

DRIFT MITIGATING ADJUVANTS – HOW THEY WORK

2016 Annual TPSA Conference

Presented by Ray Pigati, WinField



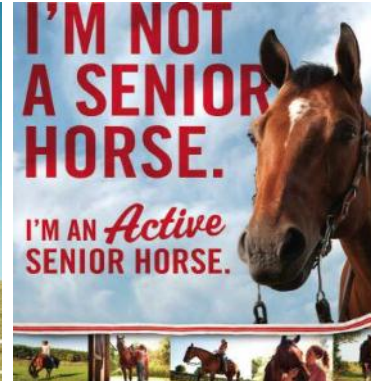
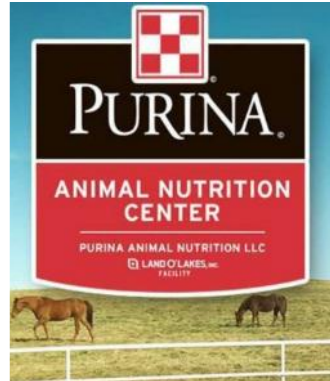
A FARMER-OWNED FORTUNE 200 COMPANY



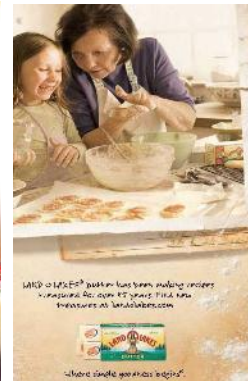
Agriculture services, crop inputs



Animal nutrition and feed



Dairy foods



WINFIELD™


PURINA



DRIFT MITIGATING ADJUVANTS – HOW THEY WORK - OVERVIEW

- Droplet Fate
 - What happens when spray solution leaves the nozzle tip?
- Influencing Droplet Size
 - A droplet's fate is correlated to its size
- The Ideal Droplet Distribution
 - For the most efficient use of a pesticide application – what is the ideal droplet distribution
- Achieving the Ideal Droplet Distribution
 - How adjuvants can help

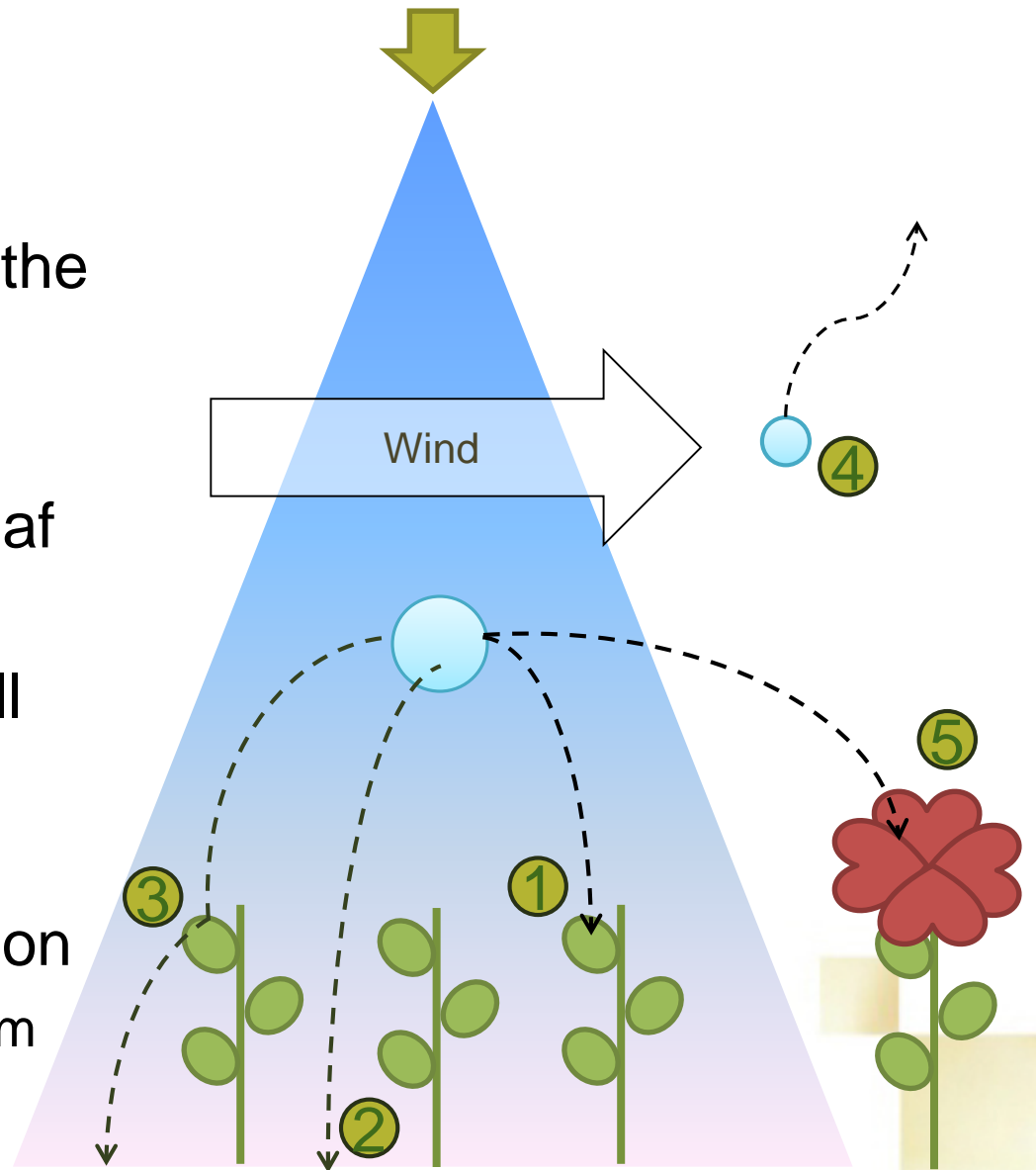




DROPLET FATE

DROPLET FATE

1. On-Target application: the goal is 100%
2. Missing the target
3. Run or bounce off of leaf
 - Big Droplets: $> 600 \mu\text{m}$
4. Evaporation: very small droplets
 - Tiny Droplets: $< 50 \mu\text{m}$
5. Drift: off-target deposition
 - Small Droplets: $50\text{-}200 \mu\text{m}$



DROPLET FATE - BOUNCE

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DROPLET FATE - BOUNCE



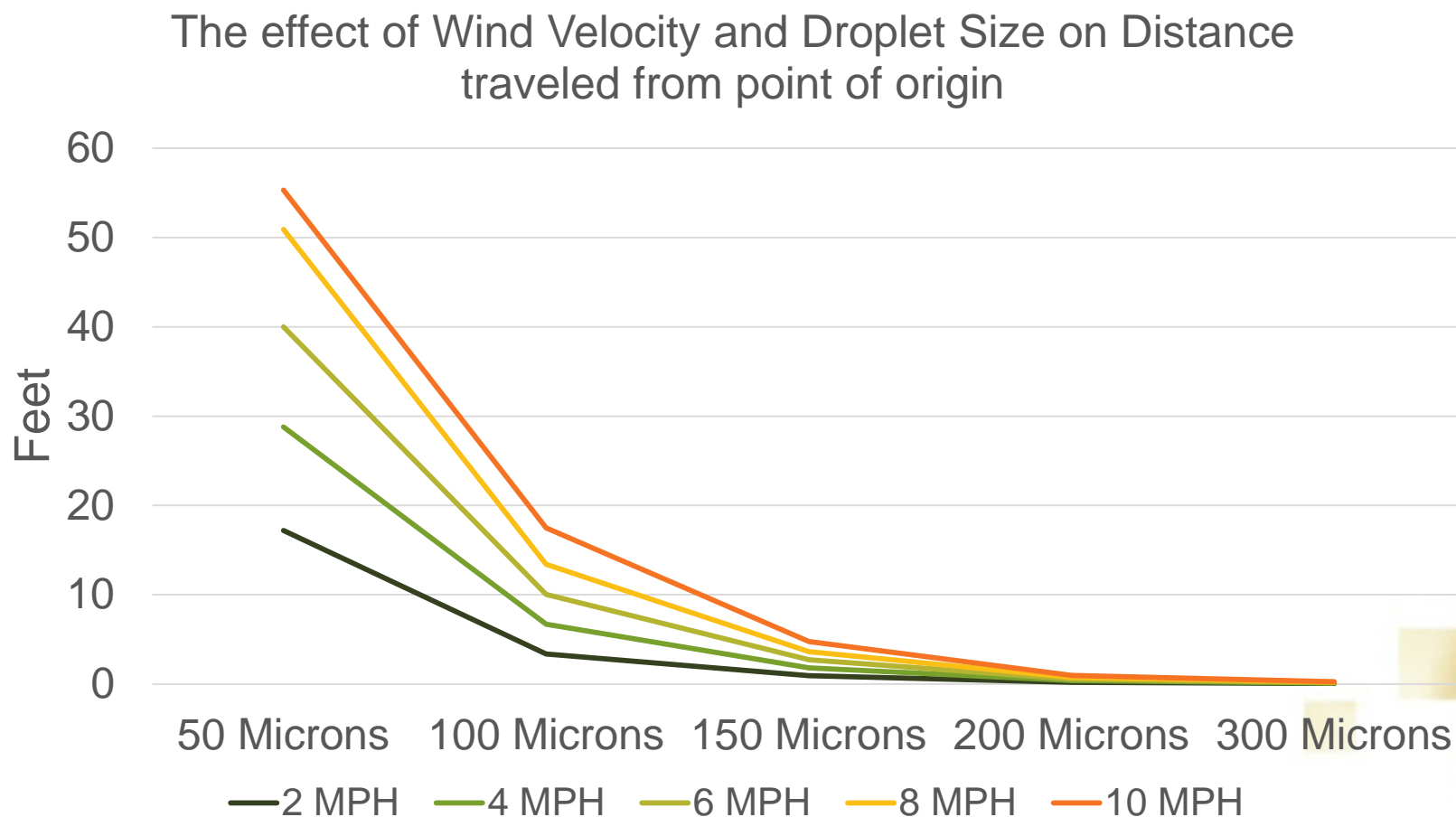
DROPLET FATE - EVAPORATION

- Very fine droplets may stop falling and evaporate before they land on a plant
- Fine droplets can blow away and land off-target
- Droplets shrink as they fall—may be too small to be effective
- High humidity reduces evaporation— droplets drift farther

Droplet Diameter (μm)	Time to Evaporate (sec)	Vertical Deceleration Distance (in)
20	0.3	< 1
50	1.5	3
100	7	9
150	16	16
200	29	25

