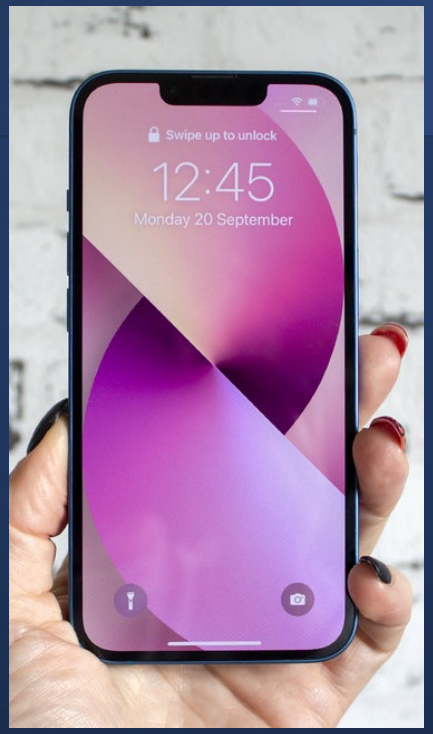
# How Accurate are Available Weather Resources for Pesticide Applicators?

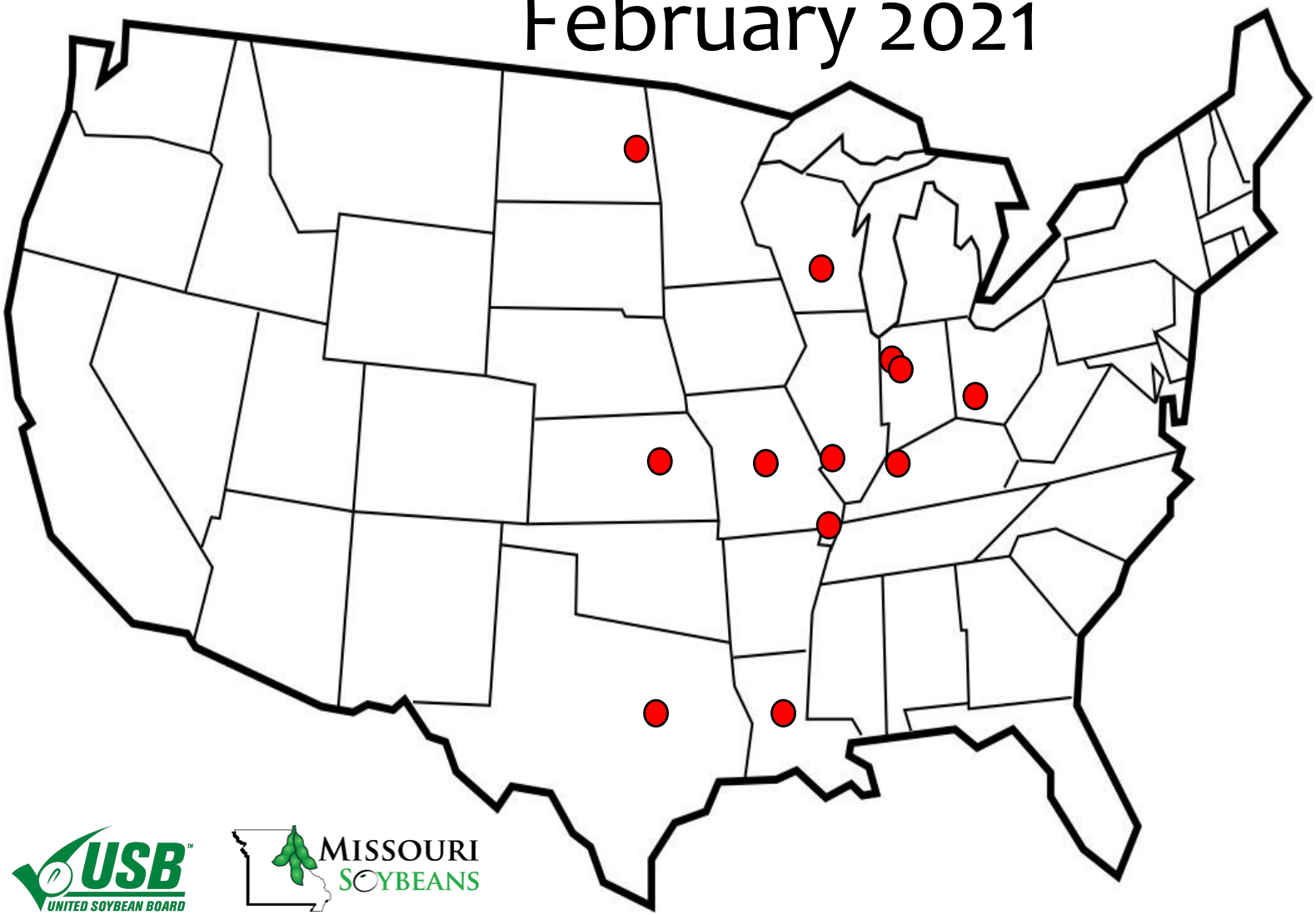




Mizzou weedscience

# USDA Climate Hub ADIM Workshop

## February 2021



Nicholas Arneson
Nikola Arsenijevic
Kevin Bradley
Ivan Cuvaca
Karla Gage
Maggie Ginn
Zachary Howard
Joe Ikley
Bill Johnson
Jamie Knight
Sarah Lancaster
Lauren Lazaro
Travis Legleiter
Mark Loux
Eric Miller
Taylor Nix
Scott Nolte
Bryan Young
Rodrigo Werle
Marcelo Zimmer

USB UNITED SOYBEAN BOARD

MISSOURI SOYBEANS

USDA Climate Hubs
U.S. DEPARTMENT OF AGRICULTURE

# USDA Climate Hub ADIM Workshop
# February 2021

Nicholas Arneson
Nikola Arsenijevic
Kevin Bradley
Ivan Cuvaca
Karla Gage
Maggie Ginn
Zachary Howard
Joe Ikley
Bill Johnson
Jamie Knight
Sarah Lancaster
Lauren Lazaro
Travis Legleiter
Mark Loux
Eric Miller
Taylor Nix
Scott Nolte
Bryan Young
Rodrigo Werle
Marcelo Zimmer

## Weather Tools

Car thermometer
**Engenia Spray Tool**
**Kestrel Handheld**
**NOAA**
**Pocket Spray Smart**
**RRXtend Spray**
SpotOn Inversion Tester
**Weather Underground**

