

Evaluation of new technologies to minimize worker exposure to pesticide drift in orchards

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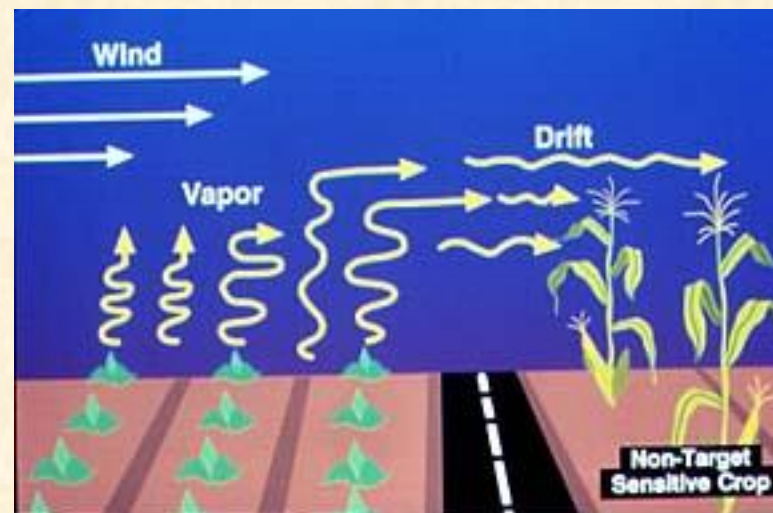
Pesticides and Farm Worker Protection



What is Pesticide Drift?

- **Primary drift:** off-target movement during or shortly after application
 - ✓ Regulatory
 - ✓ “Spray drift”
 - ✓ Application method, meteorology, canopy, droplet size, human activity

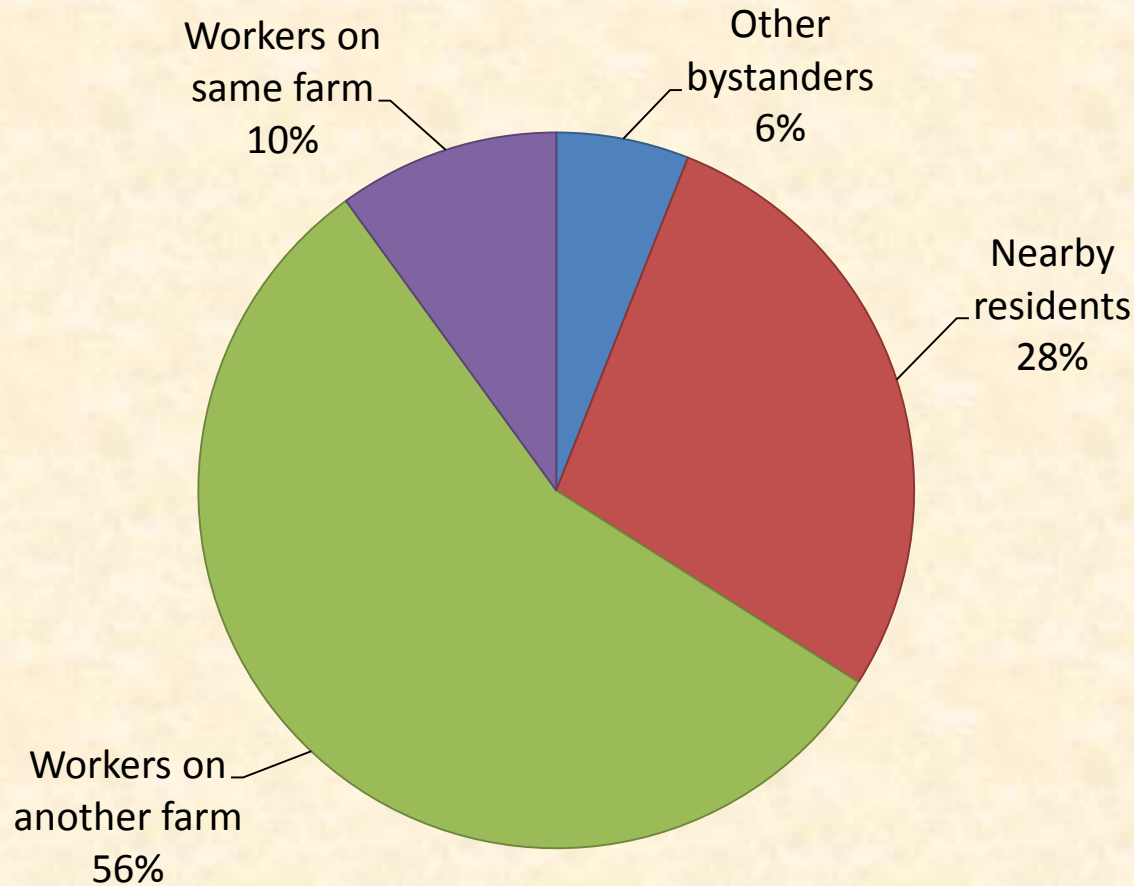
- **Secondary drift:** off-target movement post-application
 - ✓ Non-regulatory
 - ✓ “Vapor drift” or resuspension
 - ✓ Temperature, vapor pressure, wind, particle size, human activity