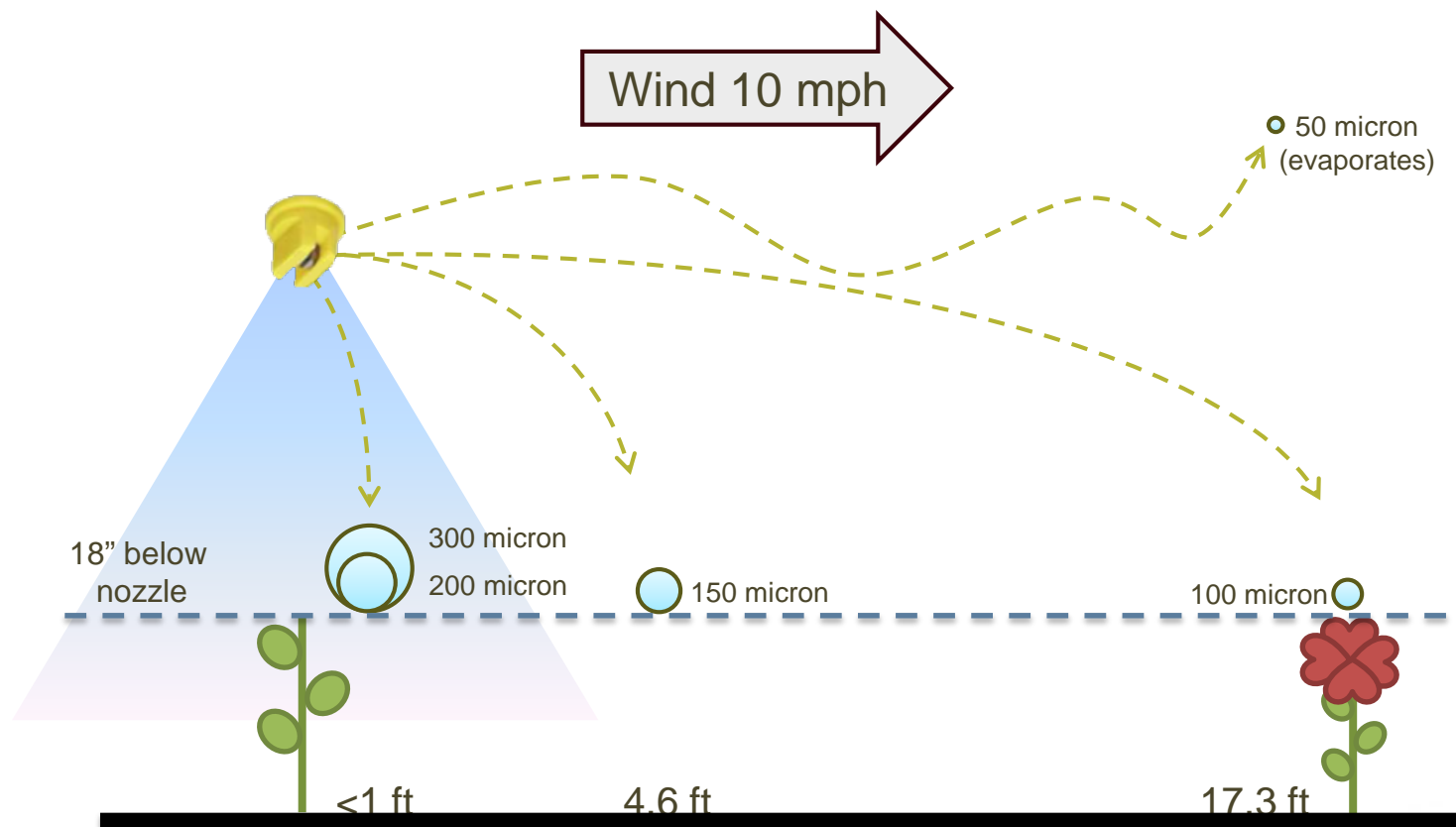
Conditions : 90°F, 36% RH, 25 psi, 3.75% pesticide solution.
From Wolf, Kansas State University. Strategies to Reduce Spray Drift.

DROPLET FATE – DRIFT



From Ozkan OSU Extension Fact Sheet AEX-525-98.

DROPLET FATE – DRIFT



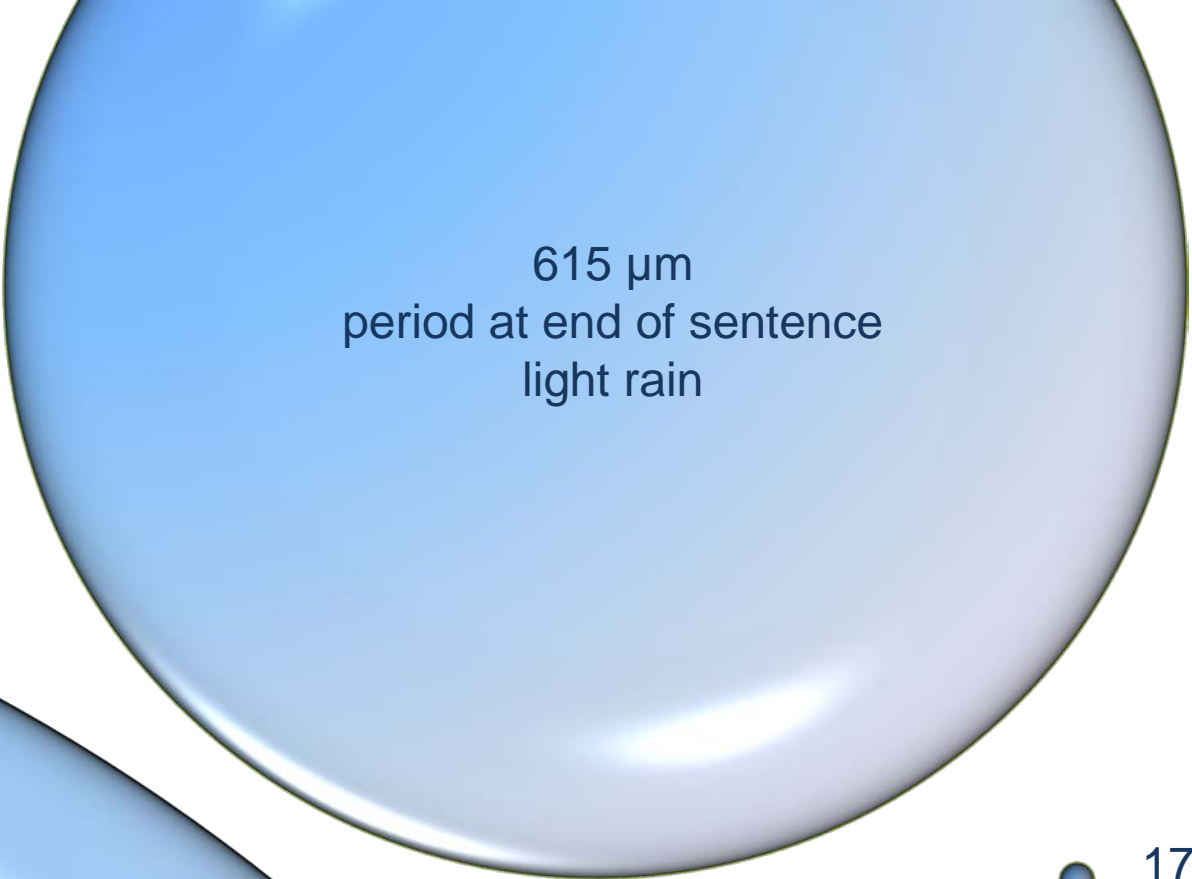
From Ozkan OSU Extension Fact Sheet AEX-525-98.

DROPLET FATE


There are many factors that determine droplet fate and one applicators can influence the most every application is **droplet size.**