## Dates

May to September 2021
20 tests per location
Different times of day

## Variables Measured

Air Temperature, Wind Speed, Wind Direction, Inversion Potential

# Air Temperature by Resource

**June 3 at 3:12 PM at West Lafayette, IN**

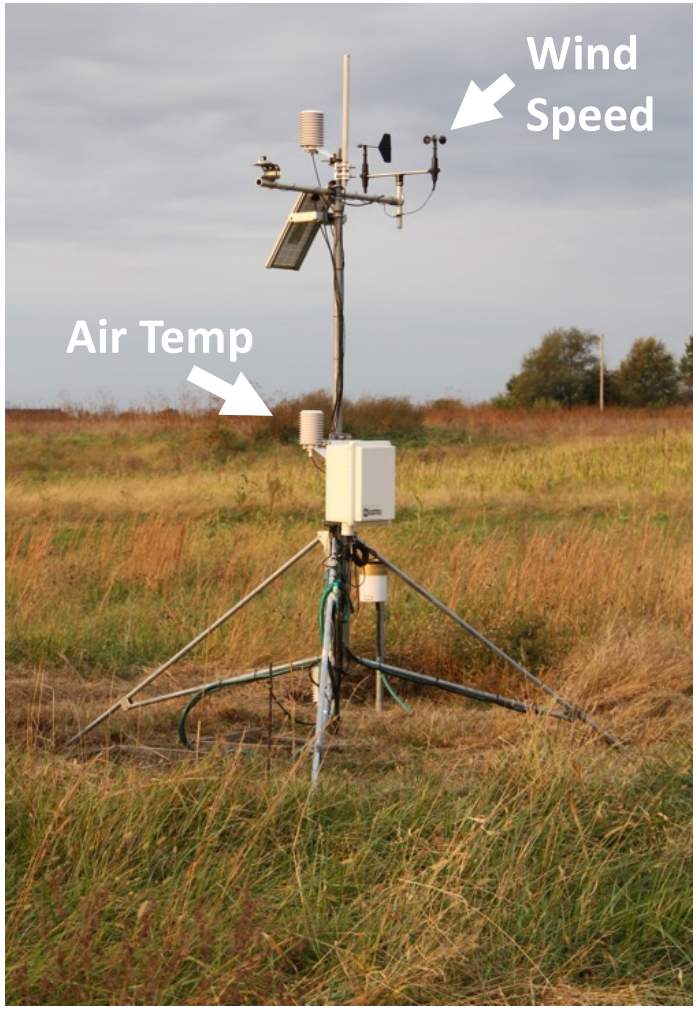
| Weather Resource | Air Temp °F |
|---|---|
| Engenia Spray Tool | 78 |
| Kestrel Handheld | 84 |
| NOAA | 77 |
| Pocket Spray | 78 |
| RRXtend Spray | 78 |
| Weather Station | 79 |
| Weather Underground | 82 |

# Air Temperature by Resource

**June 14 at 12:23 PM at Carbondale, IL**


| Weather Resource | Air Temp °F |
|---|---|
| Engenia Spray Tool | 83 |
| Kestrel Handheld | 83 |
| NOAA | 81 |
| Pocket Spray | 84 |
| RRXtend Spray | 85 |
| Weather Station | 83 |
| Weather Underground | 82 |