Contemporary Orchard Airblast Sprayer



Who is Impacted by Agricultural Pesticide Drift in Washington?



Source: WA DOH, Combined illness case data (2005-2012)

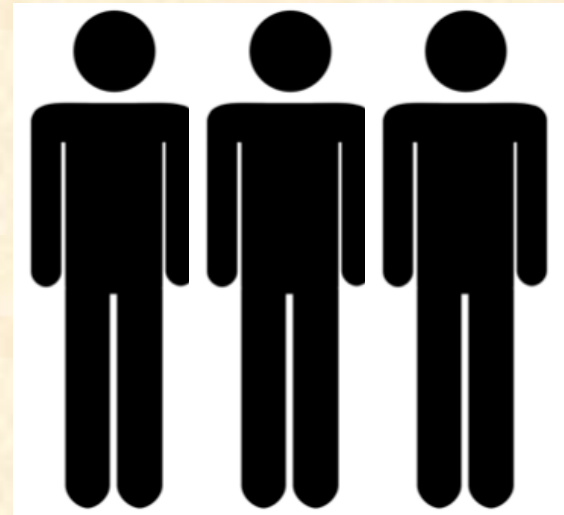
Drift Case

Meets the WA DOH case definition for an individual with a documented drift exposure.

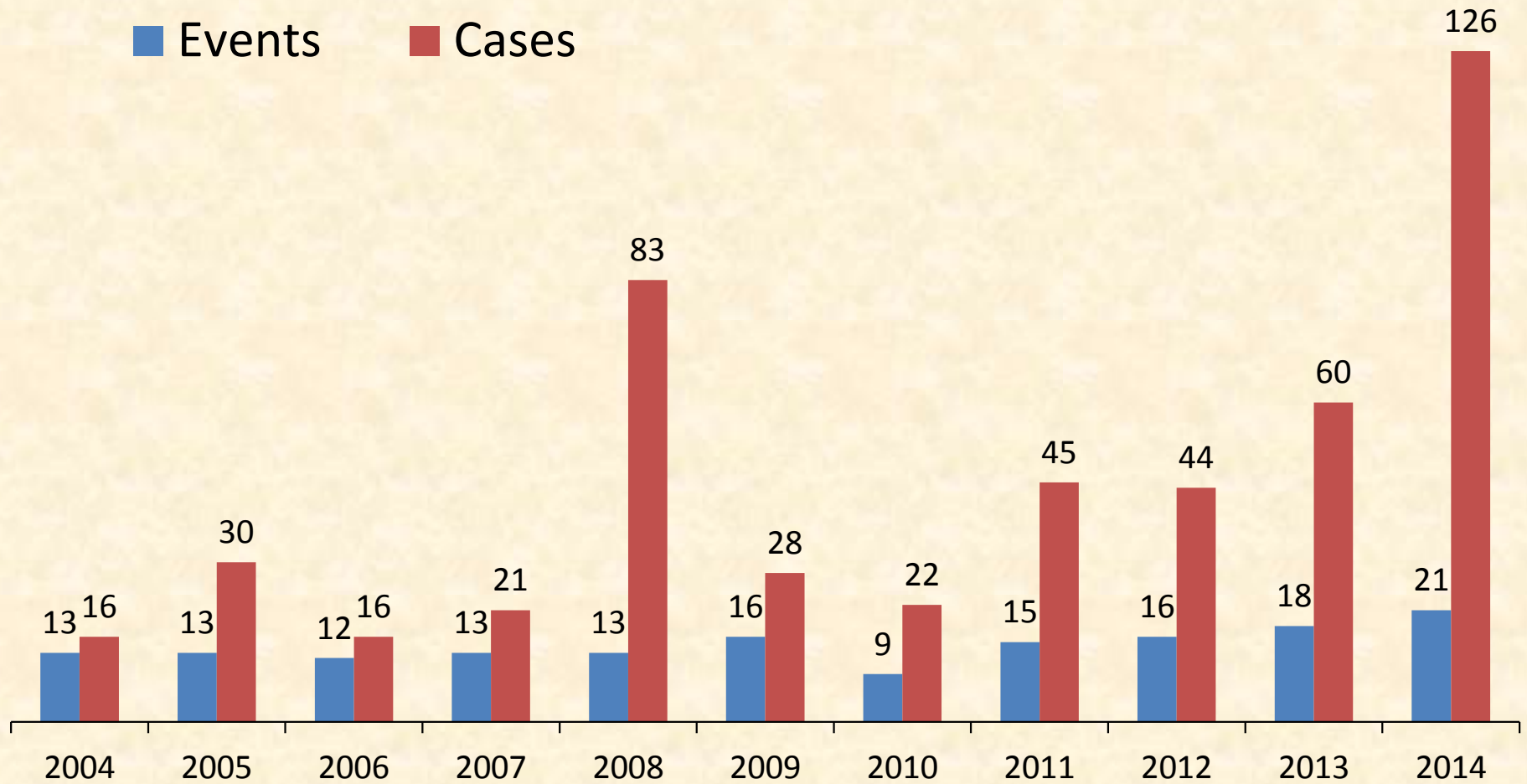


Drift Event

An incident where one or more drift cases experienced exposure from a particular source.



Agricultural Drift Events & Cases



Source: DOH Pesticide Illness Data, Agricultural Pesticide Drift, 2004-2014

Columbia River Basin



Wenatchee

“Apple Capital of the World”

Orchards near Wenatchee, WA



Sunrise Orchard Aerial View

Pilot Study (2014)

Orchard block sprayed with
micronutrient products



Pilot Study Objectives

- ✓ Identify suitable site, matrices, and pesticide tracers
- ✓ Establish standard operating procedures (SOPs)
- ✓ Conduct multiple spray trials to test whether different tracers can be collected on a single sampling matrix
- ✓ Validate inductively coupled mass spectrometry (ICP-MS) as analytical method for tracers

PAK-BLAST airblast sprayer



Micronutrient Tracers

✧ Molybdenum product mix

- ✓ Manni Plex B Moly (product name)
- ✓ 0.5% molybdenum (water soluble)



✧ Zinc product mix

- ✓ Carbol (product name)
- ✓ 10% zinc



Passive Sampling Matrices

Sampling media	Vertical	Horizontal
Low-density polyethylene tubing	X	
Pipe cleaners	X	
Chromatography filter paper		X