INFLUENCING DROPLET SIZE TO MINIMIZE DRIFT




615 μm
period at end of sentence
light rain



300 μm
toothbrush bristle
fine misty rain



17 μm
fog



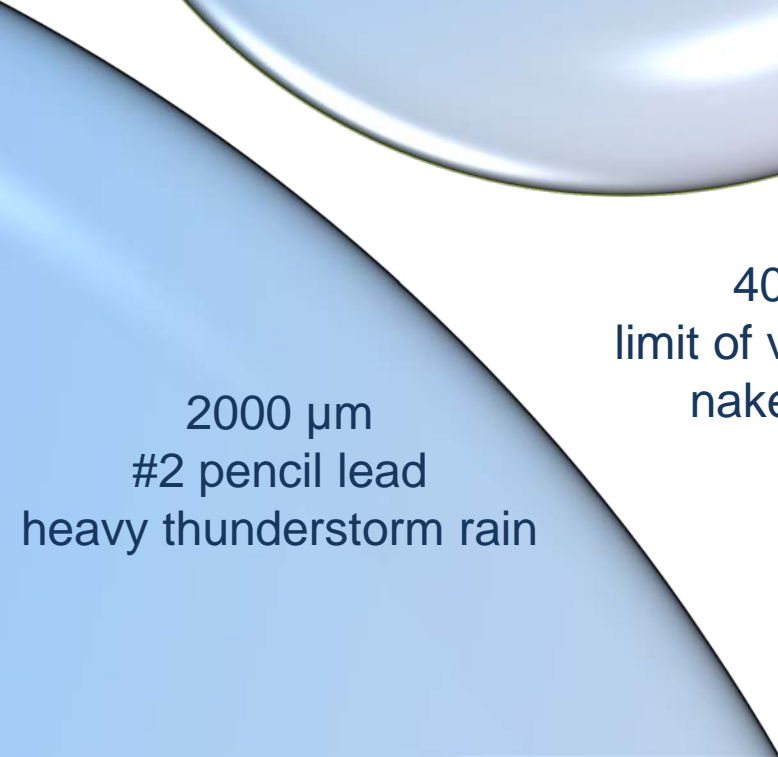
40 μm
limit of visibility to
naked eye



105 μm
human hair
mist



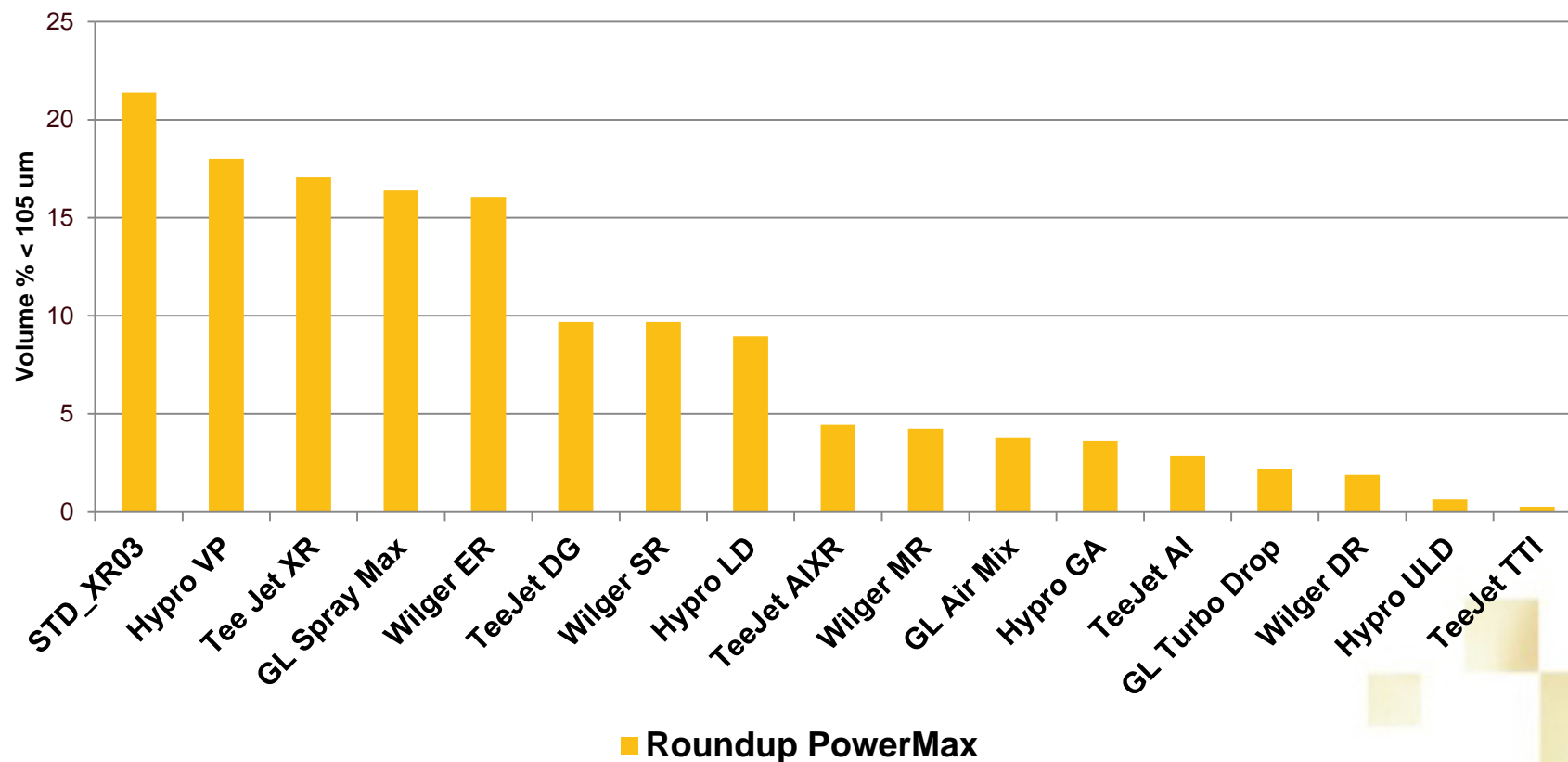
210 μm
2 sheets of paper



2000 μm
#2 pencil lead
heavy thunderstorm rain

INFLUENCING DROPLET SIZE - NOZZLES

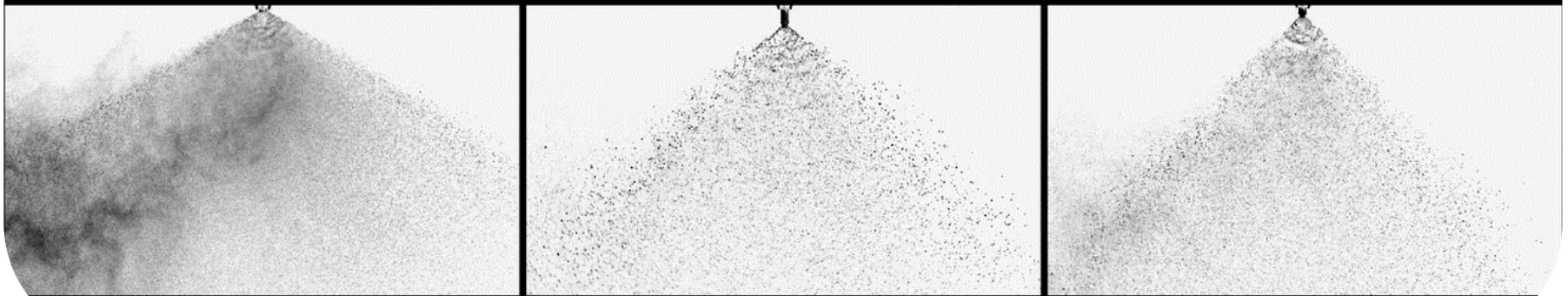
% Driftable Fines
11004 Nozzles



INFLUENCING DROPLET SIZE - NOZZLES

Nozzle Comparison - 40 PSI Wind XR, AI, AIXR TeeJet®

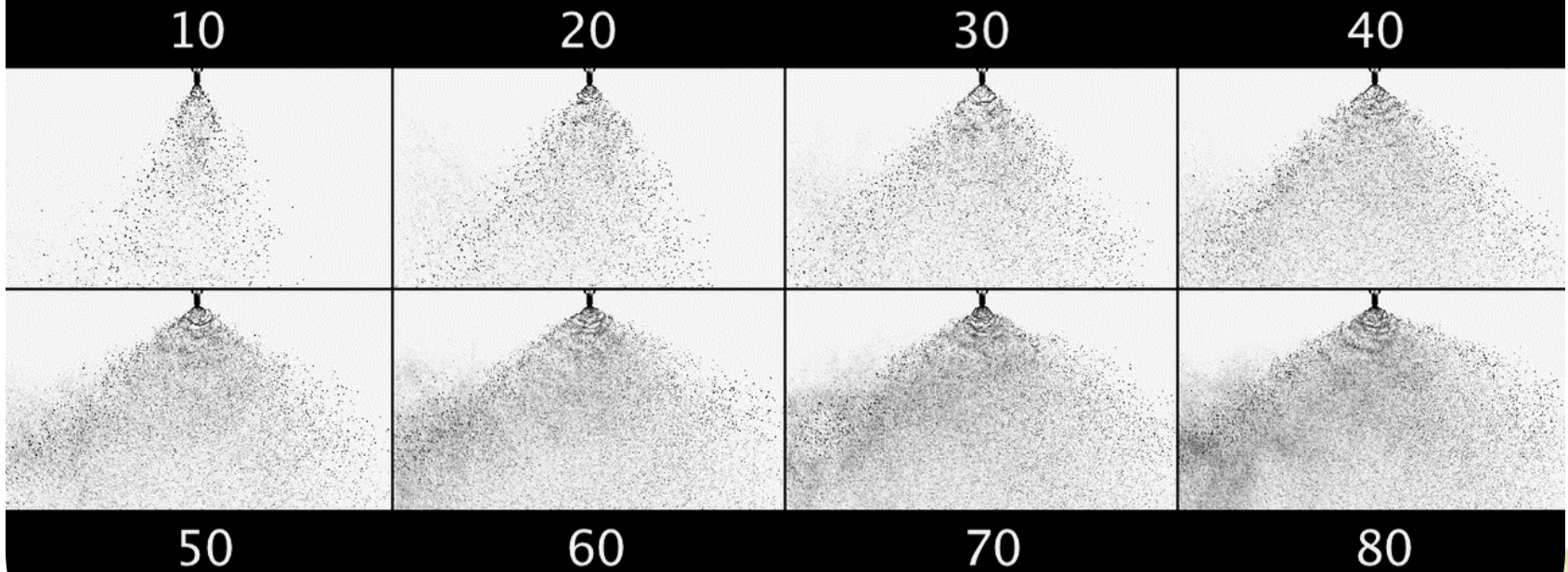
©2009 Winfield Solutions, LLC



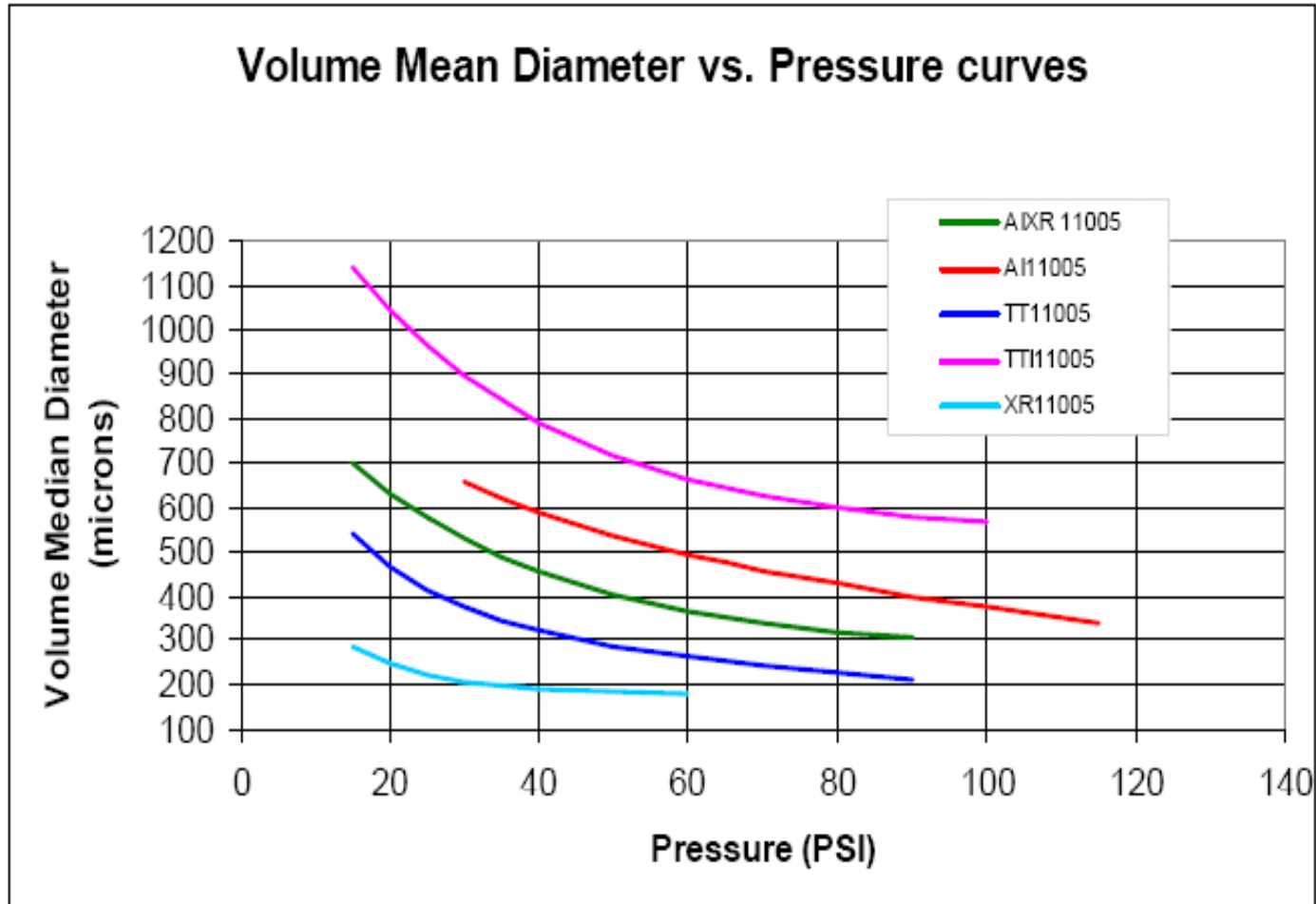
INFLUENCING DROPLET SIZE - PRESSURE