# Using Weather Stations as a Point of Reference

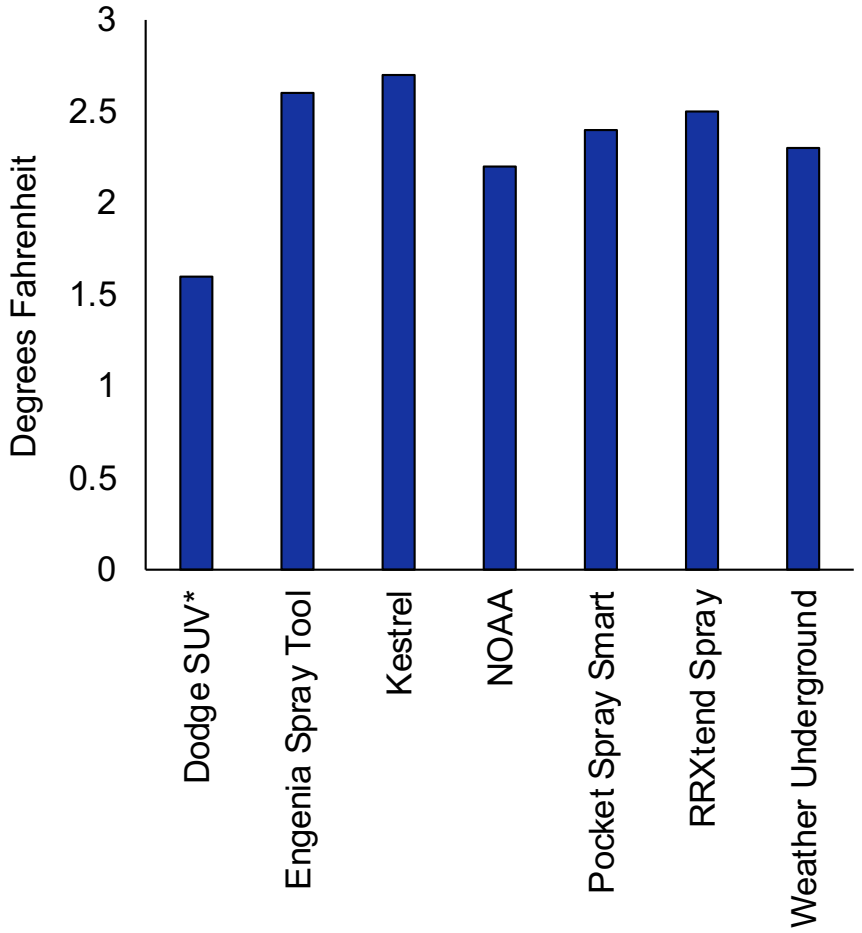



- Real-time weather data
- Averaged in 5-minute intervals
- Routine QC

Dr. Pat Guinan
State Climatologist

# Air Temperature Variations

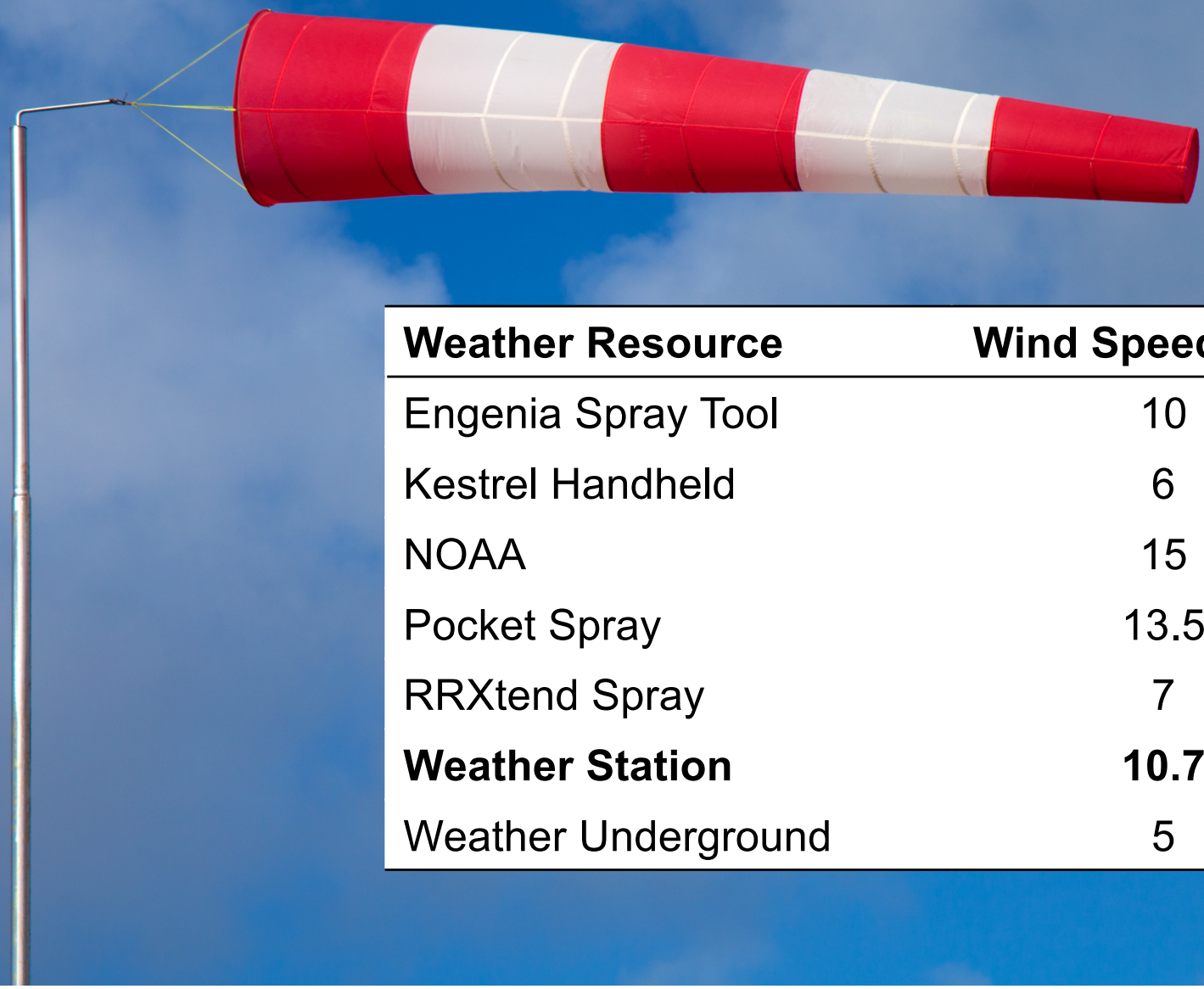
## Deviation of air temperature from weather station




n=1,571

# Wind Speed by Resource

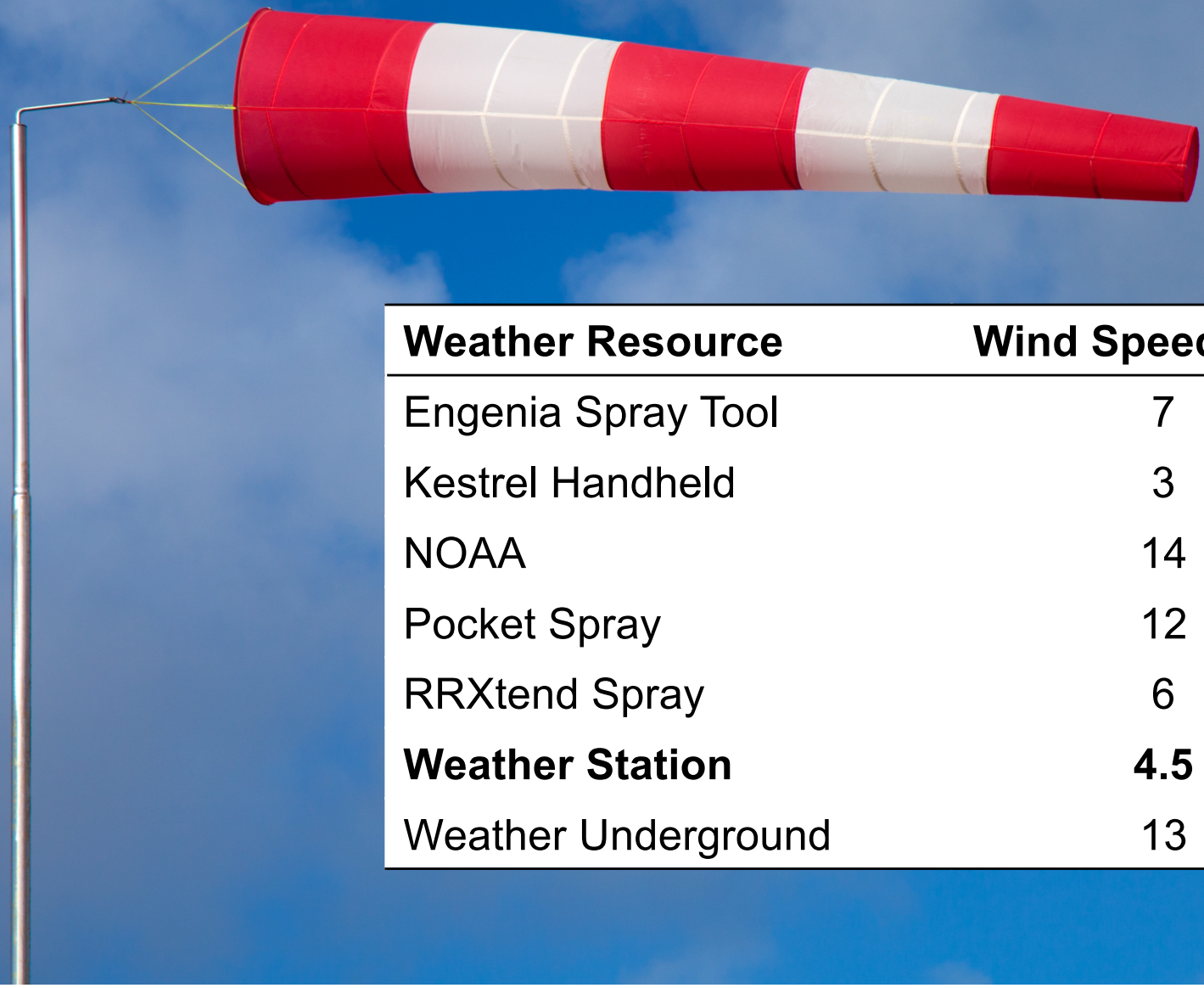
**May 28 at 9:15 AM, Columbia, Missouri**



| Weather Resource | Wind Speed (mph) |
|---|---|
| Engenia Spray Tool | 10 |
| Kestrel Handheld | 6 |
| NOAA | 15 |
| Pocket Spray | 13.5 |
| RRXtend Spray | 7 |
| **Weather Station** | **10.7** |
| Weather Underground | 5 |