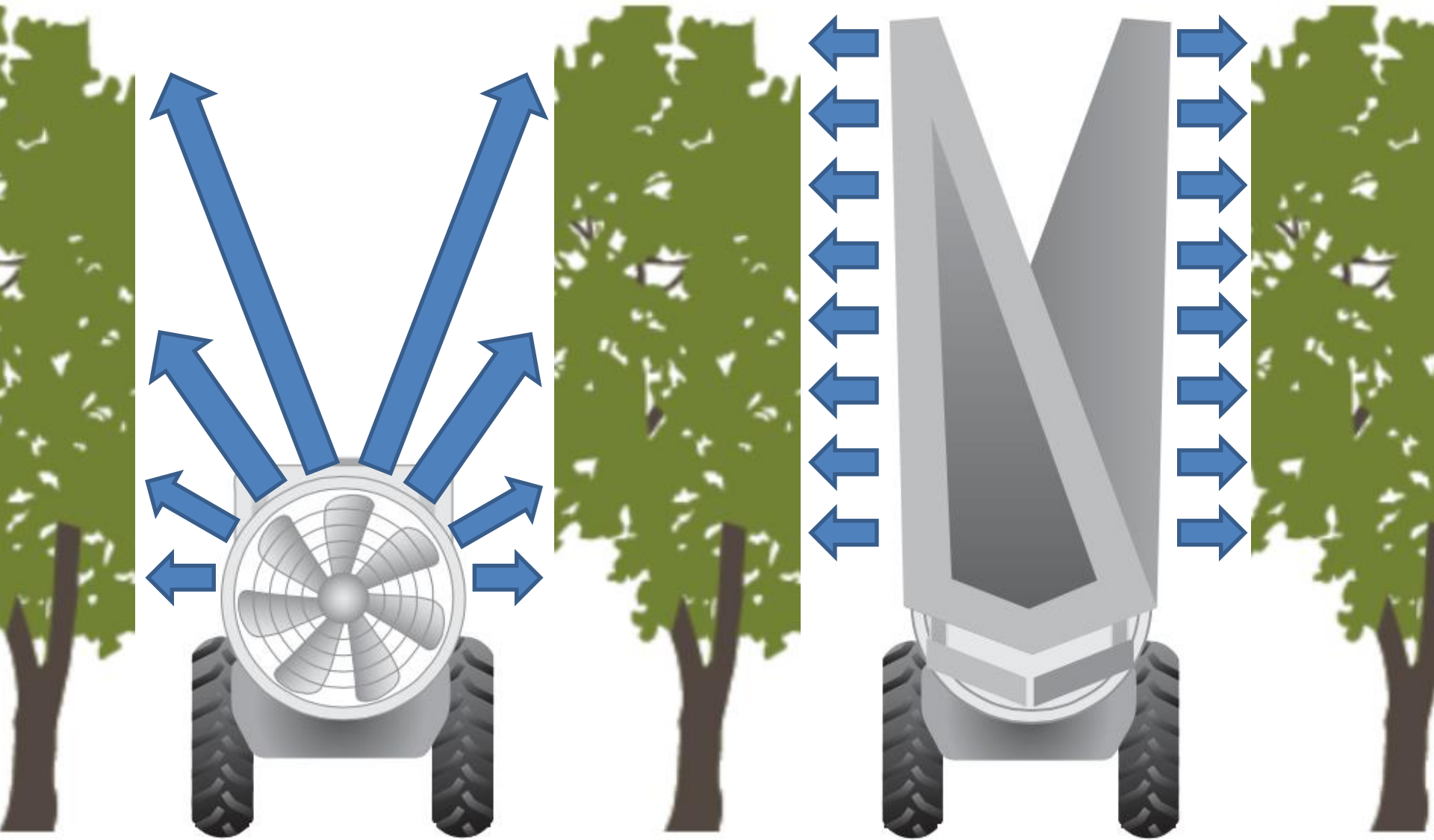
Pilot Study Results (2014)

Sampling media + tracer	GM(GSD) ng/cm ²	Ratio of Recovered mass to LOQ
LDPE + Zn	186 (3)	71
LDPE + Mo	2.7 (2)	35
Filter paper + Zn	169 (3)	20
Filter paper + Mo	2.0 ()	66

Key Findings

- ✓ Proof of concept for sampling design and SOPs
- ✓ Zinc and Molybdenum effective as tracers for drift studies
- ✓ Pipe cleaner samplers need to be free of metals
- ✓ Wind conditions at Sunrise orchard favorable for drift studies that compare different spray technologies

Drift Potential of Orchard Spray Technologies



TURBO MIST tower sprayer (2015)



QUANTUM MIST tower sprayer (2016)