Pressure Comparison Wind - 10-80 PSI AI TeeJet® AI11002

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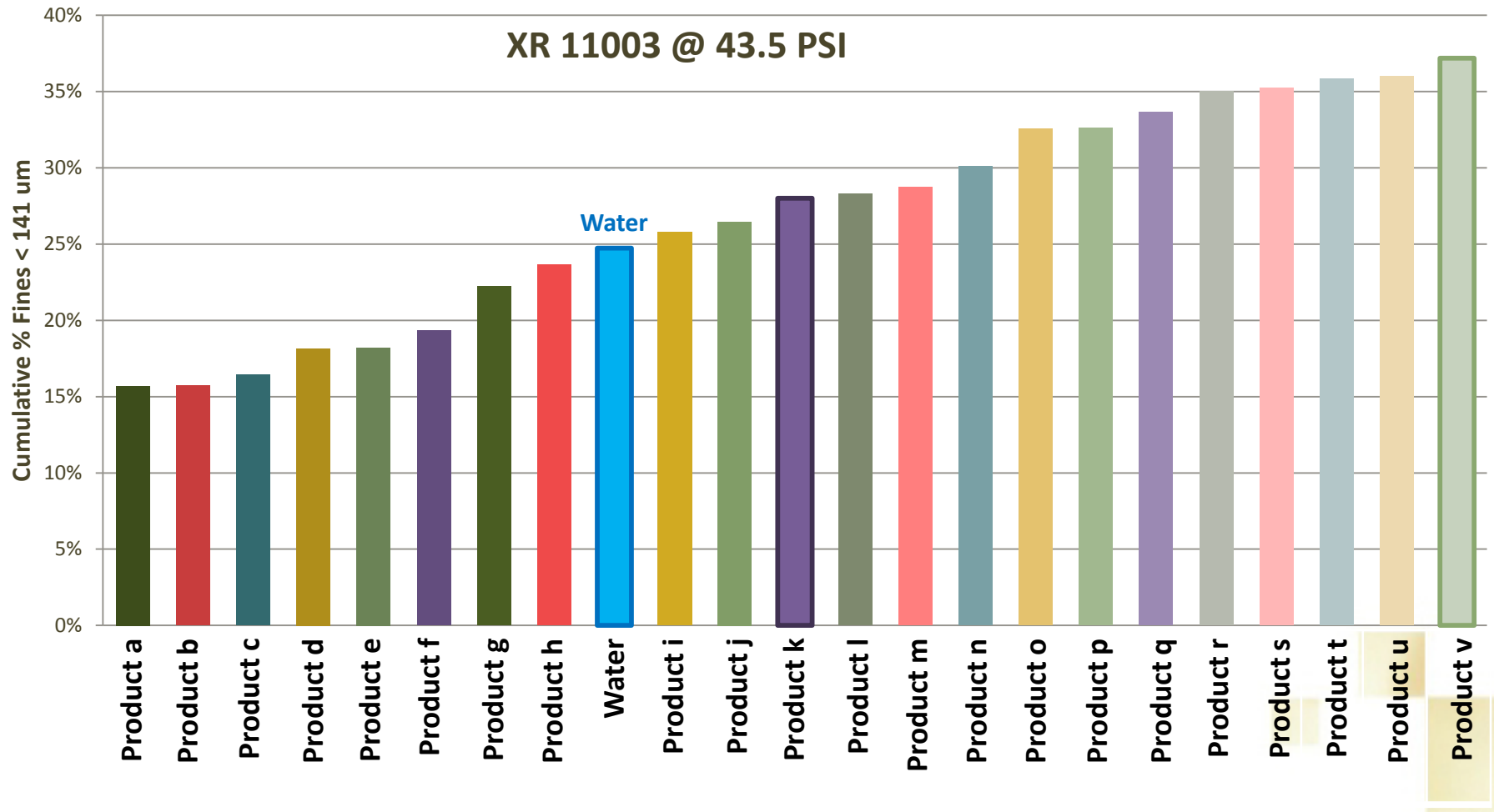


INFLUENCING DROPLET SIZE - PRESSURE



Courtesy of TeeJet® Technologies

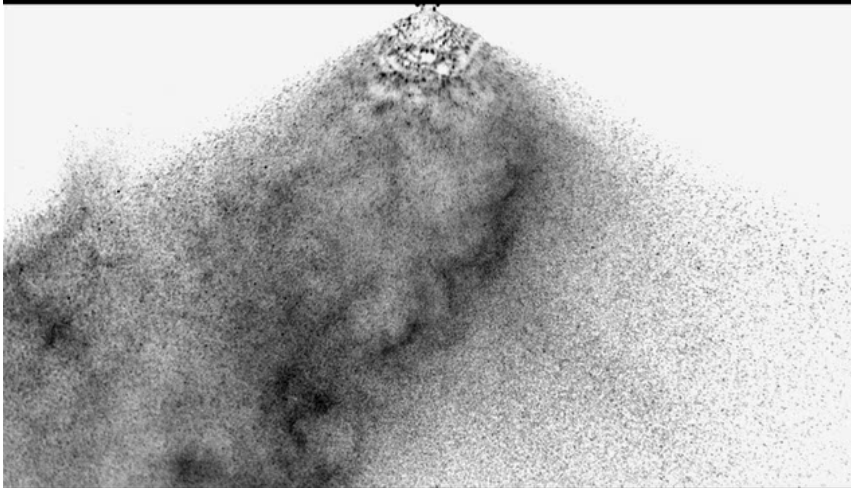
INFLUENCING DROPLET SIZE – TANK-MIXES



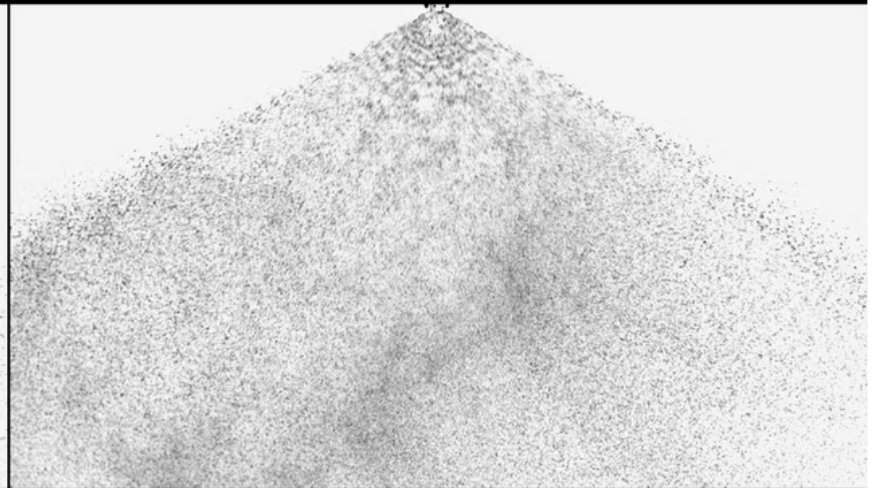
INFLUENCING DROPLET SIZE - ADJUVANTS

Spray Comparison Wind - XR TeeJet®

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Herbicide Alone



Herbicide + InterLock®

THE IDEAL DROPLET DISTRIBUTION



THE GOLDBLOCKS DROPLET



Droplets Cannot Be

1. Too Big

- Bounce off the leaf
- Miss Target

2. Too Small

- Evaporate
- Drift off target

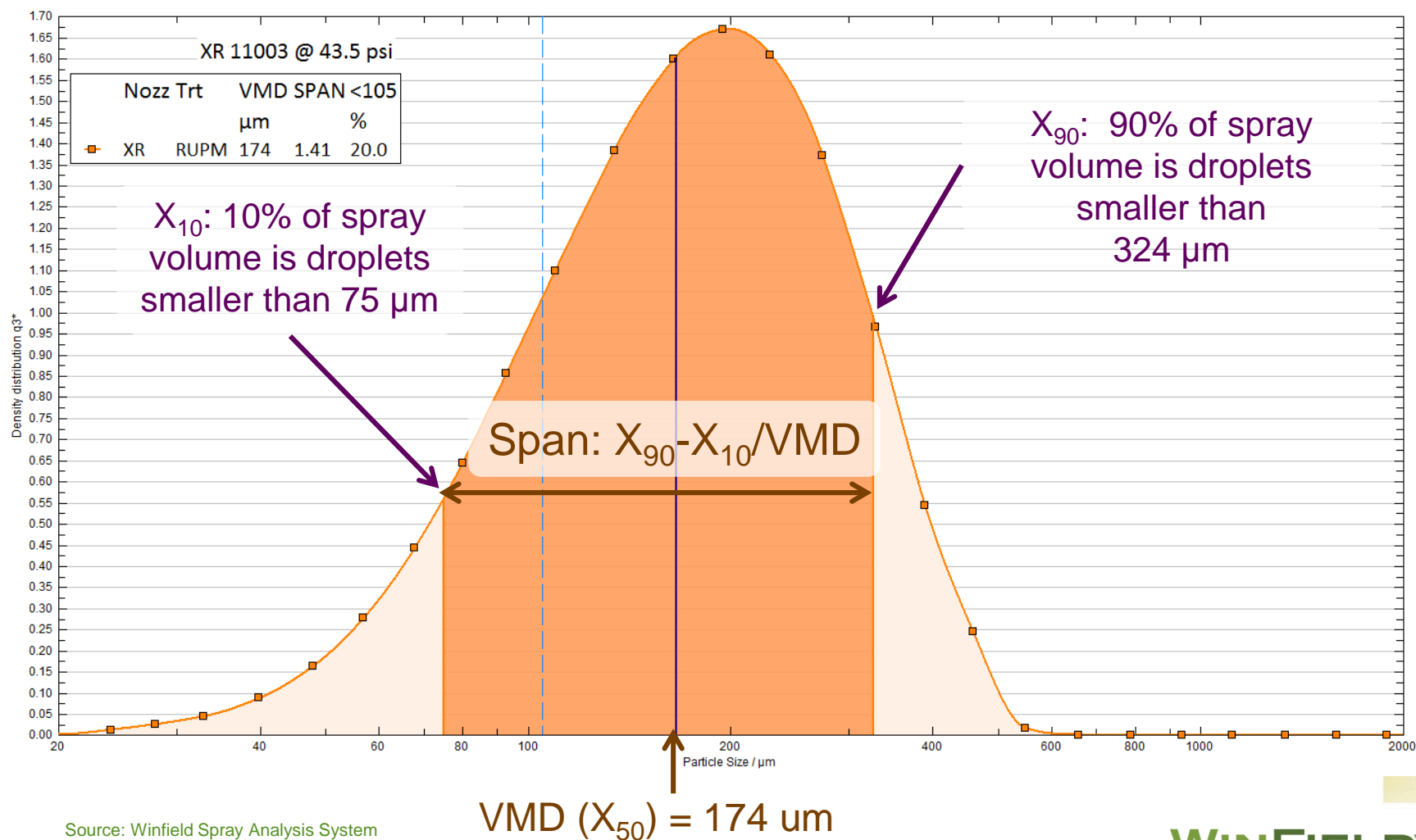
3. The Have To Be.....Just Right!