# Wind Speed by Resource

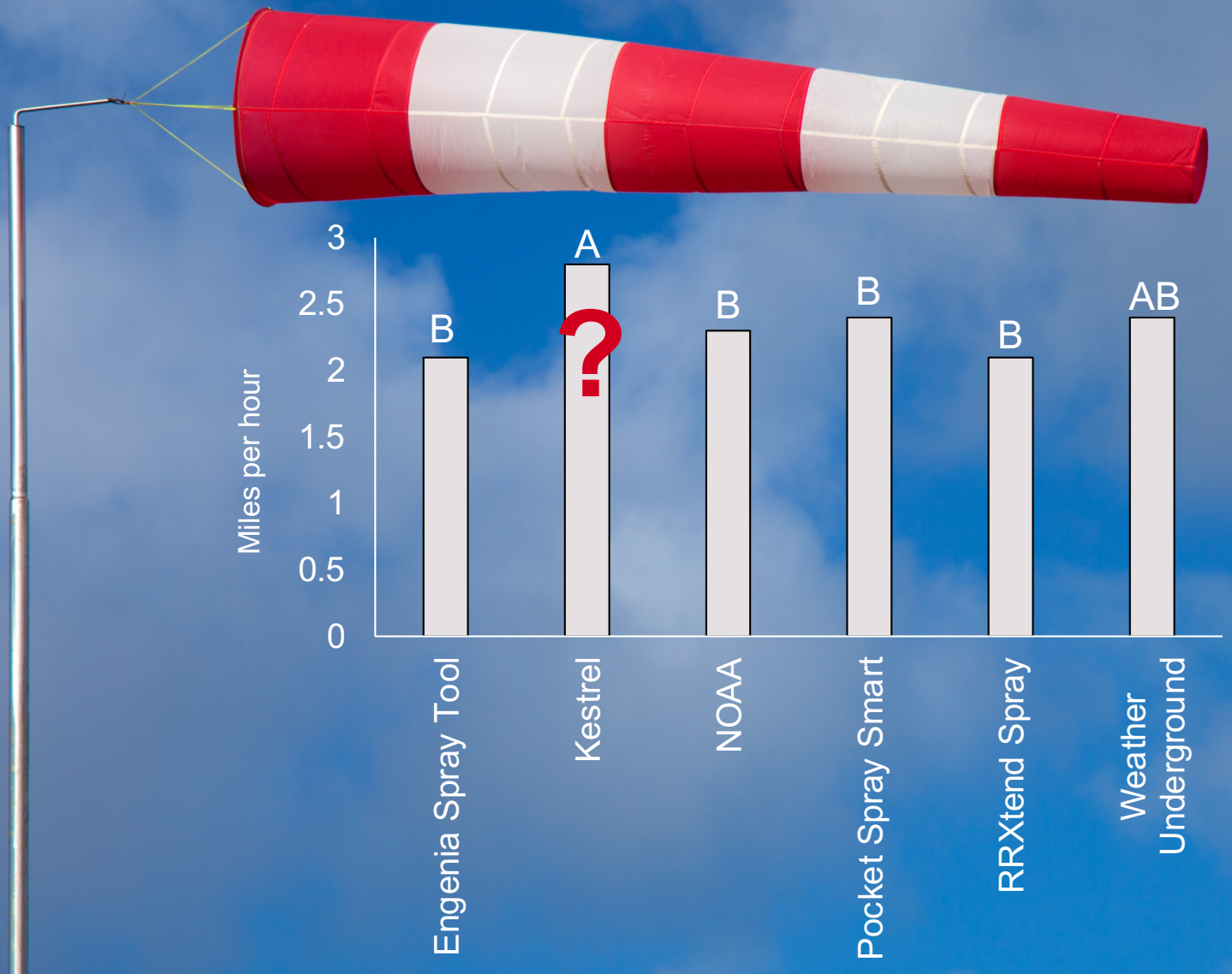
**June 24 at 12:23 PM, Carbondale, Illinois**



| Weather Resource | Wind Speed (mph) |
|---|---|
| Engenia Spray Tool | 7 |
| Kestrel Handheld | 3 |
| NOAA | 14 |
| Pocket Spray | 12 |
| RRXtend Spray | 6 |
| **Weather Station** | **4.5** |
| Weather Underground | 13 |

