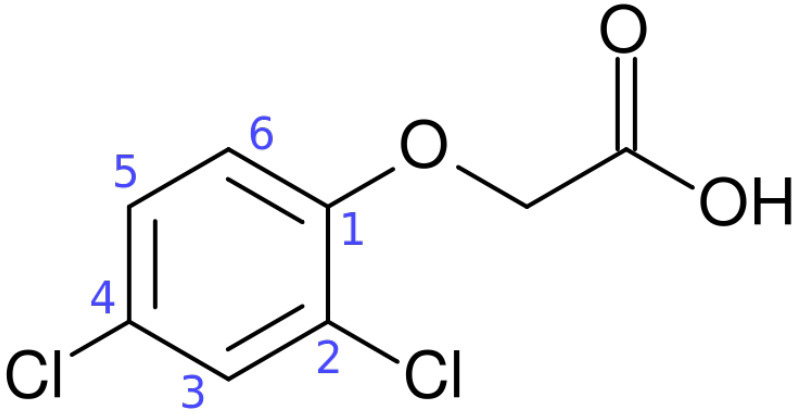
How they work

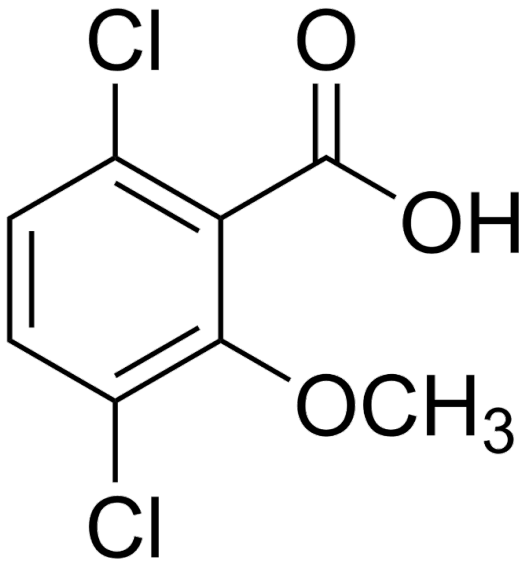
Synthetic Auxins

- mimic plant growth regulator hormone *"auxin"*
- upon exposure they are translocated to plant meristems
  - cause uncontrolled plant growth
    - leads to tissue damage and ultimately death
    - *"death by growth"*
  - are very effective against broadleaves

2,4-Dichlorophenoxyacetic acid

- first modern herbicide, 1945
- defoliating compound in Agent Orange
- three formulations: *ester* < *amine* < *choline*
- over 1,500 herbicide products contain 2,4-D





Dicamba 3,6-dichloro-2-methoxybenzoic acid

- commercial release in 1960's
- used for weed control in corn, wheat, pastures, and lawns
- *often 2,4-D is co-active ingredient*

What is the big deal?

Particle Drift

occurs when small spray droplets move from the site to sensitive crop during application

a challenge with all pesticides

Vapor Drift

occurs at time of application or days later where herbicide volatilizes into a gas and travels far distances (i.e. miles)

vapor drift exposure usually occurs within 12-24 hrs. of original application, symptoms may take days/weeks to show

a challenge only with highly volatile herbicides

New Technology

Dow AgroSciences	Monsanto
• ***'Enlist' System***	• ***'Xtend' System***
• corn and soybean tolerance to 2,4-D and glyphosate	• Soybean and cotton tolerance to dicamba and glyphosate
• *Choline salt formulation* = 96% reduction in volatility	• *Vapor Grip technology* = 90% reduction in volatility

Challenge with new technologies

- Adoption of new technology = more widespread use
- Some producers, knowingly or unknowingly, may not follow new safety measures on label to minimize drift occurrence
  - Ex. tank mixing ammonium sulfate can eliminate the benefit of VaporGrip technology
- Or may illegally utilize old formulations of 2,4-D or Dicamba

Sensitive Crops

- All broadleaves

<u>Crops sensitive at ultra-low concentrations</u>

- Grapes
- Tomatoes
- Blueberries
- Peaches
- Tobacco
- Nursery crops (ornamentals)
- Other fruits and vegetables

All grape cultivars are highly sensitive!

- herbicide concentrations of 100x below the recommended label rate have been reported to cause injury to grapevines
- rates as low as 0.0025 lbs. of active ingredient per acre can cause injury
- noted cultivar differences

Auxin Herbicide Symptoms

– Stem twisting and epinasty (downward twisting)

– Leaf malformations (leaf cupping, crinkling, strapping [parallel veins], puckering, bubbling)

– Callus tissue formation

Leaf crinkling

Leaf & stem rolling

Symptoms of 2,4-D

2,4-D Damage on Tomato Leaves

Credit: Reducing 2,4-D and Dicamba Drift Risk to Fruits, Vegetables and Landscape Plants.

https://ohioline.osu.edu/factsheet/hyg-6105

Symptoms of Dicamba

Dicamba Drift Damage on Grapes

https://ohioline.osu.edu/factsheet/hyg-6105

Symptoms of Glyphosate

Can injure grapevines but not due to vapor drift

Risk Factors

Spray drift risk elevated when:

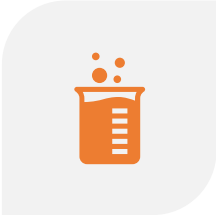
- **Weather**
  - high wind and sometimes low-wind
  - low relative humidity (especially coupled with high temperatures)
  - temperature inversion
- **Spray Characteristics**
  - droplet size (lager sizes = less likely to drift)
  - viscosity (higher thickness = less drift potential)
  - formulation (ester vs. amine vs. choline)

What can <u>applicators</u> do to mitigate drift?