SPAN

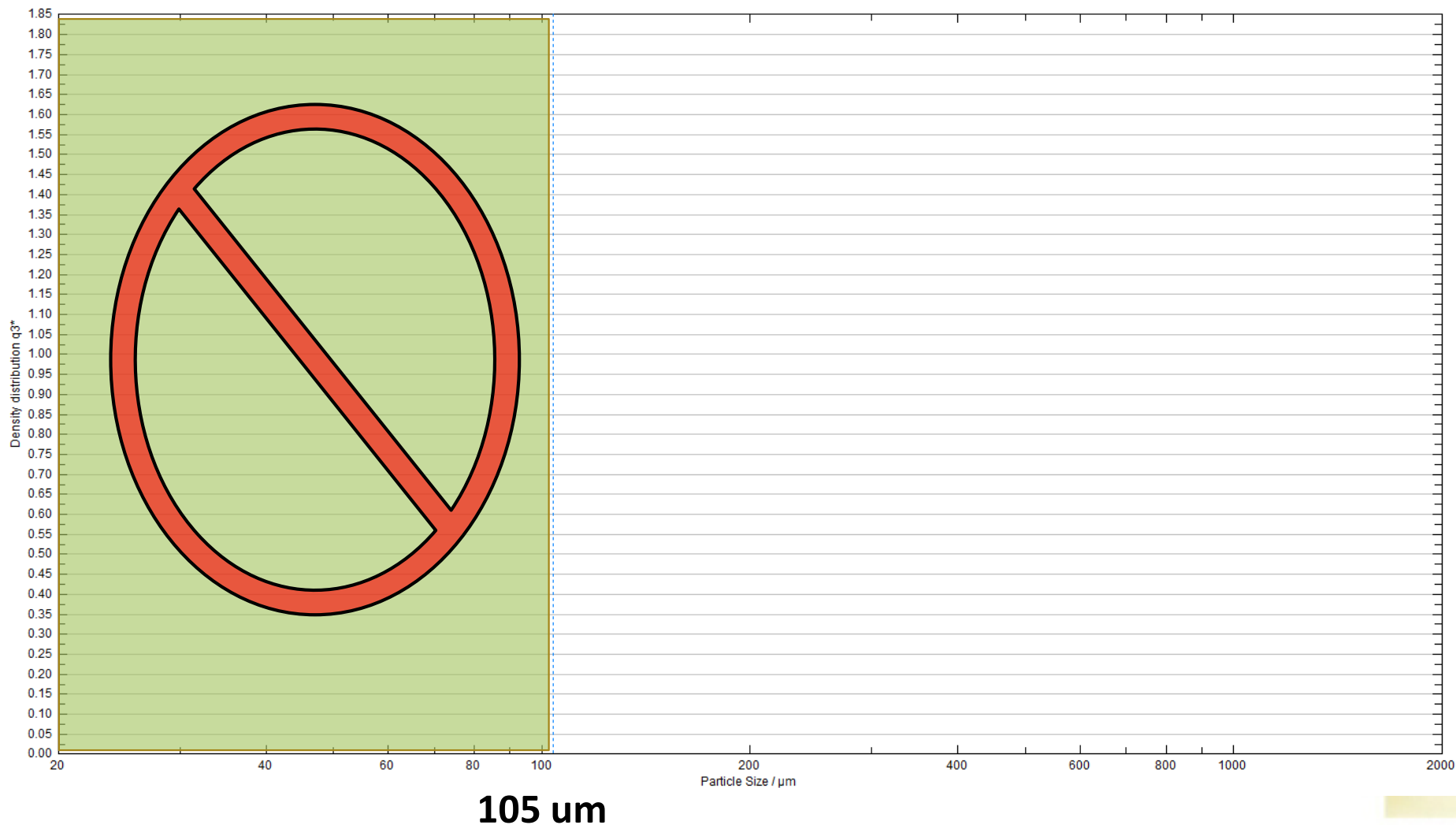
- Relative span of a spray
 - $(X_{90} - X_{10})/X_{50}$
 - Where $n\%$ of the volume is made up of droplets smaller than X_n (percentile)
 - **Higher span → more variable spray pattern**
 - There is no ideal span, but a span of 1.0 would be very consistent and a span of 1.5 would be highly variable



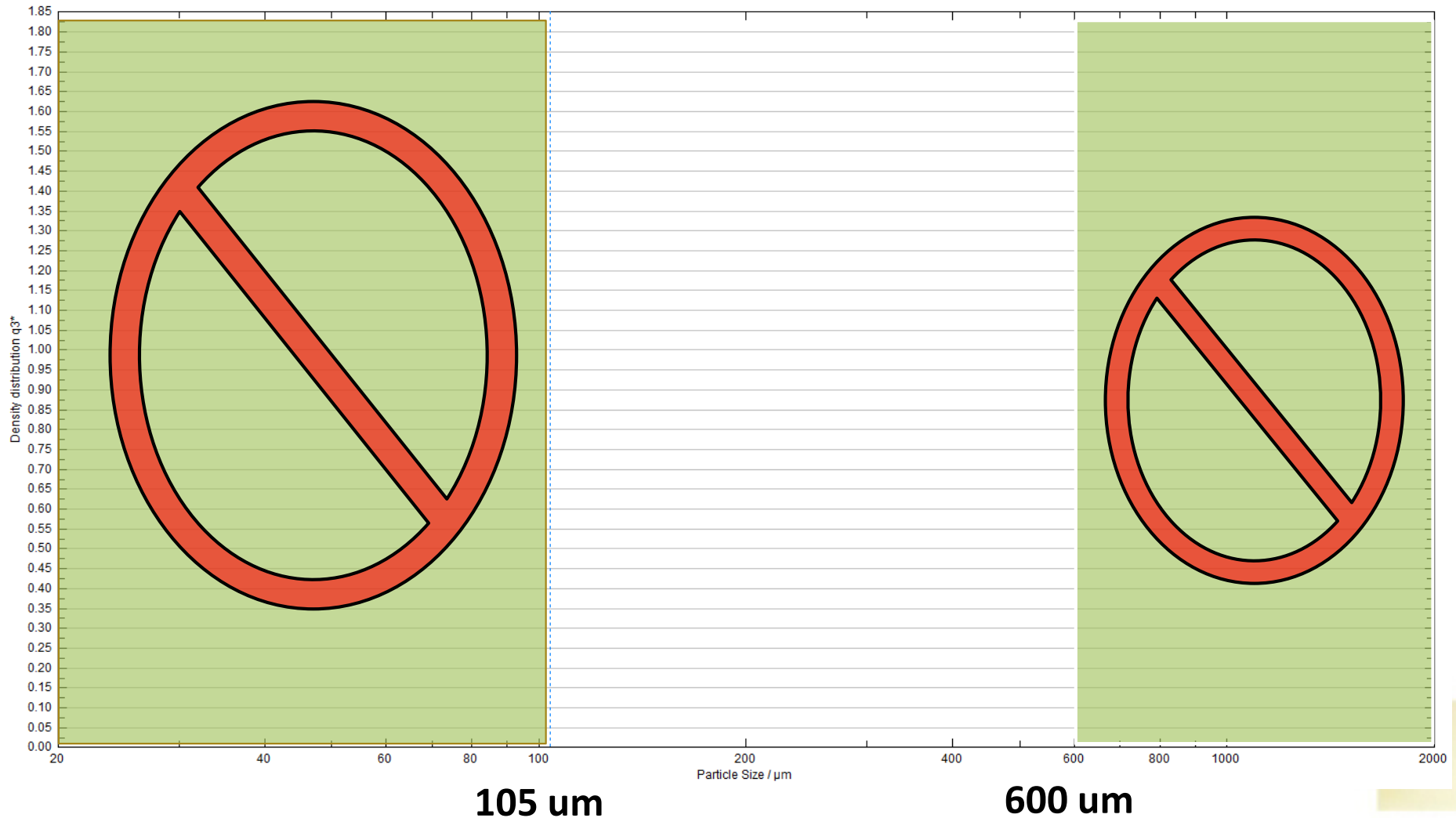
DROPLET SIZE DISTRIBUTIONS: SPAN



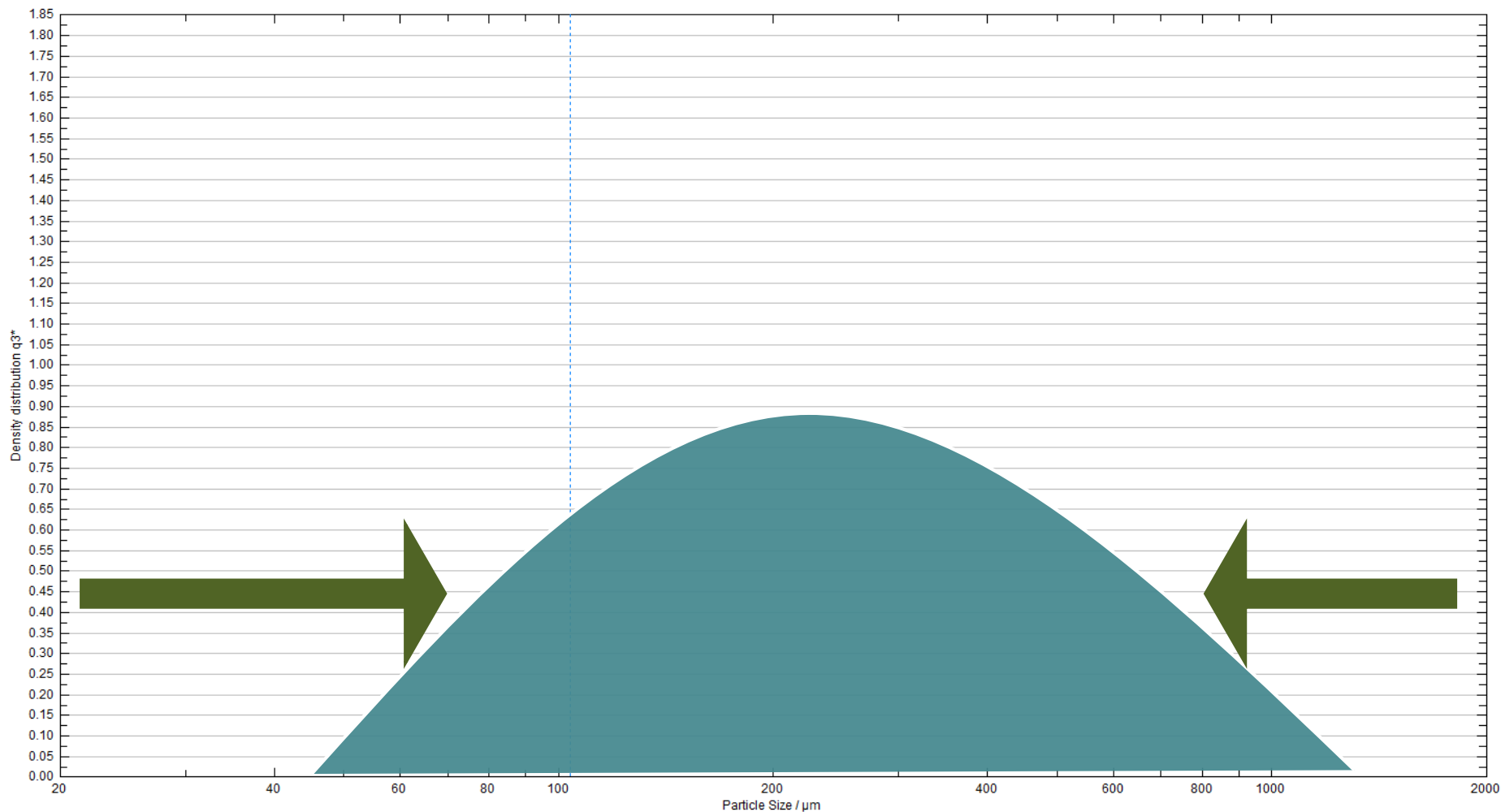
THE IDEAL DROPLET DISTRIBUTION— LIMIT DRIFTABLE FINES