# Wind Speed Variation

## Deviation of wind speed from weather station

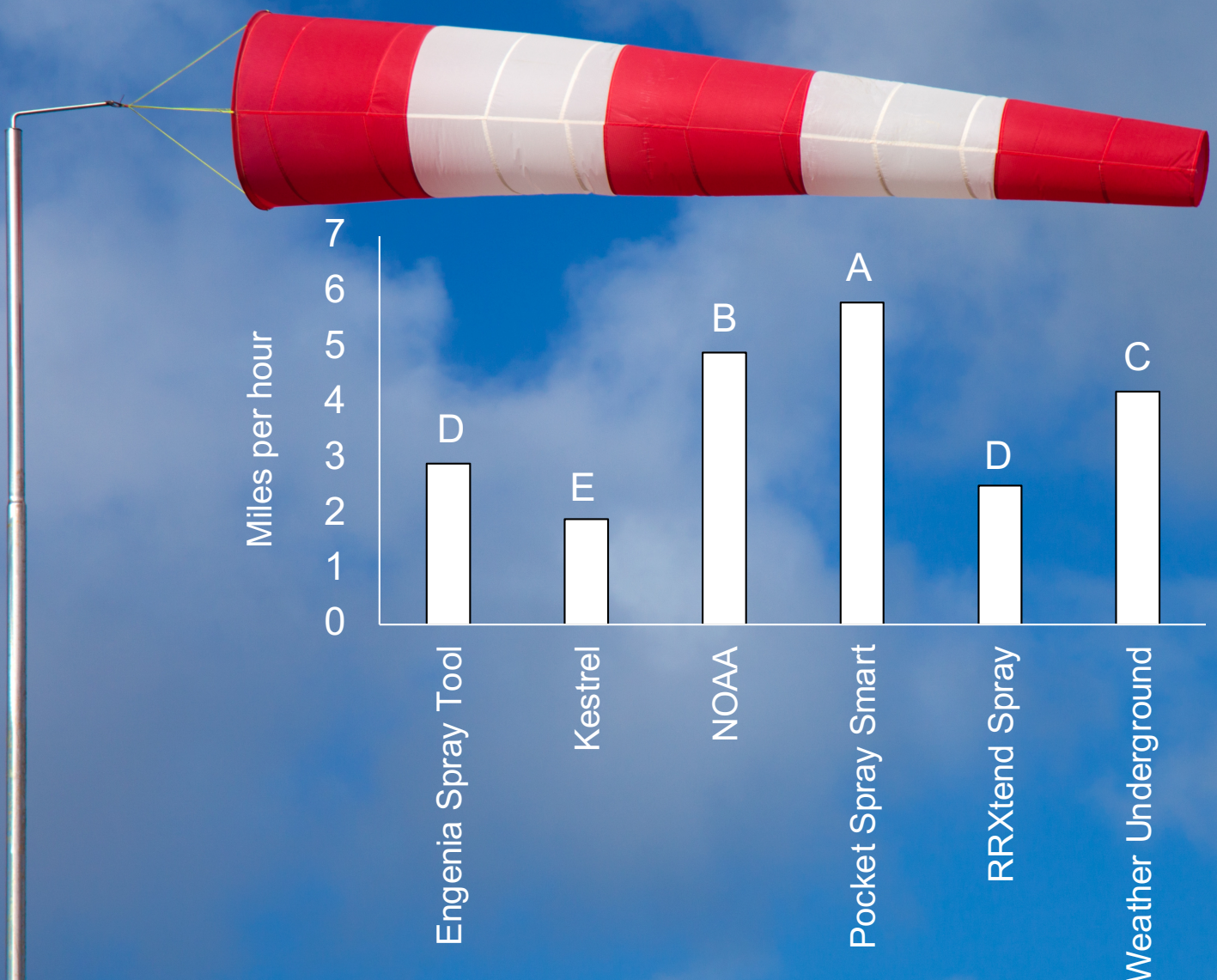



n=1,560

# Wind Speed Variation

Transform weather station wind speed to ~boom height:

$V_2=v_1(Z_2/Z_1)^{\alpha}$

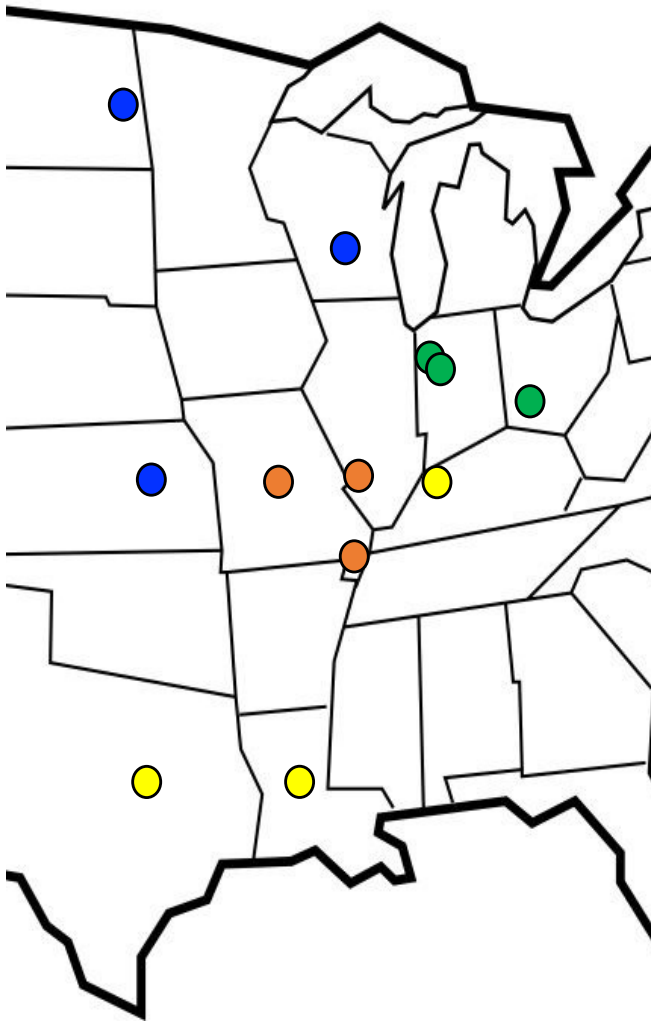



n=1,458

p<0.01

# Wind Speed Variation

Across all apps



North Dakota[a]

Kansas[ab]

Ohio[bc]

Wisconsin[bcd]

Kentucky[cde]

Missouri_Portageville[def]

Indiana[ef]

Illinois[ef]

Texas[f]

Missouri_Columbia[fg]