<u>You are ultimately responsible for managing drift</u>

- read and abide by label laws
- monitor weather conditions
- adjust application equipment
- use alternative herbicides or formulations
- use drift control additives when possible
- communicate with local sensitive crop growers

Application Equipment



SELECT NOZZLES THAT PRODUCE COARSE DROPLET SIZES

INCREASE NOZZLE SIZE (LARGER SPRAY CAPACITY)

USE LOWER END OF PRESSURE RANGE (AVOID PRESSURES OVER 45 PSI)

LOWER SPRAY BOOM HEIGHT

CALIBRATE SPRAYER

REPLACE WORN NOZZLES

APPLY HERBICIDES UNDER LABELED SPRAY CONDITIONS

There is no quick fix – ongoing issue

Communication is key!

Flag the Technology

SCS-2016-15

TEXAS A&M AGRILIFE EXTENSION

TEXAS A&M AGRILIFE RESEARCH

Flag the Technology
And Avoid Crop Injury!

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Cotton Specialist *(College Station)*

Flag the Technology is a field marking program originally developed by personnel at the University of Arkansas[1] and is now a widely accepted practice to reduce the risk of a misapplication. This practice will also make the applicator aware of sensitive crops adjacent to the field being sprayed. Recent herbicide tolerant crop introductions have provided new options for controlling herbicide resistant weeds. However, the herbicides used in these programs can have

Flags should be placed at all likely entry points and/or GPS coordinates into the field.

Preferred Flag Size

6' x 1/4" fiberglass pole with minimum 11" x 17" flag for maximum visibility

Color Codes

RED
signifies conventional varieties with no herbicide technology traits, vineyards, apiaries, orchards, vegetable fields and organic crop production. *Extreme caution.*

YELLOW
is the color chosen for Clearfield® rice, sunflower, wheat and canola technologies, STS® soybeans[1] and INZEN grain sorghum.

WHITE
represents technology that is tolerant to glyphosate herbicide. (e.g., Roundup Ready, Glytol)

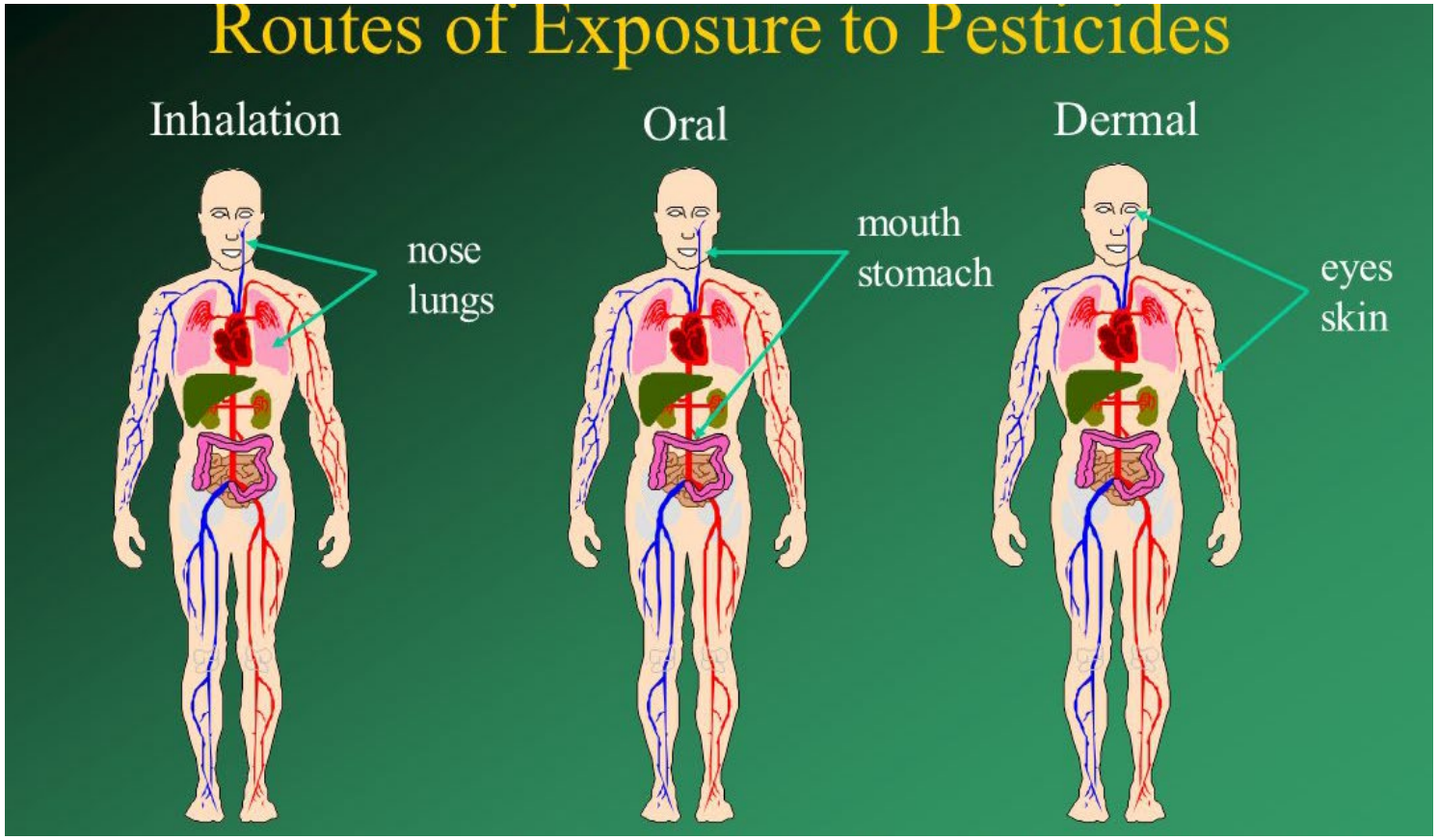
TEAL (with White Stripes)
indicates tolerance to both 2,4-D and FOP (ACCase) herbicides. The white stripes indicate tolerance to glyphosate. Where glufosinate tolerant cotton and soybean are planted, a green flag should be added to denote tolerance to glufosinate [2].