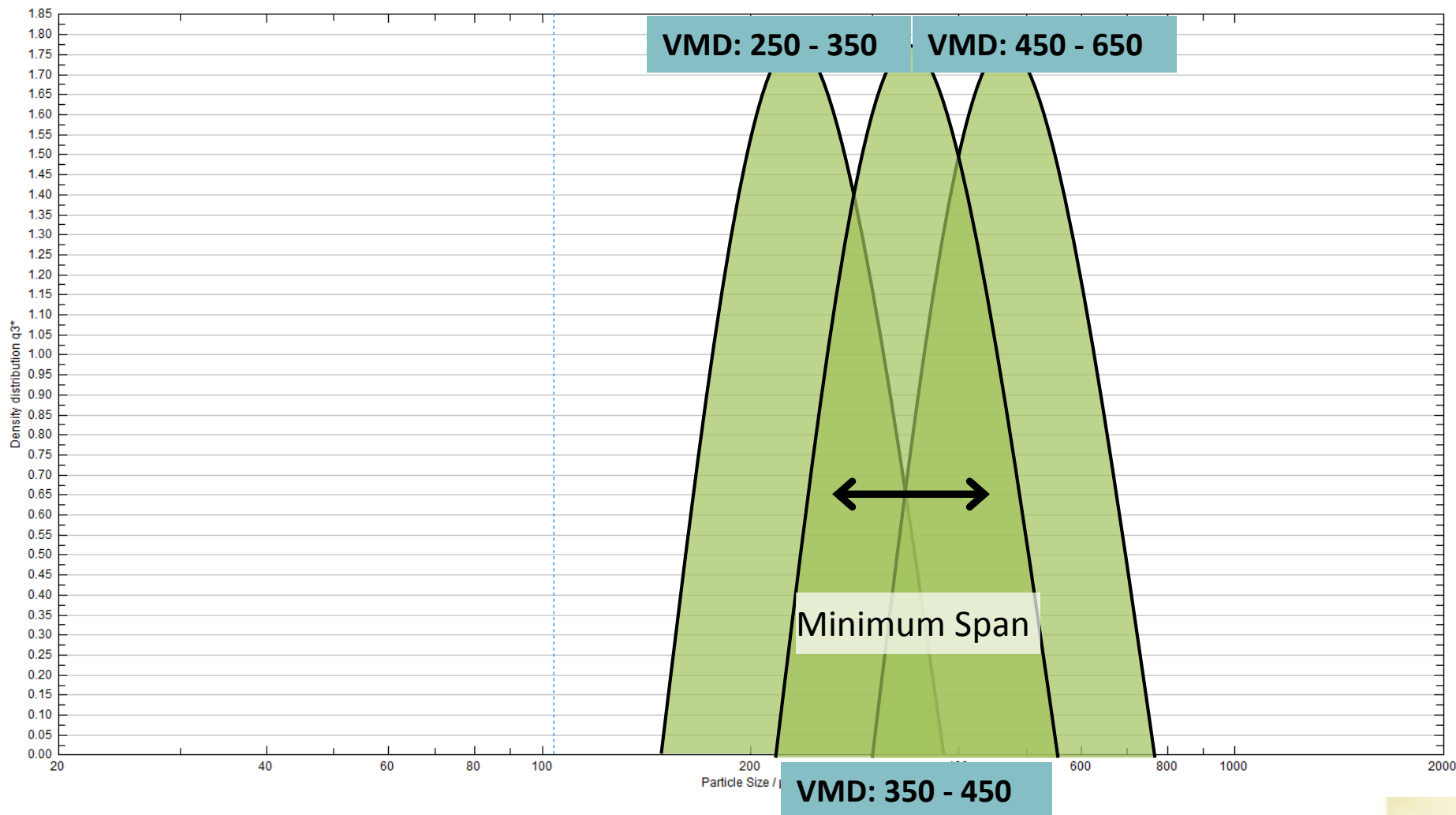
THE IDEAL DROPLET DISTRIBUTION— LIMIT BIG DROPLETS



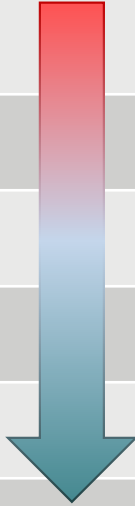
THE IDEAL DROPLET DISTRIBUTION – LIMIT SPAN



THE IDEAL DROPLET SPECTRUM – NARROW SPAN AND RIGHT SIZE



THE IDEAL DROPLET SPECTRUM – HERBICIDE CLASS SPECIFIC

Spray Quality	VMD (µm)*	Drops per in ²	Contact I & F	Systemic I & F	Contact Foliar H	Systemic Foliar H	Soil-Applied H	Incorp. Soil-Applied H	Drift Potential
VF	<136	>4582							HIGH
F	136-177	2078	✓						
M	177-218	1112	✓	✓	✓	✓			
C	218-349	271		✓	✓	✓	✓	✓	
VC	349-428	147				✓	✓	✓	
XC	428-622	48						✓	
UC	> 622	<48						✓	LOW

Droplet size classifications: Spraying Systems TeeJet Technologies Catalog 51

Applications: Kansas State Extension Publication MF2869, *Droplet Size Calibration: a New Approach to Effective Spraying*, March 2009

Droplets/in²: E. Spandl, Winfield Solutions (2009). At 10 GPA, for upper limit of size class.

Spray quality based upon ASABE S572.1.

THE IDEAL DROPLET DISTRIBUTION – IT DEPENDS!

*Advantages and Disadvantages of Different Droplet Sizes**

Equivalent droplet volume in each quadrant

+’S

- Excellent coverage
- Low droplet bounce

-’S

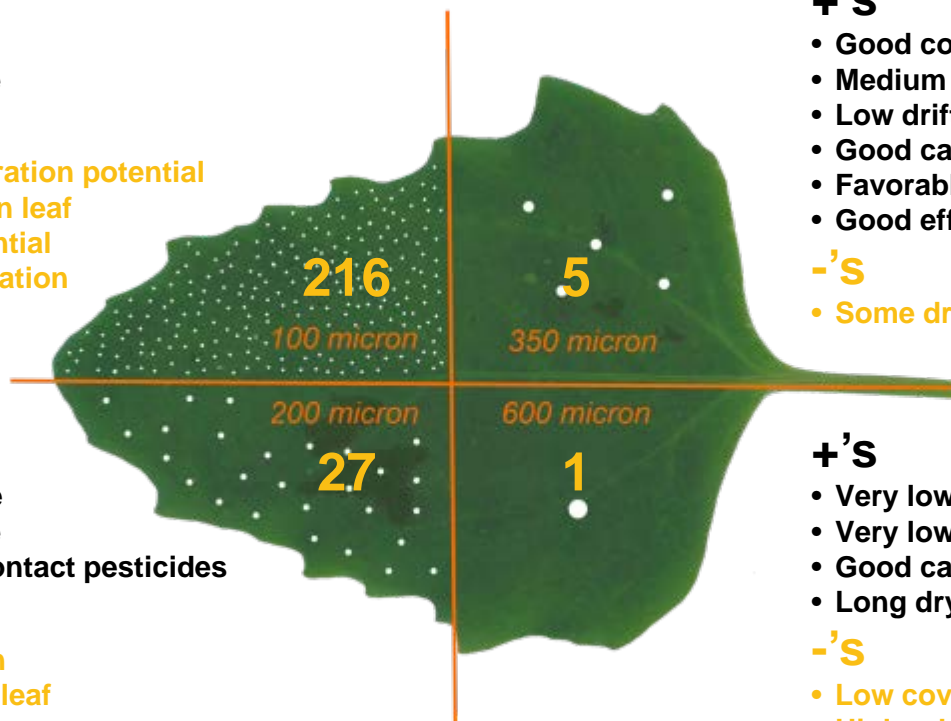
- Very high air evaporation potential
- Quick drying time on leaf
- Very high drift potential
- Poor canopy penetration

+’S

- Very good coverage
- Low droplet bounce
- Good efficacy for contact pesticides

-’S

- High air evaporation
- Fast drying time on leaf
- High drift potential
- Moderate canopy penetration



+’S

- Good coverage
- Medium evaporation
- Low drift potential
- Good canopy penetration
- Favorable drying time on leaf
- Good efficacy for systemic pesticides

-’S

- Some droplet bounce/spatter

+’S

- Very low evaporation
- Very low drift potential
- Good canopy penetration
- Long drying time on leaf

-’S

- Low coverage
- Hi droplet bounce/spatter
- Reduced efficacy for many pesticides

*Relative comparisons. Results vary depending on environment, products included, adjuvants, canopy characteristics, and other factors.