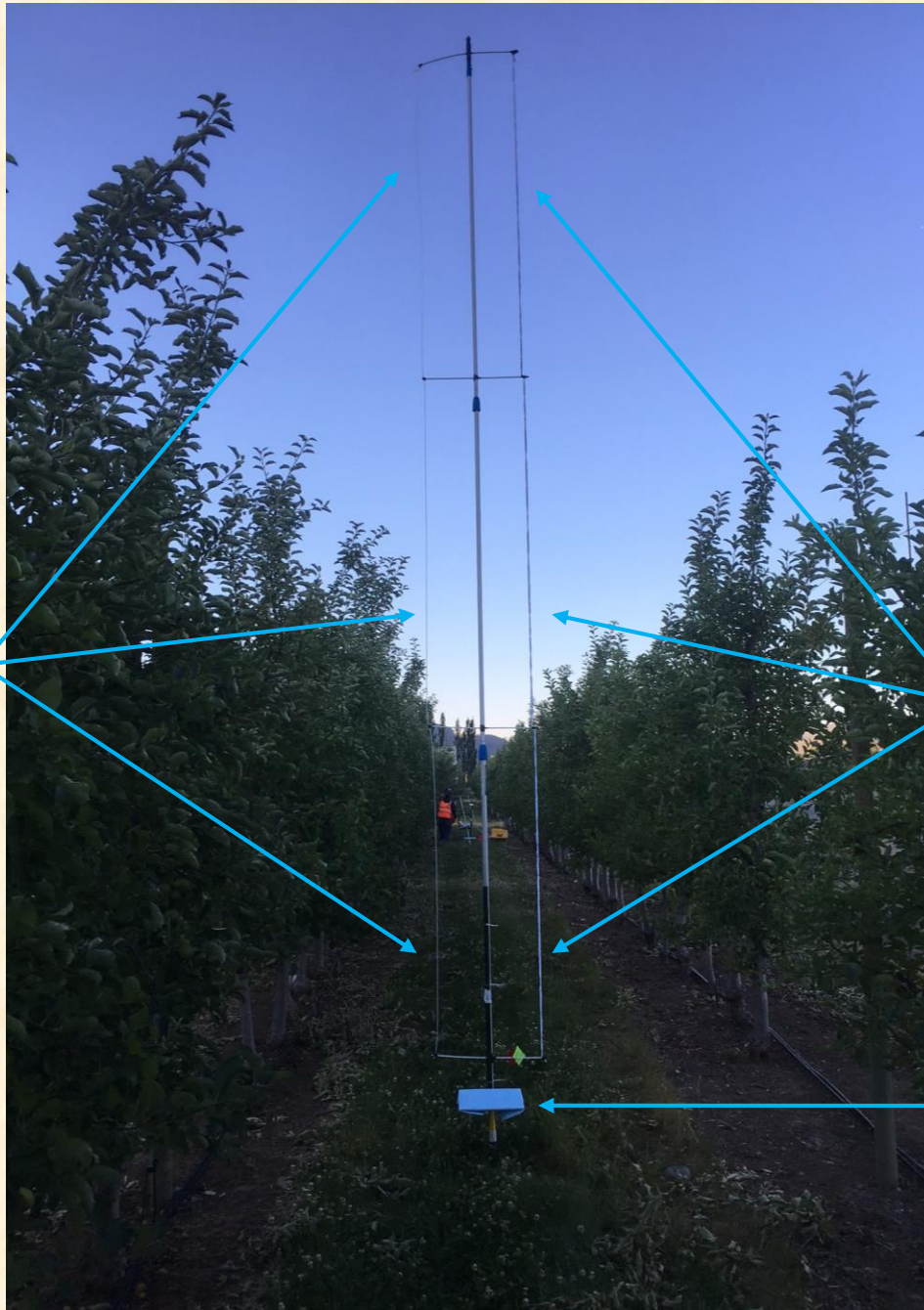
10-Meter Meteorology (Met) Station

Wind Speed/Direction: ultrasonic anemometer

Temperature/Humidity: RH probe



Sampling Mast



Airborne drift sampling

LDPE plastic tubing
(2 m sections)

Airborne drift sampling

Polyester with cotton core pipe cleaner
(2 m sections)

Deposition drift sampling

Filter paper

Real-Time, Size-Selective Sampling (2016)