GREEN
This technology is tolerant to glufosinate.

BLACK & WHITE
The black and white checks indicate tolerance to both dicamba and glyphosate. A green flag should be added for cotton to denote glufosinate tolerance [2].

[1] Although many herbicides are in the ALS family of herbicides, crops with this technology are not tolerant to all ALS herbicides.
[2] Stacked technologies may require more than 1 flag.

Produced by the Department of Soil & Crop Sciences
soilcrop.tamu.edu



If you can smell the product in the air, you are getting an inhalation exposure to the product.

If you can taste the product, you are getting an ingestion exposure to the product.

Don’t Forget!!!

TRIMEC® CLASSIC
BROADLEAF HERBICIDE

Controls Dandelion, Knotweed, Plantain, Henbit, and Other Species Of Broadleaf Weeds as Listed

ACTIVE INGREDIENTS:

Dimethylamine salt of 2,4-dichlorophenoxyacetic acid	25.93%
Dimethylamine salt of (+)-(R)-2-(2-methyl-4-chlorophenoxy)propionic acid	6.93%
Dimethylamine salt of dicamba: 3,6-dichloro-o-anisic acid	2.76%
OTHER INGREDIENTS	64.38%
TOTAL	100.00%

THIS PRODUCT CONTAINS:
1.98 lb. 2,4-dichlorophenoxyacetic acid equivalent per gallon or 21.54%.
0.53 lb. (+)-(R)-2-(2-methyl-4-chlorophenoxy)propionic acid equivalent per gallon or 5.73%.
0.21 lb. 3,6-dichloro-o-anisic acid equivalent per gallon or 2.29%
Isomer Specific by AOAC Method.

KEEP OUT OF REACH OF CHILDREN
DANGER - PELIGRO

Si Usted no entiende la etiqueta, busque a alguien para que se la explique a Usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

READ THE ENTIRE LABEL FIRST. OBSERVE ALL PRECAUTIONS AND FOLLOW DIRECTIONS CAREFULLY.

PRECAUTIONARY STATEMENTS

First Aid	
If in eyes:	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a poison control center or doctor for treatment advice.
If on skin or clothing:	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call a poison control center or doctor for treatment advice.
If swallowed:	• Call a poison control center or doctor immediately for treatment advice. • Have person sip a glass of water if able to swallow. • Do not induce vomiting unless told to do so by a poison control center or doctor. • Do not give anything by mouth to an unconscious person.
If inhaled:	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. • Call a poison control center or doctor for treatment advice.
Have the product container or label with you when calling a poison control center or doctor or going for treatment. You may also contact 1-877-800-5556 for emergency medical treatment advice. **Note to Physician:** Probable mucosal damage may contraindicate the use of gastric lavage.	

Environmental Hazards
This pesticide is toxic to fish and aquatic invertebrates and may adversely affect non-target plants. Do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas. Do not contaminate water when disposing of equipment wash waters or rinsate.

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This chemical has properties and characteristics associated with chemicals detected in groundwater. The use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination. Application around a cistern or well may result in contamination of drinking water or groundwater.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.

For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

Agricultural Use Requirements

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170.

Spray Drift Management

A variety of factors including weather conditions (e.g., wind direction, wind speed, temperature, relative humidity) and method of ground application can influence pesticide drift. The applicator must evaluate all factors and make appropriate adjustments when applying this product.