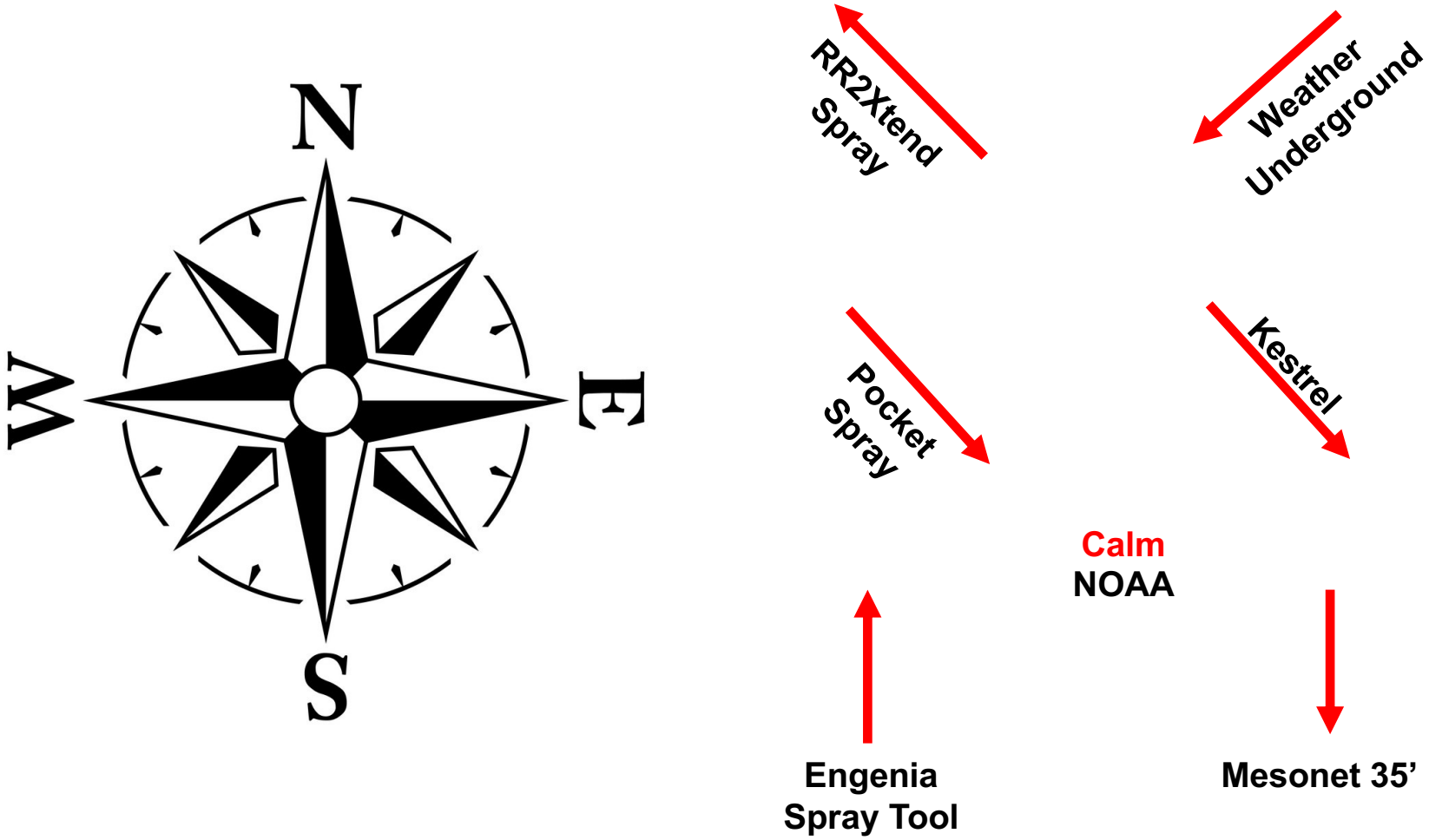
Louisiana[g]

Most variation

Least variation

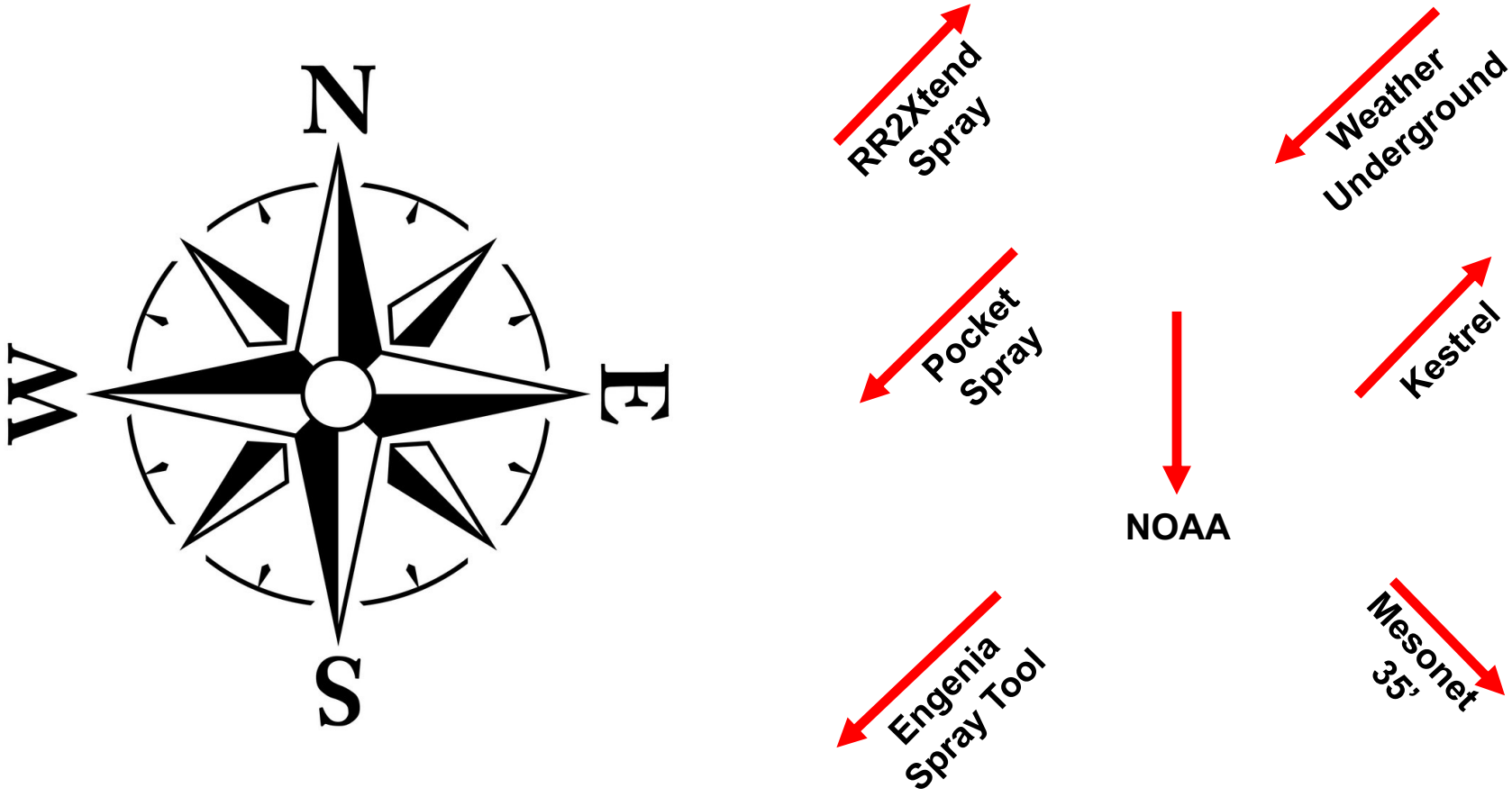
# Wind Direction by Resource

(June 14, 2021 at 5:10 PM, Kansas)