Dylos[®] Air Particle Counter

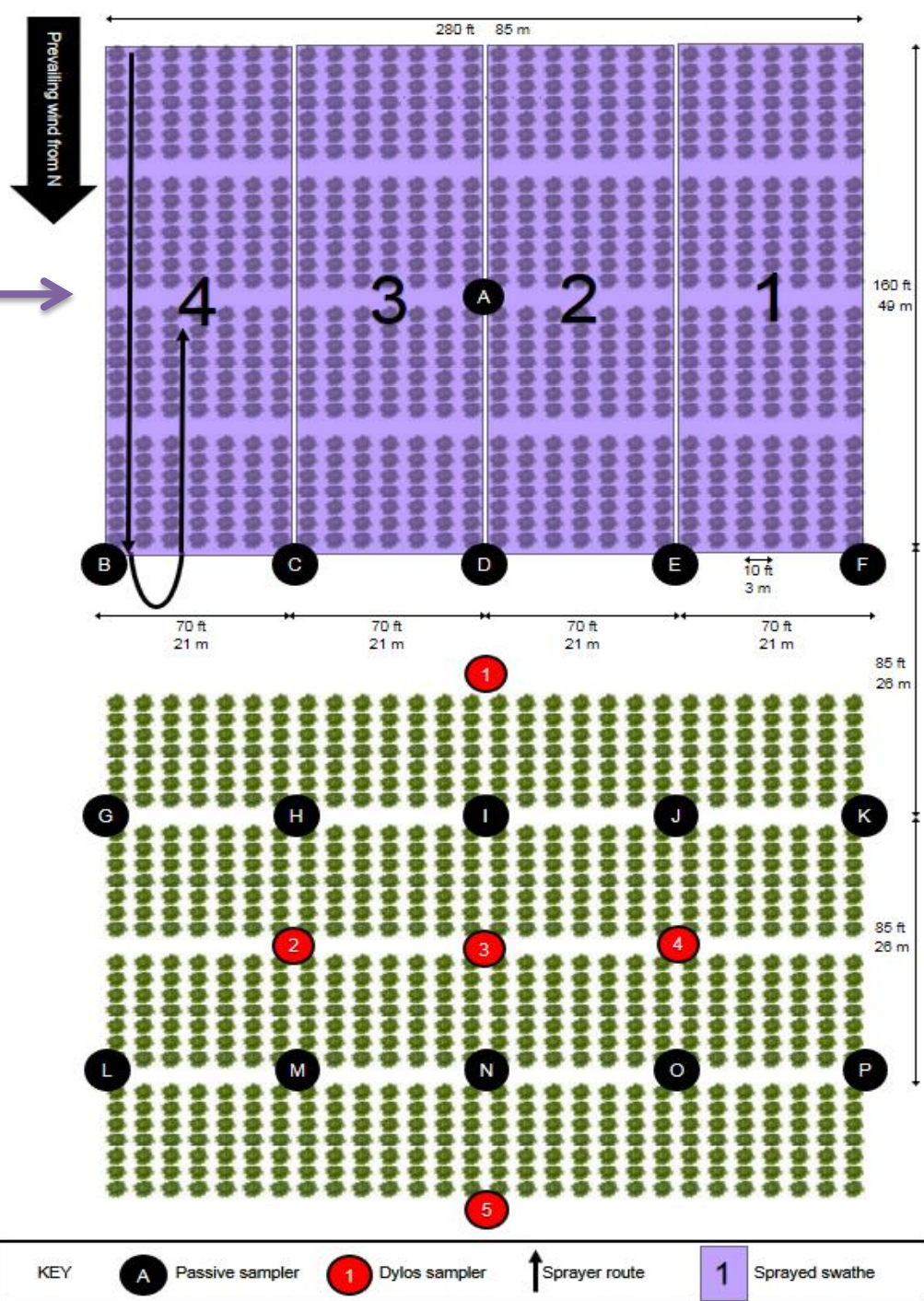


Orchard Field Trials (2015 & 2016)