THE IDEAL DROPLET DISTRIBUTION

USE THE RIGHT NOZZLE WITH INTERLOCK® ADJUVANT TO OPTIMIZE YOUR SPRAY INVESTMENT

InterLock® Advantage: % Reduction of Driftable Fine Droplets Using Manufacturer Recommended Nozzles

XF to VF
EXTRA FINE TO VERY FINE

Not Recommended
High Drift Risk

M to C
MEDIUM TO COARSE

Contact and Systemic Products
Good Coverage
Low Drift Risk

F to M
FINE TO MEDIUM

Contact Products
Excellent Coverage
Moderate Drift Risk

VC to UC
VERY COARSE TO ULTRA-COARSE

Systemic Products
Low Coverage
Low Drift Risk

SPRAY DROPLET MEASUREMENTS*

Nozzles 110° 04	VMD (µm)	Drops per in ²	% Fines <105 µm	InterLock® Advantage
TeeJet® XR	235	887	7.1	58%
Hypro® ADI	332	316	2.5	41%
Wilger® SR	299	431	3.6	63%

SPRAY DROPLET MEASUREMENTS*

Nozzles 110° 04	VMD (µm)	Drops per in ²	% Fines <105 µm	InterLock® Advantage
TeeJet® AIXR	401	179	1.5	67%
Hypro® GA	409	168	1.1	69%
Wilger® MR	382	206	1.6	64%

SPRAY DROPLET MEASUREMENTS*

Nozzles 110° 04	VMD (µm)	Drops per in ²	% Fines <105 µm	InterLock® Advantage
TeeJet® TTI	664	39	0.2	11%
Hypro® ULD	564	64	0.3	52%
Wilger® DR	485	101	0.5	72%

* Droplet size measured in the WinField™ Spray Analysis System 18" below standard ground nozzles sprayed at 40 psi. VMD, % fines and droplets per in² (by VMD) reported for 32 oz/A Roundup PowerMAX® + InterLock® 4 oz/A at 10 GPA. Nozzles and products were tested in accordance with ASABE S572.1 and ASTM E2798-11. WinField, Class Act, InterLock, MasterLock, NG and Preference are registered trademarks of Winfield Solutions, LLC. All other trademarks are the property of their respective owners.
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An aerial photograph of a vast, lush green agricultural field, likely corn. A dirt road runs diagonally across the field. A white pickup truck is parked on the road, with two people standing nearby. In the background, there are more fields, some trees, and a few buildings under a hazy sky. The image is overlaid with a semi-transparent white box containing the title text.

DRIFT MITIGATING ADJUVANTS ACHIEVING THE IDEAL DROPLET SPECTRUM

THE DROPLET SIZE CHALLENGE

- Must get a droplet that isn't so small that it drifts, that it isn't so big that it doesn't achieve adequate coverage and bounces off.
- Droplet size goals shift depending on the application
 - A narrow span is better
- We can influence this by:
 - Nozzles
 - Pressure
 - What goes into the tank
 - GPA
 - Adjuvants!



DRIFT MITIGATING ADJUVANTS

- Encapsulators

- Suspends small capsules(150-180 microns) of pesticide in the spray solution significantly reducing the amount of pesticide contained in drift susceptible fines.
- Do not affect spray droplet size, work for systemic and contact herbicides

- Thickeners or Viscosity Modifiers

- Increases the viscosity of spray solutions which in turn increases droplet size and reduces the amount of drift susceptible fines.
- Does enlarge spray droplet size, works best with systemic herbicides