Droplet Size

Use only Medium or coarser spray nozzles according to ASAE (S 572) definition of standard nozzles or a volume mean diameter of 300 microns or greater for spinning atomizer nozzles.

Wind Speed

Do not apply at wind speeds greater than 10 mph. Only apply this product if the wind direction favors on-target deposition and there are not sensitive areas (including, but not limited to, bodies of water, known habitat for nontarget species, nontarget crops) within 250 feet downwind.

Temperature Inversions

If applying at wind speeds less than 3 mph, the applicator must determine if: a) conditions of temperature inversion exist, or b) stable atmospheric conditions exist at or below nozzle height. Do not make applications into areas of temperature inversions or stable atmospheric conditions.

Susceptible Plants

Do not apply under circumstances where spray drift may occur to food, forage, or other plantings that might be damaged or crops thereof rendered unfit for sale, use or consumption. Susceptible crops include, but are not limited to, cotton, okra, flowers, grapes (in growing stage), fruit trees (foliage), soybeans (vegetative stage), ornamentals, sunflowers, tomatoes, beans, and other vegetables, or tobacco. Small amounts of spray drift that might not be visible may injure susceptible broadleaf plants.

Other State and Local Requirements

Applicators must follow all state and local pesticide drift requirements regarding application of 2,4-D herbicides. Where states have more stringent regulations, they must be observed.

Equipment

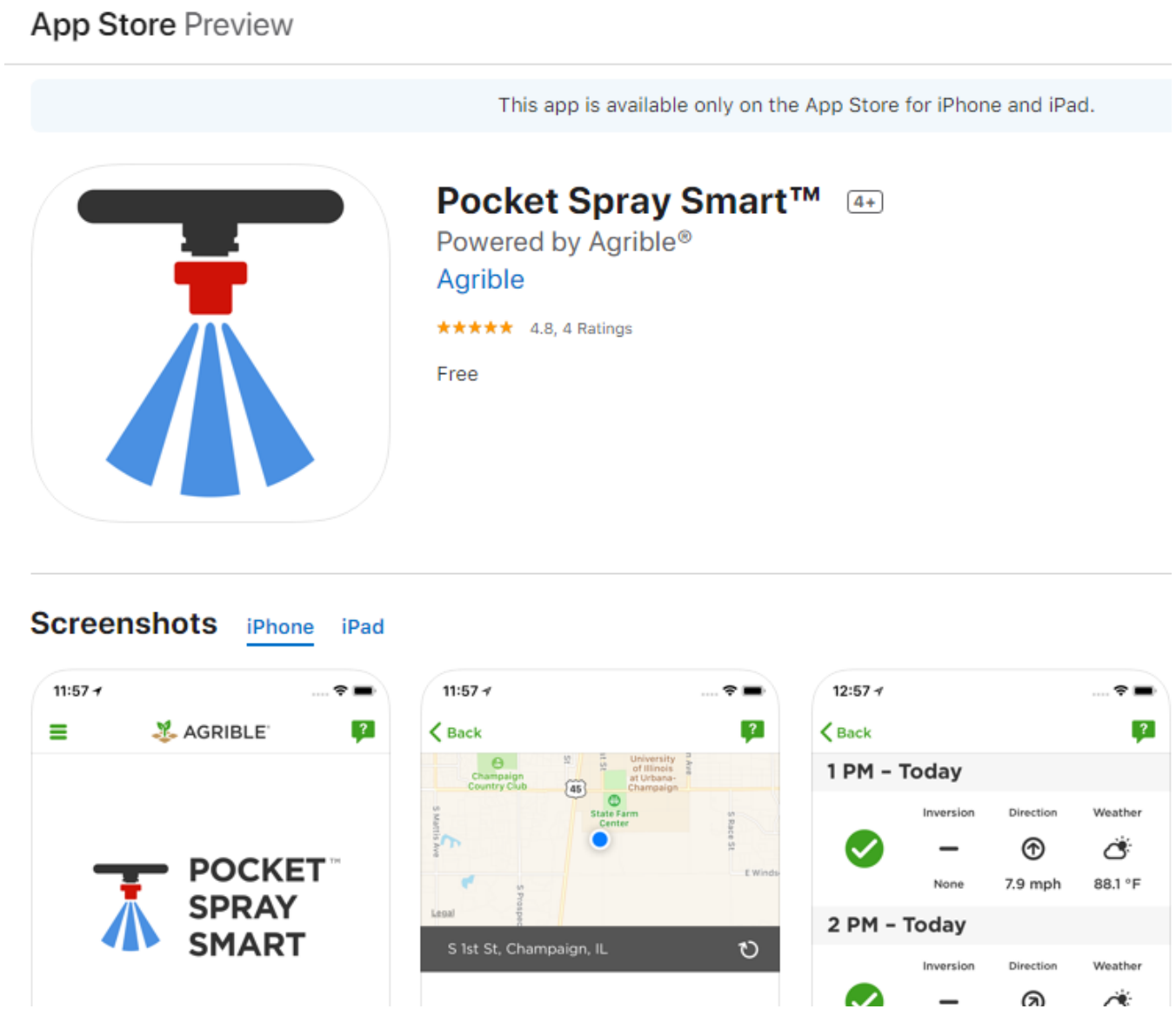
All ground application equipment must be properly maintained and calibrated using appropriate carriers or surrogates. Do not apply with a nozzle height greater than 4 feet above the crop canopy. Do not apply by aerial application.