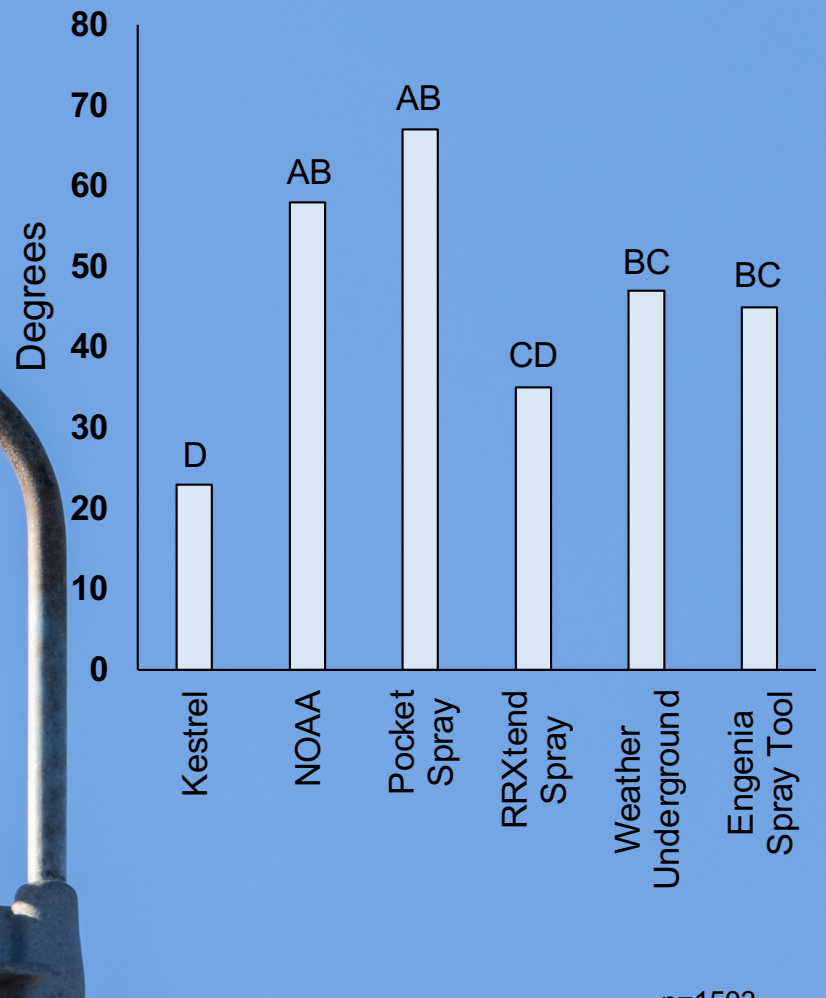
# Wind Direction by Resource

(July 6, 2021 at 9:15 AM, Kentucky)