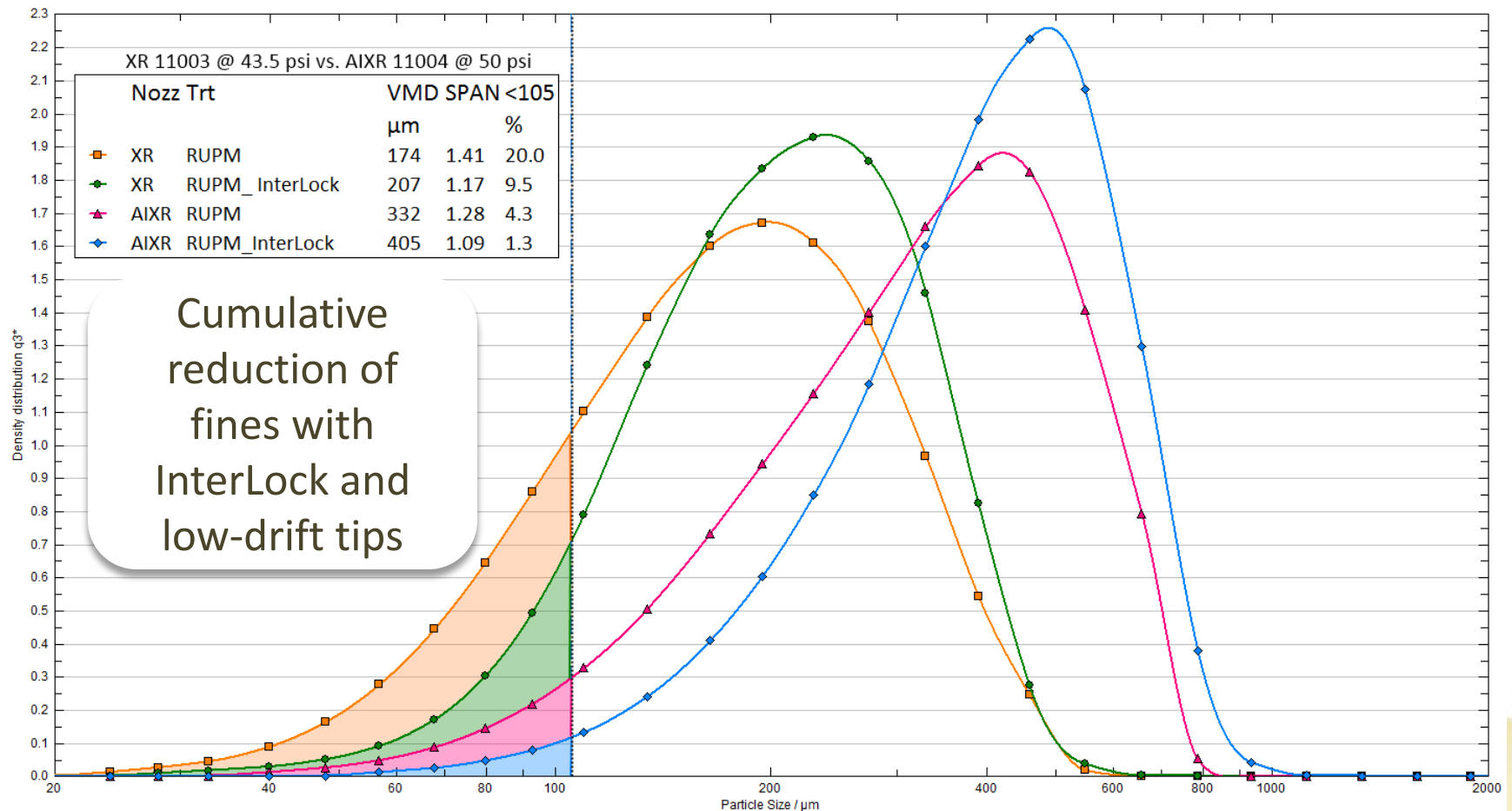
- Velocity Modifier

- Changes the velocity that the droplet comes out of the nozzle

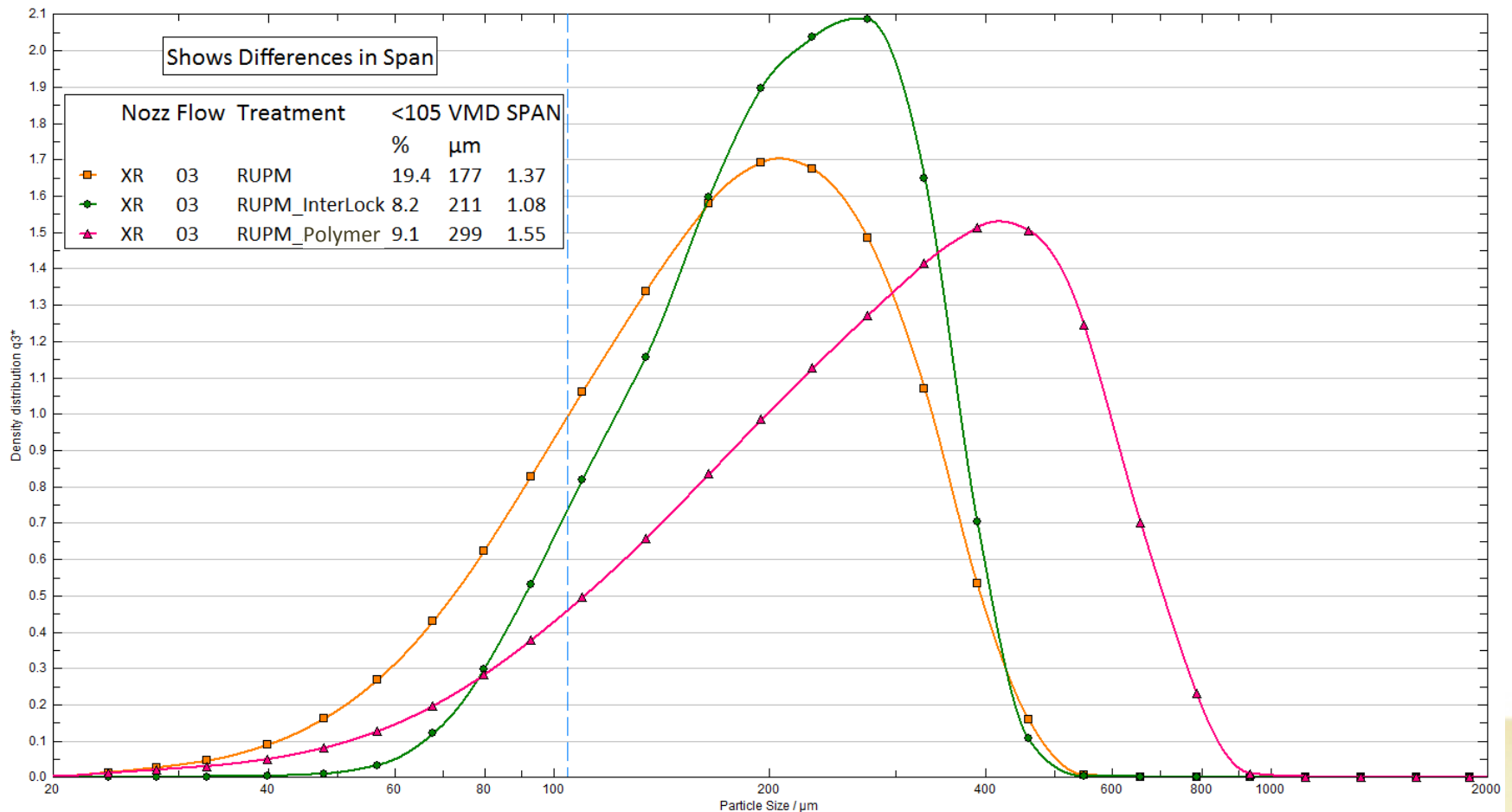
WINFIELD DRIFT MITIGATION ADJUVANTS

- InterLock®
- MasterLock®
- PowerLock®

MINIMIZE FINES WITH ADJUVANTS

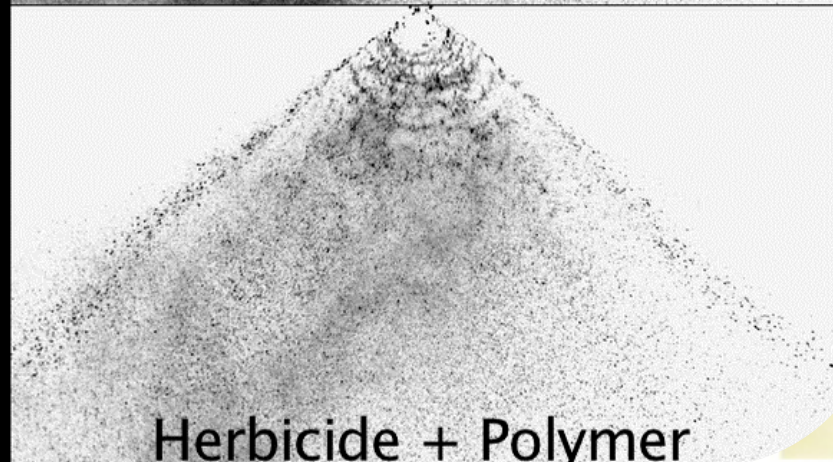
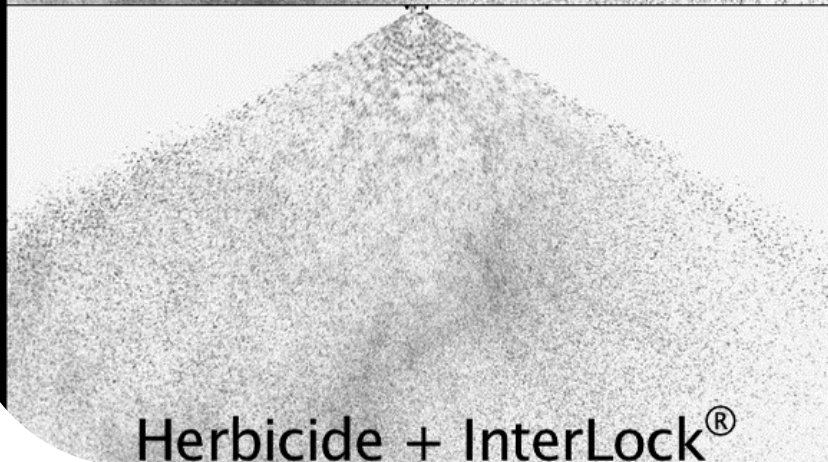
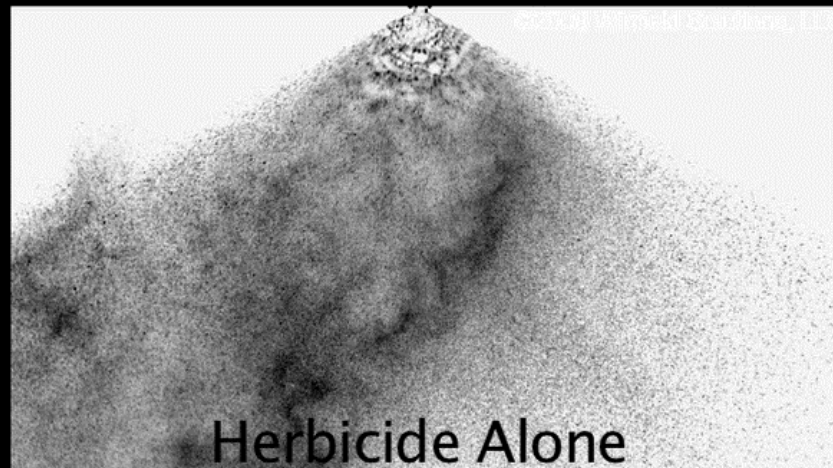
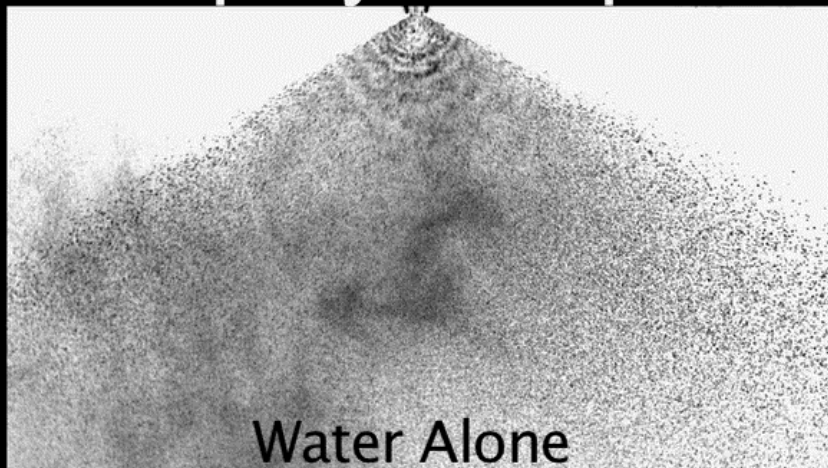


MINIMIZE DRIFTABLE FINES – BUT WATCH YOU DON'T GO TOO FAR....



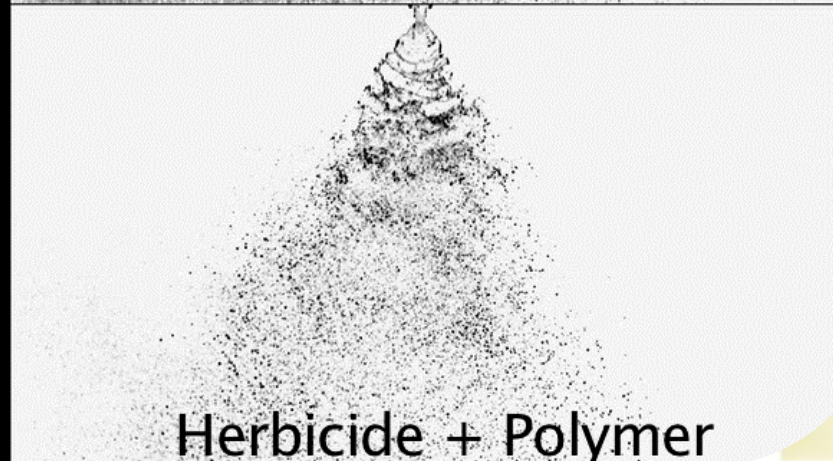
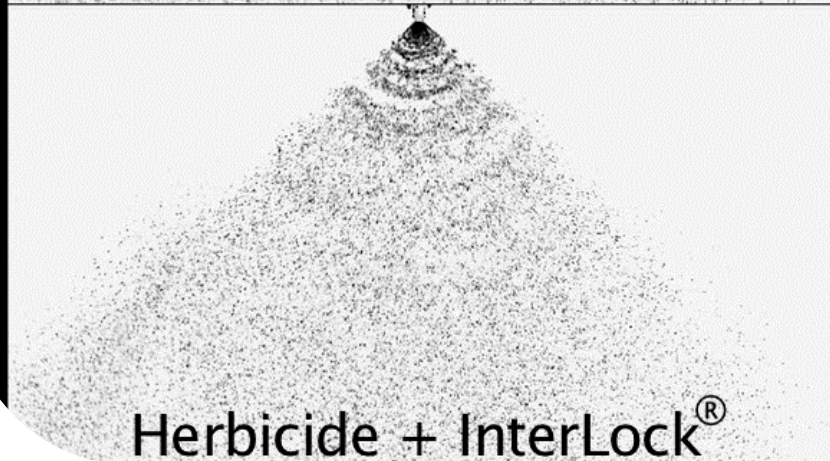
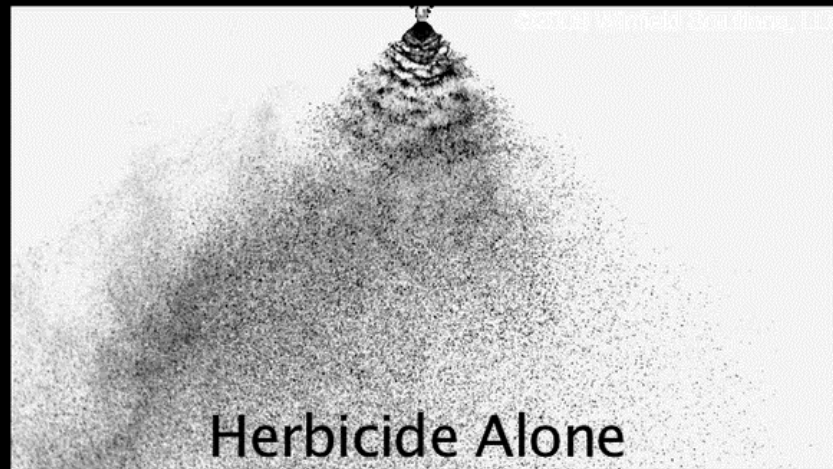
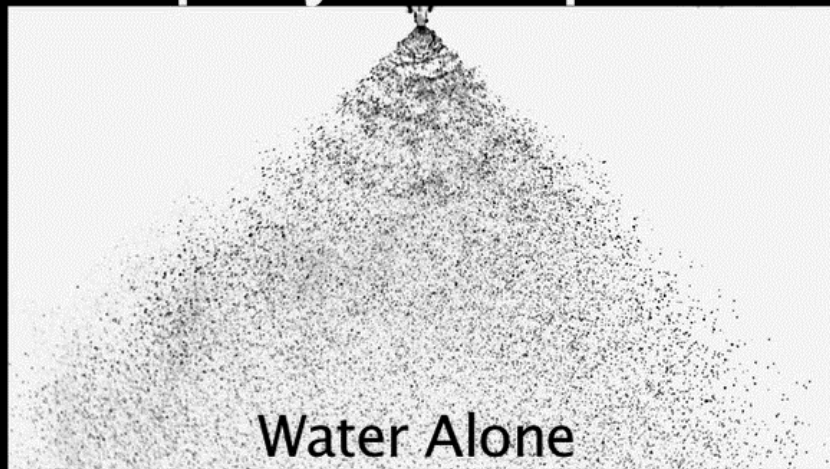
DROPLET SIZE – USING DRIFT MITIGATING ADJUVANTS

Spray Comparison Wind - XR TeeJet®



DROPLET SIZE – USING DRIFT MITIGATING ADJUVANTS

Spray Comparison Wind - AIXR TeeJet®



DROPLET SIZE – USING DRIFT MITIGATING ADJUVANTS



DRIFT MITIGATING – DEPOSITION



DRIFT MITIGATING ADJUVANTS - INTERLOCK

- How does InterLock and the rest of the InterLock family of products work?
 - Squeezes the span
 - Reduces fines
 - Speeds up the droplets coming out of the nozzle
 - Changes the shear of the droplet coming out of the nozzle
- What InterLock is
 - It is a fine tuning tool for spray application, that can help mitigate drift from the spray solution.



DRIFT MITIGATION

Before any spray application 100% of the spray solution has potential to drift and 100% of the spray solution has potential to hit the target.

THANK YOU