Example Apps for Monitoring Spray Conditions

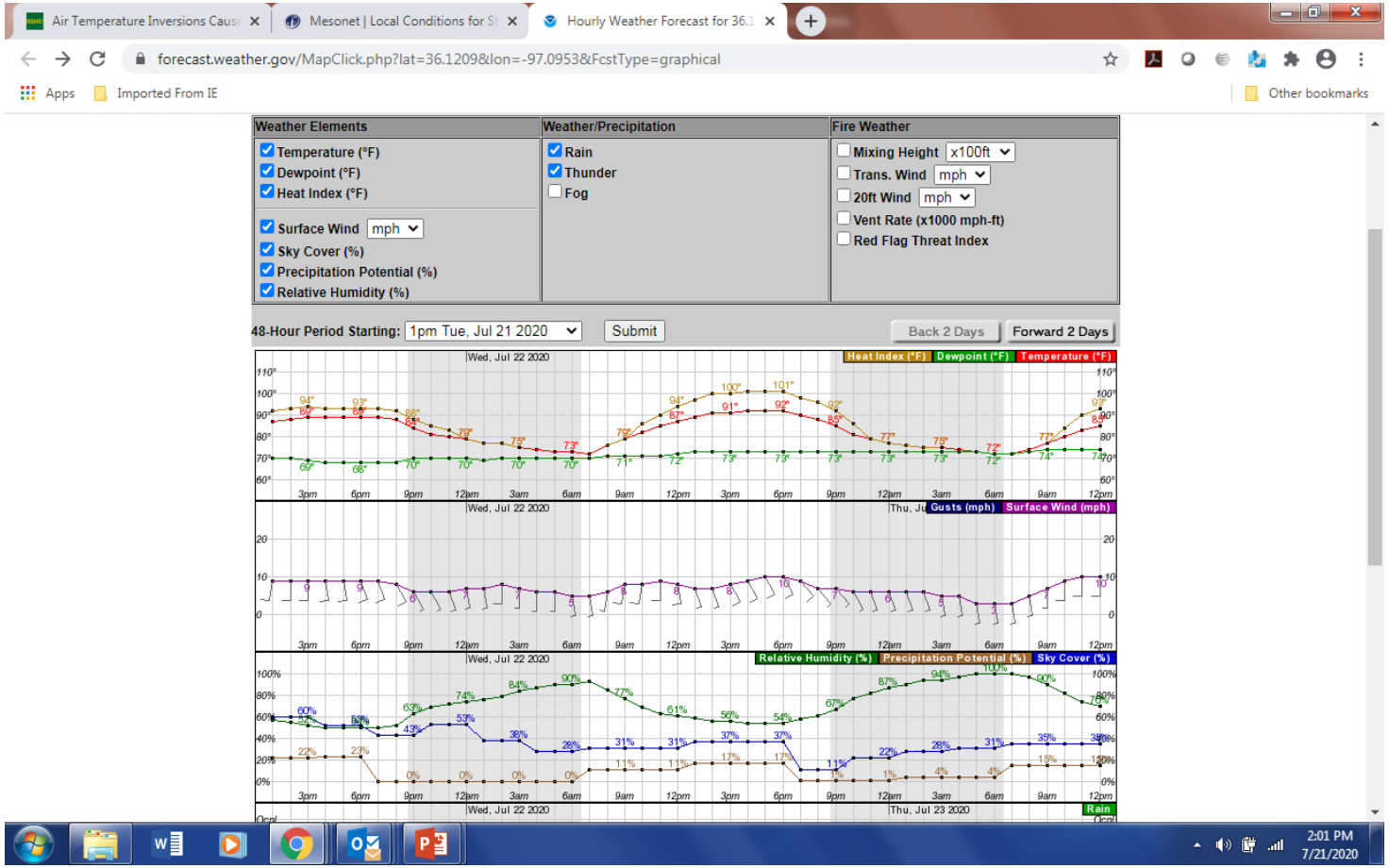
FREE !