1-acre orchard block
sprayed with micro-
nutrients

Downwind samplers

- Passive samplers at 3 heights
- Real-time particle samplers at 2 heights

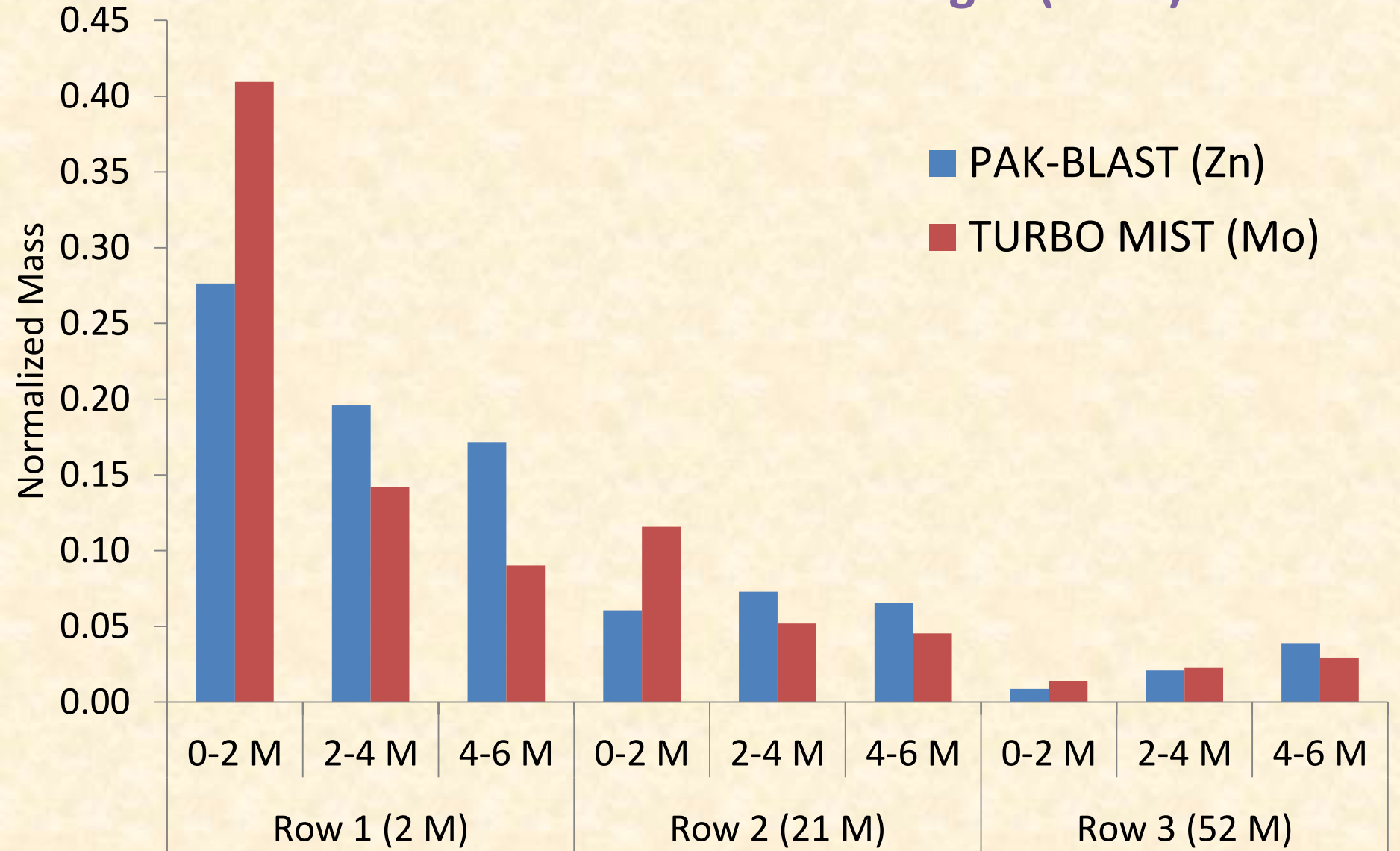


Airblast and Tower Sprayer Video

2015 Field Study Objectives

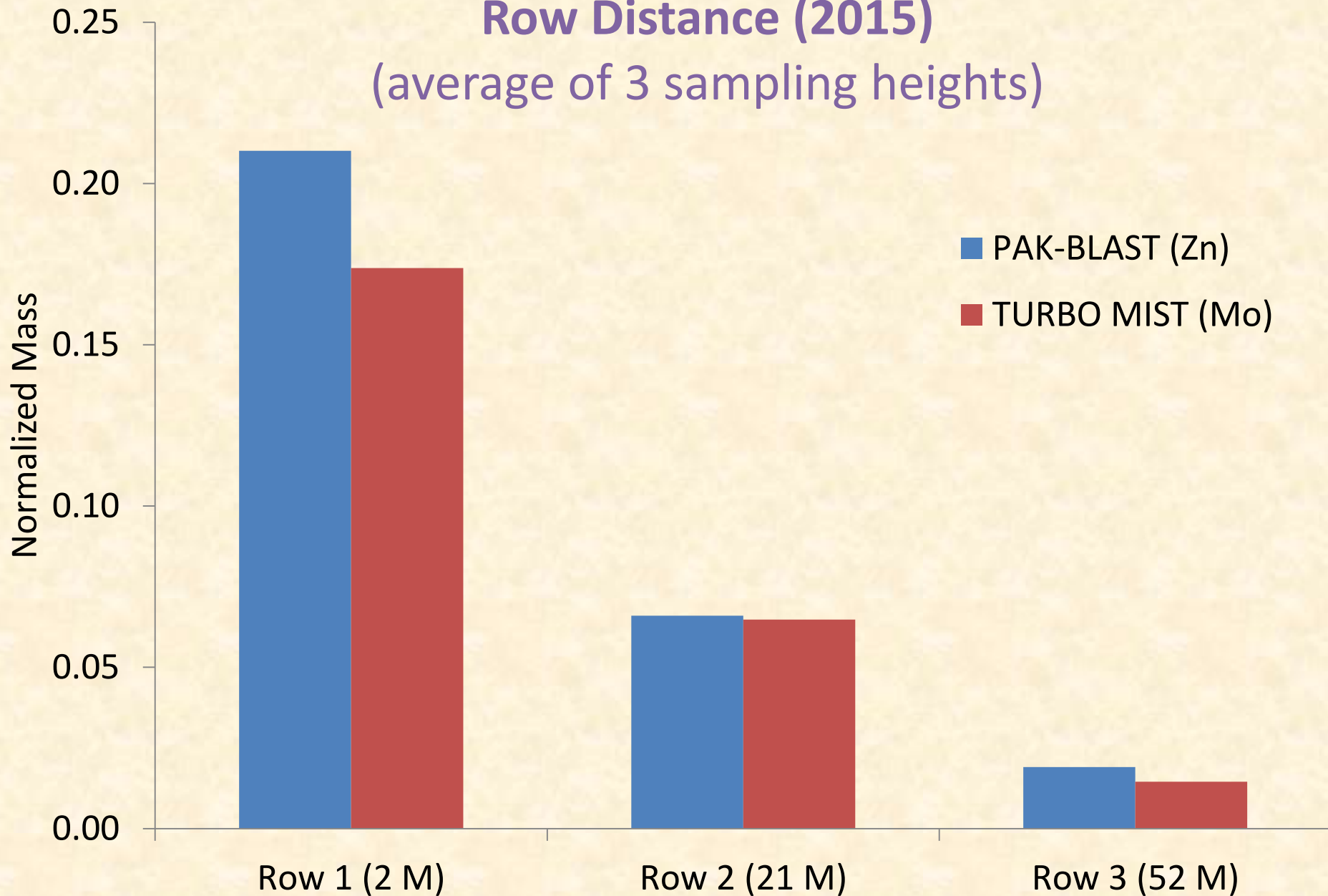
- ✓ Compare tower and airblast sprayers
- ✓ Use Zinc and Molybdenum as tracers
- ✓ Use new pipe cleaners: cotton + polyethylene
- ✓ Collect meteorological data during sprays

Mean Airborne Drift on Vertical Pipe Cleaner by Row Distance and Mast Height (2015)



Mean Airborne Drift on Vertical Pipe Cleaner by Row Distance (2015)

(average of 3 sampling heights)



Preliminary Findings (2015)

- ✓ New pipe cleaners effective as samplers
- ✓ Differences between two spray technologies not striking at first glance
- ✓ Results require further analysis
- ✓ Real-time size selective sampling should help to better understand pesticide drift

Safety is the “work of changing minds, and it’s not done overnight.”

~ ‘Practical Solutions’ project participant