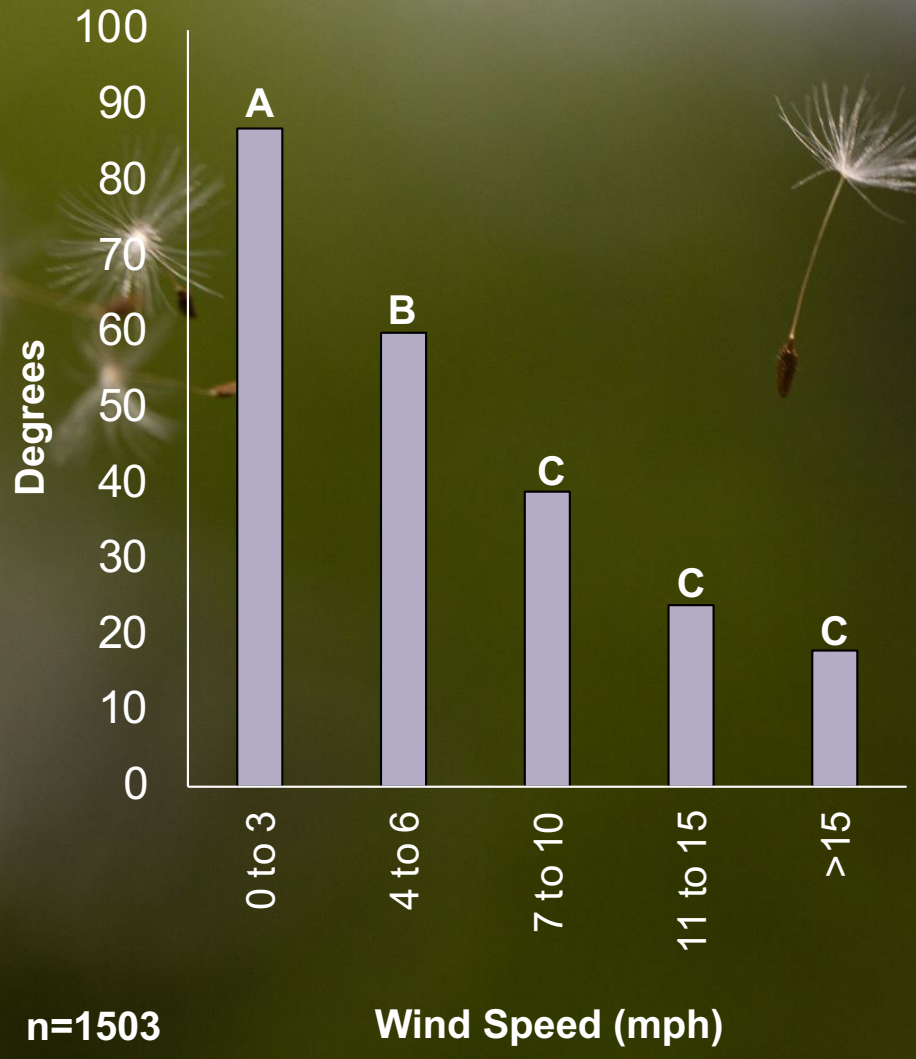
# Variation in Wind Direction

Deviation of wind direction from weather station

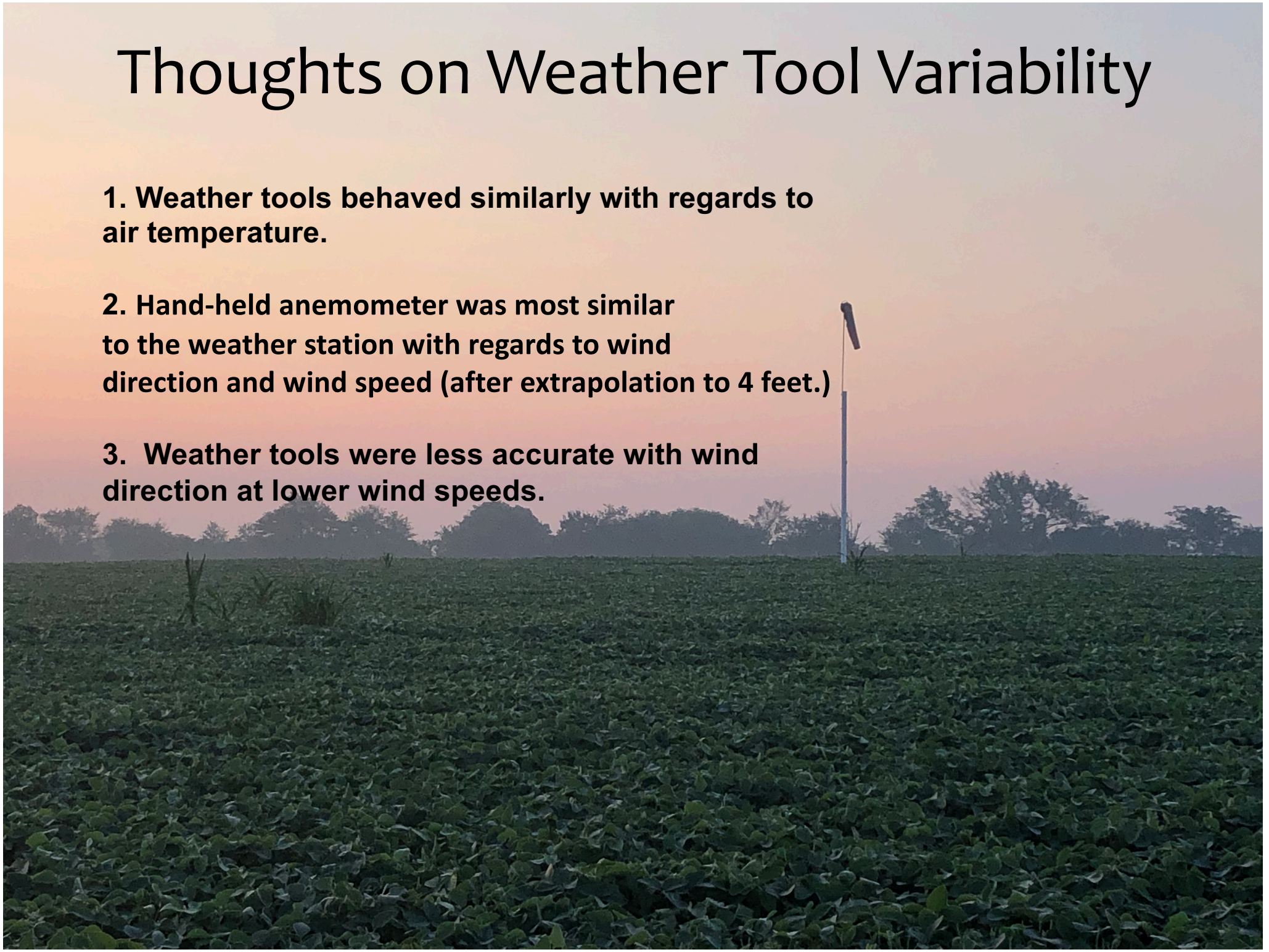



n=1503

# Wind direction was more accurate at higher wind speeds



# Thoughts on Weather Tool Variability



**1. Weather tools behaved similarly with regards to air temperature.**

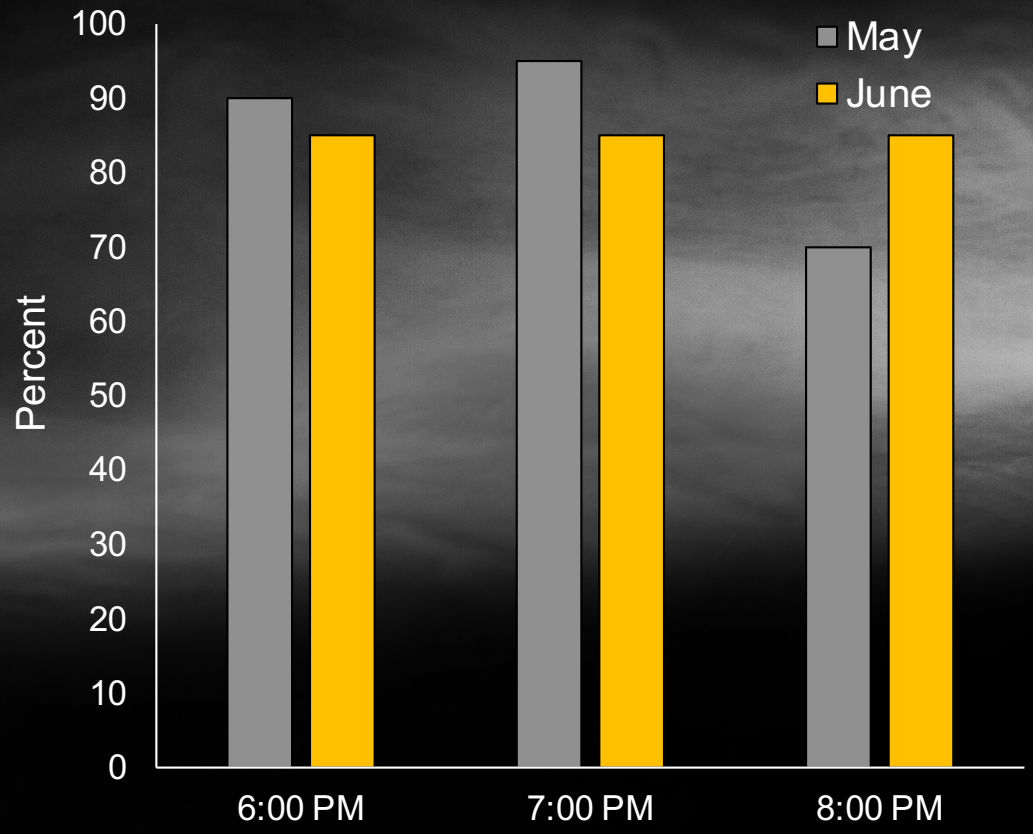
**2. Hand-held anemometer was most similar to the weather station with regards to wind direction and wind speed (after extrapolation to 4 feet.)**

**3. Weather tools were less accurate with wind direction at lower wind speeds.**

# Forecasting Inversions

Predicted evening wind speeds were recorded during the day and compared to actual evening wind speeds.

How often did the forecasted wind speeds result in correct application decisions?*




- RRXtend Spray App was used for analysis.
- Missouri data is presented.
- Performance has been topography dependent.


**Mandy Bish**
bishm@missouri.edu
573-882-9878

**Kevin Bradley**
bradleyke@missouri.edu
573-882-4039

Mizzou weed science

WAR AGAINST WEEDS
SILVER BULLETS ARE FOR WEREWOLVES

id weeds