Only Apple for now

BOOOOO

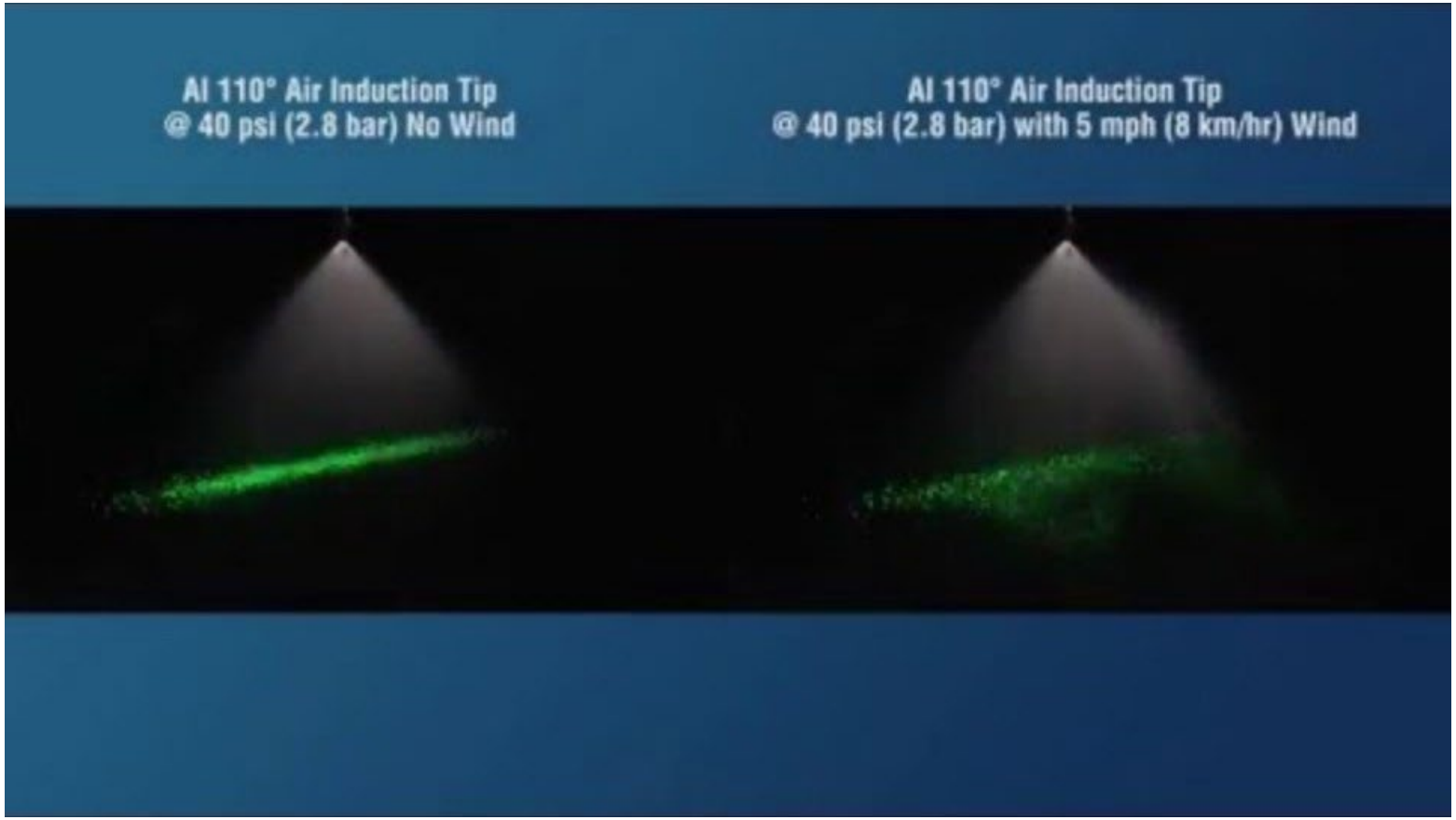


Point Forecast at https://forecast.weather.gov



Concept: Increased air speed distorts nozzle spray pattern.
Why: Increased collision of air particles push spray particles from intended flight path.

<u>Effect of 5 mph wind on drift</u>



Concept: Wind speed varies with height above turf
Why: “Friction” or “Drag” created by the turf surface slows the air speed close to the ground

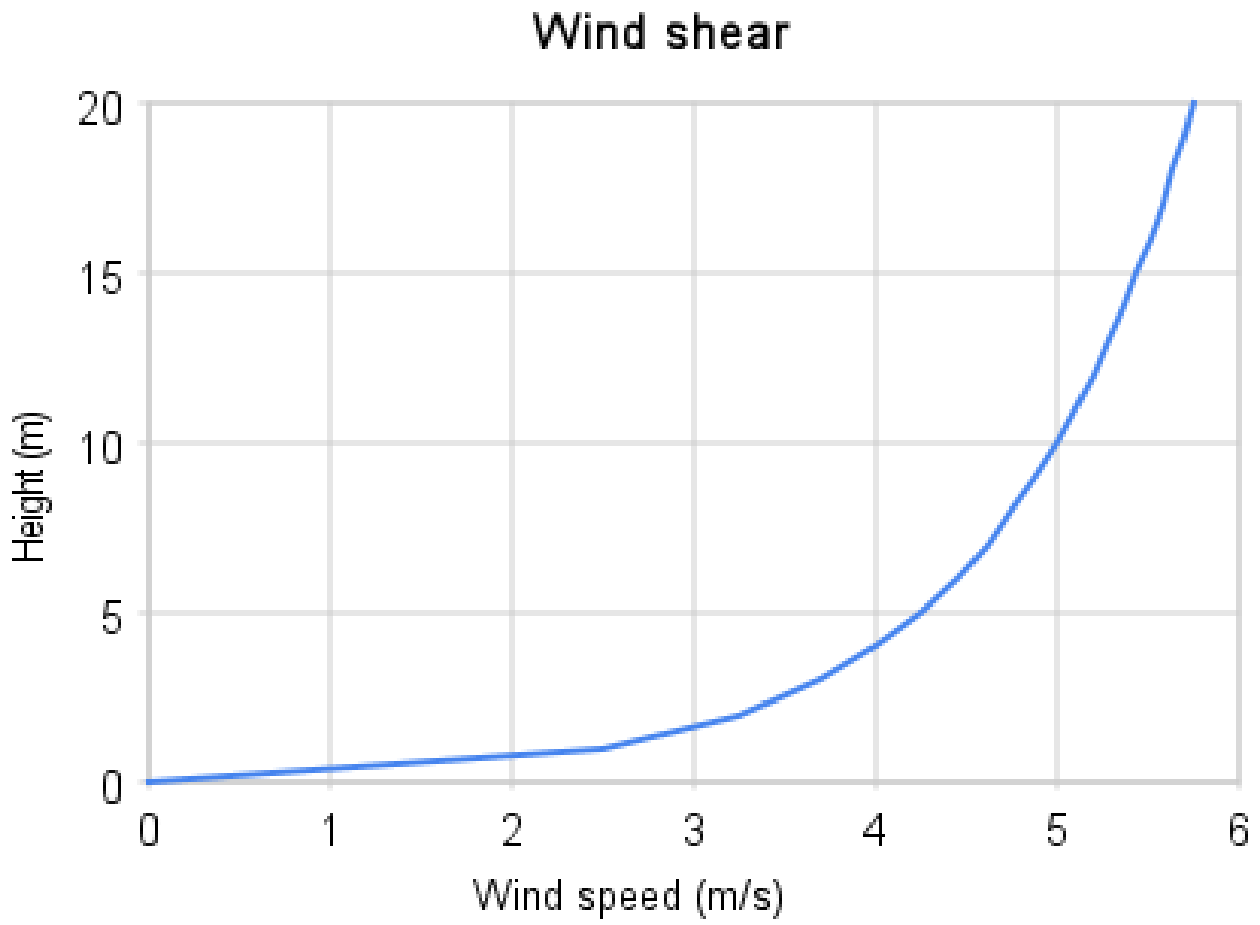
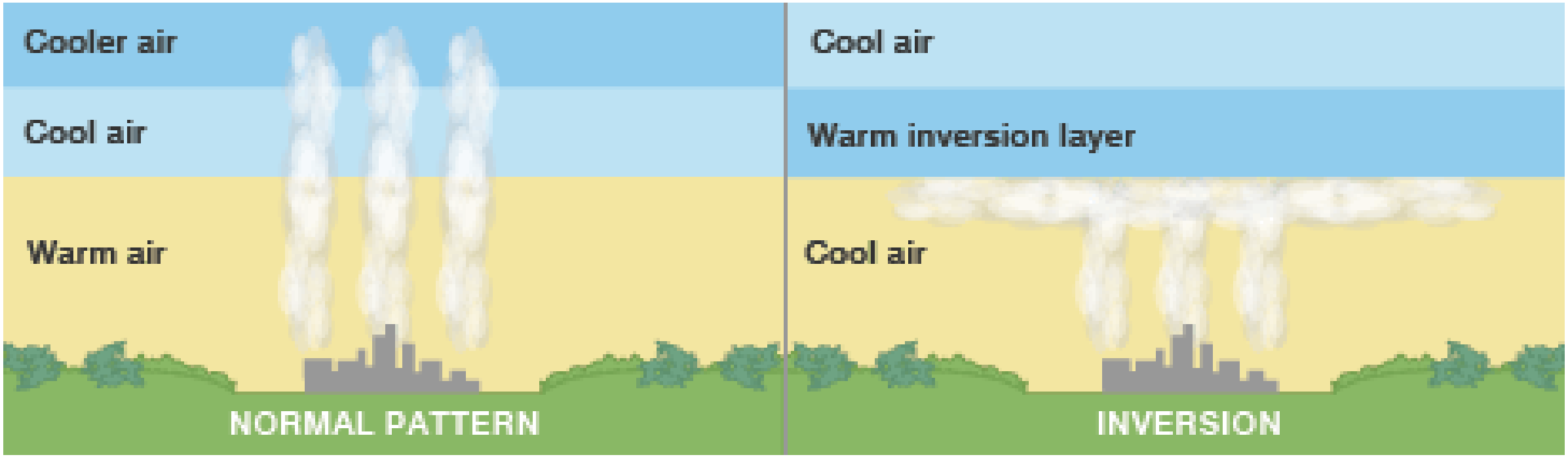


Image credit: Dio Real Skills at: https://diorealskills.org/2012/05/18/wind-energy-2-air-velocity/

Extreme example of temperature inversion

Temperature Inversion

- Temperature inversion, a reversal of the normal behavior of temperature that results in a layer of cool air at the surface becoming overlain by warmer air, which caps upward moving air.
- Temperature inversions trap very fine spray droplets in the air near the surface. This droplet filled air can then move horizontally and injure near by plants or flow to people, animals, sensitive environments.

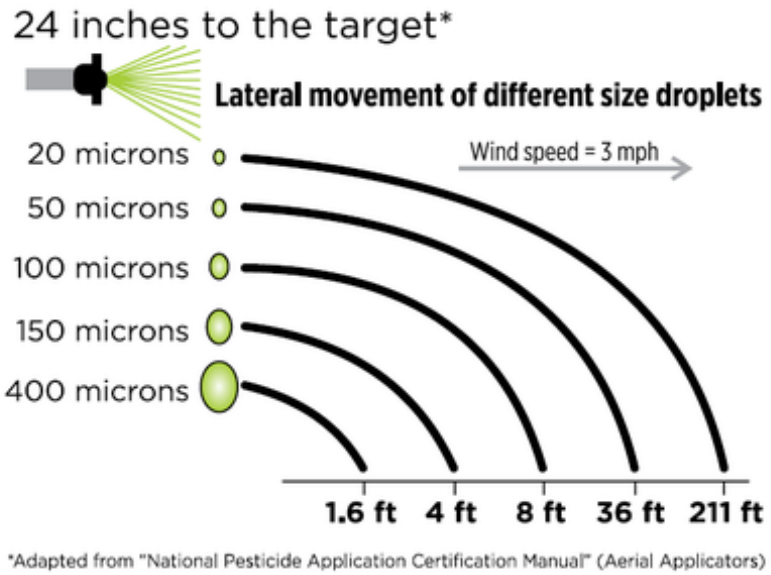


Example temperature inversion

Concept: Very small droplets have great potential to move off target whether by wind or temperature inversion effect.
Why: Smaller drops stay suspended in air longer than larger, heavy drops.

Inversions and Pesticide Spray Drift

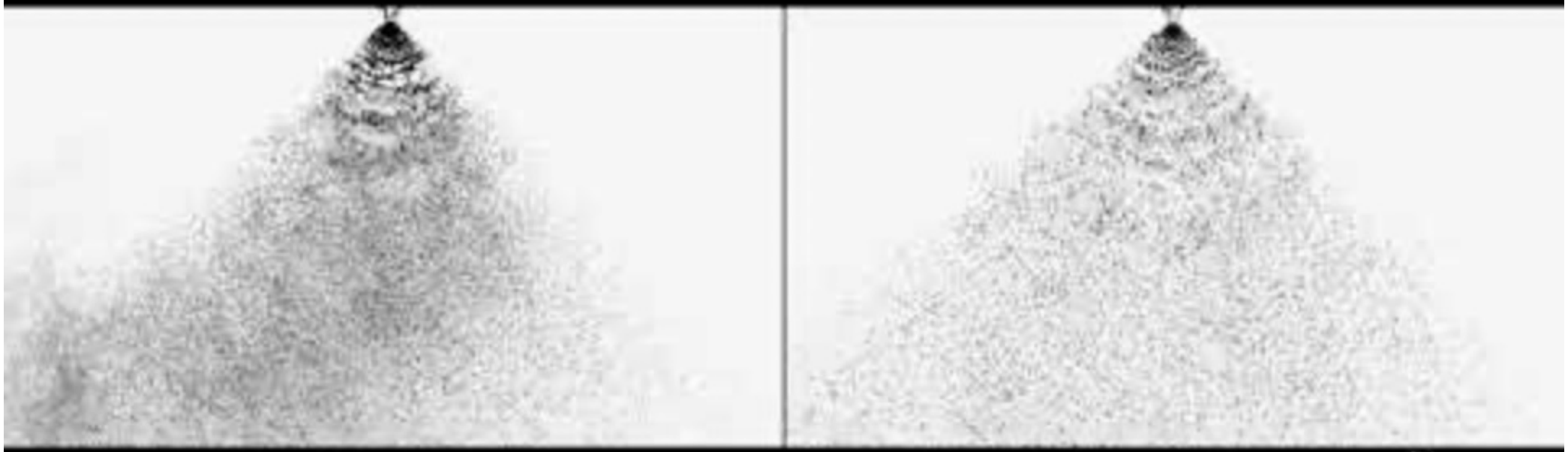
Spraying during an inversion never is recommended, even with drift-reducing nozzles or drift retardants. Drift-reducing nozzles or drift retardants still produce some fine drops less than 200 microns in diameter that are likely to drift. These small drops often will stay suspended and move horizontally across fields **(Figure 9).**



*Adapted from "National Pesticide Application Certification Manual" (Aerial Applicators)

Figure 9. Dense air suspends fine spray drops, and small ones can move large distances in low-wind conditions.

Spray Comparison Wind - AIXR TeeJet®



Herbicide Alone

Herbicide + InterLock®

Drift Summary

Make decisions that give you the greatest number of options during times of year when wind speed, temperature, or temperature inversions would cause you problems

Avoid spraying during temperature inversions

Avoid spraying when winds would cause drift

Avoid use of products that pose too high of volatility risk during those special times of year when volatility is likely

Choose nozzles types, spray system pressures, drift control additives, nozzle mounting heights appropriately.

Questions?

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